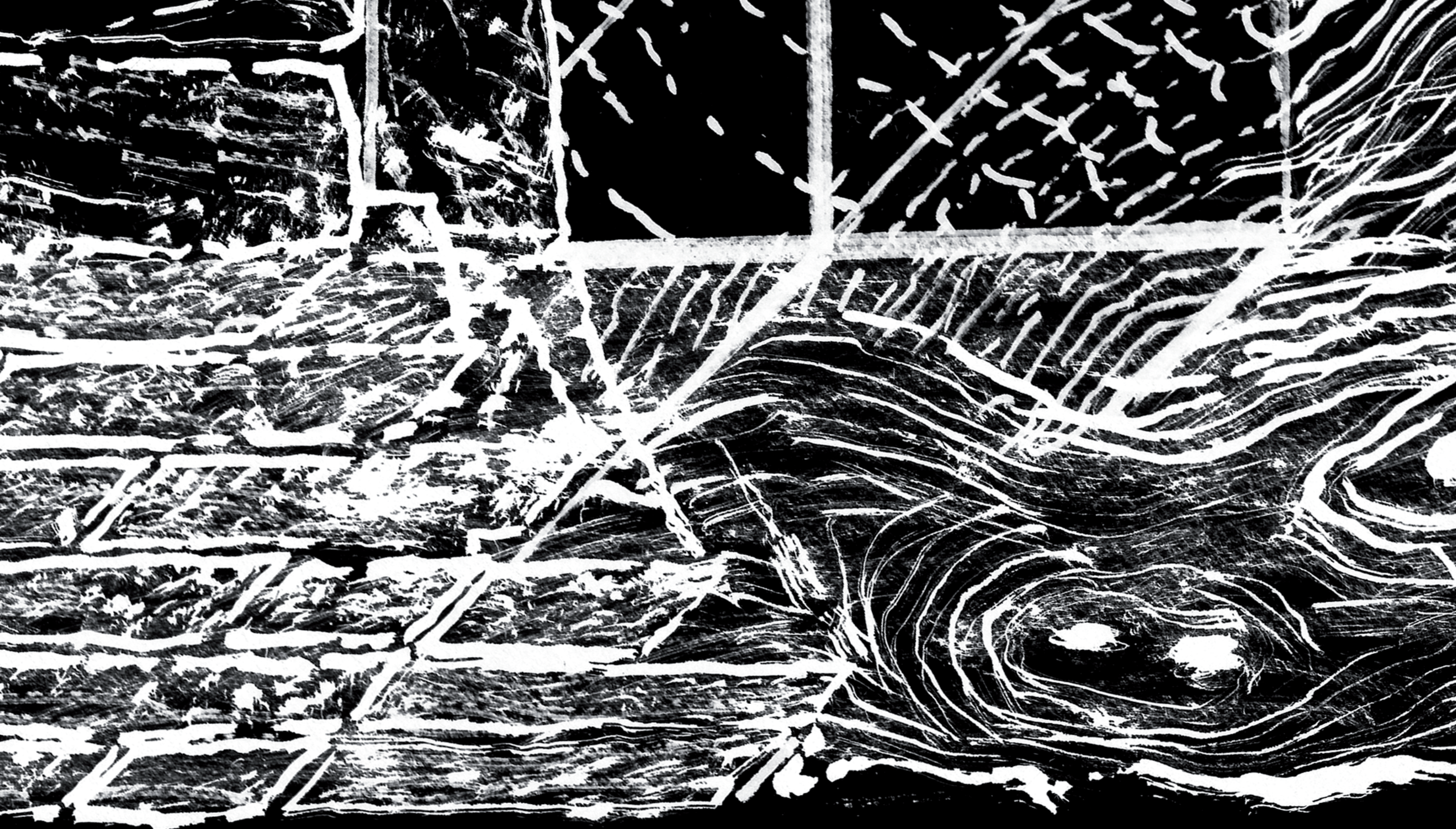

ARCHITECTURE OF CHALLENGES - MATERIALS FOR THE FUTURE

A limit cannot be crossed, but it does not signify the “end of science,” only the end of particular possibilities that nature, of which we are children or perhaps even grandchildren, offers us.

Stanisław Lem

ARCHITECTURE OF CHALLENGES - MATERIALS FOR THE FUTURE

Head of works, editor-in-chief:
Anna Maria Wierzbicka

Reviewer:
Maciej Lasocki
Agata Gawlik

Scientific Committee:
Anna Maria Wierzbicka
Maria Arno
Paweł Trębacz
Renta Józwik
Kinga Zinowiec-Cieplik
Magdalena Duda
Martyna Rowicka-Michałowska

Graphic design and Typesetting:
Martyna Rowicka-Michałowska

Cover based on graphics by:
Konrad Kucza-Kuczynski

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ul. Polna 50, 00-644 Warszawa

ARCHITECTURE OF CHALLENGES - MATERIALS FOR THE FUTURE

collective work
edited by Anna Maria Wierzbicka

Warsaw 2024

The conference “Architecture of Challenges: Materials for the Future,” organized by the Faculty of Architecture at Warsaw University of Technology along with the Royal Łazienki Museum, the National Institute of Architecture and Urban Planning, and the Academy of Fine Arts, serves as a significant forum for the exchange of knowledge and experience among architects, scientists, and business representatives. After a successful inaugural meeting focused on the architecture of the future, expectations for subsequent discussions are high. The meeting planned for 2024 focuses on the future of architecture and innovative materials that could play a crucial role in sustainable development in the face of global challenges such as climate change, migration, and energy crises.

In the face of global ecological and social challenges, contemporary architects and urban planners are tasked not only with designing functional and aesthetically pleasing spaces but also those that comply with the principles of sustainable development. The conference “Architecture of Challenges: Materials for the Future” becomes a platform where experts from various fields can collaboratively seek new solutions and materials that will reduce the negative impact of construction on the environment.

One of the conference’s main topics is the search for building materials that are not only durable and economical but also environmentally friendly. For instance, innovations in the production of cement, which is one of the primary sources of carbon dioxide emissions in the construction industry, can significantly contribute to reducing the global carbon footprint.

The conference emphasizes the need to integrate sustainable practices into every aspect of urban design. For example, using green roofs and facades can not only enhance urban aesthetics but also improve air quality and reduce the urban heat island effect.

Discussions also address the impact of architecture on the psychological and physical well-being of residents. Designing public spaces that promote social integration and physical activity aligns with the broader concept of sustainable development.

The conference “Architecture of Challenges: Materials for the Future” sheds light on the complexity and multidimensionality of challenges faced by contemporary architecture. The exchange of knowledge and experiences among representatives from various fields is critical to understanding and effectively responding to the needs of both present and future generations. Discussions and presentations on innovative materials and sustainable design practices demonstrate that the future of architecture lies in a harmonious combination of technology, ecology, and humanities.

We invite you to participate in this inspiring journey towards the future, where every voice has the potential to contribute to shaping a sustainable world.

dr hab. Eng. arch. Anna Maria Wierzbicka,
professor of Warsaw University of Technology

Faculty of Architecture
WARSAW UNIVERSITY OF TECHNOLOGY

The publication accompanying Architecture of Challenges - Materials for the Future conference summarizes the discussion that researchers in architecture, urban planning and construction engineering conducted in Warsaw in June 2024. It concerned material innovations and changes that occur in architecture as a result of breakthrough technical solutions.

When shaping the living environment, architects explore materials to construct buildings, provide comfort, protect against unfavorable external conditions, also to verbalize metaphorical, symbolic messages. The relationship between architecture and materials originally tended to a tectonic dimension. Regularities observed in the natural world were adapted to the designs of human habitations and public buildings. The solutions were tested mainly by trial and error. Designers achieved certainty in founding the building on the ground, creating supports and coverings, as well as effectively binding elements into larger structures. The materials were processed using specific tools, which were also gradually improved.

After the publication of Philosophiæ Naturalis Principia Mathematica, and thanks to the development of empirical methodology, the analysis of the material stepped into the new era. It was no longer the exclusive domain of craftsmen. Mathematical models of the physical properties were developed. Operations on these models allowed for simulations and optimizations, and thanks to them, more effective use of materials. Technological inventions of the industrial era were particularly important for the emergence of new architectural concepts. Thanks to them, we gained structural steel, reinforced concrete as well as processes that guaranteed the repeatability of design patterns in the mass scale.

Even today, working with materials is the basis for architectural reflection. Thanks to the digitization of the design workshop and manufacturing processes, architecture uses CAD-CAM methods, digital processing and assembly, and 3D printing. Intelligent materials, nano-ingridients, hybrids, composites and biomaterials are used to construct buildings. All this happens to meet functional, technical, and aesthetic needs.
In the highly developed world exposed to the crisis, it is particularly important to be aware of the costs of production, use and disposal of materials. Living in a rapidly evolving environment, we need to control how we build. Limitation and moderation, which guarantee the sustainability of development, become more important than momentary satisfaction.

Expressing my gratitude to those involved in organizing a conference on Materials for the Future at our University, I am convinced it will have a real impact on improving the prospect of tomorrow. As designers, we are obliged to develop creative awareness in the spirit of responsibility. By discussing, exchanging views, as well as writing down our thoughts and presenting them to the Reader, we improve ourselves as engineers. I would like to thank all conference participants for this effort.

prof. dr hab. Eng. arch. Jan Słyk
Pro Vice-Chancellor for Studies Warsaw University of Technology

Warsaw University
of Technology

We are living in dynamic times. They bring new challenges, anxieties and promises. It is a moment when the forms of teaching, research and artistic activity alike must re-evaluate their essence. Not only in terms of content and form, but also, and perhaps above all, in ethical and social terms.

For a long time, history has revealed to us what function consciousness, science and art play in the society. Since immemorial time, these areas have been the backbone of functioning cultures and have provided opportunities for economic and social growth. Today, when the whole world is facing new challenges, we also have to notice them in the surrounding world, reality and architecture.

The conference “Architecture of Challenges - Materials for the Future” is not the first collaboration between the Academy of Fine Arts in Warsaw and the Warsaw University of Technology. The Faculty of Architecture, which is particularly familiar to me in terms of shaping the landscape, the cityscape, is the perfect partner for a dialogue about the world. About its shape, rhythm, form and tangibility.

It is extremely exciting to be able to lean together on the issue of matter. On the question of a broad, creative approach to the building fabric and the tools that become, as it were, co-responsible for the final form: a building, a painting, a photograph or a sculpture - the reality with which we interact with.

Today, I am particularly delighted that the Warsaw Academy’s key message for openness to dialogue and the search for forms of expression in various aspects of creation is taking the form of this conference.

The exchange of opinions, experiences and, above all, different perspectives on certain aspects of the action, which should never be judged one-sidedly.

I hope that the experience of the upcoming meetings will contribute to building our strength.

A strength based on diversity and creativity. A strength based on diversity and creativity. This is what I wish you and myself.

Prof. Ph.D. Prot Jarnuszkiewicz
Vice-Rector for External Cooperation and Promotion
Academy of Fine Arts in Warsaw

ACADEMY OF FINE ARTS IN WARSAW

Museums play a crucial role in preserving, researching and disseminating cultural heritage for present and future generations. Faced with dynamic technological development and changing social expectations, they face new challenges and opportunities. At a time when museums are not only being used as places to store collections, but are also becoming centers of education, inspiration and social interaction, it has become important to emphasize the role of interdisciplinarity in the context of their activities. In museums, we create new cognitive and creative opportunities, which contribute to a deeper understanding of cultural heritage and its relevance for contemporary society. In times of rapid technological development and the search for new innovations, the subject of the conference becomes particularly relevant. We are observing an increasing interest in innovative materials, which play not only a key role in the process of architectural creation, but also in the conservation of works of art, among others. We analyze the challenges of cultural heritage protection in the digital era and the application of modern technologies in the research, presentation and interpretation of museum collections.

I would like to emphasize the importance of our cooperation with the Warsaw University of Technology. The partnership between the Royal Łazienki Museum and such an influential university opens up new opportunities for both institutions. We are bringing together the fields of culture and science, creating a dynamic environment that encourages innovative ideas as well as research.

I would like to thank all the participants for their input into the scientific debate and their commitment to seek for new solutions. I would also like to thank the co-organizers of the conference: The Faculty of Architecture at the Warsaw University of Technology, the National Institute of Architecture and Urban Planning and the Academy of Fine Arts in Warsaw, as well as the Honorary Patrons and Partners, especially the Ministry of Culture and National Heritage.

Dr Marianna Otmianowska
Director of the Royal Łazienki Museum in Warsaw

ROYAL
LAZIENKI
MUSEUM

Two words about material.

The material of the house is the substance. It is the content of it. Apart from the structure of the house, it is also the most important ethical message, just as it was once an aesthetic message. Today, beauty is not what is made beautiful, but what is wise. Beauty is also something that has tangible, touchable spirit.

In the changing paradigm of building, the use of material must take into account its three attributes:

it must be durable

it must be local

it must be energy efficient.

One must also add the necessity of handcrafted, artisanal processing of the material. Only the traces of the chisel, the grinding stone or the stonecutter's cyclone leave a speck of the material's spirit. Martin Heidegger used to say: 'Craftsmanship is a rare and precious thing'.

Only in this way does the material allow the transformed space to affect us in all its fullness and richness. Only in this way does it become poetic matter.

A phenomenological approach to the field of art that is architecture indicates that only a space designed in this way can have a profound emotional dimension. It can, as Juhani Pallasmaa aims to do, play the role of reconciling us with the surrounding world. It thus has a profound existential dimension.

prof. dr hab. Eng. arch. Bolesław Stelmach
Director of National Institute of Architecture and Urban Planning

NI AiU NARODOWY INSTYTUT ARCHITEKTURY I URBANISTYKI

The materials of the future are an element of the circular economy Challenges that have arisen on a global scale in the 21st century force us to reconsider the economic model of human civilization. In order to have a future, we must move to a circular economy, or a closed-loop economy. It is an economic model that involves renting, sharing, reusing and recycling products or resources for as long as possible. The closed loop economy is based on three principles:

- Reduce (reduction in the use of resources and preference for renewable materials);

- Reuse (effective and repeated use of products);

- Recycle (restoration of products and waste for further use).

Among the main advantages of the circular economy are environmental protection, reducing dependence on raw materials, increasing competitiveness, stimulating innovation and economic growth, as well as creating more jobs. In Ukraine, where a terrible war is going on, the transition to a new type of economy is of particular importance. In the conditions of a lack of resources, the processing of construction waste, which was formed as a result of the destruction caused by the war, becomes relevant. This will help not only to restore order in the destroyed cities, but also to partially provide Ukraine with construction materials necessary for its reconstruction. According to local self-government bodies, as of the beginning of 2024, about 600,000 tons of demolition waste have been accumulated at temporary storage sites and landfills. Russia's shelling of the territory of Ukraine does not stop, so the amount of waste is increasing. But the good news is that the waste from the destruction can be processed and develop the Ukrainian economy. Currently, the processing of construction waste from buildings destroyed by Russia in Ukraine is mainly handled by international companies. Ukrainian entrepreneurs are just entering this market. The Israeli company GreenMix works with the destruction in Buch. It will implement a pilot project for the construction of a plant for the processing of construction waste in the Kyiv region and the dismantling of destroyed buildings near Kyiv. In Gostomel, 6 residential buildings for 310 families, a school for 1000 students and a children's school are being renovated. Materials from destroyed objects near Gostomel airport will be used for construction. This project is implemented by the French company Neo-Eco with the financial support of the French government. The Ukrainian experience of processing and reusing materials from demolition can be very valuable for other countries of the world that will move to a circular economy.

Oleksandr Chyzhevskyi
President of the National Union of Architects of Ukraine

Oleksandr Baranovskyi
Project Coordinator

In the realm of architectural creation, the choice of building material plays a pivotal role. This essay explores the triumphs and hurdles that will shape the future of architecture in today's fast-paced technological landscape. We delve into five thematic areas that highlight the impact of innovative building materials on architectural aesthetics, functionality, and sustainability. From embracing biophilic materials to responding to civilizational challenges through modern materials, this exploration aims to shed light on the transformative power of materials in shaping the architectural landscape.

Architecture, as an art form, is intrinsically linked to the materials used in its creation. The choice of building material not only determines the structural integrity of a building but also influences its aesthetic appeal, functionality, and environmental impact. In today's era of rapid technological advancement, architects and designers are presented with a vast array of innovative materials that have the potential to revolutionize the way we perceive and interact with architectural spaces. This essay aims to examine the role of cutting-edge building materials in shaping the future of architecture, considering their impact on human well-being, architectural aesthetics, technological advancements, economic efficiency, and urban planning.

I. HUMAN AND THE ENVIRONMENT - Embracing biophilic building materials:
Recent advancements in materials engineering have led to the development of biophilic building materials that mimic natural elements to enhance human well-being and foster a connection to the environment. Materials such as living walls, green roofs, and sustainable timber not only improve indoor air quality and thermal comfort but also create a sense of harmony and tranquility within architectural spaces. By integrating biophilic materials into building design, architects can promote health and wellness while reducing the ecological footprint of construction projects.

II. AESTHETICS OF THE ARCHITECTURAL FORM in light of innovative materials:
Innovative building materials serve as a catalyst for pushing the boundaries of architectural aesthetics. Materials like smart glass and translucent concrete enable architects to create dynamic and visually striking designs that play with light, transparency, and texture. Natural elements such as hempcrete, straw bale, and mycelium offer sustainable alternatives that inspire the creation of unique architectural forms. By experimenting with new materials and construction techniques, architects can sculpt buildings that not only appeal to the eye but also prioritize functionality, sustainability, and user experience.

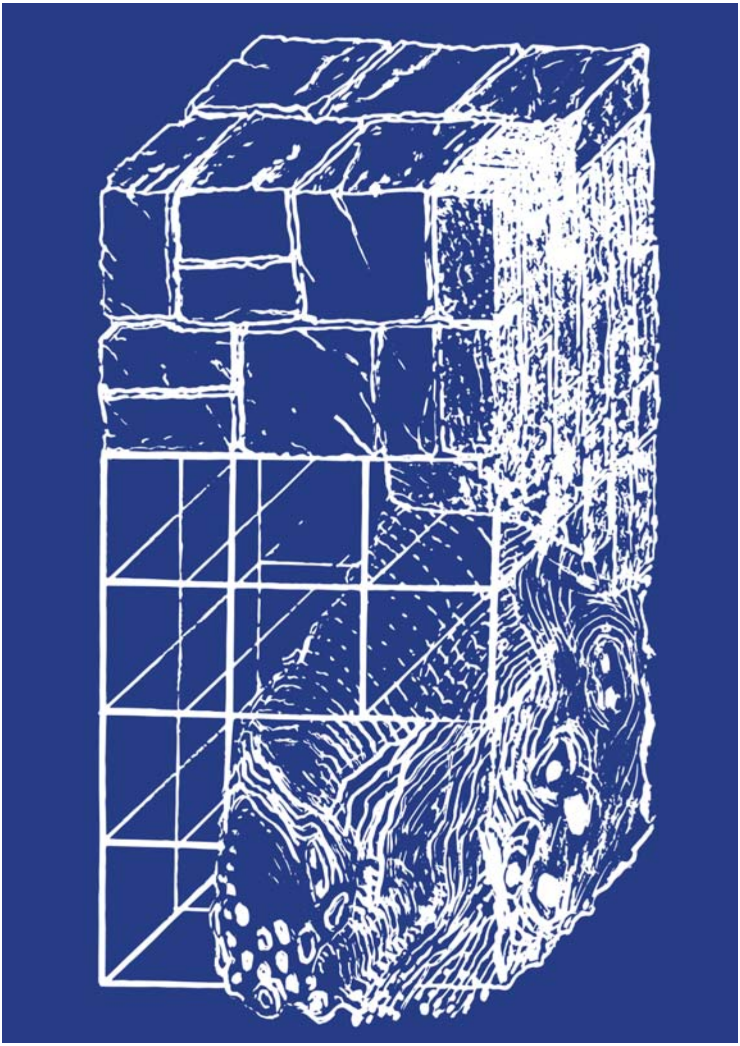
III. INTELLIGENT MATERIALS:
The integration of intelligent materials, such as self-healing concrete, shape-memory alloys, and responsive facades, revolutionizes the way buildings respond to external stimuli and internal conditions. These materials offer opportunities for monitoring and controlling crucial building parameters, optimizing energy efficiency, and ensuring the longevity of architectural structures. By incorporating intelligent materials into architectural design, architects can create buildings that adapt to changing environmental conditions and user needs, promoting sustainability and resilience.

IV. ECONOMISATION OF PROCESSES - Crafting materials for the future:
Advanced technologies in material science and construction processes enable architects to optimize solutions, reduce waste, and enhance productivity during the building process. Prefabricated materials, 3D printing, and digital fabrication techniques streamline construction workflows, minimize construction time, and lower costs. By embracing innovative construction methods and materials, architects can create efficient and cost-effective buildings that meet the demands of a rapidly evolving urban landscape.

V. RESPONSE TO CIVILIZATIONAL CHALLENGES - Integrating modern materials in architecture and urban planning:
The conceptualization and adoption of modern building materials present a unique opportunity to address civilizational challenges such as climate change, urbanization, and resource depletion. Sustainable materials like recycled steel, bamboo, and rammed earth offer environmentally friendly alternatives that reduce carbon emissions and promote circular economies. By integrating modern materials into architectural design and urban planning, architects can contribute to the creation of resilient, livable, and sustainable cities that meet the needs of present and future generations.

In conclusion, the choice of building material plays a crucial role in shaping the future of architecture. By embracing innovative materials that prioritize human well-being, aesthetic excellence, technological advancement, economic efficiency, and environmental sustainability, architects can redefine the way we perceive and interact with the built environment. The integration of cutting-edge materials into architectural design not only enhances the visual and functional aspects of buildings but also contributes to the creation of resilient, sustainable, and vibrant urban spaces that reflect the values and aspirations of society. As we navigate the complexities of the modern world, the exploration and utilization of innovative building materials will continue to be a driving force in shaping the architectural landscape and building a better future for all.

Anna Maria Wierzbicka
Maria Arno
Renata Jóźwik
Anita Orchowska
Hubert Trammer
Paweł Trębacz
Kinga Zinowiec-Cieplik
Magdalena Duda
Martyna Rowicka-Michałowska



1. AERTS BRAM

2. BOLTSHAUSER ROGER

3. BONENBERG AGATA

4. CRUZ MARCOS

5. LUDWIG FERDINAND

6. ŁĄTKA JERZY

7. MANZI ZAMUDIO GABRIEAL

8. PIOS MAGDALENA

9. ROCHE FRANCOIS

10. SCHUITEN LUC

11. STOPUL SLAVA

12. TOFILUK ANNA

13. VOSTRYKOV OLEKSII

14. WENNERSTEN EDWARD

15. WOŚ PRZEMYSŁAW

16. ZAWADZKA-SOBIERAJ ANNA, DOWGIAŁŁO JAN

17. ZIĘTA OSKAR

AERTS BRAM

Aerts Bram

ATAMA
atelier for transformative architecture
& masterplanning
Bomastraat 10
B-9000 Gent, Belgium

info@atama-mail.be

Bram Aerts founded ATAMA – known as TRANS until 2023 – in 2011 together with Carolien Pasmans. After graduating from KULeuven, he gained professional experience in Brussels and Antwerp. With more than 15 years of expertise in architecture and urban planning, he focuses on the creative direction of the office, client relations, communication and research. He is closely involved in all ATAMA projects, from conception to realization, including the Leietheater Deinze, Masterplan Pelt, the Design Museum Ghent, RITCS Brussels and the Dockside tower Brussels.

The agency received (international) recognition for various projects, such as the selection for the EU Mies van der Rohe award 2019, as laureate Big Mat Award 2019, Belgian Building Awards and the Jo Crepain prizes 2019.

Bram Aerts is a dedicated teacher at the Faculty of Architecture KULeuven Sint-Lucas Ghent and previously at the University of Antwerp and the Rotterdam Academy of Architecture. He often acts as an external jury member at design reviews.

Bram Aerts gives lectures and is a jury member in architectural competitions in Flanders, Brussels and internationally. He acts as an author and has contributed to publications such as City Made (nai 010 – 2018) and As a Theater (MER Paper Kunsthalle – 2020).

Since 2021, Bram Aerts has been a member of the Quality Chamber of the city of Ghent. In this capacity, he advises clients and designers on the quality of projects realized in Ghent.

Transformative actions

ATAMA is an architectural practice working on transformative projects with pressing social, cultural and ecological challenges. We design spatial transformations that are simultaneously autonomous and mediating in an often complex, urban context where change to the human environment can be supported in multiple ways. Our designs are inspired by history and enable repurposing in the future. We clarify what is essential in a project and allow it to emerge. Each project aims to be a generous backdrop for life.

Bram Aerts - director of ATAMA - will elaborate through three ongoing projects on how the practice is working on a transformative agenda in Flanders and Brussels.
In the botanical garden of Meise near Brussels a new building that serves the maintenance of the garden creates is about to be erected. The material from which the building will be constructed is special. It is wrapped in a heavy wall of rammed earth, a 'friendly wall' that supports the route to the boiler room and the logistically usable area. The wall does not provide the neighbors with a hard boundary but with a piece of nature. On the wall, in the microclimate under the trees, a specific vegetation will develop. At the logistics square, a number of colossal columns stand like old trees in the garden. Built from reclaimed concrete segments, the columns already have a whole life behind them. Stacked like classical columns, they are silent witnesses to the time and nature that surround the building. Seemingly built for eternity, the building is a source of materials for new constructions and a model project of circular construction.

Arlon53 – an office building in the European Union District of Brussels – is about to be radically transformed. It bears an affinity to a generation of iconic post-war buildings in Brussels, but it also has some shortcomings – dead-end outdoor spaces, a non-transparent plinth a disturbingly oversized central support structure, an undefined crown. The design will primarily perpetuate the building by preserving its characteristic load-bearing concrete façade, but will also rid it of a number of inaccuracies. The design goes beyond a technical and energy upgrade and corrects it 'à peu près'. A strategic and ambitious structural correction results in a future-proof office environment, which can uniquely take its place in the office landscape of the European district.

The Design Museum Ghent is currently being extended with a new wing that solves the missing link between the buildings on the site. As part of the project, the design team developed a new brick that combines extreme carbon reduction with processing residual streams of various materials. The bricks are made from 63% recycled municipal waste aggregates from the city of Gent and they are unfired, allowing for carbonation in atmospheric conditions and reducing the energy associated with fired brick production. A Gent Waste Brick has 1/3 the embodied carbon of a typical clay fired brick The bricks are certified for use n construction on external facing façades. Residents will be given the opportunity to make a brick as part of the museum's unique engagement program.

The project has been funded through a grant from Circular Flanders and agent, on behalf of the City of Gent, and researched in collaboration with Design Museum Gent, agent, Carmody Groarke, BC Materials, Local Works Studio and ATAMA architects.

BOLTSHAUSER ROGER

Boltshauser Roger

Headquarters
Dubsstrasse 45
CH - 8003 Zurich
Branch
Räffelstrasse 25
CH - 8045 Zurich
Boltshauser Architektur GmbH
Schäftlarnstraße 10
Kontorhaus 2, Büro 10-12
D - 81371 Munich

info@boltshauser.info

Roger Boltshauser graduated from the Swiss Federal Institute of Technology Zurich (ETH) in 1995 and founded Boltshauser Architekten AG in Zurich the following year. Currently, a team of around 75 employees works on projects in all phases, from competition and study commission to project planning and implementation planning up to and including cost management and construction management. In addition to the main office in Zurich, a second office was opened in Munich in 2021.

In addition to his practice, he was a research assistant at the Institute for the History and Theory of Architecture (gta) from 1996 to 1998 and a teaching assistant at the chair of Peter Märkli at ETH Zurich and EPFL Lausanne from 1997 and 1999. Between 2004 and 2010 he was engaged as a lecturer for design at the University of Applied Sciences Chur (HTW) and between 2005 and 2009 at the master degree course at Anhalt University of Applied Sciences (DIA) and Chur Institute of Architecture (CIA). From 2016 to 2017 he was a guest professor at EPFL Lausanne and from 2017 to 2018 at TU Munich. Since 2018 he is a lecturer at ETH Zurich.

Response

Whether the smallest buildings, temporary exhibition spaces, large housing developments, complex technical buildings or almost self-sufficient administrative buildings: At the heart of Roger Boltshauser's work is the aspiration to create convincing and sustainable architecture. His designs repeatedly produce innovative solutions in terms of the use of resources and energy. The choice of materials plays just as important a role as passive construction measures. One focus of his work has always been on earth building and its further development.

Roger Boltshauser is an advocate of an integral approach in which architecture operates at the interface between society, politics, economics and ecology. "Architecture is not just about meeting design requirements," says Boltshauser, "but also about understanding and respecting the rules of construction and creating a work that has an inherent constructive aesthetic as a result." This also means constantly questioning and, to a certain extent, redefining oneself as an architect. "Our responsibility extends beyond building to the environment, society, the place and its culture."

AGATA BONENBERG

Bonenberg Agata

Professor
Director of the Institute of Interior Design and Industrial Design
Poznan University Of Technology
Faculty of Architecture

agata.bonenberg@put.poznan.pl

Agata Bonenberg is a member of the Council for Academic Excellence (Rada Doskonałości Naukowej) under the Ministry of Science and Higher Education of the Republic of Poland. She holds the position of full professor at the Faculty of Architecture, Poznan University of Technology, where she also serves as the Director of the Institute of Interior Design and Industry Design and heads the Interior Design course of study. Additionally, she is a visiting professor at Chongqing Jiaotong University in China.

Throughout her professional career, she has worked for renowned architectural firms such as Renzo Piano Building Workshop in Genova, Italy, and has contributed to various architectural projects across Germany, Australia, and Scotland. She has been a team member for prestigious museum designs in Europe and the USA, including MUSE in Trento.

From 2014 to 2020, she taught at the Scuola di Architettura e Società and Architettura Urbanistica Ingegneria delle Costruzioni at Politecnico di Milano. Bonenberg is the author of over 120 scientific peer-reviewed publications, holds multiple patents, and is recognized as an architect and designer.

Her research at the Institute of Interior Design and Industry Design focuses on sustainability in architecture and interior design, with an emphasis on implementing new materials such as Mycelium Material for growing elements of furnishing and finishes. She also leads studies in universal, inclusive, and accessible design principles.

Exploring Micelium-Based Composites: A Fresh Eco-Aesthetic Approach to Interior Design

Mycelium-based composites (MBCs) offer an eco-friendly alternative for creating sustainable interior elements, including furniture and wall cladding elements. While these biocomposites boast numerous ecological benefits, they introduce challenges concerning aesthetics and, as a result, consumer acceptance. Products grown from living mycelium on lignocellulosic substrates have porous, irregular surfaces and coloring, deriving from their natural origins. This may evoke apprehension due to strong fungal associations. Evaluating the degree of potential user's acceptance of these materials is imperative for their integration into practical applications. The research was performed in collaboration with Poznan University of Life Sciences Sydor, M.; Cofta, G.; Doczekalska. To investigate this, a series of studies were performed, with respondents acknowledged for their expertise in interior design. The study employed prototype MBC products crafted by the authors and subjected to three complementary consumer tests. Through rigorous analysis of obtained results, human reactions were assessed to ascertain the extent of likability and aesthetic acceptance towards MBC-derived products. Findings indicated a prevailing positive or neutral appraisal of MBC materials among respondents, underscoring their potential for favorable reception. The responses after the pairwise comparison of the MBC with wall cladding samples pointed out the advantage of ceramic reference material above the MBC based on an overall assessment. The respondents also declared that the chamotte clay cladding would be easier to fit into the aesthetics of a modern interior and would be in better accordance with its style. Although the MBC was less visually appealing, the respondents found it more interesting, original, and ecological. The performed tests suggested that the respondents had double standards regarding MBCs. MBCs were generally accepted as ecological, but not in their own homes. All of these results support current and future applications of MBCs for manufacturing items where enhanced aesthetics are required. The overall positive evaluation of the mycelium-based composite (MBC) among architecture and interior design students aged 19–24 years, demonstrated that continued research into the material in question could yield good commercialization results in the coming years. The main observation is that the younger generation of designers showed a high level of acceptance for the material itself and its products. According to study participants, the MBC material can be described as "likable" and highly ecological. The wall cladding made of the MBC had advantages regarding its uniqueness, its consistency with eco-styled interiors, and the fact that it is interesting. The results of the experiments suggest double standards in the respondents. MBCs were generally accepted, but not in their own homes. It followed that MBCs were perceived as clearly ecological, but at the same time, they raised some concerns. Some people may be hesitant to use MBCs in their homes or in products they consume due to concerns about fungal growth and associated health risks. Additionally, MBCs are a relatively new technology, and there is still much to learn about their properties, durability, and applications. This can lead to uncertainty and skepticism among consumers and industry professionals alike. Working with this material and other bio-materials can lead to a paradigm shift in aesthetics in which the design is mainstream. High technology and highly sophisticated aesthetics and production methods, will perhaps soon take on a more casual, nature-like form.

Cruz Marcos

DipArch MArch PhD OASRN ARB
Professor of Innovative Environments
Co-director Bio-ID
The Bartlett School of Architecture
University College London

m.cruz@ucl.ac.uk

Marcos Cruz is an Architect and co-founder of Studio Biocene. He is Professor of Innovative Environments at The Bartlett, UCL where he co-runs the MArch/MSc Bio-Integrated Design, two award-winning masters that operate in the crossroads of architecture, biology, and engineering. Cruz's research and teaching (UCL, IaaC, University Westminster, UCLA) is aimed at creating new forms of bio-integrated and sustainable design for the future built environment, focusing on bioreceptive materials, poikilohydric design and neoplasmatic architecture (RIBA President's research award 2008). Cruz's research In addition to his directorship of the Bartlett (2010-14), Cruz was principal of the practice marcosandmarjan (2000-2014) and team member of the Kunsthaus Graz with Peter Cook and Colin Fournier (2000). Cruz published numerous books and articles, lectured and exhibited internationally, and regularly serves on juries and advisory boards.

Bioreceptive design for the Biocene

The talk explores ways to integrate biological growth in architecture as a way to create innovative materials that improve the environmental quality of cities. Against the established idea that buildings can look forever new, the proposed work embraces aesthetics of impurity derived from self-regulated growth on walls and structures that age over time. Central to what can be consider a novel ornamental dimension of design is the use of poikilohydric species (algae, mosses, lichens) that are grown on bioreceptive materials that switch on and off their photosynthetic activity without the need for irrigation or maintenance.

The disconnect between the built environment and natural world has never been greater. This has led to unjustifiable social inequalities, depletion of finite resources, and unbalancing of delicate biogeochemical cycles. In the short term, our highest priority is to reduce emissions to stem climate change. But with global populations expected to reach 10.9 billion in 2100 and our building stock to double by 2050; we don't know how our long-term future will look like. How will design processes have to change if we are to guarantee our long-term survival on the planet?

Bio-integrated design is a method that takes this question as the departure point for a vision of how we all need to define our future human habitat. It emerges from the complex relationship between specific climates, contexts and programs, and the interfacial properties of materials and organisms. Biology plays a central role that goes beyond being a simple environmental regulator, model or inspiration; it is in itself the medium of a multi-layered approach that is environmentally and socially integrated.

Illustrated projects will showcase several applications that range from prototypes and exhibition installations to small-scale building designs that are being developed in Studio Biocene and its research association with the Bio-ID lab at UCL. The work derives from interdisciplinary work methodologies traded between architects and scientists that range from lab tests to outdoor observational studies, reflecting a mix of computationally-driven forms and innovative composites. Scaled-up constructs (tiles, walls and building components) function as scaffolds in which biochemical properties, morphological variability and tectonic expression create a backdrop that both hosts and influences a complex presence of biological life in architecture.

LUDWIG FERDINAND

Ludwig Ferdinand

Technical University of Munich
TUM School of Engineering and Design
Professorship for Green Technologies in Landscape Architecture
Department of Architecture
Office Weihenstephan:
Emil-Ramann-Straße 6
D - 85350 Freising

ferdinand.ludwig(at)tum.de

Ferdinand Ludwig is Professor for Green Technologies in Landscape Architecture and Director of the Research Group Baubotanik at the Technical University of Munich (TUM). He is founding partner of OLA – Office for Living Architecture in Stuttgart, Germany. After studying architecture, he received his doctorate in "Botanical Foundations of Baubotanik and their Application in Design" from the University of Stuttgart. His research focuses on architectural concepts in which plants play a central role. Their functional and conceptual integration not only provides answers to the pressing ecological questions of our time, such as adaptation to climate change. It also poses the methodological challenge of how to deal with aspects of growth and decay, chance and probability can be dealt with in design.

Author of "Growing Architecture – How to Design and Build with Trees" (Birkhäuser, 2022) and numerous scientific articles, Ferdinand is an internationally renowned researcher and lecturer. His projects developed at the interface of research, teaching and experimental practice, such as the three-storey Plane Tree Cube, Baubotanik Footbridge or the pavilion Aborkitchen, are internationally recognised and represent a new approach to design with living trees.

Growing Architecture – Designing and Building with Trees

The term Baubotanik describes a form of architecture in which structures are created through the interaction of technical joining and plant growth by manipulating the growth of trees or their parts, joining them with each other and connecting them with non-living components in such a way that they merge into a botanical-technical entity. With their trunks, branches and roots, trees are directly tangible as "living building materials". Their growth form can be manipulated to a relatively high degree with comparatively simple technical means to be transformed into different architecturally meaningful structures. In this regard, the tree is seen as a building element, as a "living semi-finished product". Nevertheless, it must be understood as a biological entity that is in constant exchange with its environment and needs to be treated accordingly.

Baubotanik allows to create green structures as integral elements of the built environment, which are usable within a very short time and offer many ecological qualities of decades-old trees. These include, in particular, microclimatic effects such as cooling through evaporation and purifying the air by binding fine dust. Unlike purely technically minded ecological construction methods, which try to minimize the intervention in an ecosystem, Baubotanik projects are always in active exchange with their environment through their vital processes, change it and are shaped by it in their development: they adapt their shape to the light and wind conditions, react to drought, heat or frost.

In Baubotanik, the architect becomes a co-designer who – like a gardener – creates a structure together with a tree. It will never be "finished", even if the desired stages of development are reached sooner or later. For classical architecture, which in principle is always designed in contrast to nature and constructed as something as permanent as possible, this is an imposition: Neither the size nor the proportions of a building can be determined exactly by the designer. And especially in the temperate climate zones, its appearance can also change with the seasons: In autumn it first becomes colorful and then loses its leaves, in winter it is bare and may appear gnarly, in spring it sprouts again, perhaps blossoms, and in summer it is densely foliated, possibly barely recognizable as a building.

Historic examples of living architecture range from German "Tanzlinden" and Meghalaya's Living Root Bridges to simple rural practices such as hedge laying. The research into this approach takes up aspects that were already

being discussed at the legendary Institute for Lightweight Construction (IL, University of Stuttgart, Germany) in the 1970s and 80s by Frei Otto and his team. Building on these traditions, the work of research group Baubotanik at TUM and Office for Living Architecture OLA in Stuttgart develop the theoretical and practical foundations that have been lacking up to now by means of empirical studies, experimental structures and the development of design and engineering tools. In this way, the research aims to generate design knowledge that enables the conception, planning and realization of architecture with living trees and makes them applicable on a broader scale. The keynote lecture introduces the conceptual framework of Baubotanik on the basis of project examples in order to provide an outlook on future chances and challenges.

Łątka Jerzy

dr Eng. arch., Faculty of Architecture, Wroclaw University of Science and Technology

jerzy.latka@pwr.edu.pl

Jerzy Łątka, born in Bielsko-Biała (1983), Poland is an architect, designer and assistant professor at the Faculty of Architecture Wroclaw University of Science and Technology. In his designs and research Jerzy deals with paper as a building material in innovative structures as well as temporary, emergency and social oriented architecture. He gained professional and scientific experiences in international architectural practices and universities. He worked in Poland, Ireland, Romania, Great Brittan, Israel, Japan, the Netherlands and Germany. In 2013 as a student of Shigeru Ban at Kyoto University of Art and Design he took part in the design and realization of the relief Paper Nursery School in Yaan, China. In 2017 Jerzy was selected as one of the 10 top innovators under 35 from Poland by MIT Technology Review and as one of the 30 Creative Citizens of Wroclaw, Poland. In the same year Jerzy defended PhD thesis entitled: "Paper in architecture. Research by design, engineering and prototyping" and was awarded with the title of Doctor at TU Delft, the Netherlands. Since March 2021 he is a head of interdisciplinary research grant at Wroclaw University of Science and Technology TECH (Transportable Ecological Cardboard House). Following Russia's attack on the Ukraine in February 2022, Jerzy became involved in relief work, realising an emergency shelter for Ukrainian refugees in collaboration with Shigeru Ban Architects and Voluntary Architects Network Paper Partition System and Styrofoam Housing System temporary in Poland and Ukraine. Jerzy was an author of the Caterpillar Pavilions which were exposed in Brussels in April 2024 during the Festival of New European Bauhaus. Jerzy is a leader of the research and design platform on paper in architecture: archi-tektura.eu

Implementation of paper-based materials in architectural structures

Paper is a material of natural origin, with its main building component being cellulose, the most common natural polymer on the globe, with inexhaustible resources. However, due to the rise of e-readers and electronic media dominance over print media, the paper industry needs to focus on new production branches and applications for paper and its derivatives. One direction for this is the development of packaging and specialty papers, including products resistant to moisture or fire. Packaging paper, produced using a chemical method, is made from wood with long and slender cellulose fibres, usually coniferous wood like pine and spruce, to ensure the best quantity and quality of fibre bonds, resulting in high material strength. In Europe, almost 100 000 000 tonnes of paper and board are produced annually, of which 70,5% is recycled (CEPI 2022). There is a growing demand for packaging and recycled or reusable materials.

Paper products find various uses in architectural constructions, including rod elements, plate elements, or filler material (Diarte and Shaffer, 2021). Commonly used products include paper tubes, cardboard L- and U-shapes, paperboard, corrugated cardboard, honeycomb cardboard panels and cellulose wool. These are used to build everyday objects, furniture, small architecture, pavilions, as well as residential or commercial buildings. Another application area for cellulose-based materials is relief architecture, particularly in the form of emergency shelters and temporary housing.

The oldest paper building elements date back to the eighth century in the form of Chinese screens, with the earliest known Western examples from the second half of the 19th century. Paper was widely used in construction attempts post-war until the 1950s when plastics displaced it as a more viable material. The modern era of paper architecture began with Shigeru Ban, who used paper tubes in an exhibition on the work of Alvar Aalto in 1986. Although the environmental impact of the building sector was not widely discussed at the time, paper was unequivocally associated with recycled and recyclable materials (Ban and Miyake, 2009).

The biggest risk to paper-based constructions is their sensitivity to moisture and water, as well as possible flammability depending on the product configuration. To protect the material, various preparations are used, such as polyurethane or epoxy resins, water-based varnishes, linseed varnish and wax, heat-shrinkable sleeves, or a suitably designed building envelope to minimize the risk of moisture and water damage (Jasiołek, 2023).

To protect paper elements against fire, they should be properly impregnated with flame retardant agents or, similarly to protection against moisture, with barriers like fibre cement boards.

An important aspect of structures using paper as a building material is the connections between the elements. The building elements can be joined by means of glue, screws and bolts, clips or by assembling suitably prepared, incised or moulded fragments of the structure.

Given the new developments in the paper industry, the search for new, circular materials by the building industry and successful realisations with paper as a building components, it can be assumed that paper and its derivatives have the potential to be used in architectural structures.

MANZI ZAMUDIO GABRIEAL

Manzi Zamudio Gabrieal

Arquitecta Profesora Titular
Directora Departamento de Arquitectura
Coordinadora Diplomado Arquitecturas Temporales
Facultad de Arquitectura y Urbanismo - Universidad de Chile

Profesora Diplomado en Docencia de la Arquitectura, FAU, Universidad de Chile. Architect and Bachelor of Architecture, Pontificia Universidad Católica de Chile.
Postgraduate at the Polytechnic University of Catalonia, Higher Technical School of Architecture / Escola Elissava de Disenny, in Architecture and Ephemeral Assemblies, Barcelona, Spain.
Master in Project Didactics, University of Bío Bío, Concepción.
Full Professor, Faculty of Architecture and Urbanism, University of Chile.
Director Department of Architecture, FAU, University of Chile.
Coordinator of the Diploma in Architecture and Temporary Installations, FAU Graduate School, University of Chile.
Professor Graduate in Teaching Architecture, FAU, University of Chile.

Workshop on sustanaible timber architecture Chile-Japan

LIVING TOGETHER was a workshop that celebrated the 125 years of bilateral relations between Chile and Japan. During the second semester of 2022, we had the opportunity to work with the academics and students from the School of Architecture of the University of Tokyo.

This workshop was held simultaneously in both locations and offered the opportunity to attend a series of lectures with renowned professors from Chile and Japan on timber architecture.
Living Together was the guiding idea and question that brought us together:

What makes us live better in community?

What creates a better quality of life?

What are the most urgent needs that would allow for a significant step in improving community life?

The workshop proposes initial constraints: We worked with timber as the project material, and sustainability must be addressed as the axis of the project. We choose the Chilean Patagonia for his landscape and his relationship with timber construction.

PIOS MAGDALENA

Pios Magdalena

AMBIENT
Brzeska 18/15
03-737 Warszawa

ambient@ambient-architects.com

Magdalena Pios, from 2012 a member of The Chamber of Polish Architects; an alumnus of the Faculty of Architecture at Warsaw University of Technology, postgraduate studies in Timber construction at Bern University of Applied Sciences (Bauen mit Holz, Berner Fachhochschule) and Project Management at Kozminski University. One of founders and from, 2019 to 2023 the Chairwoman of the Circle of Sustainable Architecture of Warsaw Branch the Association of Polish Architects (OW SARP). Currently vice president of the Warsaw Branch of the Association of Polish Architects. Co-designer of several buildings certified with environmental certificates LEED and BREEAM at the highest levels. Since the beginning of 2023, has been leading an architecture studio, AMBIENT, implementing sustainable architecture principles into projects. In the 2024 received the Architectural Prise of the Mayor of Warsaw for the public library design in Białołęka district. Author of publications promoting the rules of sustainable design, low carbon footprint architecture and use of natural materials.

Low carbon footprint, natural origin, recycled content – materials in modern architecture

The method to using and selecting construction materials has changed over the last 30 years due to a variety of circumstances, and it will continue to alter in the future. These factors include climate change caused by CO2 emissions, the need to reduce environmental pollution, and the need to conserve natural resources. Additional aspects connected to the influence of materials on human health include the findings of human brain research on architecture perception, architectural space needs, and the relationship between architecture and wellbeing. When it came to building materials, these factors contributed to the expansion of the meaning of previously undervalued selection criteria or the emergence of new one.

Some of these criteria are based on existing building standards or norms, while others are the subject of legislation that will go into effect in the next years. Examples include CO2 emissions from material manufacture, transportation, and disposal, as well as the circular method, which aims to reuse and recycle. Current European environmental policy's most major legislation are the European Green Deal and the Fit for 55 package. As a result of these legislation, criteria for permitted CO2 emissions per square meter of built area will be established throughout Europe. The current selection criteria will be explored in the context of Ambient's architectural initiatives.

Ambient is a studio focused on sustainable design that seeks to incorporate materials with a low carbon footprint, natural origin, recycled content, and the ability to reuse or recycle into its work. For example, in the library project in Choszczówka (Warsaw), the primary structure is made of glue laminated timber, while the slabs and walls are prefabricated panels with wooden structures, fiber-gypsum plates, and wooden wool thermal insulation. Pine wood planks are utilized for the building's facade, which have been thermally treated to increase their endurance. In addition, the windows are made of wood rather than the more conventional aluminum. In the inside, playwood is utilized for wall cladding, and two types of ceilings are installed: pine wood lamelas and heraklith panels. As a result, the building's carbon footprint was lowered when compared to a building using standard technology. Materials' end-of-life status is also considered. For example, both used ceiling kinds can be dismounted and reused. Wooden elements that cannot be reused will be used as a source of energy. Consequently, no waste will be generated. Natural linoleum was utilized for flooring rather than the more prevalent PVC. The product chosen for the project incorporates 40% recycled content (old linoleum) as well as nut shells, which were waste from the food industry. In the future, it can be recycled to create a comparable product.

The second category of criteria focuses on the health and well-being of building occupants. As a result, they use materials with low volatile organic compound emissions and formaldehyde levels. The third set of features that influence the decision is related to biophilic design. The exterior cladding with varying widths of wooden boards and a beautiful pattern of utilized wood is one example of such a choice in the analyzed building. Another example is a road with a mineral surface rather than traditional concrete or asphalt. It is water permeable surfaces, but we also identify it as a natural element - earth. The new criteria for choosing building materials lead to a new aesthetic.

ROCHE FRANCOIS

Roche Francois

New-Territories
6 rue Paulin Enfert
75013 Paris, France

Instagram: https://www.instagram.com/s_heficitionmaker/
Web: https://new-territories.com

'S/he' is the principal of 'new-territories'. Androgynous, trans-gender avatar, _S/he_, created in 1994, authorized Francois Roche, native immigrant French architect to write, talk and teach on his/her behalf, as a PS / personal secretary, an Ariadne's wire of his-her ectoplasmic system and paranoiac mind.

Exhibited among other places, at Pompidou Center, SF Moma, Barbican London, CCA Montreal, Tate Modern,…selected 10 times at Venice Biennial, in national and international Pavilion, including show at Chicago, Istanbul, Shenzen, Bangkok, Sydney, Vienna Biennales respectively in 2015, 2016, 2019, 2020, 2021. Main solo experiments, at Mam, Paris in 2006, 'I've heard About', at Le Laboratoire, Paris in 2011 ''Architecture of MOODs", at Frac Orleans "s/he would rather do FICTION MAKer", France, in 2017 and the Last Solo Show Paris Oct. 2023 ''the Chamber of PastFuture".

New-Territories seeks to articulate the real and/or fictional, geographic situations and narrative structures that can transform them, with technology, biology, robotic and human natures, physiological and psychological. New-Territories emerged through the multitude of meeting points, friendship and dispute, in the hollow of critical postures and positions with sympathy, empathy, antipathy…

Among the teaching positions held by his-her P.S. F Roche, NewT has been guest professor, over the last decade, in London, Vienna, Barcelona, Los Angeles, Paris, in New-York from 2006 to 2014 at Columbia GSAPP University, six years at RMIT (2012-18), Melbourne, and Vienna at 'The Academy of Fine Arts', KHM (Digital Art School, Koln), for the last experiments.

Fugitive paradigms_Limbo the new color

ABSTRACT: Fugitive paradigms_Limbo the new color
‘’...experimentation has shifted to a new body of instrumentation, made up of tools, computation, machinisms, but also and simultaneously of fiction and lines of subjectivity, in synchronicity with our symptoms; of fear and here and now. An opportunity to explore correlated attitudes, codependent on the forms they underpin, through their conflicts and reciprocities. It’s about discovering a postdigital, posthuman world, postactivist, postdemocratic, postfeminist, a queer world... Androgynous, carnal, disquieting, disenchanting, pornographic, transitory, transactional, where the scenarios, devices, misunderstandings, psychic and physiological fragments are the very material of walls and ceilings, cellars and attics, schizoid and paranoid paranoia, in the hollows of operative and critical fictions... The androgynous folds and folds behind which... They... Hide, trigger confusions and epidermic reactions, suspicious hostilities, fantasized idealization, even premeditated oblivion.... A lecture which will unfold practices and attitudes of a native immigrant between EU Cartesianism and ASIAn Paganism Slums”

S/he_fRoche_2024

SCHUITEN LUC

Schuiten Luc

Schuiten Architecture Studio
Avenue Huart Hamoir 83a.
1030 Bruxelles, Belgique

For nearly 40 years, architect Luc Schuiten has tirelessly sought alternative solutions to environmental degradation and the banally global architecture design. Freeing himself from rigid or traditional construction, he tries to manage materials and techniques differently, focuses his research on bioclimatic houses, dreams of habitarbres (trees' buildings) - these organic dwellings in osmosis with the plant. For urban problems, he proposes to build vertical gardens from the same poetic imagination. Over the years, this atypical architect has designed a multitude of projects driven by a concern for other life choices. This way of thinking gives shape to a new architecture based on a poetic vision where invention and the relationship with nature occupy a leading place. But it is above all in his utopian visions of futuristic architecture that he will give all the strength of his creative and imaginative expression, through his proposals for cities built solely with living materials. To define these new places of life linked to another hierarchy of values, he created the neologism of architree. As with his brother François, for whom he was the scriptwriter and author of imaginary architectures, drawing is a tool for exploring future possibilities.

Luc Schuiten is responsible for the non profit Atelier d'Architecture Schuiten and the President of the non-profit organization VEGETAL CITY. He is a founding member of Biomimicry Europa and the non-profit organization Archi Human. He communicates his vision of the world through posters, conferences, books and exhibitions for which he still works on.

Towards a plants' city

Towards a vegetal city is the architect's reflection on possible forms of futuristic urban housing and functioning, which was developed with concern for the realities and material necessities of living things.
What will our future look like? We already know that it cannot be built in the continuity of our present, because planetary resources are depleting much faster than we give them time to regenerate. The visionary architect Luc Schuiten believes that we have perhaps too quickly forgotten that we are above all biological beings existing on a planet that is itself alive. In response to this reflection, he imagines new living spaces, designed from the observation of vast ecosystems such as coral reefs or primary forests. Through different futuristic perspectives, evolving over time, a coherent and poetic world, appealing to the imagination, is gradually built. Free from any constraints of development imposed by the industrial world, this futuristic projection of our environment questions our lifestyles and transforms traditional architecture. It suggests solutions for the public and individual transport of tomorrow, proposes archiborescent habitats, and studies the future of the city of Lyon, Strasbourg, Brussels, and Shanghai by 2100. These visions of a positive future are available in through the creation of a new relationship between man and his natural environment.

Lyon: The urban center is redeveloped in order to communicate with the ground level by access ramps forming a landscape of curves and undulations. The space, all meandering, is dedicated to strolling, to the pleasure of human relationships, to creation. In the railway station, the heavy trains of the 20th century are replaced by small railway cabins forming modular, flexible and light convoys.

Strasbourg: The well-exposed facades will be transformed into vast greenhouses, forming living and growing spaces. The street facades will accommodate, as grafts, espalier crops, vegetable loggias for pleasure and culture. Their roofs will become garden roofs, combining functions of thermal insulation and of chlorophyll urban.

Brussels: Its architectural art has been maintained alongside forms provided by new plant structures, grafted onto the existing building. The large parking lot in the city center has been transformed into a landing area for flapping-wing ornithoplanes.

Shanghai: Year after year, progress in biotechnology shapes the new city. Tower buildings with bio-concrete frames designed on the model of shells, bio-glass membranes resulting from radiolarian technology and the omnipresence of plants integrated into all buildings ensure the proper functioning of various ecosystems.

Luc Schuiten chose to communicate these original concepts through the grafical and pictorial mode of expression, because it effectively allows people to instantly enter his imagination. Through his lecture, he brings his drawings to life and opens a wide door of access to his futuristic visions. These original representations of a sustainable future are supported by the close collaboration that the artist maintains with biologists from the Biomimicry Europa association.

STOPUL SLAVA

Stopul Slava

balbek bureau
86P Kazymyra Malevycha St
03150 Kyiv, Ukraine

hello@balbek.com

Slava Stopul is a London-based Ukrainian digital architect working at balbek bureau. Before joining the bureau, Slava studied at the Technical University of Munich and Politecnico di Milano and worked at the HENN international architecture practice. Slava is one of the key creators of RE:Ukraine Villages, a digital tool aimed at preserving Ukraine's rural architecture. He is also engaged in balbek bureau's R&D activities, exploring ways to elevate the studio's work with AI and other technologies.

Ukraine Villages digital tool: preserving Ukraine's rural architecture with the help of parametric design

Upon hearing of parametric architecture, one usually imagines curved, complex, futuristic-looking buildings. However, the Kyiv-based practice balbek bureau used parametric and generative design principles to address the horrifying consequences of the ongoing war. The team built an accessible online constructor that aims to preserve the unique characteristic image of the Ukrainian village and simplify the reconstruction process for regular people affected by the invasion. The digital tool allows the visitors to design their new house according to the design code of a specific region of Ukraine in 9 to 12 simple steps, each presenting a predefined set of components to choose from. Eventually, on the last step, the user may opt to download a free PDF of roughly 80 pages with a detailed description of all the decorative elements, construction guidelines, color palettes, and other specifications included in the design code of the area. The project received the code name of balbek bureau's "most innovative and technological" case, as the development process brought together professionals and enthusiasts from new disciplines previously unrepresented in the practice.

As the team proceeded from region to region, the strict project deadlines made them reconsider the underlying workflow. As a result of vigorous optimization, architects succeeded in accelerating the production cycle six times from 9 months per region to only 1,5 months per region. A more thoughtful concurrent organization of field research teams, application of BIM technologies in the digitalization of the findings, and automation of technical drawings generation allowed balbek bureau not merely to speed up the pace but equally retain the depth and quality of research.

Achieving equally broad acclaim from the general public as from the professional media, the initiative granted the studio a series of collaboration opportunities with various Ukrainian and European universities and organizations. Such cooperations reveal the rising demand and interest for scalable context-sensitive architectural solutions across various socio-cultural scenarios.

TOFILUK ANNA

Tofiluk Anna

dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

Sustainable Architecture Division of
Association of Polish Architects,
Warsaw Branch (OW SARP)

anna.tofiluk@pw.edu.pl

Architect, Assistant Professor at the Faculty of Architecture, Warsaw University of Technology (WAPW), graduate of the Faculty of Architecture, Wrocław University of Technology. Academic and teaching interests: sustainable and climate-responsible architectural/urban design, ergonomics, universal design (within the framework of the Centre for Universal Design at WAPW), construction technologies in architecture with particular emphasis on prefabrication. Author of publications related to the above topics. Member of the Sustainable Architecture Division of OW SARP. Secretary of the Board of the Warsaw Branch of the Association of Polish Architects.

Activities of the Sustainable Architecture Division of Association of Polish Architects Warsaw Branch (OW SARP) with particular emphasis on the pro-environmental assessments of buildings.

The concept of built environment shaping in sustainable way has recently been introduced into the already complex process of urban and architectural design. However, the term "sustainable architecture" can be interpreted in various ways. In essence, it entails a design idea that does not harm the future generations, yet the path to achieving this goal can be understood in multiple ways. For some architects, sustainable built environment primarily involves interaction with nature and greenery, while for others, it concerns issues related to shaping urban structure, social aspects, or the low carbon footprint of materials and energy efficiency. All these aspects are crucial, and when they form a complementary whole within a single project can it be deemed sustainable.

Therefore, the shaping of sustainable architectural and urban solutions is a complex, multithreaded, and interdisciplinary problem. This is one of the reasons why there is still a lack of ready-made, unambiguous and holistic answers, and recommendations on how to design sustainably, which are also widely available (open source), concise and help the designer at all stages of the design work.

The issue of sustainability in architectural design is the interests of the members of the Sustainable Architecture Division of the Warsaw Branch of the Association of Polish Architects (OW SARP). Within the activities, members organize discussions, lectures, and workshops, participate in conferences, and other events. They provide expert knowledge, serve as judges in competitions, and are authors of publications on sustainable architecture.

An opportunity to draw on experience, confront and combine it with the work of other researchers and practitioners was provided in 2020 by the formulation of criteria for assessing buildings in terms of sustainable, pro-environmental and climate-responsible solutions for the purposes of the Mayor of Warsaw's Architectural Award (hereinafter referred to as the Award Criteria), commissioned by the City Council. The criteria were developed by experts associated with the Sustainable Architecture Division: Justyna Biernacka, Piotr Jurkiewicz (architects), Jerzy Kwiatkowski (PhD, specialist in energy efficiency and installations), Kinga Zinowiec-Cieplik (PhD, landscape architect) and Anna Tofiluk (PhD, architect).

Award Criteria can also be used for design purposes. In the architect's work, finding criteria for sustainable design that would address a wide range of pro-environmental issues is a challenging task, assuming the rejection of commercial assessment systems. Award Criteria are aimed at built objects, but the evaluation method is described in detail (along with checklists) and publicly available (open access). Although less elaborate than large-scale commercial assessment systems, they can serve as a guide on how to shape sustainable architecture.

The following list is an overview of the issues that are addressed by the criteria:
1. Site Development – history of site, natural context, biologically active terrain, trees, water retention, recreational area, fencing, green roof and walls, light pollution.

2. Mobility – access to public transportation, pedestrian priority, car parking, bicycle parking, electromobility.

3. Sustainable Facility Use – proximity to services, shared internal spaces, inclusivity, potential for adaptation.

4. Design Solutions: Structure, Materials, Details – structural design, materials, transparent partitions, solar reflectance of the building envelope, shading elements on facades, elimination of thermal bridges.

5. Energy Efficiency, Installations – energy performance, use of renewable energy sources, building air tightness, monitoring of utility consumption, emission of pollutants, internal transport, lighting installation, water consumption.

6. Comfort and Health – indoor air quality, natural ventilation, thermal comfort, daylighting, acoustic comfort, greenery in the building.

VOSTRYKOV OLEKSII

Vostrykov Oleksii

Replus Bureau
1 Soborna Sq, Lviv
79008, Ukraine

41 Devonshire St,
London W1G 7AJ,
Great Britain

Oleksii Vostrykov is a project manager in Replus Bureau in Lviv.
Every interior designer in the Replus team uses the method which changes everything. A place to live becomes a unique new universe, and a place to work converts into a state-of-the-art ordered ecosystem. The business with the Replus Bureau interior design emphasizes identity and keeps the authenticity simultaneously.
Rethinking, renovating, recycling, and reformatting create the Replus Bureau architectural language. We revitalize as many authentic elements as possible to make it a calling card of the interior.
Replus Bureau offers interior design services for hospitality, residential and commercial needs. Our cases demonstrate minimalist and stylish flats, houses, restaurants, bars, offices, and public spaces.
Oleksii Vostrykov as a project manager, successfully manage a flexible, demanding and often changing design and construction processes that require special approach and methodology in Replus Bureau projects.

Materials for the Future. Upcycling

In our time, when environmental issues are becoming increasingly important, we must actively seek innovative solutions to ensure sustainable development. My speech will be dedicated to a topic that is extremely important in this context - upcycling in the construction industry and the use of building materials. I would like to explore the opportunities that upcycling presents to us and how this idea can change our future, ensuring more efficient use of resources and creating a more sustainable and environmentally safe environment for future generations.

At this conference, I have chosen to focus on upcycling due to its potential to transform our approach to construction. The idea of upcycling and using secondary materials not only allows us to reduce waste and negative environmental impact but also opens doors to new opportunities in design, technology, and economics. Today, I would like to discuss examples of successful upcycling implementation, address barriers to its widespread adoption, and consider ways to overcome these obstacles.

The problem of the lack of a tendency to reuse building materials worldwide lies in the economic, environmental, and social impact of construction waste on our surroundings. Shortcomings in the culture of recycling and upcycling materials lead to significant resource depletion, environmental pollution, and rapid depletion of natural resources.

This problem poses numerous challenges that hinder sustainable development. Firstly, the underutilization of building materials leads to significant resource wastage that could have been reused. Every year, millions of tons of construction waste are dumped in landfills, taking up space and polluting the environment. Secondly, insufficient attention to the recycling and upcycling of building materials leads to increased emissions into the atmosphere and contamination of water bodies, which has a serious negative impact on human health and the ecosystem as a whole. For example, a large amount of old concrete and metal structures that are not subject to recycling create problems with disposal and lead to the depletion of natural resources for the production of new materials. Without effective measures to address this problem, we face the risk of further exacerbating the environmental crisis and sharply reducing the quality of life on the planet.

Therefore, manufacturers, designers, and consumers must work together to develop and implement innovative technologies and approaches aimed at reducing waste and increasing the upcycling and utilization of construction waste. Only by implementing these measures can we ensure a sustainable and environmentally safe future for all of us.

Upcycling proves to be a key solution to addressing the crisis of excessive use of building materials for two reasons: ecological and economic.

Firstly, upcycling contributes to waste reduction and environmental pollution by transforming waste into useful materials. Instead of dumping construction waste in landfills or incinerating it, we can recycle it into new building materials. This helps conserve natural resources, reduce greenhouse gas emissions, and reduce the need for extracting new materials. Secondly, upcycling opens up new opportunities for economic development by creating a market for secondary materials. Recycling construction waste can become a source of income for businesses specializing in this field and stimulate innovation in design and technology. Additionally, using secondary materials can lower construction costs, which will be a crucial factor in ensuring the affordability of housing and infrastructure for all segments of the population.

Thus, upcycling is not only an ecological necessity but also a beneficial economic strategic decision that can contribute to the development of a sustainable and efficient construction industry in the future.

WENNERSTEN EDWARD

Wennersten Edward

Dutch Bamboo Foundation
Badweg 8,
7101 JZ Winterswijk, The Netherlands

LEED AP - Leadership in Energy & Environmental Design Accredited Professional.
Founder and Natural Carbon Solutions Pioneer.
MSc. Sustainability Management, Columbia University Earth Institute, 2017.
BSc. Environmental & Business Economics, Rutgers University, 2003.

European Bamboo Research Project Dutch Bamboo Foundation with ArtEZ University

Our first collaborative research project is currently wrapping up, after starting in March of 2022. Bamboo is a promising renewable raw material which grows quickly, absorbs large amounts of CO2 and contains useful chemical and mechanical properties. Up until now, it has been imported exclusively from Asia and South America - in the near future we will have large-scale bamboo plantations in Europe. This opens up the gate for exploration into the possibilities for a sustainable bamboo supply chain. The new bamboo species grown in Europe have a slightly different composition than the tropical varieties, which means that more research is needed and much about the bamboo's properties is still unclear. So, is it possible to transform the entire supply chain into something sustainable and transparent every step of the way – from cultivation and processing raw material to the semi-finished product and design, all the way up to furniture and engineered building materials?

The lectureship and research group from the ArtEZ Tactical Design department is investigating everything that a sustainable bamboo supply chain would involve. They are collaborating with the various bamboo organizations and companies involved in growing, fibre processing, wood preservation and furniture production, including designers, students, and teachers at ArtEZ from several disciplinary backgrounds.

The first step to understand the scope of the project was to learn what shapes the current state of the European bamboo supply chain, and to find out how we could make improvements by growing locally. Location, scale, and accessibility was absolutely crucial to this project. We want to make the biggest but most realistic impact to the European bamboo supply chain.

Contextualizing the needs of increasing local sources of European bamboo and understanding innovative design use cases to construct a European bamboo supply chain for our brightest and most creative minds.

WOŚ PRZEMYSŁAW

Woś Przemysław

SWIADOM
Architectural Studio
Koszykowa 60/62 m.11, Warsaw

architekt@swiadom.pl

Przemysław Woś, architect, co-founder, designer at the ŚWIADOM studio."Świadom" is a Polish word which can be translated as "being aware". The ending "-dom", means "home".
He creates responsible architecture that takes into account and regenerates surrounding ecosystems. He spreads a new narrative of the role of designers and builds awareness among clients.
Graduated from the Faculty of Architecture at the Warsaw University of Technology and École Nationale Supérieure d'Architecture et de Paysage de Lille in France. He is a member of OSBN (the Polish Natural Building Association). For more than 10 years, he has been specializing in the design of buildings and interiors with a low and negative carbon footprint, reaching, among others, to bio-based technologies. He is always willing to share his knowledge at lectures in Europe f.ex. at the Faculty of Architecture of the Warsaw University of Technology.

Public buildings made with bio-based materials. A fragrant future.

In the era of the climate crisis, where the construction sector is responsible for almost 40% of greenhouse gas emissions, with concrete production alone contributing to 8%, in a world where resources are finite, construction sand will run out and iron mines will be depleted in few decades - we need to take action. We have the tools, knowledge, and proven technologies for this.

One of the solutions is to use low-emission materials with zero or negative carbon footprint, such as bio-based materials.

In Europe, the first residential buildings, constructed in a manner similar to today's practices and capable of meeting even current thermal requirements, recently celebrated their centenary. They were built by the architect and inventor Emile Feuillette in France. These were single-family homes.

Although today we still design such buildings, we know that multi-family buildings have a greater environmental sense in terms of their footprint. They consume fewer materials, less land, and less energy per inhabitant. The impact on more optimal urban planning is also a significant argument. Today, we can create such facilities and neighbourhoods using low-emission materials.

In recent years, attention has been drawn to the amount of energy consumed during the operation of a building. This is important, but it only addresses part of the problem. Today, it is crucial to examine the investment impact throughout the building's life cycle (LCA - Life Cycle Assessment). From planning and investment preparation, through the operational period to the disposal of materials used for construction. In this category, one of the most interesting solutions is the use of bio-based materials.

To change trends in the construction sector, apart from legal pressure, it is good to showcase good examples. Building trust among private citizens and the entire investment sector. In many European cities, local authorities are leaders in this regard. Investments in public facilities pave the way for changes commensurate with the challenges we face today.

France is a leader in such efforts in Europe. The number of investments realized with straw insulation has exceeded 10,000 buildings. These include predominantly public facilities such as schools, offices, and multi-family residential buildings. Other countries are following a similar path, each adapting to the legislative circumstances that apply.

The criterion adopted for selecting examples in the presentation was the function and area of the building, the use of bio-based materials, and possibly low-tech technological solutions.

One example I would like to mention is the "Les Boutours" kindergarten in Rosny sous Bois, France, on the outskirts of Paris. The investment completed in 2014 was the first of its kind that the city decided to undertake.

Les Boutours is a project by Atelier d'Architecture LA RUCHE. It has a usable area of 2500m2. Its walls are made of prefabricated wooden structural-insulation panels filled with straw. The roof structure was designed to support a real active vegetable garden of 600m2 for the school's students. The facility meets passive energy standards. Ventilation equipment has been minimized thanks to the use of Canadian wells (ground heat exchangers) and natural ventilation, supported by indoor and outdoor air quality sensors. The paints used inside are prepared based on oils from local plants.

Following the success of this investment, the authorities ordered another 4 facilities using similar technology, each time with more bold solutions.

In France, England, Germany, Denmark, the Netherlands, and other European countries, we can see how the growing awareness among local governments and society translates into trust in low-emission architecture and an appreciation for its impact on the health of users. As a result, we are witnessing an increasing number of such projects being implemented.

My goal was to demonstrate the popularity and feasibility of such projects on a larger scale.

ZAWADZKA-SOBIERAJ ANNA, DOWGIAŁŁO JAN

Zawadzka-Sobieraj Anna

Dowgiałło Jan

mech.build ecological architecture studio.
ul. Grójecka 40/31, Warsaw

Natural Construction's National Association

Anna Zawadzka-Sobieraj - sociologist, architect.
Built Environment Manager at Materiality sp. z o.o., specialist for the introduction of EU criteria for environmentally sustainable activities related to Taxonomy in development investments. From 2019 to 2023 on the Board of Directors of OW SARP, plenipotentiary for natural construction. In the Jury of the Architectural Award of the President of the City of Warsaw (2021). Co-author of a currently completed grant (on behalf of project partner OSBN): 'Decarbonisation of building processes - introducing natural materials with a zero-carbon footprint, including wood into the circular economy in construction'. Project leader EIA PIB, grant amount €744,951 under the EEA Funds. As part of the grant, she was the content editor for the development of the Investor's Guide to Natural Building. She cooperated with the Ministry of Climate, in the team of experts of OW SARP, in the development of concepts and regulations and judging of competitions, and the organisation of the conference DOM Z KLIMATEM (HOUSE WITH CLIMATE).

Jan Dowgiałło - architect
Expert in the Urban Planning and Architecture Commission and the Pracownia Zmiany Foundation (in the field of inclusive and regenerative urbanism). Designer of small and large, permanent and temporary forms, academic lecturer and DIY builder. Specialist in urban prototyping, regenerative design and the use of local, natural and upcycled materials and green and energy-efficient technologies in architecture. Co-author of the Investor's Guide to Natural Building.

Decarbonisation of construction processes - introducing zero carbon natural materials, including wood, into circular construction

Natural construction is not a new discovery. It is based on traditionally used materials - clay, straw, hemp, earth, timber, locally sourced from the surrounding environment. For this reason, it evokes associations with ancient architecture, open-air museums, and manual construction of buildings that seems inadequate for the present day.
Nothing could be further from the truth. Modern natural construction is based on optimisation of component production and the building process.

This is clearly demonstrated by the implementation of the grant project “Decarbonisation of construction processes - introducing zero carbon natural materials, including wood, into circular construction”. The project was led by The Institute of Environmental Protection – National Research Institute (IOŚ) partnered by the Polish Natural Building Association (OSBN). Funding worth €744,951 was received from Iceland, Liechtenstein and Norway under the EEA Funds.
The results of the grant are: substantive studies, including sets of recommendations and laboratory results; educational activities, including the preparation of a curriculum for universities; and an information campaign.

The study verified the use of technologies based on natural materials as a tool for decarbonisation of the construction industry. Natural building solutions reduce emissions in the production of materials, the organisation of the construction process, operational footprint of the building and the disposal of construction waste. Efforts to reduce emissions in the building sector have so far focused on reducing ‘operational’ carbon emissions from buildings, i.e.: heating, cooling and lighting. Much has been done to increase the energy efficiency of buildings. However, the production processes and management of building materials during the construction and post-use phases are also significant contributors to emissions.

As suggested by Dyson et al. (2023), switching to biomaterials could lead to cumulative emissions savings in the construction sector of up to 40 per cent by 2060 in many parts of the world.

The results of the research work proved that natural building techniques fit into the principles of cradle-to-cradle economy. As biodegradable materials circulate in a closed biological cycle, they undergo natural decomposition and return their nutrients to the earth, regenerating nature. Demolition waste from buildings made of natural materials can be easily managed and can be reused even within the same project.

Benyus (2014) points to the need to stop the industrial ‘exhalation’ of pollution and to learn to ‘breathe’ carbon dioxide into products and store it for centuries. The grant also demonstrated the validity of the use of natural materials in relation to the legislative action taken by the European Union to achieve climate neutrality.

The first designs for multifamily buildings based on the criteria in the EU taxonomy, or DNSH (Do No Significant Harm) principle, are currently being prepared. One of the DNSH rules defines an acceptable level of emissions of VOCs - volatile organic compounds or formaldehydes. According to Berge (2009), building materials that emit gases or dust can cause health problems for their occupants or users; primarily allergies, skin and mucous membrane irritation. Materials of plant and organic origin are non-toxic.

The study paid particular attention to natural construction materials such as straw, hempcrete and rammed earth as well as finishes like tadelakt, clay or lime plasters, including their applicability in conventional buildings. The possibility of using natural materials in renovations and thermal upgrades is also presented. This is a sizable part of the construction industry that has been so far practically taken over by carbon-intensive materials. In addition, an important aspect of natural technologies is the ability to create vapor diffusion-open walls which allow buildings to ‘breathe’. Buildings undergoing renovation were often originally constructed as diffusion-open, but under- or non-insulated. The use of non-breathable insulating materials often worsens the humidity conditions of renovated buildings and promotes the growth of fungi and mould.

ZIĘTA OSKAR

Zięta Oskar

architect | process designer | artist
Zięta Studio
ul. Stanisława Moniuszki 29/2
51-610 Wrocław, Poland

info@zieta.pl

Architect, process designer and artist. As a doctoral student at ETH Zurich, under the supervision of Prof. Ludger Hovestadt he conducted his first work on the properties and processes for optimizing the production of steel components. Fascinated by the creations of French architect Jean Prouvé, Oskar Zięta asked himself what a world of bionic metal structures could look like using the potential of new technologies. Thanks to his consistent work and dedication, almost two decades after raising his first questions about steel, today he is called sculptor 4.0, and Wired magazine has hailed his objects as "furniture of the future." He is the creator of the world's first inflatable steel profile, whose capabilities he demonstrated in 2010 by designing the Blow & Roll installation for the Victoria and Albert Museum in London. He has received numerous design awards, including the Red Dot Design Award (2008), the Schweizer Design Preis (2008), the German Design Council Prize (2009), and the Audi Mentor Prize (2011). His NAWA urban installation (Wrocław 2017) was nominated for the prestigious European Union Prize for Contemporary Architecture, the Mies van der Rohe Award. Zięta's works are in the collections of the Museum für Gestaltung in Zurich, the Pinakothek in Munich, the Museum of Fine Arts in Montreal, and the Centre Pompidou in Paris, among others. Zięta's achievements are founded on his proprietary method of forming steel with internal pressure, FiDU, which has led to the release of such icons as the PLOPP stool and the ULTRALEGGERA chair. In his creations, he manifests a passion for constant discovery of material potential and the artistry of interdisciplinarity. Oskar Zięta lives in Wrocław, where he runs the Zieta Studio, inextricably linked to Zielona Gora, where the production workshop of metal-pumped realizations is located.

The Potential of Deformed Steel Profiles in a Sustainable and Ultralight Perspective

Architecture has always been full of challenges. Today, these challenges are amplified by the pace of technological development, automation, and artificial intelligence. Concurrently, designers and manufacturers are increasingly expected to think and act sustainably. I have adhered to this idea from the beginning of my journey in architecture and design, designing solutions, objects, and processes. One of the key areas of my studies, as well as challenges in architecture, is increasing the strength-to-weight ratio of structures. Strength, meaning safety, durability, and longevity. This process is grounded in the principle of reduction – the maximum reduction of material used to produce a given element. This, in turn, leads to the concept of ultralightness, which I apply on many levels. In design, I introduce literal ultralightness – tangible, and virtual ultralightness (replacing gigabytes of data with kilobytes).

The foundation of the above is the FiDU technology, a technology of free deformation, deforming with internal pressure. During my research work at ETH in Zurich, I sought the appropriate technology for stabilizing thin steel membranes for architecture, design, and other engineering fields. During analyses, I often observed the so-called DIN 8580 error, which signals to an engineer: incorrect deformation/error/ the result of this deformation is not correct. I did not dismiss imperfect constructions; I was fascinated about those ultralight constructions emerged, which could be adjusted to the designed shape and could be fitted to the force arrow with cross-sections. I was heavily criticized, but I believed in the sense of my actions. I believed and still believe in an ultralight and monomaterial future. This is only possible through conscious design. Unfortunately, many revolutionary ideas die in closed drawers or today on hard drives.

For me, the prism of FiDU's potential is design. Functional objects are technological manifestos but also a safe area for testing large-scale solutions. The starting point is the world's first rolled steel profile, stabilized solely by internal pressure. The tightly edge-welded membranes respond quickly and spontaneously when air is injected between them. The key to working with deformation is prediction, but also trusting the material's freedom – controlled loss of control. Of course, the less load-bearing the construction, the more freedom in design. However, I know that synergy and lack of radicalization allow for a compromise between these two worlds. Control and its absence. Paper and algorithms. Hot molten metal and ultrathin sheet metal membrane.

Stabilizing metal structures with internal pressure is an alphabet of solutions for architecture, heavy industry, and space exploration. An alphabet of ultralight solutions, precisely tailored to form and force arrows, in contrast to standard profiles, in defiance of an overly heavy and often oversized world. FiDU technology answers loudly asked questions about sustainable development, ultralightness, and monomateriality. Only today, combined with parametric design and the computational potential of algorithms, does FiDU maximize its potentials. It is a technology that allows for the optimization of the design and production process, but also for the maximum utilization of material. It involves advanced computer simulations, studies on the characteristics of each of the 2000 metal alloys, choices, and decisions. It is an invitation to the world of tailor-made metal constructions.

1. Achramowicz Radosław, Kuhnert Ewa
2. Arno Maria
3. Bąbik Jakub, Kwieciński Krystian
4. Bazylevych Viktoriya, Trębacz Piotr, Pieńkowski Jakub
5. Bilous Olena, Kwieciński Tomasz Kosma
6. Bonenberg Agata
7. Bonenberg Wojciech
8. Celewicz Piotr
9. Chudzińska Agnieszka, Orchowska Anita, Omotara Adebayo, Hassan Ahmed Somia
10. Dąbrowska-Żółtak Karolina
11. Duda Magdalena
12. Farenyuk G
13. Gawalak Agata
14. Gawell Ewelina, Wardzińska Agnieszka
15. Gawell Ewelina, Paleski Tomasz
16. Gołębiewski Michał
17. Goncikowski Marcin
18. Idak Yuliya, Hnes Liudmyla, Anita Orchowska, Pavlenko Tetiana
19. Jorgen Artur
20. Jóżwik Renata
21. Kalata Szymon
22. Kaplinska Mariana, Bokalo Ihor
23. Kashchenko Oleksandr, Kryvoruchko Yuriy, Tovbych Valerii
24. Kaufman Maciej
25. Kędrzyńska Martyna
26. Klimowicz Joanna, Nowak Anna
27. Koznarska Halyna, Zinowiec-Cieplik Kinga
28. Kryvoruchko Yuriy, Voronych Yaryna
29. Kryvoruchko Yuriy, Wierzbicka Anna Maria, Voronych Yaryna
30. Lasocki Maciej
31. Linda Svitlana, Sosnova Nadiya, Kaufman Maciej

32. Ławińska Katarzyna, Miśkiewicz Katarzyna, Lasoń-Rydel Magdalena, Masłowska-Lipowicz Iwona
33. Łątka Jerzy, Jorgen Artur, Pawłosik Daria
34. Nawrocka Marta, Szymanik Maciej
35. Neumann Magorzata
36. Nowak-Pieńkowska Małgorzata
37. Nozaki Tsutomu
38. Onufriv Iaryna, Lukashchuk Halyna, Duda Magdalena
39. Orchowska Anita, Chudzińska Agnieszka
40. Pavliv Andriy, Kvasnytsya Roksolyana, Strzelecki Filip
41. Pavliuk Nataliia, Pavliuk Yustyna, Arno Maria
42. Pawłosik Daria
43. Petryshyn Halyna, Trębacz Paweł
44. Podhalański Boguslaw
45. Rowicka-Michałowska Martyna
46. Rybarczyk Tomasz, Drobiec Łukasz
47. Siennicki Mirosław, Barcewicz Wioleta, Wierzbicki Stanisław
48. Sigurtà Davide, Longo Olivia, Vazzoler Alessandra
49. Stankiewicz-Świniarska Ewa
50. Strzała Marcin
51. Sworczuk UWrWszula
52. Świniarski Bartosz
53. Tarczewski Romuald
54. Terelak Marcelina
55. Trębacz Paweł
56. Trębacz Piotr, Pałczyński Łukasz, Gago Wiktor
57. Tulkowska Karolina
58. Uścinowicz Jerzy
59. Vazzoler Alessandra, Giovanni Plizzari, Longo Olivia, Sigurtà Davide
60. Wierzbicka Anna Maria, Ławińska Katarzyna
61. Wrona Mariusz
62. Zinowiec-Cieplik Kinga

Achramowicz Radosław
dr hab. Eng. arch. associate professor,
Warsaw University of Technology,
Faculty of Architecture

radoslaw.achramowicz@pw.edu.pl

Kuhnert Ewa
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

ewa.kuhnert.dok@pw.edu.pl

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Growing Architecture as an attempt to address contemporary challenges related to circularity

What does it mean Growing Architecture? It is certainly the variability of the form, program and function of the object. Looking from different point of view it is also the physical variability of material, structure and construction. The aim is to research another aspect – biochemical conversion – which is reflected in circularity, a term derived from economics and reflected in modern architecture.

Contemporary, the process of shaping and transformation is becoming more important than the final product. This variability has long existed in architecture, but today's novelty is everything that has the prefix ""bio"" and which is reflected in bionics – it all draws inspiration from the kingdom of animals, plants and fungi. We approach the above inspirations using the project analysis method: fauna is represented by laboratory culture of animal cells – In Vitro Meat Habitat from 2011; flora is shown through the tree house named Fab Tree Lab developed at MIT in the early 2000s, while the last one example – fungus can be observed in the 2014 Hy-Fi Tower. Despite formal diversity together with different material and construction approaches, the above examples have one parameter in common, that is a priority for the modern world – biodegradability.

The first example, In Vitro Meat Habitat by Mitchell Joachim, is a vision of a house built from meat cells grown in the laboratory (Carrington, 2015). The process involves obtaining muscle cells from a living animal (Post, 2012), grown under appropriate conditions to achieve a para-architectural form and structure. In the designer's intention, a completely natural coating could in the future replace a traditional wall with a structure consisting of tissue, skin and bones. The growth of meat cells would enable the controlled production of building materials that evolve according to user needs and changing environmental conditions.

Another example is the concept of Fab Tree House created by Joachim also, who combined traditional construction techniques with vegetation (Heinonen, 2013). Instead of conventional materials such as concrete or steel, the house's frame is constructed from growing trees to create a ""living"" spatial structure in which apartments can be located. The changeability of form over time is a crucial aspect here; it is the living trees that develop, giving the buildings a dynamic structure.

The last project is Hy-Fi Tower, where the main building material is fungus (Benjamin, 2014). The major design challenge was to prevent the degradation of the bearing material – the substructure on which fungi grow and feed. For this purpose a three-layer wall was used: the interior is the core of the structure made of an organic substrate on which fungi grow; the next two layers are fully organic bricks, which provide insulation and durability. The entire structure is integrated to safely facilitate the growth of fungi, while shaping the architectural form.

The structures grow in all presented here examples, it has result in subtly evolving buildings. Meat, trees, and mushrooms change shape and size, adapting to the architect's set conditions over time. Mentioned conditions include general size and program parameters, with particular emphasis on the number and type of users. Like any organism, the buildings mentioned here are characterised by phases of "birth", "growth" and "dying". Due to the properties of the materials described, we can formulate a final conclusion: the entire building can decompose and transform back into natural matter, without causing long-term environmental pollution (Muniyasamy, Karthikeyan, Nagarajan, 2019) - corresponds with circularity.

Arno Maria
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

maria.arno@pw.edu.pl

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Challenges of architectural heritage protection in times of climate crisis

The scientific approach to the protection of monuments has been developing ever since the 18th century. In the 20th century, the protection of monuments took on an international character. In 1931 in Athens, at the First International Congress of Architects and Technicians of Historic Monuments, universal principles of conservation activities were defined. The Athens Charter raised, inter alia, two important points: integration of monuments with the modern world, i.e. the use of historic buildings to ensure the continuity of their existence; preserving the character of historic cities by protecting entire complexes and views (Szmygin, 2015). Since then, several dozen international documents have been created, mainly by UNESCO and ICOMOS, specifying the principles and guidelines for the protection and conservation of material cultural heritage – buildings, building complexes, and cultural landscapes.

For heritage buildings, the most important external factors are cultural, legislative and policy frameworks that protect the historic environment and determine the scope of permissible renovation (Konarzewski, Jeleński, 2022, p. 11). It is also essential to consider conservation as a process in which it is important to think ahead rather than to focus on the needs of today. The overriding goal is to sustain the heritage for future generations. Thus, the theory of monument protection is, in a sense, a precursor of sustainability thinking. The challenge is to find methods that will effectively protect the cultural heritage, respect authenticity and the principle of minimum intervention while maintaining the usefulness of historic buildings, limit their negative impact on the environment and climate, and strengthen their resilience and resistance to threats (Konarzewski, Jeleński, 2022, p. 31).

The adaptation to a new function of a building is a one of the possibilities to preserve material heritage of the past, but also as an attempt to save the intangible values that are important for the local community, as these buildings play an important role in maintaining social bonds and identity, participating in the construction of memory and the experience of continuity. Therefore, the adaptation of heritage buildings to contemporary functions, and the improvement of their utility standards, including energy efficiency, is acceptable from the conservation perspective. Adaptive reuse is not an emerging theme or a trend, but the constitutive nature of heritage, just as resilience is not a recent challenge, but the way of life of communities and their heritage" (Weir, Wijnia, 2024, p. 343).

Heritage conservation might also apply to the townscape as part of the wider landscape. Therefore, it requires the integration of various types of spatial, social, economic, and environmental aspects. Adaptive reuse is a form of sustainable urban renewal as it prolongs the building's life. It is not only a process of converting buildings by recycling their usable components for a new use, but also a method and strategy that can be used to preserve cultural heritage. It is a process of renovating the old or obsolete building while maintaining the historic and cultural heritage and create a new dynamism in line with the spirit and requirements of the times. There is a growing global awareness of limited resources, expanding ecological footprint and climate change caused by excessive carbon emissions (Stone, 2020).

Heritage conservation has a multifaced nature and should be analyzed from several perspectives – conservation, modernization, heritage, climate, theory and practice.

Bąbik Jakub
Eng. arch.

jakub.babik2.stud@pw.edu.pl

Kwieciński Krystian
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

krystian.kwiecinski@pw.edu.pl

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Computational form-finding of acoustic surfaces for increased patient comfort in hospital

Hospitals play a crucial role in the healthcare system, presenting design challenges on many levels. One of the fundamental design considerations in hospitals is acoustics, which can negatively affect blood pressure, heart rate, respiratory rate, cognitive function, and sleep quality (Amanda Ampt, Patrick Harris, and Michelle Maxwell, 2008). World Health Organization (WHO) guidelines indicate recommended noise levels in hospitals, which are often far exceeded (de Lima Andrade et al., 2021).

In assessing noise in hospitals, the most relevant parameters are sound pressure level (SPL) and reverberation time (RT60) (Salehi, Karimina, Saleh, 2019). There are various methods to improve acoustic comfort by changing the room's geometry and/or finishing materials, such as adding acoustic panels (Deng, Xie, and Kang, 2023; MacLeod et al., 2007). In hospitals, acoustic ceilings are made of acoustic panels, mostly mineral wool, carbon foam, or fabric. These materials are characterized by different noise reduction coefficients (NRC). Typically, acoustic panels are uniformly fixed under the ceiling. However, in hospital rooms, primarily, patients' acoustic comfort should be improved. The study aims to find the optimal form of the acoustic ceiling to improve the acoustic comfort of patients in hospital beds by minimizing the sound power reaching them.

Methods

The simulation study uses a ray tracing method to track sound rays from the source (a person standing at a patient's bedside). The method simulates sound propagation by calculating the power of rays and sound pressure at the receiver location (the head of the other patient in the bed on the opposite side of the room). For the study, a digital model of the hospital room was equipped with a parametric ceiling consisting of triangular panels. The form of the ceiling could be changed by modifying the Z-axis position of each vertex. The ceiling would be digitally fabricated from panels like Auralex (NRC value of 0.8).

An optimization algorithm performed a form-finding of the acoustic ceiling, minimizing the sound power reaching the patient in the hospital room. The implemented method analyzes the effect of a suspended ceiling on acoustical conditions, adjusts its form by changing the position of control points, assesses improvement in acoustics, and then makes changes again till finding the best solution.

Results

The first situation presents the distribution of sound propagation rays hitting the receiver in the case of a completely flat ceiling. The distribution of sound power ranges from 13.87 W to 15.44 W, and the sound pressure level at the receiver is 33.44 dB.

Studies were performed to evaluate various forms of acoustic ceilings. The final geometry of the ceiling favorably affects the propagation of sound rays in the room. The resulting geometry made it possible to reduce the number of rays reaching the receiver. The solution with the best acoustic properties reduced the sound power at the receiver by 3.23 dB, yielding a result of 30.19 dB.

Studies demonstrate that tailoring the geometric shape of acoustic ceilings enhances acoustic comfort by dispersing sound waves and reducing noise exposure for patients. However, the static nature of current designs may not adequately address dynamic hospital environments. Three potential strategies for improvement include optimizing static forms to minimize average sound levels, implementing dynamic structures that adapt to changing conditions, or adopting a compromise approach with select stages of variable geometry. Further research is underway to assess the feasibility of these strategies.

Bazylevych Viktoriya
dr Eng. arch.,
Lviv Polytechnic National University,
Architecture and Design Institute

bazylevychv@gmail.com

Trębacz Piotr
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

pt@ati.waw.pl

Pieńkowski Jakub
mSc. Eng. Arch,
Warsaw University of Technology,
Faculty of Architecture

jakub.pienkowski@pw.edu.pl

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Materials for sustainable development and resilience in the architecture of resort-based hotel complexes of the world in 2019-2021

The architecture of resort-based hotel complexes must cater to the tourist's interest and provide comfortable lodging. However, the most pressing task of the present and the future is to ensure the sustainable development and resilience of buildings. Therefore, the aspect of the rational selection of materials with the optimal ratio of the size of their ecological backpack and constructive, form-forming, and aesthetic qualities is important.

Trends in the use of materials in 24 newly constructed resort-based hotel complexes in 2019-2021 across countries such as Portugal, Italy, France, Norway, Croatia, Slovakia, Turkey, the USA, Brazil, Mexico, the Republic of the Maldives, Indonesia, Thailand, India, South Korea, Japan researched precisely from this point of view.

Among the most commonly used in these types of hotels are such well-known materials in the architecture of previous centuries as concrete, rammed soil, various types of natural stone, various types of wood, brick, metal, glass, plant fibers of various types.

The expertise of the designer, constructor and craftsman, as well as modern technologies, made it possible to ensure strength and achieve perfect finishing and a variety of surface tactile textures from these materials.

Trends in the use of materials in the architecture of resort-based hotel complexes of the world in 2019-2021, which ensure their sustainable development and resilience:

- the use of natural materials like rammed soil, natural stone, brick, wood, glass, metal, , and plant fibers, which are long-lived and eco-friendly, can be reused, recycled and decomposed without harming the environment;

- the use of locally-sourced materials that are found directly on the site such as soil or nearby such as bamboo and produced in a local factory like bricks. This shortens their supply chains to the site and can significantly reduce the carbon footprint;

- involvement of craftsmen from local communities in the production and processing of materials, including manual work such as brick-making. Manual work is the most eco-friendly type of work. However, there are risks of using slave labor, which goes against the sustainable development goals;

- processing of materials that creates new tactile textures or emphasizes their natural visual texture. This reduces further operating costs for the care of elements made of these materials. For example, aestheticization of the surface of concrete walls with prints of bamboo, formwork made of cedar or coconut wood will need a minimum of additional care in the future. Weathering, fading, minor chipping of the surface will only give it additional decorativeness;

- a more optimal selection of the use of materials in architectural elements. For example, the use of very thin glass partitions in rooms with high humidity such as bathrooms and saunas;

- the use of translucent materials for enclosing structures not only in residential premises but also in restaurants, lobbies, saunas. This is done to ensure the visual connection between these premises and the surrounding landscape and the formation of a healthy human environment (Sustainable Development Goal #3).

The rational selection of materials, their optimal processing and thoughtful application, the choice of the shortest supply chains, and the involvement of craftsmen from local communities - these are the approaches that ensured the sustainable development and resilience of the architecture of resort-based hotel complexes of the world 2019-2021, while simultaneously ensuring the extraordinary aesthetics of their environment.

Bilous Olena
Eng. arch.,
National University Lviv Polytechnic,
Architecture and Design Institute

olena.y.bilous@lpnu.ua

Kwieciński Tomasz Kosma
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

tomasz.kosma.kwiecinski@pw.edu.pl

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The use of sandwich panels in the construction of housing for internally displaced persons

The urgent need for rapid and efficient housing solutions is paramount in regions grappling with displacement due to conflict, natural disasters, or urbanization. Addressing this challenge requires innovative approaches prioritizing speed, affordability, and sustainability. One of the effective ways to construct residential buildings is to use frameless rapid construction technology of modern, energy-efficient sandwich panels [1]. The lightness of prefabricated elements and system connectors enables the quick construction of objects. Nevertheless, many issues should be recognized to rationally shape residential facilities, such as ensuring structural safety, functionality, thermal comfort aesthetics, etc. Contextualizing the global need for efficient housing solutions underscores the relevance and urgency of exploring the potential of frameless rapid construction technology. While the immediate focus may be on regions such as Ukraine facing internal displacement, the principles and advantages of this construction method extend to diverse contexts worldwide. The comprehensive analysis of this construction method's positive and negative aspects is essential for informed decision-making and effective implementation as manufacturers push to minimize costs and maximize allowable spans [3].

A sandwich panel is a building material with a three-layer structure: two sheets of rigid material (metal, PVC, fiberboard, magnesite board) and a layer of insulation between them [2]. All parts of sandwich panels are glued together by hot or cold pressing. Depending on the purpose, roofing and wall panels are distinguished. In residential construction, sandwich panels are used to build prefabricated frame houses. The adoption of modern materials like sandwich panels over traditional bricks and foam blocks is attributed to several advantages:

1. Speed of Construction: Sandwich panels enable rapid construction, significantly reducing the time required for building completion. The lightweight nature of these panels facilitates swift assembly, eliminating the need for expensive specialized equipment and minimizing construction timelines.
2. Low Weight: The lightweight characteristics of sandwich panels lessen the structural demands on the building's foundation and frame. This allows for the use of more straightforward foundation types, reducing earthwork requirements and enabling construction even in unstable ground conditions.
3. Year-Round Construction: Unlike conventional building methods that weather conditions may restrict, sandwich panel construction can proceed throughout the year. The absence of reliance on concrete solutions makes this method resilient to low temperatures, ensuring consistent progress regardless of seasonal variations.
4. Minimal Finishing Requirements: Sandwich panels arrive at the construction site ready for installation, eliminating the need for extensive finishing works like plastering or painting. This saves time and labour costs, with the option for additional finishes such as siding or natural stone for aesthetic enhancement.
5. Built-In Thermal Insulation: Sandwich panels offer superior thermal insulation properties, maintaining comfortable indoor temperatures and reducing energy consumption. Compared to traditional building materials, they provide significantly higher levels of heat retention, enhancing energy efficiency and reducing heating costs.
6. Hygienic and Pest-Resistant: Sandwich panels are inherently resistant to pests and mould, eliminating the need for chemical treatments. Their composition and construction make them unappealing to rodents and insects, ensuring hygienic living conditions for occupants. In conclusion, frameless rapid construction technology using sandwich panels represents a promising solution for addressing the global need for efficient and sustainable housing. While initially deployed in response to urgent crises such as displacement in Ukraine, the principles and advantages of this construction method transcend geopolitical boundaries and offer scalable solutions for diverse housing challenges worldwide. Through informed analysis and strategic implementation, frameless rapid construction technology can play a pivotal role in advancing equitable, resilient, and sustainable communities across the globe.

Bonenberg Agata

Bonenberg Agata
prof. dr hab. Eng. arch.,
Poznań University of Technology,
Faculty of Architecture

agata.boneneberg@put.poznan.pl

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Exploring Micelium-Based Composites: A Fresh Eco-Aesthetic Approach to Interior Design

Mycelium-based composites (MBCs) offer an eco-friendly alternative for creating sustainable interior elements, including furniture and wall cladding elements. While these biocomposites boast numerous ecological benefits, they introduce challenges concerning aesthetics and, as a result, consumer acceptance [2]. Products grown from living mycelium on lignocellulosic substrates have porous, irregular surfaces and coloring, deriving from their natural origins [1]. This may evoke apprehension due to strong fungal associations. Evaluating the degree of potential user's acceptance of these materials is imperative for their integration into practical applications. The research was performed in collaboration with Poznan University of Life Sciences Sydor, M.; Cofta, G.; Doczekalska. To investigate this, a series of studies were performed, with respondents acknowledged for their expertise in interior design [3]. The study employed prototype MBC products crafted by the authors and subjected to three complementary consumer tests. Through rigorous analysis of obtained results, human reactions were assessed to ascertain the extent of likability and aesthetic acceptance towards MBC-derived products. Findings indicated a prevailing positive or neutral appraisal of MBC materials among respondents, underscoring their potential for favorable reception. The responses after the pairwise comparison of the MBC with wall cladding samples pointed out the advantage of ceramic reference material above the MBC based on an overall assessment. The respondents also declared that the chamotte clay cladding would be easier to fit into the aesthetics of a modern interior and would be in better accordance with its style. Although the MBC was less visually appealing, the respondents found it more interesting, original, and ecological. The performed tests suggested that the respondents had double standards regarding MBCs. MBCs were generally accepted as ecological, but not in their own homes. All of these results support current and future applications of MBCs for manufacturing items where enhanced aesthetics are required. The overall positive evaluation of the mycelium-based composite (MBC) among architecture and interior design students aged 19–24 years, demonstrated that continued research into the material in question could yield good commercialization results in the coming years. The main observation is that the younger generation of designers showed a high level of acceptance for the material itself and its products. According to study participants, the MBC material can be described as "likable" and highly ecological. The wall cladding made of the MBC had advantages regarding its uniqueness, its consistency with eco-styled interiors, and the fact that it is interesting. The results of the experiments suggest double standards in the respondents. MBCs were generally accepted, but not in their own homes. It followed that MBCs were perceived as clearly ecological, but at the same time, they raised some concerns. Some people may be hesitant to use MBCs in their homes or in products they consume due to concerns about fungal growth and associated health risks. Additionally, MBCs are a relatively new technology, and there is still much to learn about their properties, durability, and applications. This can lead to uncertainty and skepticism among consumers and industry professionals alike. Working with this material and other bio-materials can lead to a paradigm shift in aesthetics in which the design is mainstream. High technology and highly sophisticated aesthetics and production methods, will perhaps soon take on a more casual, nature-like form.

Bonenberg Wojciech

Bonenberg Wojciech
prof. dr hab. Eng. arch.,
Poznań University of Technology,
Faculty of Architecture

wojciech.bonenberg@put.poznan.pl

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Innovative materials transforming architecture and urban development

In the evolving field of architecture and urban planning, modern materials play a pivotal role in shaping sustainable, efficient, and aesthetically pleasing urban environments. The integration of these materials reflects a response to the challenges of environmental sustainability, economic pressures, and evolving societal needs.

One of the key materials revolutionizing architecture is high-performance concrete (Kahn, 2024). Unlike traditional concrete, high-performance varieties offer improved durability, strength, and a reduced environmental footprint. They incorporate industrial by-products like fly ash and slag, which not only help in reducing the cement content—thus lowering CO_2 emissions—but also enhance the material's performance characteristics in terms of strength and longevity.

Another significant advancement is in the use of structural insulated panels (SIPs) (Khademibami, 2023). These panels combine several construction steps into a single product, offering excellent thermal insulation and air tightness, which significantly reduce heating and cooling demands, thereby enhancing energy efficiency. SIPs streamline the construction process, reduce waste, and significantly cut down on-site construction time.

The use of transparent aluminum, a new technology derived from aluminum oxynitride, is beginning to make an impact in urban design. This material combines the hardness and heat-resistant qualities of alumina with the transparency of glass, offering a robust alternative to traditional glass and plastics used in high-stress environments. Its application ranges from bullet-proof windows to transparent roofing, allowing for secure yet aesthetically open spaces.

In the realm of adaptive materials, shape memory alloys (SMAs) stand out. These materials can return to their original shape after deformation, an attribute particularly useful in earthquake-prone areas. SMAs can be used in structures as seismic dampers, effectively absorbing and dissipating earthquake energy, thereby enhancing building resilience.

Moreover, photovoltaic glass is transforming buildings into energy-producing entities. This glass not only serves the traditional role of providing natural lighting but also converts solar energy into electricity. The integration of photovoltaic glass into building facades and roofs helps in achieving energy self-sufficiency and is a step towards the net-zero energy building concept, which is gaining traction in urban planning.

Innovations in sustainable materials also include the increased use of timber in high-rise construction. Cross-laminated timber (CLT) and glued laminated timber (glulam) are examples of engineered wood products that are strong, lightweight, and sustainable. They offer a reduced carbon footprint compared to steel and concrete and allow for faster construction times, making them an attractive choice for urban development.

Lastly, the development of self-healing materials, such as bio-concrete, which uses bacteria to heal cracks in the concrete, represents a breakthrough in maintenance and durability (Makovsky, 2023). This material can significantly extend the lifespan of urban infrastructure, reduce maintenance costs, and enhance overall sustainability.

The continuous advancement and application of these modern materials in architecture and urban planning are crucial for developing future cities that are not only environmentally sustainable and economically viable but also resilient and adaptive to the changing needs of society. These materials foster the creation of innovative spaces that enhance urban life, demonstrating the dynamic interplay between technology and urban development.

In conclusion, modern materials in architecture and urban planning not only define contemporary urban landscapes, but also play a key role in creating sustainable and resilient environments that are able to meet the challenges of the future.

Celewicz Piotr
dr Eng. arch.,
Cracow University of Technology,
Faculty of Architecture

piotr.celewicz@pk.edu.pl

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Media facades of the future

Architectural creation is an extremely complex and demanding process. The creator of the work, for others the demiurge or the design team, struggles with many problems leading to the goal. The realization of the design idea is a magic formula that explains the validity of the thought logic leading to obtaining the most optimal architecture in the author's approach. A process in which initial ideas are refined to the final product by repeating non-linear component activities. Attributes such as beauty, aesthetics, form, functionality, and their relation to the urban environment that is later used by the community of the place are also important. The materialization of the work takes place through the selection of materials and the combination of which creates architecture. The physical characteristics of building materials are important in understanding and feeling buildings and spaces, but also in construction, building physics, and the perception of surrounding space.

An important issue that I would like to draw the reader's attention to in this article is the topic of facades that allow us to keep up with the times. They are made of structures, materials, and components that allow the display of content using artificial light. They are also large-format screens of media content and influence the urban space of modern cities. They often fit into the narrative structure of urban events, creating the color of places or interacting with users of public spaces. Illumination of facades with artificial light can be achieved in various ways. The most important topics discussed are the milestones represented by some of the objects included in the outstanding examples of contemporary architecture. However, the latest implementations reveal a previously unheard-of use of facade material that allows not only to emit light but also to absorb energy from the environment, creating a positive energy balance for buildings in line with the trends of sustainable architecture, shaping the resilience of cities and responsibility for the climate within the construction industry. I would like to support my considerations with a cross-sectional account of examples and implementations that are important from the point of view of the issues discussed. Kunsthaus Graz (Austria) is a facility realized as a result of a competition for a museum of contemporary art. It has an innovative facade structure for the time of its creation, which represents a low-resolution screen. Projector mapping, which is popularised during urban events, as a replacement for the cost-intensive facade due to the zero cost of building construction. Another milestone is the exhibition pavilion at the Novartis campus in Basel, Switzerland, whose media façade is the only one with a positive energy balance.Media facades need content control and software to fully utilize their potential. It becomes possible to create virtual interfaces, an extension of the architecture that shapes its new properties. It is also worth mentioning the very high investment costs related to complex components of architectural facades, their servicing, programming, and maintenance. Not every part of the building is suitable for such use.

The interactivity of media building facades with the users of the space can, through appropriate aesthetic treatments, give the impression of living urban structures. The appropriate content is a development of architectural or urban planning thought, not a billboard. They require a lot of effort to avoid wasting the opportunity to beautify cities due to the low value of the projections displayed.

Chudzińska Agnieszka
dr Eng. arch,
Warsaw University of Technology,
Faculty of Architecture

agnieszka.chudzinska@pw.edu.pl

Orchowska Anita
dr Eng. arch,
Warsaw University of Technology,
Faculty of Architecture

anita.orchowska@pw.edu.pl

Omotara Adebayo
student,
Warsaw University of Technology,
Faculty of Architecture

omotara.adebayo.stud@pw.edu.pl

Hassan Ahmed Somia
student,
Warsaw University of Technology,
Faculty of Architecture

somia_ahmed.hassan.stud@pw.edu.pl

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Hassan Ahmed Somia

Review of finished products from recycled and natural materials in interior design

In the face of rapid technological development and increased environmental awareness, modern interior design faces the challenge of integrating innovative, organic finishing materials. These materials, the focus of our analysis, reflect the principles of sustainability and the New European Bauhaus philosophy, which promotes the combination of functionality, accessibility and aesthetics with respect for nature. Their use in interior design demonstrates how ecological awareness integrates with the cultural context of exploring new paths of innovation. This thesis explores the use of raw materials such as mushrooms, hemp, straw, clay, bamboo, brick, reclaimed wood, wicker, shells, natural stone, textiles, and algae, which are transforming themselves from marginalized waste into key elements of sustainable design. Their use not only reduces environmental impact by reducing CO2 emissions and promoting recycling, but also brings unique aesthetic possibilities that reflect modern interior design trends with deep respect for nature.

The easiest solution is not to cover structural walls, leaving their natural texture as a decorative element. This is particularly popular with hemp concrete and rammed earth.(Gomaa, Schade, Bao, & Xie, 2023) In existing buildings, one can be limited to partition walls built from reclaimed bricks and wood, prefabricated mycelium blocks, and hemp concrete. Mycelium panels use Pleurotus ostreatus, a species of mycelium that is capable of processing wood and plant waste. The mycelium absorbs the base material, which, reinforced by several days of growth, solidly cements the structure. It is an energy-efficient method, making it highly economical (Eduardo, 2020).

As an alternative to traditional materials, wall panels of varying thicknesses require a solid substructure, especially those made of rammed earth due to their weight (Maniatidis & Walker, 2003). Companies specializing in mycelium also offer acoustic wall panels made of this raw material.

Materials such as rammed earth, hemp concrete and mycelium can be used in public spaces and around fireplaces due to their fire resistance. They also provide excellent thermal mass, which promotes the regulation of internal temperature (“HEMPCRETE – AN ECO-FRIENDLY BUILDING MATERIAL”, 2023).

Many of the materials mentioned are used in the production of furniture, not only for private interiors, but also for public interiors. They are also used to create impregnated kitchen and bathroom countertops, for example, from rammed earth, which are resistant to stains and moisture. Lamps made from mycelium offer a unique design, and box beams made from reclaimed wood effectively mimic traditional structural beams, being more durable than their artificial plaster or plywood counterparts.

Introducing innovative organic finishing materials into modern interior design is a process that requires not only creativity from designers, but also the use of advanced technologies. The development of 3D printing, innovative methods of integrating natural materials with modern composites, and advanced processing techniques enable the effective use of these raw materials, opening up new horizons for interior design. These materials not only fit into the aesthetic and functional expectations of modern spaces, but also promote sustainability and respond to global environmental trends. However, fully integrating these innovative solutions into current building standards is a challenge. It requires an ongoing dialogue between designers, engineers and users, who are increasingly looking for spaces that are compatible with ecological ideas and healthy lifestyles.

Dąbrowska-Żółtak Karolina
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

karolina.dabrowska@pw.edu.pl

Bibliography:

1. Linn, C. (2014). Kinetic architecture: Design for active envelopes. Images publishing.

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Architecture in motion: core material challenges in kinetic design

The industrial revolutions have paved the way for the development of contemporary kinetic architecture. This is based on the integration of new technologies with architectural designs (Wojtowicz & Wrona, 2017), where materials science plays an indispensable role in the analysis and optimization of dynamic systems. The movement in architecture provides new opportunities, but is also associated with challenges, such as materials facing new design requirements and the use of classic materials in new ways.

Contemporary kinetic solutions not only act as performative elements, showcasing a facility, but also fulfill specific functions such as controlling sunlight, reorganizing public space, and adapting to current environmental conditions and user needs (Linn, 2014; Schumacher et al., 2019). One of the mostly cited is the kinetic façade of the Al Bachar Towers in Dubai. Completed in 2012 and designed by Aedas Architects, the dynamic structure inspired by origami is intended to provide shade and a unique visual identity for the building.

Kinetic architecture requires designers to ensure user safety, system reliability, and provide power to the mechanism. It could also be useful to use deformable, highly flexible, or foldable covers to protect elements against external factors and drain water, making them an essential component of kinetic roofs.

Limiting the maximum forces and angular momentum can increase safety. This can be done by reducing speed or weight of the mechanism. However, reducing speed can impact functionality, while reducing weight while maintaining stiffness and accuracy can improve safety. It can reduce maximum loads and emergency stop time, especially when scaling up the system. The Shed, a cultural facility in New York completed in 2019 and designed by Diller Scofidio + Renfro and Rockwell Group, is an example of limiting the mass of the moving part while maintaining the stiffness of the structure moving on the rails. The supporting structure of the movable volume, which slides on steel rails, was limited to a rigid steel frame filled with light, gas-filled pneumatic cushions made of ETFE material.

A separate challenge is the design of materials that, already at the design and production stages, would not only fill the structure elements, but also act as actuators. Two groups can be distinguished here - materials whose dimension change in a given direction can be precisely controlled, and self-reacting materials that, without external power, change their shape in response to changing environmental factors such as temperature or humidity.

Examples of the first type are dielectric elastomers, which change shape in response to applied pressure. While these materials are currently used in soft robotics, they are not yet widely used on an architectural scale.

The second type, known as self-reacting materials, has already been tested in the construction of pavilions for over a decade. For instance, bimetals that bend under the influence of temperature increases were used in the Bloom pavilion by DO|SU Studio Architecture in 2011. In the HygroSkin pavilion from 2013, designed by Achim Menges Architect, Oliver David Krieg, and Steffen Reichert, the anisotropic properties of wooden scales were used. Adaptive shading panels printed using 4D printing technology were used in the ITKE pavilion in 2023 in Stuttgart. These panels change their shape in response to changing environmental conditions.

Kinetic architecture is not the main trend in construction, but it still developed an is a fascinating area of research that creates challenges and functions, requiring intensive interdisciplinary research including materials science.

Duda Magdalena
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

magdalena.duda@pw.edu.pl

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Cohesive residential development: the impact of sustainable design on spatial structure in the context of Man and the Environment

The spread of urban areas resulting from increased population concentration in cities necessitates searching for specific design solutions (Pluta, 2014), making it an urgent call, particularly in constructing new, cohesive residential settlements. The analysis of standards and regulations (Farr, 2008; Dover & Massengale, 2014) got us to where we are today regarding urban lifestyle advocates for sustainable urbanism. The study covers various aspects focusing on the practical and creative promotion of sustainable development (Beatley, 2000; Kibert, 2022):

- Sustainable Building Materials: The settlement uses sustainable building materials such as certified wood, concrete with fly ash additives, and environmentally friendly insulation materials. The aim is to explore and demonstrate how modern materials can create functional, aesthetically pleasing, and ecologically friendly settlements.
- Energy Efficiency: Most buildings in the neighbourhood are energy-efficient, with adequately insulated walls, high-efficiency windows, and heating and cooling systems based on renewable energy sources such as heat pumps and solar collectors. The buildings are oriented and shaped to make optimal use of the sun's energy, with appropriate spacing between them.
- Green Roofs and Walls: The settlement features green roofs and walls, which improve thermal insulation, reduce the urban heat island effect, and increase biodiversity. They promote the health and well-being of residents and integrate architecture with the natural environment.
- Recycling and Water Conservation Systems: The settlement has advanced waste recycling and water conservation systems, including rainwater harvesting, sedimentation, and water purification.
- Green Spaces and Recreation: The settlement is integrated with surrounding green areas, parks, and allotment gardens, with planned greenery designed at a particular closed system. Tree-lined avenues, shared spaces, and bike paths encourage an active lifestyle and improve residents' quality of life.
- Integrated Transport Systems: The neighbourhood is designed to promote sustainable modes of transportation, such as walking, cycling, and public transport, with easy access to public transportation stations and bicycle infrastructure. It is located near a planned metro station in a post-industrial area largely undeveloped, with issues of underutilised urban land.

The article aims to identify a residential settlement project within Warsaw's social neighbourhood strategy as a practical example where urban designing sets clear rules for constructing cohesive quarters of development and where architecture, infrastructure, and residents' lifestyles are harmoniously integrated to minimise environmental impact and promote sustainable urban development.

The recommended residential complex is based on a spatial structure built around a network of public spaces, where the highest-ranking element in the hierarchy crystallises the layout of the settlement and organises its accessible space. At the intersections of connecting directions, nodes emerge, concentrating the life of the local centre. Social and commercial services at these designated nodal points take on a distinctive form of urban interiors with a specific functional program. A transparent communication network enables pedestrian and vehicular traffic flow, while the concept of green spaces underscores the urban structure in symbiosis with human and environmental friendliness. An additional project asset is analysing and utilising deeply rooted functional and communication ties with the surrounding urban areas, aligning with the trend of transforming urbanised environments and directing development within the city. Moreover, such an approach to constructing a cohesive residential community aligns with revitalising neglected or underutilised parts of the city, which can be integral to creating the discussed type of neighbourhood.

The article offers practical guidance and recommendations for designers, urban planners, and city decision-makers aiming to create functional, sustainable residential settlements.

Gawell Ewelina
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

ewelina.gawell@pw.edu.pl

Wardzińska Agnieszka
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

agnieszka.wardzinska.stud@pw.edu.pl

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Wooden architecture computational manufacturing

The increasing popularity of timber in architecture raises the discussion about how the renewable resource should be used effectively. Therefore, the analysis of selected aspects of timber building elements production is key. Since timber is created by nature, its applications shouldn't be considered only in production technology. Proper material analysis is crucial in the search for rational resource use, by judging the structural properties, tree species characteristics, their possible applications in architecture, as well as the whole process of material creation Architecture is a valuable source of information in this context, pointing to possible spatial and material solutions.

Wooden architecture design should be understood as a process integrating the work of nature (raw material growth) and of tools used by humans (designing and building implementation). Architecture then means not only the built object, but also a process integrating it with its natural environment. Human tools can be physical (saws, modern cnc machines, etc.), but also digital modelling programmes for designing and manufacturing (algorithms, optimization, simulating results, structural analysis, file to factory systems).

Realizing the assumption of including natural creation of material in the design process can be achieved with the support of computational design tools [1]. These integrate the process itself and its multiple elements, keeping the possibility of modification by changing input data. Computational tools have been applied to several wood architecture designs in the past, therefore a case study is a vital element of research. Projects have been divided into three categories, by the area of application of computational tools: pre-design analysis, design, building implementation.

Firstly, a project was done as part of baubotanik construction research at the University of Stuttgart with the aim of simulating tree growth, using physics and botany principles [2]. Not only can this approach limit material losses during construction, but also create possibilities of controlled growth of building materials.

Another example is the research being conducted by the Architectural Association in Hooke Park, where the focus is the analysis of available resources. Researchers and designers have aimed to optimally use timber available locally - on 150 hectares of woodland belonging to the campus, mostly deciduous. In projects such as the Biomass Boiler House, Woodland Cabin and Wood Chip Barn, the first design step was to carefully analyze available wood - often without even cutting it down. The use of computational tools supported the composing the irregular material into architecture, created in a parallel process [3]. This allowed the authors to achieve timber constructions both effective and unique.

The last area of computational tools application discussed is the building implementation stage, when we can still improve efficiency and reduce material losses by using adaptive tools, such as cnc machines. One of many examples of that optimization is the construction of The Sequential Roof, built by ETH Zurich [4]. The roof consists of multilayered trusses, comprised of nearly 50 thousand different elements. Based on regular beams, they needed to be robotically cut to length, then immediately placed in their correct spots and attached. This task would be impossible without robotic assistance, or at least would have been significantly more time, resource and energy consuming.

There are undeniable strengths in natural timber architecture, and to enhance them, the process of manufacturing construction materials need to be efficient - from seed to human use - in which modern computational design tools can be an integral support.

Gawell Ewelina
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

ewelina.gawell@pw.edu.pl

Paleski Tomasz
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

tomasz.paleski.stud@pw.edu.pl

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Neural networks in the design of biophilic surfaces for architectural interiors

In architectural spaces, biophilia can be manifested through the desire to dwell on and surround oneself with elements of natural origin. This collection can include building materials, living vegetation, and even spaces with access to natural lighting and more (Peters & D'Penna, 2020). While users perceive a space through all senses, sight typically plays the dominant role in the perception process. The benefits of such spaces include an improvement in emotional mood, reduced stress levels (Gaekwad et al., 2022), reduction in blood pressure and heart rate, etc. (Tsunetsugu et al., 2007). Thinking of sustainable design, the use of natural elements makes sense in specific spaces and proportions - so that the human actually benefits from them.

Modern digital tools capable of collecting and analysing large amounts of data make it possible to simulate human perception in a designed building. This is of particular interest due to the neural network algorithms usage, which enables the acquisition of complex nature data in the user-architectural interior relationship context. Central to this approach is the initial learning phase of the tool. It consists of gathering a database used later for interpolating favourable architectural solutions. As part of the proposed approach, it is necessary to identify two sets of information: first - biophilic elements used in a given interior; and second - psychological reactions of potential users. The first step involves "teaching" the tool to recognise the types of architectural interiors, their character and the used natural materials. With parametric design, it is possible to produce a suitably large set of example architectural interiors that can serve as a training set for the proposed neural network. The learning process can be conducted by analysing images generated from the model from a human perspective. An extended form of the isovist algorithm can be used for this purpose, examining both the distances between elements and the colour or degree of brightness of a given surface (Peng et al., 2017), identifying the type of building material used. The algorithm currently employed for this type of analysis is convolutional networks, providing the capability to classify individual objects within a predefined pattern. Alongside the first set, it is necessary to gather data on the impact of space on humans through sociometric as well as physiological research. The challenge of acquiring reliable information for subsequent use warrants a separate study. Values can be of two kinds: subjective, as exemplified by a scale of 16 psychological categories relating to individual areas of human perception (Coburn et al., 2020), and objective - relating to physiological parameters (Tsunetsugu et al., 2007). The next phase would be to combine the data from the two sets to find relationships between sets of objects and psychological values. In this case, it would be necessary to analyse the identified objects in the first phase of the process, their proportion and scale in relation to the total, and then convert them into numerical data. Unlike the first one, where we had to deal with classification, this task would be a study of the course of the function. The final element of the proposed tool would be the creation of a generative adversarial network (GAN) type of layout, where the aforementioned two interconnected modules would carry out an optimisation process towards identifying the most favourable layouts in terms of their impact on the user.

Gołębiewski Michał
dr Eng. Arch.,
Warsaw University of Technology,
Faculty of Architecture

michal.golebiewski@pw.edu.pl

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Bio-composite made of hemp and lime and its effect on energy demand of a building

In the face of challenges related to the ongoing degradation of the environment, new technological solutions are being sought to ensure continued economic growth while reducing environmental nuisance. This also applies to construction technologies, as buildings are responsible for approximately 36% of energy consumption and approximately 39% of greenhouse gases emissions (IEA, 2018).

The production of building materials affects the natural environment through the process of sourcing of raw materials that leads to degradation of the land and ecosystem, but also through energy expenditure related to extraction, transport and processing of materials, as well as possible emission of pollutants resulting from these processes. More favorable environmental properties are presented by bio-composites, such as hempcrete which, due to the content of the plant component is characterized by lower initial embodied energy (most of the energy for the “”production”” of biomass comes from solar radiation acquired in photosynthesis) and lower carbon footprint (CO2 absorbed by plants during their growth lowers the total emission) (Florentin et al, 2017). Moreover, plants are renewable raw materials whose production, if properly carried out, causes less interference in the ecosystem.

The properties of materials that make up the building’s outer casing are also an important factor when assessing environmental impact of building during its use phase. This applies especially to insulating materials, through which heat is transmitted between the interior and the exterior, thus generating energy demand for heating or cooling. The hemp-lime composite is characterized by properties that may significantly improve building’s energy performance. Firstly, material’s coefficient of thermal conductivity is low – approx. 0,1 W/(mK). Secondly, it can be used to insulate all external partitions: roofs, walls and floors in timber frame buildings, which allows for the continuity of thermal insulation layers and reduces the occurrence of thermal bridges. Moreover, the material ensures relatively high (compared to some traditional solutions) airtightness of the partitions, limiting heat losses related to infiltration. The low thermal diffusivity of the composite contributes to a lower density of the heat flux through the partition in the case of large daily exterior temperature amplitudes. The high moisture diffusivity and very high moisture effusivity allows hempcrete to contribute to the natural regulation of air humidity in the interior, creating a better microclimate and reducing the need for energy-intensive ventilation. Finally, the relatively high thermal capacity of the material has a beneficial effect on possibility of maintaining a constant air temperature in the interior and reducing the demand for energy for heating in transitional periods or cooling during summer.

Ultimately, it is important whether the material goes back to nature as a waste or whether it can be reused in the technical cycle. The composition and chemical characteristics of the composite enables its partial reuse in new buildings or disposal without the risk of polluting the soil, water or air with harmful substances.

Analysis of examples of applications of the lime-hemp composite confirms that the material can be effectively used in various types of buildings, in various climatic conditions and using different construction techniques (Allin, 2012). Wider use of bio-composites in construction may be crucial for further preserving the earth’s natural resources.

Goncikowski Marcin
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

marcin.goncikowski@pw.edu.pl

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New materials in skyscraper construction (Working Title)

The current problem regarding the introduction of a circular economy is the method of managing construction waste. According to research, the construction sector is responsible for creating approximately 1/3 of the world's solid waste (Bertino et al., 2021). For this reason, strategies to extend the life of buildings, increase their flexibility, and in the event of their demolition, maximize the use of the material from which they were built are becoming crucial (Arira et al. 2020). This text presents a case study analyzing the use of materials and systems of the Ilmet high-rise building, intended for demolition for the construction of another high-rise building with a similar function. Both buildings are located in Warsaw, in the Wola district. The works were carried out by the Kuryłowicz&Associates design studio.

In order to assess the possibility of re-using elements of the Ilmet building, the first step was to analyze the construction and as-built documentation as well as a site visit.

The following building elements have been initially identified for reuse:

- Stone from the entrance hall to be used after dismantling as a finish for the elevator hall floors

- Stone from the facade to be used after dismantling as steps and floors of representative staircases in the above-ground part and cladding of interior finishing, e.g. entrance halls

- Radiator covers to be used after dismantling as filling for balustrades in emergency staircases

- Considering the possibility of reusing parts of ventilation ducts

- Considering the possibility of reusing the Ilmet generator as a generator for tenants

- Stone from sidewalk surfaces to be reused after dismantling.

From the extracted materials, the first step was to examine the possibility of using the facade stones as finishing elements for the walls of representative interiors - the two-story entrance lobby. For this purpose, several cladding patterns made of dismantled stone were designed, and samples and interior simulations were made.
8 samples of patterns measuring 45x45 cm were made, selected from the architect's proposal.
The author's professional experience and literature (Rkshan et al., 2020) indicate that the re-use of materials from dismantled buildings will be an increasingly common phenomenon. One of the designer's tasks will be not only the selection of materials from the palette available on the primary construction market, but also work on the use of demolition materials. In the author's opinion, each time you will need steps analogous to those described when working on the use of built-in materials, i.e.:

- assessment of the building manager's documentation, as-built design, or, in the absence thereof, a construction inventory

- thorough assessment of the building and its elements by the designer

- identifying reusable elements

- simulations of the use of elements in the project

- preparation of samples related to the development of reuse technologies

- cost assessment

- final choice of how to reuse the element in the project

The reuse of building components is a sustainable approach that can reduce the environmental footprints of the buildings significantly. It should be assumed that technologies and procedures related to the re-use of building materials will be dynamically developed in the near future, and that part of the materials of the future will be waste from construction sites.

Idak Yuliya
ScD,
Lviv Polytechnic National University,
Architecture and Design Institute

yuliia.v.idak@lpnu.ua

Hnes Liudmyla
dr Eng. arch.,
Lviv Polytechnic National University,
Architecture and Design Institute

liudmyla.b.hnes@lpnu.ua

Orchowska Anita
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

anita.orchowska@pw.edu.pl

Pavlenko Tetiana
dr Eng. arch.,
National University
“Zaporizhzhia Polytechnic”

tanya.mukha.85@gmail.com

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Attractive qualities of building decorative materials: challenges and decision-making in architecture

The high level of arrangement in both architectural and urban environments is closely linked to the correctness of design decisions, the execution of work according to modern technologies, and operational conditions. Increasing demands for quality and durability drive continuous improvement in manufacturing technologies and the expansion of the range of available materials for the decorative finishing of architectural buildings and structures.

At the beginning of the 21st century, the active development of both residential and public construction, as well as the active modernization of already formed structures, led to an increase in demand for building decorative materials, while competition in the real estate market intensified attention to available solutions. This resulted in the widespread use of materials that over time lose their attractiveness, thereby depreciating the appearance of objects and increasing the risk of their rapid wear.

In such a situation, the choice becomes difficult because it is necessary to ensure quality, efficiency, and aesthetics at an affordable price. Therefore, the development of mechanisms and decision-making aimed at preserving the properties of materials over a long period and compliance with modern aesthetic and technical standards are particularly relevant tasks. Scientific research conducted in this direction focuses on the development of environmentally oriented materials aimed at preserving the natural environment and its sustainable development.

The research is aimed at studying the attractive qualities of the current state of decorative embellishments of buildings and structures. Evaluation includes both external appearance and internal content of residential and public objects in Lviv. Additionally, the interrelation between decor elements and their impact on the emotional and physical well-being of users is considered. Therefore, considering the variety of functions performed by the studied objects, their decorative solutions are examined for their aesthetic properties over time and their influence on the comfort and safety of consumers. It is emphasized that in the design process, aesthetic aspects and those related to health are particularly important for the reliable and stable functioning of the human living environment.

This research delves into the decorative embellishment not only of current buildings and structures but also focuses on identifying trends in the replacement of finishing materials. Using the main building of the National University «Lviv Polytechnic» as a case study, the evolution of interior and exterior decorative embellishments over several decades is traced. Characteristics of staircases, vestibule coverings, external stairs, and embankments are taken into consideration. Emphasis is placed on unsuccessful practices in the application of finishing materials during the construction and modernization of individual and multi-apartment residential buildings, as well as the creation of small architectural forms in areas of mass housing development.

Analysing contemporary practices and innovative approaches to decorative design reveals potential opportunities for further development and improvement of design solutions. Such research also allows for the identification not only of the strengths of modern decor but also its weaknesses and potential problems that require attention and improvement, thus falling within the purview of manufacturers and designers.

The methodological basis of the research consisted of historical-comparative and evaluative-comparative analysis of decorative embellishments in public and residential buildings. This allowed for the identification of trends in the use of materials, styles, and decoration techniques, as well as the assessment of their effectiveness and impact on the perception of the human living environment. Furthermore, such analysis will help identify best practices and opportunities for further improvement of design and organization of the urban environment.

Jorgen Artur
mSc. Eng. arch.,
Faculty of Architecture,
Wrocław University of Science and Technology

arturjorgen@gmail.com

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Lack of air raid shelters in Poland and Europe's security challenges in light of the war in Ukraine

The Russian Federation's invasion of Ukraine on February 24, 2022, has created a high risk of conflict for Europe, particularly for neighboring countries in the central and eastern regions. The start of the "Special Military Operation" has resulted in significant loss of life and injuries among civilians, with 30,457 individuals in Ukraine having been killed or injured as of February 15, 2024. The majority of these casualties are due to aerial attacks, including missiles, drones, and other long-range weapons. (OHCHR, 2024)

In addition to the obvious problems associated with military attacks, there is the issue of people becoming accustomed to such a condition. As a result, anti-aircraft alarms during the following days of the war did not prompt the desired defensive reactions among the population. For example, from June 26th to June 30th, 2023, the anti-aircraft alarms did not disturb the daily activities of the residents of Lviv. However, just a few days later, on July 4th, 2023, three of ten rockets reached their target, killing 22 civilians. (Perun, 2023)
It cannot be guaranteed that civilians will be fully protected by parties involved in a conflict, even if they comply with the laws of war. This is because weapons can be imperfect and can cause shrapnel, or accidental actions may occur due to human weaknesses. Despite the existence of shelters, people may not always use them. However, when there is massive shelling, people are forced to seek immediate shelter. In cities, there are usually facilities such as subways, underground buildings, or other infrastructure that can quickly function as air raid shelters.

Switzerland is an example of a state that can protect all its citizens from a nuclear attack by taking advantage of its mountainous location. It is perfectly secure against military attacks due to its existing infrastructure of tunnels, underground parking lots, and basements in residential buildings. These facilities can provide shelter for residents and access to hospitals, thanks to a range of security systems. (Wieliński, 2012)

During World War II, the Riese project in the Walbrzych Mountains of Poland was designed to be the headquarters of A. Hitler and was also used as a site for developing secret weapons. Today, the system of underground tunnels and chambers created during that time could be used as a shelter to protect the local population. However, due to the uneven distribution of high population density areas across the country, Poland cannot fully utilize its natural terrain for shelter purposes. Large population centres located on flat terrain are easy targets for aerial attacks, and the proximity of Warsaw to the eastern border makes it particularly vulnerable to attack.

Shelters should consider flood risks and be sunken into the ground. Smaller structures, separate from each other, with entrances free from debris should be planned. Architectural and structural components alone cannot ensure safety. A technical zone is required for security and a supply of uncontaminated air.

According to the District Headquarters of the State Fire Service in Sanok, there are only 224,114 temporary shelters and 10,622 protective structures in Poland, of which only 903 are actual shelters. Although their capacity is estimated to exceed the population of Poland, these facilities cannot be solely relied upon to ensure the safety of the population during a military attack. They may only be used for protection during severe weather events. (KPPSPS 2024)

Jóźwik Renata
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

renata.jozwik@pw.edu.pl

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Urban design in the Anthropocene era – the context of timely development and materials

Changes in the approach to the built environment are being developed under the broad banner of sustainability. The climate and environmental situation are prompting a rethinking of the protection of shrinking natural areas and resources while simultaneously considering ongoing development needs (Elmqvist et al., 2021). The concept of the compact city is one response to these challenges, aiming to prevent suburban sprawl through densification and modernisation of urban areas within city limits.

The modernisation of urban quarters should adopt a circular, comprehensive approach encompassing the build, operation, and disposal phases with a plan considering the timing of specific uses and the potential for change. This approach somewhat aligns with the idea of temporary urbanism, although it focuses on temporary uses without assuming permanent transformability (Andreas & Kraftl, 2021).

To date, conceptualisations of the circularity of cities have primarily focused on their economies (Prendeville et al., 2018). The conceptualisation of this approach in city design and planning incorporates a specific, geographically dependent, constructivist dimension with a critical view of the metabolic approach (Martin & De Meulder, 2018).

New development paths involving transformative urban planning include the use of materials capable of being recycled, reused, or modularly transformed for the construction of spatial objects. Such an approach has been exemplified in the theoretical concept of the city of Reburg, where buildings serve as banks of materials for future developments.

Circular materials in architecture represent a paradigm shift towards sustainability and resource efficiency. Unlike traditional linear models of production and consumption, circularity emphasizes the reuse, recycling, and repurposing of materials to minimize waste and environmental impact.

Architects are increasingly turning to circular materials to design buildings that are not just aesthetically pleasing but also environmentally responsible. These materials can range from reclaimed wood and recycled steel to innovative bio-based composites and 3D-printed bioplastics. By incorporating these materials into their designs, architects can create structures that contribute positively to the environment throughout their lifecycle.

Circular materials also offer opportunities for creativity and innovation in architectural design. Designers can experiment with unconventional materials and construction techniques to achieve unique and visually striking results while reducing their ecological footprint. Additionally, using circular materials can help architects meet green building standards and certifications, demonstrating their commitment to sustainability.

Furthermore, embracing circularity in architecture can inspire a shift towards a more sustainable built environment on a larger scale. By showcasing the feasibility and benefits of using circular materials in construction, architects can influence industry practices and encourage stakeholders to adopt more environmentally friendly approaches. Ultimately, the integration of circular materials into architectural design represents a significant step towards creating a more sustainable and resilient future.

However, the circular approach to the city has its limitations and cannot be the dominant concept (Williams, 2019). Previous frameworks have focused on bio-cycles and techno-cycles without adequately considering social factors (Prendeville et al., 2018). The cultural significance of European cities, where buildings represent heritage, demands a fixation, quality, and connection between place and society —a spatial articulation that should not be interchangeable. These aspects need further consideration when exploring possibilities for transforming cities and selecting appropriate building materials.

Kalata Szymon
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

szymon.kalata@pw.edu.pl

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1. F. Schmidt, “Modern technologies in modular construction”, Warsaw 2023.

2. J. Kowalski, ‘Sustainable building materials’, Kraków 2021.

3. A. Deplazes, ‘ Architektur konstruieren. Vom Rohmaterial zum Bauwerk’, Basel 2005.

Wood in the construction of modular portable buildings on the example of the temporary pavilion of the Museum of Modern Art in Warsaw

The subject of this article is to examine the viability of using timber as a structural material for the construction of modular multi-use portable buildings. The benefits and drawbacks of adopting such a solution are considered. The focus is on the example of the temporary pavilion of the Museum of Modern Art in Warsaw by the prominent Austrian architect Adolf Krischanitz.

Nowadays, wood is increasingly used as a construction material for buildings, including temporary buildings with public functions. Wood has many advantages; it is a lightweight material with high strength and good thermal insulation, it is easy to work with and, unlike steel, it does not undergo sudden deformation when exposed to fire and high temperatures. Wood also has a positive environmental impact and is recyclable after dismantling. An example of the use of wood in a modular portable structure is the temporary pavilion of the Museum of Modern Art in Warsaw.

The research was conducted by analysing the literature focusing on the use of wood in the construction of portable temporary buildings. It was based on the technical and construction documentation of the MSN pavilion building, on interviews with the author of the project Adolf Krischanitz, on interviews with the users of the pavilion, and on the author's own experience, who acted as the designer and was responsible for the construction and execution design of the pavilion adaptation for the Warsaw location and supervised the construction.

The Museum of Modern Art's pavilion was designed as a portable, wooden building for multiple uses. It is a medium-sized exhibition pavilion with a rectangular plan measuring 56m in length, 20m in width and 11m in height. The first location of the building was a plot of land in the centre of Berlin, where the Temporäre Kunsthalle operated in the pavilion from 2008 to 2010. The building has a partially dismantled structure. Wall modules, roof girders and floor elements are being dismantled. The reinforced concrete foundations and floors are not dismantled. Each of the modular elements is suitable for wheeled transport and has specific place on a semi-trailer for transport related to the construction schedule. The 2.5m by 11m wall modules are made in the form of a KVH timber 'cassette' filled with mineral wool thermal insulation. The module is finished with fibre cement board on the outside and plasterboard on the inside. The installation of the modules does not require scaffolding. The use of such a solution significantly speeds up construction and facilitates the organisation of the construction site, which is particularly important in dense urban areas. It is worth mentioning that during storage and transport of the pavilion, some of the elements and modules became biodegraded and deformed, and it was necessary to repair and replace elements of the modules.

The use of wood as a material for the temporary MSN pavilion is part of the prevailing trend for sustainable construction. Wood is a renewable and biodegradable material, helping to reduce carbon emissions and reducing the carbon footprint. Wood has many advantages but it also has disadvantages. It deforms when exposed to moisture and biodegrades with prolonged contact. It is worth mentioning that the formal procedures in Poland for a temporary or portable building are the same as for any other building, and the frequent changes in technical and construction regulations and their heterogeneity in EU countries make it necessary each time to adapt the facility to current requirements, including fire protection regulations. Using the example of the temporary MSN pavilion in Warsaw, it should be recognized that timber is a good material for use in the construction of temporary buildings, offering economical and ecological solutions. The modularity of the building allows it to be dismantled and moved to another location, which is a good solution for changing needs. In order for a wooden structure to remain durable, proper design solutions as well as maintenance must be taken care of.

Kaplinska Mariana
dr,
Lviv Polytechnic National University,
Architecture and Design Institute

mkaplinska@gmail.com

Bokalo Ihor
dr,
Lviv Polytechnic National University,
Architecture and Design Institute

bo.ihor@gmail.com

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Modern Materials Affecting Historic Architecture

One of the challenges we face due to the use of modern building materials, despite all their benefits and perspectives, is the transformation of historic architecture in a way that leads to the loss of the local features of the built environment as well as its ability to embody certain cultural identity. Generally speaking we face a potential loss of architectural heritage. Materials are one of the factors determining architectural form, which changes drastically with the transition from traditional to modern construction methods.

Ukrainian traditional wooden vernacular architecture may serve as an illustrative example, when once very tall four-pitched thatched roofs became shorter with the use of wooden shingle and ceramic tiles, then even shorter with the use of metal roofing. Today the tradition to build such wooden architecture as well as the professional knowledge and craftsmanship are almost lost, however, while roofs in general may remain pitched in individual residential architecture, in most cases of modern development it became flat. Modern materials are able to prevent water penetration and protect the building from precipitation at any angle of the roof. So that traditional materials that affected the characteristic image of historic buildings and of the whole inherited environment for centuries, today recede into the background. Necessity does not dictate slopes have to be done anymore, so it's just an architectural caprice or a matter of taste they are still in use. Together with the increase of the size of buildings, this completely changes a traditional ruralscape.

Leaving aside the roofs, transformation of a building structure components occurs in two main directions: the increase of the building skeleton weight, due to the use of heavy concrete and iron, and the reduction of the building shell weight, when the walls are made as light and thermally efficient infill of the skeleton.

It seems that modern materials allow to create architecture of any conceivable form, and this form can be easily generated with the help of architectural design software. In practice such morphogenesis remains limited to software features and skills of a particular designer, as a result a form often appears simplified, even rough, and lacks finesse and detailing. Serial manufacturing is another reason to reduce the prices, simplify architectural details and construction nodes.

Modern materials require high-tech modern tools and construction skills and methods that are different from traditional ones and displace them. Since the demand for traditional architecture and building craftsmanship decreases at some point, construction crews lose their skills. Traditional methods become forgotten. The trend of architectural globalization and industrial optimization makes once familiar and affordable traditional methods and the use of sustainable, reusable and safe materials, such as wood or ceramics, exclusive, expensive and elitist.

It is difficult to predict the behavior of new building materials for decades ahead in terms of their durability, safety for human health and environmental effect. What we can be sure of is that they are not always easily compatible with traditional ones, and while using in valuable historic architecture attention needs to be paid to preserve its authenticity and assure reversibility.

We all are fascinated with the novelty, flexibility and freedom of expression modern materials allow. Nevertheless, they have to be considered carefully for traditional materials and construction methods to be preserved for future generations.

Kashchenko Oleksandr
prof. dr hab. Eng. arch.,
Kyiv National University of Construction and Architecture

kashchenko.ov@knuba.edu.ua

Kryvoruchko Yuriy
dr hab. Eng. arch.,
Lviv Polytechnic National University, Architecture and Design Institute

yurikryv@gmail.com

Tovbych Valerii
prof. dr hab. Eng. arch.,
Kyiv National University of Construction and Architecture

tovbych@gmail.com

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Modern architectural education in Ukraine: challenges and prospects

Architectural education is a dynamic field, the transformation of which occurs under the influence of internal factors inherent in the educational sphere and external factors - social, economic, technical.
The architectural education program must consist of a fundamental core that enriches its self-identification and variable blocks, the essence of which is to provide education with modernity, progressive transformation, dynamic development. The variable components that have gained integrality become part of the fundamental core, freeing the information space for the newest components.
The architectural specialty is formed on the synthesis of the requirements of society and the target tasks of architectural education. The caveats of modern architectural education are:
- excessive administration of the educational process, frequent changes of target principles;
- reduction of requirements for the level of training of applicants;
- devaluation of knowledge through the introduction of unsubstantiated teaching methods - accelerated, shortened, correspondence for creative specialties;
- mass opening of architectural faculties with low indicators of teaching staff, material and technical support;
- uncritical application of someone else's experience;
- lack of conceptuality of the educational process.

Actual challenges in the field of architecture are the definition of the object of activity, the boundaries of the specialty, the concepts of related specialties, since a number of fields of knowledge include architectural blocks and specializations that are not inherent in their educational programs.
The key concept that activates the process of architectural education is the motivation of students to master the specialty. The main motivational principles are:
- social significance of the profession, historical recognition;
- prestige of the profession in a local and international sense;
- the opportunity to realize a personal creative ambition, aspiration;
- constancy of the labor market;
- field of career growth.

Experience shows that the achievements of the architectural school are based on the logical organization of the structure of the educational process, such as:
- 1st year - the teaching strategy is an expository, familiarizing with information about the profession, combination of theoretical foundations with empirical experience, frontal teaching method, teaching staff - teachers;
- 2-3 year - a creative, productive system of learning based on factual material with an active method of learning in the classroom, studio, assimilation of the legislative foundations of creative activity, teaching staff - teachers, creators;
- 4th year - integrated learning strategy, creative-practical orientation, search variable method of creative work, methodological approach to solving creative problems, flexible educational process, organization of learning - workshop, pedagogical staff – creators;
- 5-6th year -- integral strategy of the educational process, theoretical content of research. The purpose of education is integrated, the experimental nature of solving creative problems, the form of organization of the educational process is individual, self-organized, the teaching staff is mentors.
The educational process should be aimed at the implementation of modern educational technologies that have international recognition - organization of flexible learning trajectories, diverse methods of providing educational services, recognition of the results of unformal and informal learning, monitoring the quality of education.
Each institution of higher education, having its inherent individuality, should strive for international cooperation in order to become a participant in the creation of a global system of architectural education.
The military aggression against Ukraine forces to adjust the program goals of architectural education in the direction of training specialists capable of working in the period of reconstruction, renovation of.

Kaufman Maciej
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

maciej.kaufman@pw.edu.pl

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Urbanite: utilizing rubble concrete in the context of circular economy, illustrated by Warsaw's post-war reconstruction and the park at the Warsaw uprising mound

Cement production accounts for approximately 8% of global carbon dioxide emissions. In developed countries, construction waste constitutes 25% to 30% of all municipal waste disposed of in landfills. The construction industry, mainly concrete producers, thus faces the challenge of sustainable transformation and closing the lifecycle of construction materials. In this context, the experience of Warsaw's reconstruction from the devastation of World War II, where recycled material - rubble concrete - was extensively utilized, is intriguing. This presentation will first delve into the historical context of pioneering rubble concrete usage in city reconstruction, followed by a discussion of the author's own experiences working with contemporary rubble concrete in the project of the Warsaw Uprising Mound Park.

The Warsaw Uprising Mound was established after 1945 as one of the four main sites for post-war rubble disposal. Ceasing storage in the 1960s, the artificial mound, estimated to have a volume of 855,400 cubic meters, spontaneously became densely overgrown with ruderal vegetation and was used as recreational space. The transformation project of the former landfill into a public park aimed, among other things, to make the mound's summit accessible to Warsaw residents and to restore public awareness of its anthropogenic structure. Both goals were achieved by constructing artificial ravines, allowing entry for people with limited mobility, made of rubble concrete based on proprietary technology.

The use of rubble concrete has ecological and historical premises. After World War II, rubble accumulated throughout the city became raw material for the construction industry. In the early post-war years, the Building Research Institute began prototyping building products from rubble concrete, which were almost immediately implemented on construction sites. Rubble concrete was locally manufactured and widely used in Warsaw until the mid-1950s. Many public and residential buildings were constructed from it, including the most famous Muranów Południowy housing estate designed by Bohdan Lachert. Dr Adam Przywara points out that rubble concrete became characteristic material for Warsaw, akin to Carrara marble for Rome, Portland limestone for London, or "Paris sandstone" for Paris.

If "concrete is the stone of modernity," rubble concrete will be the stone of the future. In the context of discussions on the carbon footprint of construction and the circular economy, landfills are increasingly seen as reserves of raw materials for "urban mining". The use of concrete with recycled aggregates was introduced into Polish standards in 2014 with the adaptation of the European standard EN 206:2013 "Concrete - Specification, performance, production and conformity". The proportion of recycled aggregate in the concrete mix depends on the expected exposure class of concrete to environmental factors and can reach up to 50%.

Concrete recovered from demolitions is called urbanite in English, which can be understood as the "urban rock" of the Anthropocene era. It certainly is in Warsaw, a city literally rebuilt from rubble. At the Warsaw Uprising Mound, rubble - raw material and the waste of reconstruction time - gains form, reintegrates into the circulation of construction materials and is restored to the inhabitants' memory.

Kędrzyńska Martyna
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

martyna.kedrzynska@pw.edu.pl

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The art of pragmatism. Material Reuse as a sustainable revitalisation tool.

Materials of the future will be the materials of the past. More and more researchers are pointing out that we will soon be forced to reuse materials not only under the aspect of the rapidly progressing climate catastrophe, but because of the physical scarcity of some materials (Gorgolewski M.,(2008). Of course, shortages are and will be dependent on the social and economic position of a location. Therefore, places with limited finances, i.e., villages, small towns, post-industrial areas, especially, will need to develop strategies to reuse both buildings and their components and use them in revitalization processes. These strategies should take the issues listed below into consideration.

Locality. Material, in the European sense, is a medium for the memory of a place and its communities. The reuse of objects and their components found on the site allow for continuity of place, a sense of belonging to it and its genius loci. Sala Beckett, which was once the building of the Pau and Justicia in Poblenou workers cooperative, has been reappropriated in a highly sensitive way to become a theater. The building is based on the idea of layers of the structure's history, which manifests itself, for example, through the juxtaposition of the scratched plaster walls with the completely contemporary sculptural form of the skylight. The architects embedded the building's extension in the local context by carefully studying the origin and referring to all its important spatial and material features in the design. (Flores. R, Prats. E., 2020)

Pragmatism: Material reuse is nothing new. Occurred since prehistoric times, in which the reuse of material and building elements was something obvious. Such thinking has always been a manifestation of common sense and pragmatism, but in the era of capitalism it has been forgotten. Roman Diocletian Thermae are a prime example of site continuity despite a strong programmatic intervention turning a public bath into a Christian basilica. In Libken's contemporary project, a typical four-story East German apartment block located in a small village was saved from demolition and transformed into a site for art, culture and activism (Libken, 2020). The spectacular non-spectacularity of this project lies in the transformation of an object with negative connotations from the past into a unique place that benefits from the streamlined aesthetics of the original. Significant in the success of this project, is also a participatory action that involves the villagers in design decisions, so to give them back their agency and to build local community.

Aesthetics: The reuse of building elements greatly influences the design process. With a limited range of solutions found on site, it is necessary to create a new kind of aesthetic pragmatism. In the design process, design thinking should be directed by prioritizing what is available - form follows availability (Gang J.,2010). An important issue of the future is to seek innovative ways of treating the existing building fabric. It is not the refined nature of the material that determines whether a building is successful, but how people feel in it. Belgian Studio Rotor, which has been working with reused materials for many years, transformed a former print shop building into the headquarters of the Zinneke Foundation in 2013. All the windows came from secondary sources, and were of different shapes and colors. The architects' task was to assemble the façade from existing elements, the form of which they had no control over, in order to meet building regulations and achieve the best possible visual effect (Rotor).

The material is just what it is. It has objective characteristics attributed to its physicality, and the role of the designer is to give it a meaning and a certain character. Just as Michelangelo already saw his work in a block of unworked marble, the architect's task will increasingly be to look for the future shape of the designed building amidst a pile of concrete and steel.

Klimowicz Joanna
dr hab. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

joanna.klimowicz@pw.edu.pl

Nowak Anna
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

anna.nowak@pw.edu.pl

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Raw earth 3D printing as a solution for future settlements

Most of the modern populations lives in the urban areas - cities. According to the UN 55 per cent of the world's population residing in urban areas in 2018…… by 2050, 68 per cent of the world's population is projected to be urban. There is significant diversity in the urbanization levels reached by different geographic regions. (b.a. 2019) Today urbanized areas are facing many internal and external problems, especially those related with climate changes. Rapid and sudden weather anomalies (phenomena's) such hot waves, fires, floods or drought have significant influence on quality of life in modern cities. Previously people migrated for better job, now the migration is caused by lack of drinking water, clean air or even common strategy for coping with and recovering from droughts and floods. (Bhat, G. K.,et al. 2013, Opitz-Stapletion S. et al., 2017).

Today's growing agglomerations, giving residents new jobs and new spaces to live in, face such significant problems affecting the quality of life as noise, smog (pollution), lack of sufficient biologically active areas, lack of ventilation or overheating problems. In an effort to provide their residents with the best possible living conditions, modern cities are trying to introduce various types of modern technologies and solutions to improve the comfort of residents. On the one hand, modern technologies make it possible to monitor any changes taking place on our globe, and on the other hand, they are increasingly standing up for residents who would like to live in places that are friendly and adapted to their needs. Modern solutions are therefore being sought to protect the population from ongoing climate change.

Among the new methods that could become future-oriented when it comes to erecting buildings is 3D printing, currently used in construction. It is one current new technology that could contribute to the use of one of the more accessible materials - clay. Clay as a building material has been known since ancient times. The most known raw earth buildings are: Great Wall in China build 2000 years ago and Alhambra Palace in Spain form 13th century. Today clay, it is one of the materials that can contribute to the development of eco-friendly construction. Buildings made by clay might be given as a self-help constructions allowing many people to realize their dream about home. Particularly dedicated for those people who are interested in sustainable development, pro-ecological and pro-environmental design, because raw earth is often a credible alternative to cement (and concrete), the production of which involves between 6 and 8 per cent of the world's annual CO2 production (Dethier J., 2020) It might be treated as alternative to many other contemporary materials. Earthen materials are perfectly in line with Circular Economy principles through their infinite re-usability and re-cyclability, with their only downside being the addition of recyclable components, if required. (Morel J..C. et al., 2021)

Looking forward to the future the constructions made by raw earth might become one of the most needed by 21st century societies. Especially when we will be looking for reusable materials for construction Earthen buildings can be easy returned to earth, they can be treated as a materials in the building life cycle (cradle to cradle). Their look benefits user by its aesthetic purity of the whole arrangements. Compilation of 3D printing and using the raw earth materials for construction might be to solution for future settlements.

Koznarska Halyna
dr Eng. arch.,
Lviv Polytechnic National University,
Architecture and Design Institute

halyna.y.koznarska@lpnu.ua

Zinowiec-Cieplik Kinga
dr Eng. landscape arch.,
Warsaw University of Technology,
Faculty of Architecture

kinga.cieplik@pw.edu.pl

Wiśniewski Leszek
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture
leszek.wisniewski@pw.edu.pl

Bibliography:

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Modern solar energy systems’ influence on urban landscape aesthetic qualities

In recent decades, the world has increased attention to the harmful effects of fossil energy sources on the planet’s ecosystem and the need to use renewable energy sources. After the start of Russia’s full-scale war against Ukraine, the European Commission introduced the REPowerEU plan (European Commission: REPowerEU, 2024), which foresees faster transition to renewable energy sources in order to get free of Russian gas dependency. One of the initiatives of the EU Strategy for solar energy is the “European Solar Roof Initiative” which aims to accelerate the harnessing of the vast and underutilized potential of rooftops for clean energy production. It is proposed to introduce the obligation to install solar energy systems in various types of buildings over the coming years, starting with new public and commercial buildings, as well as residential buildings (European Commission: Solar energy, 2024).

Installation of solar roofs enables consumers to gain part of their electricity needs. Many households are installing solar but this trend, in addition to positive consequences, has many negative ones. Installation of panels on an existing roof often provokes subsequent destruction of the entire structure. After all, solar panels have rather large weight, you should as well remember the wind load, which increases every year due to climate change. It is necessary to emphasize the loss of aesthetic appearance of the building itself in the city environment. In most cases, installed solar panels are not coordinated with its environment and have a negative impact on the overall order of the city. The authentic appearance of buildings is disturbed and the general landscape of the city is distorted.

The most optimal solution is to include photovoltaic elements already at the building design stage. This will enable the composition of the object to harmonize with its surroundings. In addition to solar panels, specific technologies are currently available, e.g. solar roof tiles, which perfectly accumulate solar energy, with very good mechanical (Tesla. 2024) and aesthetic properties (Solarstone. 2024).

The designer must select appropriate components from different manufacturers to ensure a functional and aesthetic result. Too low compatibility between systems from different manufacturers is a big challenge. The existence of integrated production of all solar roof elements could provide the designer with greater opportunities to implement bold architectural solutions using renewable energy sources.

To sum up, it should be noted that despite the economic efficiency and beneficial impact on the urban ecosystem, the installation of photovoltaic roofs may lead to the loss of the authentic city landscape. The installation of photovoltaic technologies itself requires a comprehensive design and technological approach to achieve spatial order.

Kryvoruchko Yuriy
dr hab. inż. arch.,
Lviv Polytechnic National University,
Architecture and Design Institute

yurikryv@gmail.com

Voronych Yaryna
mgr inż.,
Lviv Polytechnic National University,
Architecture and Design Institute

yvoronych@gmail.com

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Neighborhood environment and historical spatial archetypes in the planning structure of the modern city

In the city of Zolochiv in Western Ukraine, scientists and experts in the field of urban planning, architecture and anthropology from 7 countries of the world (USA, Germany, Italy, Poland, Great Britain, Canada, and Ukraine) held two interdisciplinary workshops and developed architectural and urban planning tools and mitigation mechanisms trauma caused by war.

A survey of residents, including internally displaced persons, found that mitigating trauma and reducing contradictions between socio-cultural groups of townspeople is achieved by creating open public spaces of the "neighborhood" for dialogue and communication between people.

In the workshops, a methodology for creating a neighborhood environment was developed using the historically composed spatial archetypes of the city and their translation into the modern planning structure of the city.

The spatial structure characteristic of historical cities generated social interaction of residents. There are more than 400 historical settlements in Ukraine. Zolochev's experience can be applied to historical settlements, which most often need sources of growth and activity activation. The social activity of the population, the vital activities of the city can maintain and develop the cultural potential of these historical and important settlements for Ukraine. It is the historical structures of cities, having significant cultural potential, that are most vulnerable in modern development.

When designing open public spaces in the structure of the city, it is advisable to rely on the idea of a 15-minute city with a traditional small-town pedestrian accessibility zone from housing to the place of work, education, children's preschools, the concentration of services in the city center, and the proximity of recreation areas. It is advisable to look for places of possible activation in the urban fabric, centers of attraction - stops of local passenger transport (for example, a school bus stop), a small store, kiosk, workshop, where simple services can be provided (bakery, repair of shoes, clothes, appliances).

Best practices in the design of new urban development objects with a sufficient number of open public spaces in the neighborhood within a 15-minute walking distance in historic cities will ensure the activation of public functions and the consolidation of urban society.

Such a technique will allow at the same time to preserve and develop the compositional-spatial structure of cities by defining a peculiar code that formed local spatial stereotypes for centuries.

The method of creating a neighborhood environment, the use of historical spatial archetypes of the city in the development projects of the modern planning structure of the city and its surroundings (in the Comprehensive plans for the development of the territory of territorial communities) can be introduced into the normative legislative framework in the form of zoning, which will take into account the content, density, spatial stereotypes of settlements and intensity use of spatial potential and resources of the territory.

It is necessary to bring the developed Methodology and Best Practices for the development of the territories of territorial communities to the consideration of the Urban Planning Council under the Ministry of Development of Communities, Territories and Infrastructure of Ukraine (Ministry of Reconstruction) with the aim of introducing them into the legislative field and the practice of designing the development of communities, territories and infrastructure. The working group of the Verkhovna Rada on the development of the Urban Planning Code of Ukraine should take into account the proposals of the international group of experts and designers regarding the implementation of the Methodology and Best Practices for the Urban Planning Code of Ukraine.

Kryvoruchko Yuriy
dr hab. inż. arch.,
Lviv Polytechnic National University,
Architecture and Design Institute

yurikryv@gmail.com

Wierzbicka Anna Maria
dr hab. Eng. arch., associate professor,
Warsaw University of Technology,
Faculty of Architecture

anna.wierzbicka@pw.edu.pl

Voronych Yaryna
mgr inż.,
Lviv Polytechnic National University,
Architecture and Design Institute

yvoronych@gmail.com

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The realities of the war dictate the direction of the rebuilding of Ukraine

In the aftermath of the war between Ukraine and Russia, the destruction of cities, villages, and critical infrastructure has left a significant impact on Ukraine.

With over a million residential buildings, schools, hospitals, and transportation networks destroyed, the country faces a daunting task of reconstruction. The conflict has resulted in a humanitarian crisis, displacing millions of refugees from Ukraine. The reconstruction efforts necessitate a substantial investment of $486 billion by the end of 2023.

To rebuild the country, the reconstruction plans must follow the principles of "build back better," emphasizing the enhancement of the previous state. Sustainable construction strategies, decentralized approaches, and the integration of renewable energy sources are vital components for successful reconstruction. International collaboration is crucial, with a focus on reducing CO2 emissions from construction and aiming for carbon neutrality in buildings by 2050.

The war in Ukraine has caused a lot of destruction, and many people have lost their homes and cannot return to their place of residence. In such a situation, rebuilding infrastructure and housing becomes a key challenge. When implementing reconstruction plans, various factors should be considered, such as choosing building materials that align with the idea of the New European Bauhaus, which focuses on sustainable development and safety issues. NEB, based on three values: aesthetics, sustainable development, integration, and additionally considering reconstruction after wartime, can potentially change the face of social, ecological, and economic growth. As the first value, aesthetics refers to harmonious and beautiful design that respects nature, surroundings, and history.

Sustainable development, the second critical value, is the foundation of the New European Bauhaus program. By sustainably using resources, drawing inspiration from nature, and caring for reconstruction after wartime destruction, these projects aim to minimize the negative impact on the natural and social environment. For example, rebuilding historical buildings after wartime destruction can be done using renewable materials and low-impact environmental methods combined with modern energy technologies.

Integration, the third value, is crucial in reconstruction after wartime destruction. Actions promoting social inclusion, combating inequalities, and rebuilding local communities are significant for post-conflict reconstruction.

Choosing suitable materials is crucial in the "Build back better" concept. The investor's decision regarding the materials used for reconstruction significantly impacts durability and sustainable development. In this context, issues such as circularity, renewability, CO2 emissions, and the use of renewable resources should be considered. Avoiding the transportation of materials from distant regions is essential for both economic and ecological reasons.

One of the key materials that can be used in reconstruction is wood. A leading producer of wood in Europe can play a significant role in supplying materials for reconstruction. Wood can not only be used as a finishing material but also as a structural material in lightweight timber prefabrication. Lightweight timber prefabrication allows for faster and more efficient construction of housing, while reducing CO2 emissions and production costs.

Cross-laminated timber (CLT) is increasingly used for building houses and office buildings. This is an efficient and ecological way to use wood, which can contribute to the sustainable reconstruction of the destroyed landscape. Building materials are a vital part of the reconstruction process, and the right choice can significantly impact the durability and effectiveness of actions.

Linda Svitlana
prof. dr hab. Eng. arch.,
Lviv Polytechnic National University,
Architecture and Design Institute

svitlana.m.linda@lpnu.ua

Sosnova Nadiya
dr hab. Eng. arch.,
Lviv Polytechnic National University,
Architecture and Design Institute

nadiia.s.sosnova@lpnu.ua

Kaufman Maciej
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

maciej.kaufman@pw.edu.pl

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The importance of building materials in the shaping of inclusive urban space

The article is devoted to the choice of footpath material for a comfortable space for the movement of disable people. This topic is particularly relevant for Ukraine, as active hostilities continue and the number of injured people is constantly growing. Statistical studies show that Ukraine is projected to have the largest share of people with disabilities in Europe. Creating an inclusive urban environment is becoming an urgent need for designers. People with special needs for the organisation of the urban environment include people with various visual impairments, musculoskeletal disorders, people with temporary health problems, such as abnormal blood pressure, disorders of the vestibular apparatus after injuries, strokes, and concussions. In the context of the above, the choice of material for paving pedestrian communications is subject to particularly high requirements.

The purpose of this study is to establish the relationship between the choice of pavement material for pedestrian communication and the comfort of movement for people with disabilities. The research methodology is based on the analysis of literature sources, and the empirical basis is based on observations and surveys conducted in Lviv (Ukraine) over the past year. The object of observation was the materials of paving pedestrian spaces in the central part of the city. Observations were made at different times of the year and in different weather conditions (rain, snow, ice). The discussion of the study results includes the identification of the best materials for covering pedestrian communications for people who use wheelchairs, prostheses, crutches, canes for the blind or visually impaired.

According to the results of the study, artificial materials are poorly suited for use by visually impaired or blind people, in particular, small cement paving stones up to 12 cm in size with a chamfer, the format of which and the chamfer make it more likely that surface irregularities will occur during use. Paving made of natural materials, such as basalt and granite paving stones of 20-25 cm in size, are poorly suited for use by people in wheelchairs and with prostheses, as unevenness of the surface, its convexity and large seams between the stones become a architectural barrier. Poorly suitable for use by people with auxiliary support devices - walkers, crutches, canes - are granite paving stones of small sizes up to 12 cm, because of the convexity of its small surface, there is no support for the plane of the tip of the stick. Also difficult to move with assistive devices is the pavement made of loose materials - fine-grained stone chips used in parks.

For all of the above groups of people with mobility difficulties, 30 cm x 30 cm granite tiles are poorly suited for use, both polished, as they are slippery in rain and snow, and heat-treated, as they are not well cleaned from ice and have minor irregularities.

The developed research method was used to qualitatively analyse park surfaces in the “Burza” Action Park on the Warsaw Uprising Mound in Warsaw. Due to the significant differences in height and the steep slopes, various solutions were used in the park to improve accessibility for people with limited mobility.

Adaptation of existing materials and introduction of new ones in the construction of inclusive sidewalks and public spaces is an important aspect in solving the problem of city accessibility for all people, regardless of their physical or cognitive abilities.

Ławińska Katarzyna
dr hab. Eng.,
Łukasiewicz Research Network,
Łódź Institute of Technology

katarzyna.lawinska@lit.lukasiewicz.gov.pl

Miśkiewicz Katarzyna
mSc.,
Łukasiewicz Research Network,
Lodz Institute of Technology

katarzyna.miskiewicz@lit.lukasiewicz.gov.pl

Lasoń-Rydel Magdalena
mSc. Eng.,
Łukasiewicz Research Network,
Lodz Institute of Technology

magdalena.rydel@lit.lukasiewicz.gov.pl

Masłowska-Lipowicz Iwona
dr Eng.,
Łukasiewicz Research Network,
Lodz Institute of Technology

iwona.maslowska@lit.lukasiewicz.gov.pl

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Lasoń-Rydel Magdalena, Masłowska-Lipowicz Iwona

Use of mycelium of higher fungi to produce the material of the future

A diverse array of mushrooms, including oyster mushrooms, Armillaria, and Lentinula edodes, can be cultivated throughout the year. These mushrooms are prized for their flavor and aroma, and they possess numerous health-promoting properties. Mushrooms contain a considerable amount of moisture (85–95%), carbohydrates (35–70%), protein (15–34.7%), fat (10%), minerals (6–10.9%), and nucleic acids (3–8%) [1]. Additionally, it contains a considerable quantity of vitamins, including thiamine (1.4–2.2 mg%), riboflavin (6.7–9.0 mg%), niacin (60.6–73.3 mg%), and biotin. Corbic acid is present in quantities ranging from 92 to 144 milligrams per 100 grams, while pantothenic acid is present in quantities ranging from 21.1 to 33.3 milligrams per 100 grams. Folic acid is present in quantities ranging from 1.2 to 1.4 milligrams per 100 grams, as determined by dry weight basis [2,3]. Additionally, edible mushrooms are a rich source of micro- and macronutrients.

Despite this, they are not solely a valuable part of our diet; they are also an excellent material for the manufacture of products with a significant environmental impact. Fungal mycelium plays a crucial role in this process. It is the vegetative part of the fungus, consisting of a number of filamentous fibers that extend out of the fungus [4]. Mycelium-based bio-composite materials have been invented and widely applied to different areas, including construction, manufacturing, agriculture, and biomedical research [5].

In the research presented in this paper, an attempt was made to produce a prototype structural material based on fungal mycelium. The mycelium was pre-cultured on waste from the agro-food industry, formed into the desired shape, and then pressed and inactivated by high temperature. To ensure the highest possible growth efficiency, the culture was carried out at the temperature and humidity optimal for the growth of the fungus species. To harden the final structure, a natural biopolymer with hydrophobic properties was used to coat the produced material. The main purpose of the presented project is the cultivation of selected species of higher fungi that bind organic matter from waste through a network of fibers in a natural biological process, resulting in a lightweight and flexible construction material.

Tests conducted in an accredited laboratory demonstrated that the produced mycelium-based materials exhibited heat transfer coefficient values comparable to those of commonly used products, such as polystyrene, mineral, glass, or rock wool. Additionally, they were found to be a valuable source of nutrients for the soil and to be devoid of hazardous substances.

The distinctive characteristics of our product render it an optimal substitute for non-biodegradable materials that are commonly utilized in packaging, construction, wall panels, and other applications. Moreover, the material's fine-tuned mechanical properties enable its use in the production of biodegradable packaging materials and furnishings, as well as sound-absorbing materials.

Our material represents an environmentally friendly alternative to polystyrene foam and other synthetic materials, offering a competitive solution to the popular MDF boards.

Furthermore, the higher fungi have low requirements during breeding, making them an attractive option for use in the production of this prototype. The main benefits of using this prototype are lower production costs, lower energy consumption (production), reduced use of chemicals, and a reduced environmental impact. Additionally, the product is completely biodegradable.

In conclusion, it can be reasonably asserted that composite materials based on higher fungal mycelium are destined to become the material of the future. It is our hope that they will replace non-biodegradable materials, thereby conferring a net benefit to the environment.

Łątka Jerzy
dr Eng. arch., Faculty of Architecture, Wroclaw University of Science and Technology

jerzy.latka@pwr.edu.pl

Jorgen Artur,
mSc. Eng. arch.,
Faculty of Architecture,
Wrocław University of Science and Technology

arturjorgen@gmail.com

Pawłosik Daria
mSc. Eng. arch.,
Faculty of Architecture,
Wrocław University of Science and Technology

daria.pawlosik@gmail.com

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The Caterpillar Pavilions as an examples of implementation of timber- and paper-based materials in pop-up structures

Events such as trades, fairs, conferences or festivals require instant rearrangement of the surroundings, creating a scenography that will arouse the interest of passers-by with its form, materials, colour, illumination or sound. The pop-up structures such as stages, pavilions or exhibitions are deployed for several days and then disassembled and disposed of or moved to another location (Łątka and Święciak 2021).

One such example was the Festival of the New European Bauhaus, which took place in April 2024. The organisers of the festival commissioned the authors of this article to prepare two temporary Caterpillar Pavilions, which were to be one of the three ‘Masterpieces’ and at the same time host an exhibition related to the festival. The other two pavilions were Bamboo Trillix Pavilion by bkvv architecten (NL) and Portable City by Enorme Studio (ES) (Architectural Masterpieces in the Cinquantenaire Park, 2024).

The Caterpillar Pavilions were made from laminated timber arches and paper tubes. Each of the pavilions was made of 24 arches that had radii ranging from 235 to 265 cm. Between the arches, 330 paper tubes with a diameter of 270 mm, 7mm thickness of the wall and 600 mm in length were installed perpendicular to the centres of the arches. This created a rhythmic and soft shape of the pavilions, from which they got their name. The tubes made from recycled paper were waterproofed with the use of natural products such as linseed varnish and wax. Each of the tubes was enclosed with two caps, made of metal spigot, rubber seal and plexiglas circles that carried the exhibition.

Additionally, the tubes were illuminated with separately controlled LEDs in full RGB spectrum, this in turn added an illuminating overlay that pulsed with colours of the New European Bauhaus. Every 15 minutes, a dynamic colour show was switched on. Thanks to the WiFi connection, the colours, the rhythm and the show of the illumination could be controlled remotely.
The pavilions were the result of the collaboration of an interdisciplinary team comprising architects, IT specialists, electronics engineers and electricians and were presented in the Parc du Cinquantenaire in Brussels between 9th and 13 April. Afterwards, they were transported to Wrocław and were located on the campus of Wroclaw Tech.

The Caterpillar Pavilions were examples of the use of unusual materials in temporary structures and at the same time went along with the goals of the New European Bauhaus (New European Bausaus, 2023):

·sustainability, from climate goals to circularity, zero pollution, and biodiversity

The use of timber- and paper-based materials was a showcase of the bio-based products implemented in architectural structures.

·aesthetics, quality of experience and style beyond functionality

The form of the pavilion was unobvious, according to the survey it was associated with sculpture (37,5%), industrial construction (31,3%), animal (25%), a bacterium (18,8%) or even rock climbing.

·inclusion, from valuing diversity to securing accessibility and affordability

The pavilions were presented outdoors and were open 24h thus, anyone could enter the pavilions and visit the exhibition at any time of day. The illumination operated from 8 pm until 03 am.

Nawrocka Marta
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

marta_nawrocka@icloud.com

Szymanik Maciej
Eng. arch.,
Warsaw University of Technology

mszymanik@wsc.pl

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Synergy of the future - building materials and computer technology

In modern architecture, one can observe many directions and trends that are developing in parallel. Undeniably, one such direction is the setting of standards for sustainable construction, which includes the development and use of new building materials with the idea of reducing their negative impact on the environment. Reducing the carbon footprint is key, particularly in the construction industry, which accounts for 37% of global CO2 emissions, including 10% from the production of building materials [1]. Another phenomenon is the increasing use of advanced computer methods that can analyze the environmental impact of buildings throughout their life cycle, as well as allow optimization of any processes. In this paper, we highlight selected aspects where the use of synergies of the above directions can add value to the construction industry.

From the earliest conceptual stages, generative design tools are worth implementing, allowing far-reaching optimization of the component's geometry, depending on its intended use. With the development of 3D printing technology, there is a paradigm shift in the design of building elements. The versatility of use of a given element and its repeatability as a prefabricated item loses its importance, while its individual optimization of geometry and structure resulting strictly from the analysis of forces occurring in each element depending on its application become more important. This makes it possible to reduce the amount of material used, and therefore the weight, while increasing its strength [2]. The ability to print building components directly on site further contributes to lowering the carbon footprint of the entire process, minimizing the need to transport components. The technology thus makes it possible to take a step toward minimizing the environmental impact of materials commonly considered high-emission, such as concrete. Built in 2021 by Professor Xu Weiguo's Team, the concrete book pavilion, thanks to shape optimization, did not require the use of reinforcement, which will significantly facilitate the reuse of the material after dismantling [3].

Importantly, 3D printing technology also allows the use of bio-based materials, as exemplified by BioHome3D, a single-family home produced in late 2022 by the University of Maine's Advanced Structures and Composites Center (ASCC). Bioresin and wood fiber pulp were used to print it, and as a result the house is 100% recyclable [4].

The increasingly widespread use of BIM methodology can prove particularly helpful when working with non-standard materials that are entering the architectural and construction market. The ability to build a database of each material's property parameters in the program, such as thermal conductivity and capacity or vapor permeability, combined with data on the geometry of the material used, translates into the ability to analyze the environmental impact in real time. Several independent companies are active in this area, developing specialized third-party programs that work with BIM standards and extend their capabilities. One such program is pycab, which analyzes buildings for embedded carbon footprint using databases, providing results that are closest to reality and confronting them with the RIBA 2030 standard [5].

Essential to the full use of digital methods is the constant expansion of the materials database. Worth mentioning are Phyllis2 (TNO), which collects data on biomaterials, or the ICE Database. It is also essential that manufacturers provide comprehensive data on developed materials. This information forms the basis for further work and computer aided development.

Neumann Małgorzata
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

malgorzata.neumann.dokt@pw.edu.pl

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A customised approach to standardisation in architecture

The paradigms of prefabrication, modularity and standardisation often emerge as strategies for dealing with contemporary contexts marked by factors such as migration, the devastation of war and persistent housing shortages. Moreover, in the face of resource scarcity, the imperative to increase productivity and use materials wisely has never seemed more justified. (K. Anastasiades, 2021). Historically, the approach of optimising the building process was implemented in various ways. In Poland, prefabrication and standardisation (in Polish: “prefabrykacja i typizacja”) were the grand notions of Communist era architecture, both implemented by law towards the end of 1950’s. They were intended to bring about a simplified and cost-effective construction process by accelerating the pace of building. Prefabrication was predominantly utilised in housing, while standardisation was commonly employed to deliver small public buildings. Standardised projects were prepared in state offices in Warsaw and distributed in the form of guidelines and catalogues. Consequently, the role of the local architect was limited to the adaptation of directives to the physical conditions of the site with very limited margin for change. There were many reasons for employing standardisation in the building process in Poland at that specific time. The main one being the huge and evergrowing need for housing and public building. The rational and simplified system was suitable to providing the required public facilities and was architecturally compatible with the functionalist and modernist movements of the day. Moreover, centralised management of the building process was an easily integrated component of the communist government’s centrally planned economy (Czaplewski, 2016). The government controlled the infrastructure sector within its highly bureaucratic operational framework. The benefits of standardisation, as understood today, were at odds with the reality of a communist country. A bureaucratic need for quantifiable achievements in the building sector led to excessive focus on fulfilling required quotas. Standardisation became an autonomous goal, beyond just a means to enhance the state of the built environment (Włodarczyk, 2000) . The centralised economy reinforced state construction companies, leading to a complete monopoly in the sector. “An enforced standardisation was applied regardless of the existing spatial condition, combined with low technical and aesthetic qualities of building, it was mainly to the benefit of construction companies.”(Włodarczyk, 2000) The shortcomings of the standardised design process, including poor quality finishes, austere spaces and spatial disorder, are evident in many of the small public buildings of the time. Conversely their positive features were repeated en masse. Including the use of a frame structure for example, providing a strong but flexible framework that presents many design possibilities. Furthermore their tendencies towards open space and vegetation surrounding the buildings. Standardised architecture constitutes large parts of Polish cities, However, in the discussions of post-communist architecture it remains overshadowed by the more evocative modernist concepts of the time. With the return of the theme of optimisation and new thinking around circular economies and adaptive re-use in the construction process as a response to today’s challenges, a look back into the past and an inventory of the current urban fabric can yield interesting results.

Nowak-Pieńkowska Małgorzata
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

malgorzata.pienkowska@pw.edu.pl

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Challenges and discussions – Seagrasses as a local building material

Seagrass is a natural raw material used mainly in the furniture industry, but its potential is much greater. These photosynthetic plants are found in the shallow waters of shorelines. They are responsible for binding and storing significant amounts of CO^2. They participate in the creation of marine ecosystems as habitats for various species of organisms. They also improve the quality and transparency of water. They are used as a storm buffer on shorelines and as a wave dampening element. According to research, underwater grass meadows decrease by approximately 7% annually and therefore require protection.

A separate issue related to these plants is their presence on beaches along with other organic waste. This creates a number of discussions and questions about whether it is justified to clean the beaches of dead marine plant remains washed up on the beaches. This topic is analyzed by 14 institutions from several countries as part of the European project CONTRA (Conversion of a Nuisance To a Resource and Asset). The basic task of research is to verify and determine the specific purposes for which this material can be used. The Gdańsk University of Technology undertook to research the suitability of grass and seaweed in composting as a material for the production of fertilizers. In Sweden, the use of waste in the anaerobic digestion process (biogas) is being investigated. In the Bay of Puck (Poland), the flow of pollutants from rotting marine algae on beaches to the coastal zone was analyzed. None of the 6 different case studies consider the recovery of various seagrass leaves from (Beach wreck) to create modern building materials.

In the past, seagrass was used more often in traditional construction, but the process of collecting, drying and processing it was time-consuming and labor-intensive. Residents of settlements located on the waterfront used this material because it was free and easily available. The grass is resistant to biological corrosion due to the significant content of sea salt in the leaves.

Historical and contemporary uses:
External seagrass plasters were made as a form of camouflage on military facilities. This solution was used in the bunkers of the “”Wilczy Szaniec”” complex in Kętrzyn. A mixture of seagrass and green periwinkle was applied to the walls of buildings. The buildings blended into the surrounding landscape through their green, irregular and porous structure. In historical plasters, chaff from straw, reed, grass and bast, as well as plant fibers, wool fibers and animal hair were used as reinforcement. These materials significantly improve the tensile, bending, shock and vibration strength of plasters.

Local seagrasses were once used for roofing in Scandinavia on the Danish island of Læsø due to wood shortages. The best raw material was thoroughly dried grass with leaves over a meter long. Currently, local initiatives are being developed to preserve tangtag roofs, which are an inseparable element of the island’s cultural landscape.

Seagrass wallpapers are made of seagrass woven on hand looms and glued to a paper backing. Used to decorate interior elements or furniture.

It is important that the methods of obtaining plant raw materials involve only collecting them from beaches and not through predatory economy destroying underwater seagrass meadows. Currently, many tourist resorts are faced with the problem of beach wreck, which is unsightly and emits an unpleasant odor. Therefore, coastal cities regularly clean the beach and dispose of waste. For sustainable management of these natural wastes, a technological segregation process should be developed. When analyzing the above issue, a detailed analysis of the use of grass obtained from beaches for processing and use in construction should be carried out. It can be used as a building material or its component in natural facade plasters or under-plaster mats. In the processing of long fibers with admixtures of other natural materials, they can create boards with insulating properties. The study is partial and contributory. It may be of interest to a wider circle of researchers.

Nozaki Tsutomu
prof.,
Helena Chodkowska University of Technology and Economics

tsutomu.nozaki28@gmail.com

Bibliography:

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The ability and possibility of modern wooden architecture for sustainable architecture with harmony of nature in Japan. From traditional to the sustainable architecture by using new structure materials, Cross Laminated Timber.

What are new architectural materials for design in future?

In the 20th century the concrete, steel and glass materials for architecture had been dominated. On latter terms of the 20th century glass windows were popular as curtain wall. At the 21th centuries we must conside experience the life style with symbiosis of nature and realize them by modern wooden architecture. We must create comfortable space with natural materials such as wood for humans.

From the beginning of the 6th century traditional wooden architecture was nominated and high technology for structure of architecture in Japan. Such as wooden Buddhist Temple"Horyuji",and the biggest wooden Buddhist Temple "Toudaiji". In these buildings traditional structure without nail was used. The wooden structure can be consider as new modern materials. These new wooden materials will be developed by new wood technology in our times like Mass Timber, CLT [Cross Laminated Timber]. Talking about sustainable architecture, we must return to the modern architectural movement as Metabolism theory in 1960s.

Japanese architects, Kisho Kurokawa and Kiyonori Kikutake, created Metabolism theory, in which architecture can grow together such as human cell, life-form with society and nature change. How can contribute modern wooden architecture to sustainable architecture? Their elements save energy, provide CO2 reduction, reuse materials, use solar panel and eco materials, reuse rainwater, green walls and roofs, use geothermal heat utilization, passive design reduce environment load, use natural wind and light. Wooden architecture is sustainable, because it is possible to recycle. Now biophilia design which are interested so that people can relax in space which is designed by wood materials. Biophilia means that human can relax in a natural setting. Many Japanese architects are trying to use modern wood technology such as CLT and design high wooden buildings: hybrid wood and steel structure. These architects are among others: Kengo Kuma, Shigeru Ban, Terunobu Fujimori, Tyoo Ito, Takaharu Tezuka etc. Kengo Kuma designs new wood materials" CLT", and Shigeru Ban projects were designed in the construction of paper pipe, in Japanese, "Shikan". Texture, poster board, paper and card board are characteristic of sustainable design. Terunobu Fujimori designs the architecture in harmony with nature.

In 2025 EXPO OSAKA/KANSAI, Polish Pavilion has been designed with Japanese traditional wood structure. It is very interesting pavilion from point of use for modern wood materials. The architect, Sousuke Fujimoto, designs wooden structure in then shape of "Ring" of 12 m high. It is going to be the biggest modern wooden pavilion in the world during EXPO 2025 in Osaka/Kansai.

Onufriv Iaryna
dr Eng. arch.,
Lviv Polytechnic National University,
Architecture and Design Institute

yaryna.o.onufriv@edu.lpnu.ua

Lukashchuk Halyna
Dr in Agricultural Sciences,
Lviv Polytechnic National University,
Architecture and Design Institute

halyna.b.lukashchuk@lpnu.ua

Duda Magdalena
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

magdalena.duda@pw.edu.pl

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Landscaping as the newest ecological material in the urban environment

The contemporary urban landscape is transforming profoundly as the imperative for sustainability becomes increasingly prominent. Within this context, the urbanised environment needs to improve living conditions for its inhabitants from the point of view of ecology and comfort for people. Landscaping can be considered a new ecological material with high ecological characteristics, contributes to the improvement of the microclimate and has a positive effect on the psychological state of people, which is confirmed by numerous scientific studies [1].

In world practice, there are many types of landscaping applications as a material in city architecture. In particular, the following elements can be highlighted: green roofs, vertical landscaping in the interior and exterior, vertical farms, etc. Green roofs are created in different forms: geoplastics – the transition of the landscape to the roof of the building; lawn, beds or gardens on the roof; green public transport stops, etc.). Greening of roofs helps to regulate precipitation, improves energy saving of buildings, contributes to reducing the greenhouse effect, improving the microclimate of the house, and reducing dust and chemical pollution. One of the most essential stages of creating green roofs is the selection of an assortment of plants. In particular, the scientists studied about 27 landscaped roofs in Lviv, on which landscaping of five types is arranged: “Sedumny carpet”, “Lawn roof”, “Scented herbs”, “Grain garden”, and “Roof garden”. These green roofs are often arranged at heights from 3 to 40 m. [2]. Public space of green roofs contributes to creating vibrant and livable urban spaces, often with carefully planned unic viewing strategies [3]. Vertical landscaping in cities is mainly found in the following forms: external end walls of buildings with carpet landscaping (application of hydroponic systems); carpet landscaping made of bryophytes in the interior; container landscaping (standing and suspended containers) in buildings and public spaces; forming the walls of “smart screens” with climbing plants (exterior and interior).

Vertical farms in cities are becoming increasingly popular today due to saving space and ensuring economic stability and sustainability. Such farms are formed using various suspended structures, such as public farms in Long Island City, New York, USA, 2008, or individual farm buildings (Harlem, New York, USA, 2007). Public Farm 1 was a testament to the possibilities of rural engagement in urban environments and proposed that cities be reinvented to become a more complete and integrated system capable of producing their own food, producing their own power, and resuming their own water while creating new shared spaces for social interaction and public pleasure. The project was built entirely with recyclable materials, powered by solar energy, and irrigated by a rooftop rainwater collection system [4].

The use of greening as a material in architecture has a high potential for introducing and implementing nature-oriented solutions in modern cities in conditions of global warming. On the other hand, these materials and technologies are expensive, so they are rare, particularly in Ukraine. Therefore, one of the crucial tasks for scientists is the development of the latest technologies that would ensure the cost reduction and simplification of plant care in urban conditions.

Orchowska Anita
dr Eng. arch,
Warsaw University of Technology,
Faculty of Architecture

anita.orchowska@pw.edu.pl

Chudzińska Agnieszka
dr Eng. arch,
Warsaw University of Technology,
Faculty of Architecture

agnieszka.chudzinska@pw.edu.pl

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Contemporary possibilities for the use of reclaimed wood in interior design

At a time of strong technological advances and the growing need to manage natural resources responsibly to protect the climate, contemporary architecture faces the challenge of using rational finishing materials that meet sustainability criteria. The aim of this paper is to present the results of analyses related to the use of reclaimed wood in interior architecture, which, thanks to innovative processing methods, is now becoming a key element in the sustainable aesthetics and functionality of residential and commercial spaces. The examples presented in the paper combine wood with other finishing materials. The reuse of wood contributes to the reduction of negative environmental impact by reducing CO_2 emissions, promotes recycling and offers unique aesthetic possibilities, reflecting modern trends in architecture with respect for nature.

According to the World Bank Group, the world generates approximately 2.01 billion tonnes of municipal solid waste of which wood accounts for (5%).('Solid Waste Management', 2019). Reclaimed wood is the air-dried wood that remains after the demolition of buildings constructed with virgin wood. It has a history and personality, and its use adds a distinct flavour to the interior.

Using reclaimed wood presents a number of challenges:

-it can be difficult to access, especially in large quantities, specific species,

-often needs to be repaired due to damage, defects such as knots or holes,

-has a reduced lifespan and is exposed to the effects of time and weather,

-may contain pests, such as beetles or termites, and chemical contaminants.

Reclaimed wood is used in walls, flooring, mouldings, doors, countertops, tables, shelves, beams and wall and ceiling panels. For interiors styled with wooden structures, ready-made box beams made from reclaimed wood can be used to imitate traditional beams. In addition, furniture collections are available. Japanese designer Yuma Kano creates 'ForestBank' furniture by combining wood waste with a reactive mineral base and aqueous mineral resin, resulting in terracotta-like effects.

In order to effectively reuse timber in design, it should be taken into account at the initial stage of the process. Design should focus on verifying cross-sectional dimensions at the outset and allow for modifications to the lengths of the elements until the project is completed . (Bergsagel & Heisel, 2023). Due to the difficulty in recovering long pieces of wood, it is recommended to design smaller units. The treatment of reclaimed timber often leads to a reduction in cross-section and length, necessitating the avoidance of fixed dimensions and spans and instead the definition of dimensional ranges. The original design need not be strictly adhered to. Beams from horizontal structures can be converted into columns for vertical structures and vice versa. Large laminated beams and columns from industrial or warehouse buildings can be used as wall panels or floor plates, similarly to cross-laminated timber. (Huuhka, 2018).

The design challenge remains to integrate solutions with current building and interior standards, requiring a dialogue between designers, engineers and users, who are increasingly looking for spaces that are compatible with ecological and healthy living ideas.

Pavliv Andriy
dr hab. Eng. Arch,
Lviv Polytechnic National University,
Architecture and Design Institute

andrii.p.pavliv@lpnu.ua

Kvasnytsya Roksolyana
Ph.D in Art,
Lviv Polytechnic National University,
Architecture and Design Institute

roksoliana.b.kvasnytsia@lpnu.ua

Strzelecki Filip
mSc. Eng. Arch,
Warsaw University of Technology,
Faculty of Architecture

filip.strzelecki@pw.edu.pl

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Architecture and design for Emergency - modern Ukrainian challenges

Architecture and design for emergencies is the design culture's response to any situation requiring swift and functional solutions. The examples of such situations can be ecological, humanitarian, medical, or military crises. The concept of "design for emergency" encompasses various design notions as well as multiple media, and socio-cultural phenomena, initially observed in connection with marginalized living spaces; as such, it has become the subject of increasing societal discussion. (Milev, Y. 2011).Recent crises in healthcare (COVID-19), environmental shocks, and the decade-long Russian military invasion of Ukraine (2014-2024) have sparked significant interest in the formation of space during emergencies and the need for their systematization. ""Design for emergencies,"" which has yet to have a clear definition and is continually evolving within the scientific discipline of design, is now at the center of cultural debate in search of a more precise definition, boundaries and opportunities, advanced experiences, and necessary interdisciplinary connections. (De Angelis, C. 2024).

The goal of the ""Emergency Design for Ukraine"" project is to rebuild cities and villages in Ukraine and create a new thematic space for people in disaster areas, taking into account geographical, climatic, historical differences, pedagogical research, and the dissemination and didactics of contextualizing the implementation and compliance with local ecological, socio-cultural, and regulatory requirements (Davis Ian 1978).

The ""Emergency Design for Ukraine"" project is based on folk traditions, knowledge of local materials, sustainable development, material reuse, energy efficiency, and energy conservation. Students designed low-energy housing by collecting rainwater from rooftops for watering gardens and backyard plots or indoor spaces, which serve as accessible areas for low-cost food production. Energy-efficient buildings require minimal use of gas, electricity, or other fuels for house maintenance. At the same time, prototypes of reusable, safe, cost-effective, and energy-efficient emergency shelters powered by reusable solar panels and combining both direct and alternating current power systems were developed.

The reuse of materials makes construction more economical by using old wood, stone, brick, and other recycled building materials. Inside the house, sensor lighting and autonomous power sources are used, and special plants are grown to purify and cool the air indoors. Interior items, especially lamps, are designed to be safe for use in forested and arid steppe areas of central and southeastern Ukraine.

Access to and use of energy is a cross-cutting issue in humanitarian activities. However, there is no agreed-upon and integrated approach to action to achieve environmental resilience and energy stability in the event of an emergency.

This research aims to explore how to integrate resilient energy strategies into everyday life in shelter design for emergencies. Taking the guiding principle of the ""Quantitative Sustainability Assessment after Natural Disasters"" (QSAND) tool (Li, J. et al. 2024). To determine the requirements for affected populations, an analysis of needs was conducted through situational assessments in areas affected by military events in Ukraine, as well as on-site surveys and interviews.

This research project concerns the study of processes related to the application of design in emergencies caused by disasters, starting with reflections on the transformation of modern society.
The main goal is not only to consider newly arising opportunities for using design in this field but primarily to investigate its internal capacity to adapt, finding different solutions based on the variables that distinguish different crises (Giraldi, L. 2022).
In particular, this research focuses on the role of design in scenario modeling of Ukrainian military catastrophes. Scenario modeling of emergencies is very complex, and design could contribute by becoming an interpreter of knowledge from various disciplines, implementing synthesis, which is crucial for the project's purpose.

Pavliuk Nataliia
mSc,
Lviv Polytechnic National University,
Architecture and Design Institute

natalya.pavluk13@gmail.com

Pavliuk Yustyna
1st year Master's student,
Lviv Polytechnic National University,
Architecture and Design Institute

jastinpavluyk@gmail.com

Arno Maria
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

maria.arno@pw.edu.pl

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Challenges of designing spaces for children in wartime

Preserving children's mental health, overcoming trauma, and developing the ability to adapt to conditions, environment, and potential dangers are important tasks today. The spatial conditions of a child's life are one of the most important factors in creating a psychological climate and environment for the growth and maturation of a healthy future generation. Designing spaces for children is extremely important especially in the time of war: architecture and interior design can promote childhood development. The architect needs to plan the object so that the entire space works for health improvement. Much attention should be paid to the location of the "shelter", external and internal content. The place should be as safe as possible so that everything contributes to a quick recovery. The specificity of the design and construction of such an object is that it must be closed from prying eyes, since we are talking about the safety of people and even the cost of life (Bulakh, Obynochna, 2023). The article discusses the principles and techniques of the architectural and planning organization of shelters for mothers and children. Research and conclusions are made on the basis of a deep study by the authors in the design of such facilities.

In Lviv, there are almost no spaces for psychological help, rehabilitation by means of art therapy, art treatment. Libraries, hospital wards, corridors, dining rooms, halls, artists' workshops where they work with children and mothers are most often used for this purpose.

Children's mental health depends a lot on the child's sense of freedom - the ability to "fool around", brawl, and actually relax, get out of the total control of adults, doctors, babysitters, programmed spaces and classes. Children live in their own world, which is very different from the world of adults and from the ideas of adults about the child's world.

During the two years of the war, children have changed: before they were more open, empathetic, more active, but now they are more withdrawn, keep their distance, do not let themselves in, are trapped inside, more passive, trauma is felt, and they need their own personal space more. Mothers need the same thing as children - a moment of creativity that distracts them for a moment from worries and anxieties.

The child's psyche is the material for building the future. As our observations show, the feeling of freedom is the most important thing for a child. It is created by bright colors, work with plastic materials (plasticine, clay). An important opportunity for a child to change something is to erase what has been written or drawn. The child wants to have his own world, especially in the hospital, orphanage, school, and also at home.

It is important to structure the space where children are, from a closed (personal protected space) to an open, safe, supportive, friendly, bright environment. Children love daylight, the sun, large windows, an open horizon, the sky above their heads. It is important to have an eye-opening exploration of how children's playthings and physical surroundings affect their development (Lange, 2020). Fresh air, good ventilation of premises, mobility of space are important - when children themselves move light partitions, furniture, form their own space. In times of war, shelters are important, especially children friendly. These are challenges for architects and urban planners, how to design spaces for children in wartime.

Pawłosik Daria
mSc. Eng. arch.,
Faculty of Architecture,
Wrocław University of Science and Technology

daria.pawlosik@gmail.com

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Exploring the Potential of Selected Biomaterials in Architecture

Based on 2019 data, global plastic waste generation amounts to nearly 460 million tons annually, with the construction sector accounting for over half of this total. The vast majority, up to 91%, of the generated waste to date has not undergone recycling and persists in landfills and oceans. From an environmental perspective, recycling synthetic plastics presents a favorable solution, albeit with certain limitations. Recycling frequently results in acquiring material of lower quality and reduced performance. Moreover, such a process is not infinitely repeatable, typically limited to 2-3 cycles depending on the material utilized. Additionally, not all materials are recyclable, and establishing a cost-effective method for processing polypropylene, fibers, or low-density polyethylene (LDPE) poses a continuing challenge. (Ritchie , 2018)

A composite material is defined as a substance comprising at least two components (phases), each possessing distinct properties. The amalgamation of these components yields significantly enhanced properties compared to those exhibited by the individual components alone. In recent years, increasing awareness has underscored the significance of biocomposites, wherein at least one component is derived from biobased or biodegradable sources.

- Biobased materials: These are materials created using plant-derived raw materials.

- Biodegradable materials: These are materials that undergo biodegradation, a process where they are converted into natural substances such as water or carbon dioxide.

Fully green composites represent a subtype of biocomposites composed solely of natural raw materials. Their sourcing, use, and disposal ensure complete carbon neutrality to the environment. By amalgamating different phases, it is possible to achieve a product with weather-resistant, durable, or other desired properties tailored to its intended application. (Barton. 2014)

Architectural objects crafted from biocomposites typically utilize natural fibers such as hemp, bamboo, jute, or flax, often combined with plant resins. This approach enables the production of high-quality materials with relatively good physical properties while reducing environmental impact compared to traditional composites.

Biocomposites find application as structural elements in buildings, as well as more commonly as façade elements, furniture, and interior finishing materials. Natural Fiber Composites (NFCs) have gained significant popularity in recent years as an alternative to traditional fiber-reinforced polymers, which typically use glass or carbon fibers. NFCs utilize a combination of natural fibers with a polymer matrix. (Baldwin, 2022)

Fully green composites offer several advantages over their traditional counterparts, including reduced sourcing and production costs, lighter weight, and increased flexibility. Additionally, such biocomposites are non-irritating to the skin and non-toxic. However, they also come with some disadvantages. Biocomposites generally exhibit lower mechanical properties, absorb moisture more readily, and are less resistant to fire, weather, and microbial conditions. Although the current strength of natural fibers does not allow for the creation of composites superior to traditional Fiber-Reinforced Polymers (FRP), they are still utilized for insulation and reinforcement in lightweight structures. (Gholampour A. and Ozbakkaloglu T. 2020)

The evident advantages of biocomposites include the reduced carbon footprint of the final product and the utilization of renewable sources for raw materials. This has led to their increasing adoption across various industries, including architectural design and construction. Products made from naturally derived plastics help conserve dwindling fossil resources, facilitate easier recycling of leftover materials post-use, and in some cases, the objects themselves, along with associated waste, may biodegrade over time.

Petryshyn Halyna
prof. dr hab. Eng. arch,
Lviv Polytechnic National University,
Architecture and Design Institute

halyna.p.petryshyn@lpnu.ua

Trębacz Paweł,
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

pawel.trebacz@pw.edu.pl

Bibliography:

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The brick in the post-industrial landscape of Lviv: Re-usability of material

The trend towards revitalization and renovation is gaining momentum in Ukraine. Revitalization demonstrates the environmental friendliness of modern cities. It is a rethinking of heritage, when old buildings are given new ideas. Brick is one of the oldest building materials, and revitalization offers the opportunity to preserve and reuse it.

Post-Soviet countries have a problem with abandoned industrial buildings of factories and plants that mostly went bankrupt in the early 90s. However, these buildings actually have a much longer history, and thanks to investors, they have been revitalized and filled with new content.

Lviv has several noteworthy examples of the revitalization of post-industrial buildings, the architectural design of which is dominated by structures, exteriors, interiors, and individual artifacts made of brick, which identifies the buildings with the original stage of construction.

Interdisciplinary center for contemporary art Jam Factory (124 Bohdana Khmelnytskoho St.). The main building in the Neo-Gothic style, as well as several adjacent buildings of later periods, are located in the historic industrial district of Lviv called Pidzamche. Since 1872, the Kronik & Son vodka and liquor company has been operating here, and in Soviet times it was a vegetable processing shop for the production of jam. In 2015, the historian and cultural entrepreneur Harald Binder purchased the territory of the factory and began the process of its revitalization. The center was opened in 2023. The façades are covered with plaster, but the interiors of the exhibition hall and other rooms reveal brickwork from different periods. The interiors of the tower have been especially carefully restored.

Lem Station creative hub (on the corner of Heroiv Maidanu, Vitovskoho and Sakharova streets). The complex consists of three hangars and is designed for art and community events. The tram depot was built in 1894-1927. Brick details of the facades emphasize the stylistic features of the buildings. The revitalization project does not involve the division of large spaces, but only complements them with the necessary elements. Brick walls and authentic flooring structures have been restored in the interiors.

KIVSH multifunctional space (120 Shevchenka St.). The complex occupies a former industrial area and develops five vectors: work, education, sports, art, and gastronomy. At the end of the 19th century, barracks and military warehouses of the Leopold Salvator artillery were built on this territory, and later in the mid-twentieth century this area was converted into tool shops of the Lviv Forklift Plant. The first and second stages of the revitalization of the complex combine Austrian buildings and public space. The architecture is created by restored brick walls, complemented by high mansard floors with a metal coating. The exposition of the brick facades restores the authenticity of the buildings, as Lviv bricks were used for construction - they bear the stamps REISS, MAŁANICZ, PEŁCZYNSKA 23.

Pidzamche Town residential complex (Bohdana Khmelnytskoho Street). The residential complex consists of three separate neighborhoods - Vezha, Brama and Novyi Fort. All of them are being built on post-industrial territories, and only one of them, Brama, has preserved its post-industrial heritage. The alcoholic beverage factory of the Baczewski family was founded in the first half of the 18th century, and the main buildings of the factory were built in 1908. After World War II, the Almazinstrument plant was located on this territory. The new Brama complex has preserved valuable buildings from the early 20th century and has undergone a thorough rehabilitation of the area. The concept of revitalization of the quarter was developed taking into account the needs of the city, the potential of the location, and the wishes of the residents. The authors emphasized the industrial past of the quarter and at the same time adapted it to current needs. The abandoned brick chimney of the boiler house is the compositional center of the quarter.

Podhalański Bogusław
dr hab. Eng. arch.,
Academy of Applied Sciences in Nowy Targ

boguslaw.podhalanski@ans-nt.edu.pl

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Designing public facilities in the shadow of war

Observation of the tragic events related to the war in Ukraine has shown that one of the neglected in the design and teaching practice to date is the omission of the design in public facilities of shelters, providing the possibility of protection for employees and customers of such buildings during hostilities. This is particularly important with regard to facilities that house many people at the same time, such as schools, kindergartens and hospitals, as well as office buildings. Multifamily housing is a separate problem in this regard. Within the framework of the design subjects taught at the Academy of Applied Sciences in New Market in the Architecture Department, a search for sources of information on appropriate design solutions for modern shelters and concealments began as early as the winter semester of 2022. It turned out that the stock of information available in printed sources and on the Internet is extremely modest, with descriptions and drawings of World War II-era facilities prevailing, which do not meet the criteria for protection against modern threats. There were (and probably still are) no publicly available guidelines or norms in this field of engineering knowledge. Faced with such a state of affairs, they reached for guidelines published in Ukraine, which, after being translated into Polish, became the basis for the students to functionally and technically begin their design work. Their project tasks were expanded to include issues of ensuring the survivability of civilians in the event of armed conflict. Within the framework of inter-institutional cooperation, the teaching staff of the National Security faculty of ANS in Nowy Targ were asked to verify the solutions proposed by the students. The final designs were developed at the end of the semester and displayed at exhibitions in the University building and in several cities in Poland and Ukraine. Since then, issues related to the design of hiding places and shelters have become part of the functional-utility programs in the design of public buildings , conducted at the Department of Architecture of the ANS Institute of Technology.

Rowicka-Michałowska Martyna
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

martyna.rowicka@pw.edu.pl

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Implementation of prefabricated rammed earth

The construction industry is a major contributor to environmental degradation, causing severe air pollution through high CO_2 emissions, as well as being one of the largest producers of waste.

Natural materials such as earth have great potential to meet today's sustainable building requirements. Earth is a local, accessible material whose production has a low ecological footprint. This material can be recycled many times. Without loss of quality, it maintains optimum indoor humidity and absorbs odours. Earth has many advantages as a building material. It can carry structural loads, acts as a thermal mass and also offers many aesthetic design possibilities. The absence of negative external effects on humanity during the production, implementation and maintenance process is also an important factor.

The unique potential of rammed earth as a stable, durable and healthy building material, applicable in most climatic contexts, is contributing to a change in the perception of this material as a building material. Constructing durable, sustainable buildings using only formwork and compacting layer upon layer of earth mixtures manually with rammers can yield designs of the highest architectural quality. Nevertheless, this approach is not realistic in many industrialised parts of the world where labour is expensive.

Despite the earth's many advantages, the complex process, high variability of raw material, construction time and labour cost are constraints to its greater expansion and industrialisation. Prefabrication is primarily aimed at reducing the physical labour input.

In such a context, prefabrication offers more opportunities for the whole spectrum of projects and the possibility to implement the technology in different social, economic and environmental conditions. Economic considerations speak in favour of separating the production and installation process, mainly due to on-site logistics. Instead of employing a team of professionals to ram the ground on site, gradually erecting the building over time, cranes can quickly and efficiently install the finished elements according to schedule requirements. The erected elements are dry, allowing the other trades on site to work simultaneously.

The prefabrication process not only optimises production and construction time, but also allows for material consistency and higher product quality, a key aspect in achieving norms and standards. In the case of rammed earth, the overall product is defined by contextually unique elements: the clay used, the sand and gravel added to the soil to form the mix, the moisture level of the mix during compaction, the stability of climatic conditions during the production process and the technique of the compaction itself. All these aspects have a direct impact on the compacted soil's compressive strength, bearing capacity, thermal properties, moisture absorption coefficient and fire resistance. Prefabrication allows testing and control under laboratory conditions, as with other standardised, industrialised materials. It is possible to correct and optimise the base material (earth), control the combination of natural base materials (soil, sands, other aggregates), control the physical, thermal and mechanical properties of materials and products.

Rybarczyk Tomasz
mSc. Eng. arch.,
Solbet Sp. z o.o.

tomasz.rybarczyk@solbet.pl

Drobiec Łukasz
prof. dr hab. Eng.,
The Silesian University of Technology Faculty of Civil Engineering

Lukasz.Drobiec@polsl.pl

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Autoclaved Aerated Concrete: Modern and Ecological Material for the Future

When the production of autoclaved aerated concrete (AAC) was invented in Sweden in 1923, the inventors were faced with the task of inventing a structural building material that could be easily produced from widely available raw materials, one that would be easy to work and build with, one that could help deliver warm and durable buildings, and one which could help replace the then basic building material drastically decreasing in volume, namely wood. Since then, the material has been in use and its popularity has steadily increased. One could say it has been the same material for more than 100 years, although technologically, in terms of the production capabilities of AAC, its applications and performance characteristics, there have been huge advances. AAC still remains a state-of-the-art material in line with construction trends, or even creating them. It also fits in with expectations which did not matter much back at the time it was invented, i.e. it is environmentally friendly and it offers numerous possibilities for architectural creation.

Environmentally friendly

AAC is a material that fits in with the principles of sustainability and the circular economy. The determining factors include:

-in terms of manufacturing: use of widely available raw materials, efficient use of resources (1m3 of raw materials produces 5m3 AAC), waste-free production process, low energy requirements, use of renewable energy (electricity and green hydrogen),

-in terms of properties: low density, high porosity (80% air in volume), homogeneity, very good thermal insulation, compressive strength, non-flammability, healthy material, resistant to mold and mildew,

-applications: ease of processing, reduction of construction time, reduction of process moisture, complete building system, optimized transportation, low equipment engagement, no need for high-powered tools,

- constructed buildings: unlimited possibilities for building creation, energy efficiency, durability, no-Styrofoam construction,

- second life: AAC can be recycled and reused in the production process.

All the above-mentioned factors make AAC a decarbonizing material in the context of material production, as well as the erection and operation of buildings, their afterlife and their environmental impact.

Continuous Development of AAC

AAC offers great opportunities for creative and interesting architectural solutions. This results from the properties of AAC itself, as well as from the fact that it can be mixed with other construction materials. In this context, it is important that AAC structures are evolving and that progress is made in many directions. The functional properties of AAC (compressive strength, thermal insulation, etc.) are improving. Another direction is that new products are implemented, created and adapted to current construction trends. Yet another field of progress is the introduction of new AAC systems and structures. A wide range of research on AAC masonry has been carried out at the Silesian University of Technology for more than ten years. This world-scale research of AAC masonry offers real solutions to designers. These are actual and measurable achievements not only in material engineering, but also in the development of AAC structures.

As far as the possible applications of AAC are concerned, it is important that we learn more about AAC. Still few designers are aware how friendly AAC is as a material and what possibilities it offers. It may turn out that what the designers have been looking has long been waiting just around the corner.

Siennicki Mirosław
dr Eng.,
Warsaw University of Technology,
Faculty of Civil Engineering,

miroslaw.siennicki@pw.edu.pl

Barcewicz Wioleta
dr Eng.,
Warsaw University of Technology,
Faculty of Civil Engineering,

wioleta.barcewicz@pw.edu.pl

Wierzbicki Stanisław
dr Eng.,
Warsaw University of Technology,
Faculty of Civil Engineering

stanislaw.wierzbicki@pw.edu.pl

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Structural steel as the building material for a responsible sustainable future

Current global challenges in architecture and civil engineering increasingly incorporate aspects of sustainability, decarbonisation and the circular economy. A sustainable circular economy is one in which society reduces the burden on nature by ensuring resources remain in use for as long as possible. Once the maximum value has been extracted, the resources are then recovered and reused, remanufactured, or recycled to create new products (World Steel Association, 2016). A sustainable material that can be recycled any number of times without loss of quality and its mechanical properties is steel, which is fundamental to the circular economy. Sustainable steel architecture is a concept that focuses on using structural steel as a building material in an environmentally responsible and energy-efficient manner.

Steel is known for its strength, durability and versatility, making it a popular choice in construction. However, concerns about its carbon footprint have led to advancements in steel production techniques that minimize environmental impact. Sustainable steel architecture encompasses strategies such as recycling and reusing steel, optimizing structural designs to minimize material usage and adopting energy-efficient construction methods (Walkem, 2023). Significant quantities of recycled steel are used to manufacture new steel products, so scrap steel has a commercial value. Steel building components are fabricated under controlled conditions with minimal waste (cut-offs are also recycled as scrap). Quick assembly of steel structures also limits the amount of waste on-site. The relatively low self-weight and high strength of structural steel (compared to other structural materials) reduce the number of material deliveries to building sites and, therefore, influence not only decreasing transport costs but also the amount of CO_2 emissions generated by transport.

Steel skeletal structures can be easily dissembled (before or after the end of the building life cycle) and be reused at other locations in the same or similar form. Many demountable steel structural members (often in a good technical state due to durable methods of protection against corrosion) can be reused in new architectural solutions. Examples of such actions are increasingly being promoted in Europe. This Reuse trend has created a need in the European Union to standardise methods for assessing the technical condition of existing structures and dismantled steel structural members in their reuse in new construction investments.

Moreover, innovative steel production processes, like electric arc furnaces powered by renewable energy sources, have significantly reduced the carbon emissions associated with steel production. The term “”green steel”” is becoming increasingly popular, which essentially means producing steel without the use of fossil fuels. One of the first decarbonisation initiatives in the steel industry is XCarb™ recycled and renewably produced steel (ArcelorMittal Europe - Long Products, 2021). This innovative solution uses 100% of scrap metal processed in the electric arc furnace route powered by renewable electricity sources such as solar and wind power. Such an innovation offers steels with a very low level of CO_2 emissions per tonne of finished steel (approx. 0.3 per tonne of finished steel compared to the average for the global steel industry which is around 2.3 per tonne of steel products).

Summing up the list mentioned above of advantages of modern structural steels, it can be concluded that the durability, versatility and recyclability of steel align with the sustainability principles of architectural and structural design and allow architects to create incredible projects following the ecological needs of the current and future generations.

Sigurtà Davide
mSc. Arch.,
University of Brescia - DICATAM

davide.sigurta@unibs.it

Longo Olivia
prof. dr hab. Arch.,
University of Brescia - DICATAM

olivia.longo@unibs.it

Vazzoler Alessandra
mSc. Eng.,
University of Brescia - DICATAM

alessandra.vazzoler@unibs.it

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Biophilic recovery of Lombardy roccoli. Old forms, new uses, and vegetal materials in harmony

The theme of developing new construction materials, and their impact on the overall well-being of the human-environment system from a sustainable development perspective, has always remained somewhat muted in the cultural debate surrounding their use, and only in recent years has this become predominant.

The depletion of natural resources and the accumulation of pollutants, at all levels, is now a well-established fact within the scientific community, leading to a radical rethinking of construction practices. These have shifted towards seeking technical solutions that combine respect for sourcing, reduced impact on the building industry supply chain, and the valorization of reuse once their function is fulfilled.

In this new perspective, interest has resurfaced around the theme of so-called vegetal architectures, where we understand this term to encompass a set of designed elements in which the vegetal component is a predominant part of the compositional value; architectures that in Italy have also been cataloged and included in the lists of Cultural Heritage worthy of protection by the state.

Among these, particular attention deserves the roccolo: a vegetal architecture once used for hunting migratory birds through the use of nets within a specifically designed vegetative apparatus.

This form of hunting has recently been converted to the use of firearms, following the prohibition of net usage, demonstrating a kind of resilience of the architectural form but with unsustainable purposes.

Roccoli are mainly constituted by three interconnected elements functionally related to each other, each serving a specific function with heterogeneous forms, materials, and types but in functional relation; the latter are organized in a succession that starts from attracting migratory birds to their capture through nets in which they get entangled. Roccoli are generally horse-shaped or circular with an average diameter of 20 - 30 m, reaching larger dimensions, even up to 50 - 60 m.; the main components are:

- Tondo: the free space that defines the roccolo itself, configured as a well-kept lawn arranged on a slightly sloping ridge

- Casello: the hunter’s station, consisting of a three-story building concealed with dense vegetation on the walls and roof;

- Colonnato: the place where bird capture occurs, arranged at the edges of the tondo in a circular or horseshoe shape, consisting of a double line of tall fir, beech, or white hornbeam trees positioned about 2 m apart, within which the nets were placed.

These structures are still deeply rooted in the territory, and despite their loss of functionality, they remain an important urban-environmental sign, and in this sense, resilient, of peasant culture.

Their use for educational purposes or the integration of functions related to meditation (libraries, research centers, reading spaces, etc.) inside the “”casello”” would represent an effective biophilic iteration between functional needs for emotional tranquility with a clearly identifiable architectural form primarily made of vegetal matter.

This would thus allow for maintaining a historicized understanding of the architectural component capable of once again fully engaging with the vegetal part, achieving that fusion of intentions between the two elements of biophilic theory in architecture.

Stankiewicz-Świniarska Ewa
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

ewa.stankiewicz-swiniarska.dokt@pw.edu.pl

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Exploring the potential of plastic bricks: a sustainable solution for construction and environmental challenges

The climate crisis has dominated the world in the 21st century. One of the main sources of soil pollution is plastic, which in the natural environment does not decompose for a very long time. The construction industry, on the other hand, is responsible for 40% of global material consumption (Ness & Xing, 2017). Humanity is already using more resources than the Earth can produce or regenerate. This leads to a significant depletion of natural resources (Ellen McArthur Foundation, 2013). Innovative solutions are emerging to address both of these pervasive problems.

There is a growing attempt to use the main disadvantage of plastic, its durability and resistance to external factors, as an advantage. In poor countries, where waste is sent from all over the world, PET waste is used and transformed into bricks. This is an attempt to create a diverse alternative to traditional construction, which is intended to be an environmentally friendly way to reduce pollution. In India, the company Rhino Machines has created SPB (Silica - Plastic block), which consists of 80% sand waste and 20% plastic. According to their research, it is 2.5 times more durable than a regular red brick. (wevux.com). This gives a chance to treat it as the construction material.

The production process involves several stages. It starts with the segregation and cleaning of waste. It is then crushed into very small pieces by a crusher and mixed with sand. Heated to a temperature above 300 degrees, the resulting mass is pressed and shaped into the brick. Possibility of adding color pigments allows some flexibility in an artistic expression.

Such product offers a chance to popularize recycling and reduce the consumption of natural materials in the construction process. Transforming waste into practically useful and valuable products changes the perception of plastic and promotes innovative solutions. They can become an important part of the closed loop in the construction industry in poor countries. However becoming a building material in global scale is, for several reasons, rather doubtful.

The production of bricks requires access to a sufficient amount of waste, developed technology and production line. For obvious reasons, the main countries engaged in this production are the countries, to which waste from all over the world mainly goes and with cheap labor, such as African countries. The transport to Europe, America, and Asia would again pollute the environment, producing a carbon footprint. It would not be anymore an environmentally friendly product.

So far, the resistance of the bricks has been tested, but their heat transfer coefficient is questionable - in countries with a moderate or cold climate, they probably would not meet building standards. However, they find application in temporary structures such as pavilions. At the moment, they are mainly used as paving stones and in road construction in Kenya and Nairobi.

In summary, the creation of a plastic brick is an innovative solution that promotes modern ideas and a non-standard approach to the problem of the climate crisis. It supports the direction of creating a sustainable environment in the construction industry. Lucal actions and invention as this, hopefully will motivate to more global decisions ad actions. As an architects we are obliged to search for solutions of lowering the consumption of natural resources.

Strzała Marcin
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

marcin.strzala@pw.edu.pl

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Low adaptation of 3d concrete printing in light of an analysis of corresponding geometric architectural and technological parameters

Even before the idea of additive manufacturing (AM) was conceived, the complete automation of building processes was conceptualized. As early as 1939, engineer William E. Urschel developed and patented a wall-building machine allowing the erection of walls through continuous, layered deposition of concrete. Urschel's innovation faded into obscurity for decades until the emergence of Behrokh Khoshnevis' Contour Crafting technology, patented in 1996 and followed by the first functional prototype created in 2004. In the following years, numerous research teams continued work on applying 3D concrete printing (3DCP) in architecture. Significant success was achieved by WinSun, which in 2014 presented the first AM house. Since then, research has repeatedly demonstrated that 3DCP can be considered a full-fledged construction method (Labonnote et al., 2016) with the potential to increase building speed while reducing costs, material consumption, and CO2 emissions (Khan et al., 2021). However, the construction industry has never adopted the technology, and the 3DCP architecture remains at the stage of experimental solutions or further marketing proofs of concept.

The reasons for this may be provided by the results obtained by the author in a quantitative and comparative analysis concerning measurable, relative architectural, and technological parameters of AM architecture. The analysis included over eighty architectural objects manufactured between 2004 and 2021, of which over a quarter was 3DCP. The key element of the analysis was the introduction of scale index (SI) and resolution index (RI), aiming to verify the performance and adequate utilization of AM methods. The SI compared the maximum working area of a given technology with the size of produced architectural modules. The SI helped to determine to what extent technological limitations dictate the size of modules and when it results from objective design premises. The RI compared the maximum resolution at which a given tool can work with the accuracy of the design decisions. This index allowed an understanding of the degree to which the freeeform fabrication potential of AM was used.

In the analyzed period, the trend line for the SI rose from 25% to 38%. However, in the case of concrete architecture, the value of this index was much lower. In the case of the first object realized using ContourCrafting technology, the SI value was 14.6%. In Project Milestone, the last 3DCP analyzed case, the index value was 13.5%. A similar discrepancy between the trend line and the values for architecture printed out of concrete was observed in the case of the RI. The overall trend line rose from 4% to 36%. The examined concrete objects generally exhibit a low level of utilization of the manufacturing precision, at most 20%, which in practice meant design decisions limited to the thickness and general, often rectangular, layout of walls.

Such low results for both indexes contrast with the main declared benefits of 3DCP: reduced costs associated with labor and material consumption by 10% to 30%, excluding the costs of the tool itself, and allowing for a freeform fabrication (De Schutter et al., 2018). Meanwhile, in most of the examined cases, the presented objects imply the necessity of using complex, expensive equipment to create proportionally small elements of simple shape, which traditional prefabrication methods can reliably produce. While the tool and material aspects of 3DCP capability have been confirmed (Bhooshan et al., 2019), the design issues require redefinition to utilize the manufacturing potential offered by this method.

Sworczuk Urszula
dr Eng. arch.,
Warsaw, Poland

usworczuk@gmail.com

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Curtains of the future

The history of curtains - decorative fabric hung from the ceiling in light of exterior openings - dates back to ancient times. Excavations confirm that they were also used as a room divider. In medieval times, heavy curtains protected entrances and windows from cold and excess light. In the 20th Century, minimalism severely reduced the role of typical curtains. The main subject is to show what role curtains can play in the housing of the future.

The new role of curtains is air purification. Thay can be passive filtering thanks to the new weave design and the sequence of fabric layers. Curtains can also actively clean the air of dust from microbes and harmful substances such as nitrogen oxide and formaldehyde emitted by furniture. Examples are curtains made of photocatalytic fabrics based on technology miming plant photosynthesis. This technology also allows the fabrics to self-clean.

Another form of the additional role of curtains is to save energy. Most energy escapes through windows despite their increasingly sophisticated design. Thermal curtains will be a suitable means of regulating indoor temperature. Again, new fabrics are helpful. An interesting material is PCM (Phase Changing Material) fabric. A curtain made of such a material actively absorbs heat from the room, maintaining the temperature at +/- 25° C. In winter, it absorbs heat from radiators and gradually gives it back; in summer, it absorbs excess heat. Another interesting material among smart textiles is a fabric with built-in photovoltaic cells. The solar energy absorbed by the curtains can be used to heat the rooms in cold periods. An interesting concept is curtains that absorb electricity during the day and give it back as light in the evening.

Sound pollution is also a problem in modern cities. Curtains made of materials of the future, through their construction, can capture selected frequencies, for example sounds from the low frequency group. There is also a type of curtain that improves indoor acoustic comfort by reducing echoes and reverberations. Modern fabrics can absorb practically 100% of sound. The last group of curtains are those that block sound intensity entirely. Examples of fabrics that are able to cancel outside sound by 20dB include STC Sound Blocking fabric. Today, there is a new future for acoustic curtains. It is influenced by the invention of fabrics with piezoelectric fibres capable of converting vibrations into electricity. The curtain will be able to act as a speaker, for example.

There are also entirely new tasks ahead of curtains in connection with the weaving of fibre-optic electronics into the structure of the material, and perhaps there will be a new application for e-textiles, such as curtains can act as an image-emitting screen.

In summary, the future curtains are expected to primarily improve the comfort of life, taking over the role of previously separate devices: air conditioners, air cleaners, screens, etc., but also positively affecting other areas. Curtains of the future could help people sleep better, improve their mood, reduce energy costs and positively impact the environment. A key role will be played by smart textiles, i.e. materials that actively respond to the surrounding environment with the help of new technologies.

Świniarski Bartosz
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

bartosz.swiniarski.dokt@pw.edu.pl

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The “Forever” concrete

Marcus Vitruvius Pollio, in his work “The Ten Books on Architecture”, discusses the enduring nature of certain Greek masonry walls, proposing that when constructed with care, they could “endure to eternity” [1].

Today, given the multitude of standards and regulations, claiming eternal longevity for structures may seem hyperbolic. Nonetheless, research [2] indicates that well-maintained reinforced concrete buildings can fulfill their purpose for a century or more.

Contrastingly, a survey by the US Department of Energy [3] estimates the average lifespan of nonresidential buildings in the USA to be around 45 years.

Scientist Jennifer O’Connor, in her study [4] discovered that most structures are demolished for reasons unrelated to their physical condition.

O’Connor’s research, which analyzed various types of buildings, including wood, masonry, steel, and concrete structures, revealed that less than a third were torn down due to structural deterioration. Instead, the primary reasons for demolition were area redevelopment (35%) and functional obsolescence (22%), indicating a disconnect between the material used and the lifespan of buildings.

In Poland, where the predominant construction material is reinforced concrete, there is a growing trend of demolishing buildings that are less than 20 years old. These structures often failed to meet current market standards, incur high maintenance costs, or occupy valuable land disproportionate to their size or function.

While adapting these buildings to meet required standards may be challenging or even impossible in many cases, it’s imperative to construct new buildings in their place with a focus on enabling future improvements. This includes gradually raising standards, reducing maintenance expenses, facilitating further development of both the superstructure and infrastructure, and allowing for potential rearrangements and changes in function. This approach, known as designing for adaptive reuse, ensures that the new buildings remain pertinent and functional over time, fully harnessing the potential of the materials they are constructed from.

Designing with an intention to allow future adaptation is an approach that anticipates future changes, which provides for extending the building’s life cycle and lowering its environmental impact.

Take, for instance, the Mennica Residence by BBGK Architects, a sizable residential project featuring 460 apartments situated in Warsaw’s burgeoning city center. Constructed with a monolithic slab-column reinforced concrete structure, this design prioritizes maximum flexibility in apartment arrangement and connectivity. Deliberately, the absence of lintels and perimeter beams in the floor slabs simplifies potential future apartment amalgamations. Furthermore, structural columns are cleverly concealed within the external envelope and positioned near circulation cores, minimizing the need for additional structural walls beyond these cores.(5)

This design ethos has already yielded success within a mere four years of completion. Situated in a rapidly transforming central district, the building’s location has spurred demand for both larger, luxurious apartments and smaller rental units. Consequently, smaller apartments have seamlessly combined to create larger units, while a portion of the building originally comprising smaller units has been repurposed into a hotel, showcasing the adaptability and versatility of the design.

Embracing the timeless essence of concrete’s potential could weave a narrative of eternity into our architectural fabric, echoing Vitruvius’s vision of structures enduring forever.

Tarczewski Romuald

Tarczewski Romuald
prof. dr hab. Eng.,
Wroclaw University of Science and Technology

romuald.tarczewski@pwr.edu.pl

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Synergy of form and its carrier in architecture through the microbiological fabrication of bulk materials

One of the main challenges of decarbonization in the construction industry is to reduce the impact that the production of large quantities of concrete has on the generation of greenhouse gases. This is a very important factor to consider when implementing any sustainable construction strategy.

On the other hand, the uses of concrete are so widespread, and the possibilities for shaping are so extraordinary that it is difficult to imagine civilization as we know it without its contribution. This is evident in both public building, residential, and infrastructure projects. In the latter, it is particularly evident in those applications where it is directly exposed and interacts with the interior or landscape. Its brutal, technological honesty is a frequently used tool of formal expression by architects (Tarczewski, 2015).

Methods of producing building materials based on the process of biocalcification of sand or other unprocessed natural materials, which have been developed in recent years, allow us to hope that – at least to some extent – it will be possible to use a material with structural properties and shaping capabilities similar to traditional concrete, but which does not require energy-intensive manufacturing processes.

Some microorganisms, such as Sporosarcina pasteurii (formerly Bacillus pasteurii) are capable of solidifying sand in an environment containing calcium and urea. These bacteria are quite common – they can be extracted from soil all over the world. Their special property is to carry out the process of biocalcification of sand through ureolysis, otherwise known as biocementation. In this process, urea is converted into ammonia and carbon dioxide. The latter, in the presence of water, forms carbonate ions, which precipitate along with calcium in the form of calcite crystals. These crystals fuse sand grains to form artificial stone. The effects of the process resemble natural sandstone rock. The initial reaction takes place within twenty-four hours, and after a week the artificial stone reaches its full strength properties (Yasodian et al., 2012).

Current research work covers a wide range of possible applications of this technology. In many centers around the world, technological trials and experimental application tests are being carried out on the production of the most basic structural element, the brick, which is not fired but produced by a biocalcification process. Extensive research is being conducted on the use of the process of bacterial curing of sand in soils to increase their strength and thus improve the structural properties of the soil. This is also expected to reduce the impact of earthquakes on buildings and technical infrastructure.

The use of microbial concrete not only avoids the environmentally burdensome and energy-intensive production of cement but also opens up new possibilities for designers in shaping spatial forms. For example, complex structures resembling naturally occurring rocks, known as tafoni, can be obtained naturally. Their complex geometry means that building them out of concrete using both traditional techniques and membrane formwork would be either impossible or very expensive. Other forms that are easier to obtain through the biocalcification process than through traditional technologies include, for example, triple-periodic minimal surfaces, Infinite saddle polyhedra, or floral polyhedral (“spongy forms”). A separate group of forms are real projective planes, such as Boy’s surface, Steiner surface (“Roman surface”) (Burt, 1996).

All of these forms allow a departure from the still dominant orthogonal design paradigm and a much wider inclusion of organic forms based on multiply-curved surfaces in the vocabulary of design tools.

Terelak Marcelina
mSc. Eng. arch.,
Faculty of Architecture,
Wrocław University of Science and Technology

marcelina.terelak@pwr.edu.pl

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Styrofoam Housing System as a temporary flexible structure and assessment of its environmental impact

The aggression of Russia against Ukraine has prompted architects from all over the world to undertake design efforts to provide temporary accommodation for refugees. The housing crisis caused by military conflicts, but also by natural disasters, is a global problem and currently affects 1,8 billion people worldwide (United Nations Human Rights Office of the High Cimmissioner, 2020) . The study aims to verify the functional needs of the Ukrainian refugees in Poland as well as to test if selected aid structure could provide sufficient functional layout and ecological footprint.

Humanitarian architects are united by the belief that to solve problems architecture-based approaches should be a process, as it has a significant impact on dealing with the challenges encountered in rebuilding cities and communities after a disaster (Lubelska, 2015). Through international collaboration, with the help of researchers and students, in Wrocław has been built a prototype housing unit designed by architect Shigeru Ban. Styrofoam Housing System (SHS), by providing 32,5 m2 of living space is a temporary dwelling designed for use by a single family over a period of several weeks to several years (Ban et al., 2022).

Research confirms that this type of temporary architecture, could also have a wider application. According to surveys on the life of refugees in Poland and their plans for the future, almost ⅓ of them work remotely in Ukraine and less than half send their children to remote classes run by schools in Ukraine (Długosz et al., 2022). To provide comprehensive support, SHS could provide space for: dealing with administrative cases, integration and play areas for children, a temporary classroom or office space for remote working.

The multiplicity of solutions implemented to help those affected by the crisis of temporary non-residence also has an impact on the environment due to the use of different materials and the generation of waste.

SHS is designed with repetitive panels with a polystyrene core, reinforced with a fibreglass and laminate (Ban et al., 2022). To verify the benefits of implementing the facility in mass production, a Life Cycle Assessment (LCA) analysis was performed to assess the environmental burden of the system compared to traditional buildings. Calculations were carried out for a representative section of an SHS external wall. Its parameters were compared with walls made of conventional materials such as: timber, steel or SIP panels. The results indicate that the parameters are almost identical to other structures for example timber frame construction. Components made of steel or SIP panels cause two times higher environmental cost.

Among the large offer of relief architecture, the most desirable is the one which is low-cost, easy to produce, transport and assembly. The flexible spatial layout is an additional asset that allows the facility to be fitted with various functions. On top of that, mass production generates wastes and environmental impact. Therefore, the structures with low ecological footprint are the most desirable.

Temporary architecture is a response for the urgent need to provide a shelter for others, while taking into account the needs of users and environmental impact over the life cycle of materials. SHS designed by Shigeru Ban seems to be an optimal solution as its properties fulfil the demand for low-cost, low-weight, simple and flexible dwelling. Furthermore, the calculated environmental cost of this structure is comparable to other environmentally friendly temporary facilities.

Trębacz Paweł
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

pawel.trebacz@pw.edu.pl

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Shaping the form of urban public space as a response to the need for increased resilience of cities to climate change

In the face of ongoing climate change, the need to maintain stable living conditions in urban units is increasing. Increasing the resilience of these units is related to the impact on the main factors shaping the city's climate, i.e., insolation, wind, precipitation, humidity, landforms, and greenery (Różański, 1959). Of the air movement caused by pressure differences plays a significant role. This is because the wind allows air to circulate and exchange, supplying fresh air from clean areas and removing pollutants from the city centre. This movement also regulates and often reduces the degree of humidity in the air. It helps to reduce excessive temperature rises in the city centre and the formation of so-called 'heat islands'.

Urban public space plays an important role in increasing a city's resilience to unexpected climatic factors, as highlighted in the Declaration of the 56th World Planning Congress of ISOCARP, Doha 2021 (56thWPC, 2021). This is because the layout of public space binds the individual fragments together to form one overall urban system. To shape an appropriate climate of urban space, it is helpful to use the available knowledge and urban planning techniques developed over the centuries, with the support of contemporary research on the issue.

This is because the layout of public spaces binds the individual fragments together to form one overall urban system. To shape an appropriate urban space climate, it is helpful to use available knowledge and urban planning techniques developed over the centuries, with the support of contemporary research on the subject. A relationship that has been known for centuries is the influence of the form of urban public spaces on the climatic conditions experienced in urban interiors. In his description of how to design a city, Vitruvius drew attention to the need to adapt the layout of streets to the directions of shifting air masses (Vitruvius, 1999). The speed of flow through a built-up area depends on many factors, such as the dynamic roughness of the ground, deforming the speed of flow in the centre by up to 30%, and buildings can change wind directions in relation to the main direction by up to 20 degrees (Klemm, 2015). The most described phenomena associated with airflow are referred to as channeling, funnel, directional diverting, stepping and downwash effects. Building configurations cause strong increases in flow at angles of less than 90 degrees (the Venturi effect), temperature differences and through-holes in the urban wall. A width-to-height ratio of more than 2.4 allows courtyards and street canyons to be flushed, a ratio of 1.4-2.4 to separate flows into those flowing above and those circulating within, and below this value a flow that does not affect the interior. Just as important as increasing the airflow through the network of public spaces (streets and squares) and areas (parks, green spaces) is to achieve adequate comfort in feeling this flow. The limit for airflow is set at 5 m/s, while the safety threshold is 15 m/s for the elderly and 20 m/s for all people (Klemm, 2015). Studies have confirmed the influence of the urban grid layout on flow. Some researchers propose a combination of parameters resulting from urban morphology and wind effects (Krautheim et al., 2015).

Contemporary urban design of larger urban units should consider the effects of air mass flow to achieve relatively constant city climate conditions.

Trębacz Paweł
dr Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

pawel.trebacz@pw.edu.pl

Pałczyński Łukasz,
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

luki141@gmail.com

Gago Wiktor,
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

wiktor.gago.dokt@pw.edu.pl

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Time is the material

How are you doing? How do you feel? How do you live? - or today's questions about tomorrow. Perhaps we will be forced to make our future built from the past, primarily from the achievements of the last century, because it is this that we are stumbling over today. In architecture, this is reflected in the transformation of materials - from the high durability of the building block and its perishable connections to the extremely durable connections and the low quality of the building element, which have brought with them new but superficial formal possibilities. This has led to a situation in which the house has become an isolation from the environment, instead of being a part of it. Man has forgotten how to be part of nature, to draw from it and coexist, as other organisms on Earth are able to do. Returning "to the roots" is still possible; that we just need to look at the resources and energy we need as something we find and discover, instead of producing. Our further development depends on such a relationship with the world.

The reuse of materials from huts demolished in various parts of Poland to create a pavilion is a process that builds continuity of thought about the material, about working with it and about the previous life of that building material, that is, about the place and the people who created that life. The durable material becomes a skillful and ecologically prudent "hard drive" with a record of community history and memory. Beautiful old wood, material pulled from various regions of Poland, will be reused to create new, smaller pavilions that together can represent contemporary building culture.

Architecture becomes a monument when the life and care of the object's users disappear. Such a situation slowly begins the process of degradation. The entrance to the Polish pavilion will be the threshold of transition from the universal language of materials to an interior full of "history and time", the birth of which bears the death of objects that have ceased to serve people, and so have become monuments of a bygone time, "the garbage of history".

Only the passing of time can create a detail beyond the style of a particular era.

What we can learn from a trip to the East is the definition of nature there, "Everything what is happening by itself", which is combined with the Japanese expression **即物的** (sokubutsu), meaning 'as it is'. This approach to ourselves and the world puts the anthropocentric view on the defensive, where man's position is no different from that of a tree.

The very structure of the object is supposed to expose the main ideological message, directed towards the future: about the non-isolation of man from the environment in which he has lived and will live. We act according to the capabilities of our own body, which is closely related to the surrounding conditions. There are countless processes going on in our bodies all the time that we do not decide or think about. Heat, cold, humidity, movement, air, smell, light, sound, matter and gravity - how we think and forget about these elements shapes our homes and, as a result, our physical and mental health. Can a person live in complete isolation from them?

Tulkowska Karolina
dr hab. Eng. arch. associate professor,
Warsaw University of Technology,
Faculty of Architecture

karolina.tulkowska@pw.edu.pl

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Wood as an innovative material in living environment transformations. The "Biosourcer" office space conversion into "Bertelotte" student apartments

The "Bertelotte" student residence, designed by the NZI Architectes on behalf of Paris Habitat, is an innovative benchmark in terms of high thermal insulation. Its facades consist of prefabricated wooden panels with bio-based straw insulation. Their use allows the development of a dry and ecological sector and good insulation using a natural and efficient material. The use of wooden boxes filled with compressed straw bales is a pioneering and environmentally friendly construction method. Straw ensures very low energy consumption in winter and comfort in summer. This material is also common and eco-friendly, releasing very few volatile organic compounds (VOCs) (Magwood 2016).

Wood has been a staple material in construction for millennia, prized for its abundance, strength, and workability. From ancient timber-framed structures to medieval cathedrals and beyond, wood has played a central role in shaping architectural heritage worldwide. The use of wood in construction declined during the industrial revolution with the rise of steel and concrete, but recent advancements in timber engineering and sustainable forestry practices have sparked a renewed interest in wood as a modern building material (Hudert, Pfeiffer, 2019). Today, engineered wood products offer sustainable alternatives to conventional building materials.

The conversion of the "Biosourcer" offices into student dormitories represents an original endeavor that redefines conventional notions of space utilization and materiality within the built environment. This transformative project exemplifies an innovative approach to architectural design and sustainable construction, characterized by the strategic integration of space-efficient layouts and bio-based materials. Drawing inspiration from diverse disciplines such as architecture, urban planning, and environmental science, the project showcases a multifaceted approach to addressing contemporary challenges in urban development and resource management (Farr 2011).

Central to the design concept was the decision to open up the building volumes to allow direct sunlight into the interior spaces. This involved the demolition of a significant portion of the existing structure, creating a half-open framework that facilitates the penetration of southern light and expansive views. By prioritizing access to natural light, the project aimed to enhance the quality of living environments within the apartments, ensuring that residents could benefit from sunlight and open vistas.

In terms of sustainable construction practices, the project employed a combination of modern building techniques and bio-based materials (Sandak, Sandak, Brzezicki, Kutnar 2019). Notably, the envelope of the building was constructed using 70% prefabricated components manufactured off-site. The remaining facades were replaced with wooden frame walls, which were insulated using compressed straw bales sourced from local suppliers in the Ile de France region. This approach not only reduces the carbon footprint of the construction process but also promotes the use of renewable, locally sourced materials.

Moreover, the project showcases innovative approaches to material reuse and resource conservation, exemplified by the adaptive reuse of existing building components and the incorporation of prefabricated elements. Through careful deconstruction and salvaging techniques, the project minimizes waste generation and maximizes the utilization of reclaimed materials, reducing both environmental impact and construction costs (Rabun, Kelso 2009). Additionally, the use of prefabricated components manufactured off-site accelerates construction timelines and enhances quality control, demonstrating the potential of modular construction techniques to streamline the building process while ensuring consistency and precision.

Uścinowicz Jerzy
prof. dr hab. Eng. arch.,
Bialystok University of Technology,
Faculty of Architecture

j.uscinowicz@pb.edu.pl

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The original form and its absence in the ruins. The problem of interpretation

Paper presents “second life” of abandoned Christian temples. It focuses on searching for modern methods of saving the architecture of temples from ruination and profanation, while ensuring its dignified transformation. It presents selected examples of full or partial reconstructions of the ruins of temples and interconfessional conversions in the last quarter of a century in Poland. It also shows the process of transformation of spatial and functional structures as well as iconography of the temples, implemented throughout adaptation, modernization or extension. It covers problems in architectural conservation as well as essential ideological aspects of symbolical and liturgical nature.

Apart from a retrospective look at first post-war buildings of this type there are also latest author projects introduced. They exemplify a design method of a "non-invasive” approach to historical monuments, including respect for their historical values and adding new qualities at the same time.

These extremely different examples of the protection of temples from degradation, destruction, and sometimes desecration – through reconstruction, integration, adaptation and incorporation – have a common intentional basis. All of them seem to come from the same ideological premises. They also share a common main criterion – the protection of existing material values, but also the further development of spiritual values. In this process of protection and conservation, priority is given to spiritual values over material values. For spiritual values is where they see the search for the truth and the sense of their existence, the authentic protection of their past and present mission in the time and space of this world.

Vazzoler Alessandra
mSc. Eng.,
University of Brescia - DICATAM

alessandra.vazzoler@unibs.it

Giovanni Plizzari
Professor Eng.,
University of Brescia - DICATAM

giovanni.plizzari@unibs.it

Longo Olivia
prof. dr hab. Arch.,
University of Brescia - DICATAM

olivia.longo@unibs.it

Sigurtà Davide
mSc. Arch.,
University of Brescia - DICATAM

davide.sigurta@unibs.it

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Longo Olivia, Sigurtà Davide

Structural exoskeletons and biophilic: a new perspective of redevelopment for the existing heritage in a sustainable way

In architecture, biophilia is a design trend that uses and establishes a balanced relationship between space, form, materials and nature.

Biophilic architecture is a constantly evolving field, with the aim of creating environments that improve individua well-being and quality of life. This translates into the design of spaces that encourage the connection with nature and promote the psychophysical well-being of people.

This approach allows to promote the sustainability and conservation of natural resources, looking for ecological materials, recycled materials and renewable energy, encouraging circular architecture to offer innovative design solutions and reduce waste.

In fact, circular architecture promotes the efficient use of resources, reduces the environmental impact and promotes the durability of buildings. Recycled and renewable materials are used to create spaces that are sustainable and versatile over time. This approach stimulates innovation and contributes to the well-being of those who live there.

One of the main ways in which there is the possibility of integrating natural elements into the built environment to promote human well-being is through the use of sustainable building materials: starting from materials such as wood, stone, straw, bamboo, linen, sheep's wool up to recycled steel and concrete.

In this new perspective there is also the interest to design new types of structural interventions in a sustainable way and with a view to an "integrated design" that should be understood as that multidisciplinary process in involving different professionals, bringing to the project their skills and obtaining a high quality result.

Just think of the requalification of historic buildings where very often the structural gaps are also accompanied by architectural and energy gaps.

This must be the search engine to design adaptable interventions that adapt both the structural performance of the building and the energy and architectural efficiency, impacting the environment as little as possible.

The latter can be achieved by using intervention proposals using recycled and recyclable materials that are safe and sustainable, both environmentally and economically.

One issue in particular deserves special attention is the use of the exoskeleton on existing buildings, built before the 1980s, which allows to increase not only the energy performance and architectural quality of the urban environment but also the structural security of the building, contributing to improving the quality of life and the well-being of the inhabitants.

The exoskeleton, originally inspired by the external structure of some invertebrates, is a protective device. When applied to buildings, it results in a volumetric expansion independent of the original structure, but connected to it. This allows to design the exoskeleton in adhesion to the existing structure or distanced from it, depending on the urban limitations and needs. Usually made of metal carpentry with autonomous foundations, the exoskeleton improves the dynamic response of the existing building and promotes energy efficiency and architectural restyling.

In this perspective, the biophilic architecture allows to integrate natural elements in the structures of buildings, creating real green walls. This not only improves the aesthetic appearance, promoting the design of new elevations for the building, but also contributes to energy efficiency and promotes a harmonious coexistence between man and nature. The result? Sustainability and well-being for the occupants.

Wierzbicka Anna Maria, Ławińska Katarzyna

Wierzbicka Anna Maria
dr hab. Eng. arch. associate professor,
Warsaw University of Technology,
Faculty of Architecture

anna.wierzbicka@pw.edu.pl

Ławińska Katarzyna,
dr hab. Eng.,
Łukasiewicz Research Network,
Łódź Institute of Technology

katarzyna.lawinska@lit.lukasiewicz.gov.pl

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Building with mushroom bricks - ecological innovation in architecture

Mushroom bricks provide a sustainable alternative to traditional building materials due to their ecological nature and unique properties. The article will discuss the advantages of using mushroom bricks in construction, such as durability, insulating properties, and biodegradability. Examples of successful projects utilizing mushroom bricks will be presented to showcase the potential of this innovative material in the construction industry.

One of the key advantages of mushroom bricks is their durability. Despite their lightweight, mushroom bricks have proven to be as durable as traditional concrete blocks, making them an attractive option in construction projects where strength and stability are essential.

An example of innovative use of mushroom bricks is the pavilion in the Royal Łazienki Park designed and built in collaboration with the Łukasiewicz Center and the Faculty of Architecture at the Warsaw University of Technology. The mushroom brick created by the institution in Łódź turned out to be an excellent construction material for specialists from A3 - Architecture, Technology, and Structures - in the context and significance of the WAPW.

Another benefit of mushroom bricks is their excellent insulating properties. Due to their porous structure, mushroom bricks effectively regulate temperature and reduce energy costs, making them an ideal choice for sustainable construction projects focusing on energy efficiency. A company in the United States successfully used mushroom bricks to build affordable housing units that are not only environmentally friendly but also energy-efficient. Furthermore, mushroom bricks are biodegradable, making them a more sustainable option compared to traditional building materials that generate waste in landfills. After use, mushroom bricks can be composted and returned to the soil without harming the environment. This aspect of mushroom bricks aligns with the principles of a circular economy and sustainable design, making them an attractive choice for builders and architects who care about the environment. Mushroom bricks provide a sustainable and ecological alternative to traditional building materials. Their durability, insulating properties, and biodegradability make them a promising option for construction projects emphasizing sustainability and environmental responsibility. With advancements in research and development in this field, an increase in the use of mushroom bricks in the construction industry can be expected, contributing to a more sustainable environment for future generations.

Wrona Mariusz
mSc. Eng. arch.,
Warsaw University of Technology,
Faculty of Architecture

mariusz.wrona@pw.edu.pl

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Design aspects of portable wooden pavilions

In recent years, there has been significant interest in wood as a building material that aligns well with the concept of ecological construction. As a result, many visually striking wooden structures have been created using various techniques, from simple, almost manually crafted and assembled ones, to constructions erected fully automatedly with mathematical algorithms and the involvement of robots in manufacturing and assembling individual elements. There is also a growing popularity of structures embodying the idea of minimizing the carbon footprint through circularity. Portable pavilions, as lightweight objects with relatively small dimensions that can be easily dismantled and transported to different locations, fit perfectly into this trend. Their small scale encourages bold design expressions, providing opportunities for experiments and artistic provocations in terms of design, construction, and implementation. Imaginative shapes spark interest among audiences and become an excellent research field for the academic and scientific community.

The article discusses the design and implementation aspects of small, demountable wooden pavilions. Selected examples of realizations, especially two pavilions in the creation of which the author actively participated, allow for the presentation of the topics undertaken. They were designed and realized by master's students at the Faculty of Architecture of the Warsaw University of Technology as part of the Architecture of Technology and Structure course. Till now, the pavilion named "Ostoja" has been implemented, while the other pavilion is currently in the design phase. The "Ostoja" pavilion was realized during the summer semester in May and June 2023 in the Łazienki Królewskie park near the Hermitage building, enhancing the Architecture of Challenge - Rebuilding Ukraine conference held at that time. This pavilion has a small, circular form with a wooden skeletal structure. The entire pavilion, including the elements of the roof structure, is inscribed in a circle with a diameter of 1065cm, and the maximum height of the structure measured from the foundation to the top eyelet is 353cm. The circular shape of the structure enabled the realization of the conceptual intention to create a safe shelter and to place a symbolic flowerbed in the center of the installation. The idea of the "Ostoja" construction relies on a framework structure shaped like an inverted cone supported on columns arranged around the circumference of the circle.

The other pavilion designed as part of the Architecture of Technology and Structure course is to be built close to the place where the dismantled "Ostoja" object was located. Like "Ostoja," this pavilion will be realized as a small, lightweight, wooden skeletal structure temporarily connected to the ground by terrace anchors screwed into the soil. The latticed form of the building refers to the thematic focus of the semester activities and resembles four mushrooms growing next to each other. As with "Ostoja," the object will be assembled with minimal equipment and physical force to enable its future dismantling and reuse in another convenient location. It is noteworthy that the constructions of both pavilions are not limited to the specific context in which they are situated but also have practical utility. The installation of hammocks and seats has created comfortable conditions for pleasant relaxation while contemplating the installation itself and the exceptional park surroundings. Given the undeniable success of the "Ostoja" pavilion, which was highly popular among visitors to Łazienki Królewskie and received a prestigious award for the installation project, the author hopes for a positive reception and interest in the article, in which insights into the design and construction of these two very interesting structures are shared.

Zinowiec-Cieplik Kinga
dr Eng. landscape arch.,
Warsaw University of Technology,
Faculty of Architecture

kinga.cieplik@pw.edu.pl

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Energy interactions in human space

Is it possible to measure/determine the energy level in a person's living space? How does the material, form of space, its composition, shape and influence people at the energetic level? The questions seem simple, not to mention basic, to which science should know the answer in the 21st century. But…..

Based on Einstein's most famous physical formula E=MC2, it is widely known that matter is a manifestation of energy. At the subatomic level, elementary particles can be massless and gain mass as a result of interactions with the so-called Higgs field (CERN). Without delving into the intricacies of quantum physics, material objects, including living organisms, have their own energetic properties that will interact with each other. This is basically a pristine research area. However, the history of civilization shows that people have always observed the surrounding world and built systems of ordering the environment using energy interactions: geomancy, feng shui, dowsing... tree worship... healing practices such as acupuncture and acupressure... or tantra, etc. All of them were shrouded in the mystery of magic and were secret knowledge to which only a select few and initiated had access. Nowadays, we approach this type of activities with great caution, often calling them pseudoscience and therefore unworthy of the attention of serious researchers (Matthews 2019).

However, when we look at the problem from the perspective of quantum physics, there is field for many explorations: what, how, why, why, what purpose it serves, what impact it has... how it interacts, etc. For architects, it is crucial to know how to create space for good users' well-being. That's why designers are keenly interested in the answers. Since the 1980s (Urlich 1984), the field of broadly understood nature therapy with biophilic themes has been developing. Just 30 years ago, the biophilia hypothesis was talked about (Kellert et al. 1995), today no one questions the need for contact with nature, there is open talk about forest bathing and the positive impact of trees (Qi 2018), which - according to the principles of physics - should be done at the energy level too. Research shows well-being and concentration improving and, finally, how human physiological parameters change as a result of contact with nature. A few architectural researchers are slowly starting to look more favorably towards geomancy, trying to reach objective knowledge about Chinese feng shui (Kryžanowski 2021). Interestingly, research on the energy aspect of the problem has been omitted in this area. Everyone is aware of it, uses and/or abuses this concept, but there is no evidence, no measurements, no statistics…..

The Schumann Resonance (SR) and its impact on health is basically the only topic of the impact of energy on people in space that has been analyzed for almost last 20 years. Research shows that this phenomenon is complex, related to solar radiation (which can interfere with SR) and is responsible for regulating the biological clocks of Earth's organisms. The wavelength of the Schumann Resonance is correlated with the frequency of brain waves, therefore the brain absorbs, receives and responds to SR fluctuations. The closer the SR fluctuations are to those generated by the man brain - the body's physiological reaction has a positive impact on its well-being, and the greater the deviations - the greater the risk to well-being (Cherry 2002).

The Schuman Resonance as a global phenomenon of our Planet is difficult to control at the design level. However, being aware of energy interactions on the Earth scale, we should focus on verifying at least one of the basic problems of geomancy - Qi energy at energy levels, interactions on a local scale. Research so far has focused on formal analyzes of architecture in terms of compliance or lack thereof with the principles of Feng Shui - as a cultural element (Kryžanowski 2021). Similarly with plant energy, including: trees - everyone has heard about their positive energy, but no one has scientifically verified it, measured it or established the relationship. We already have extensive documentation of the positive impact of nature on our health, but at the energy level we are still blind. It's worth changing this....

REINTERPRETING THE SPACE

International open competition of conceptual ideas for revitalization the historical space of the Potocki Palace complex in Ivano-Frankivsk, Ukraine

TEAM

DEPARTMENT OF ARCHITECTURAL AND URBAN PLANNING
FACULTY OF ARCHITECTURE, WARSAW UNIVERSITY OF TECHNOLOGY.
Anna Maria Wierzbicka, PhD, Arch, Eng. Prof. WUT (Leader of the team)

TUTORS:
Anna Maria Wierzbicka, PhD, Eng. Arch. Prof. WUT
Pawel Trebacz, PhD, Eng. Arch.
Jakub Pienkowski, Msc, Eng. Arch.
Filip Strzelecki, Msc, Eng. Arch.

CONSULTATIONS
Kinga Zinowiec-Cieplik - PhD. Eng. - Landscape Architecture
Ewelina Gawell - PhD, Eng. Arch.- Construction
Alicia Szmelter - PhD, Eng. Arch. -History of Urban Development

STUDENTS:
Aleksandra Snopkowska - Eng. Arch.
Jasmina Aboulker - Eng. Arch.
Julia Jędrys - Eng. Arch.
Maria Wito- Eng. Arch.
Weronika Adach- Eng. Arch.

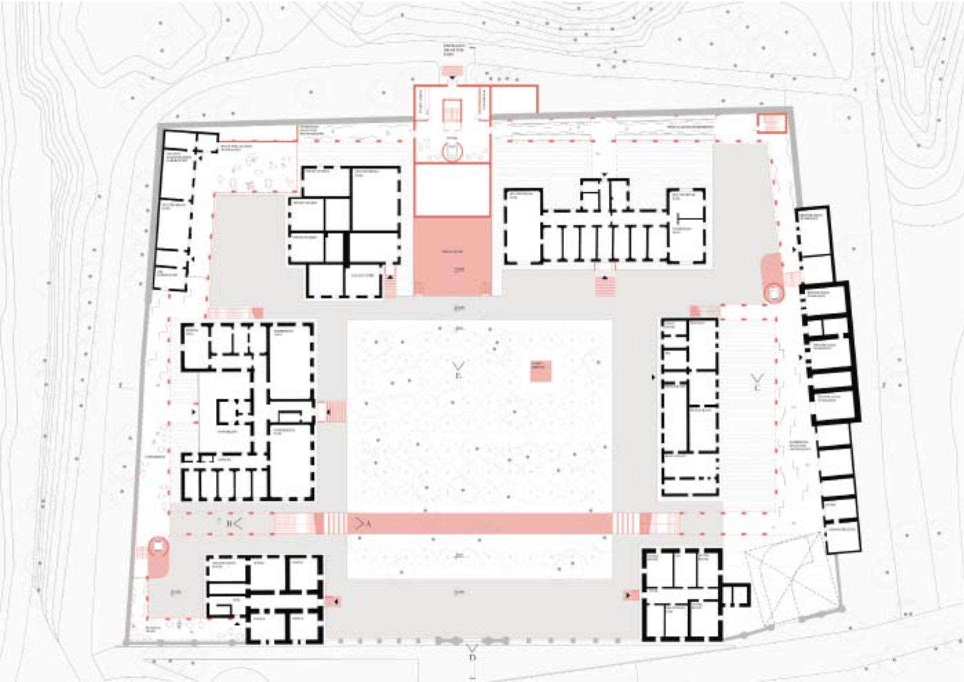
Warsaw University of Technology
Faculty of Architecture
Specialisation -A3 Architecture of Technology and Structures-
Context and Meaning
Master's degree sem. 3/11 WUT

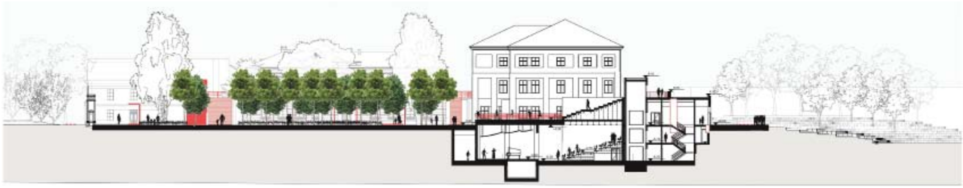
3rd place

THIRD LAYER

The main concept of the project is to create a harmonious space that respects the historical significance of the site while adapting to the contemporary needs of society. The first layer of the project is the historic buildings of the Potocki Palace, while the second layer is an establishment that includes the facilities of the military hospital. The third layer is the footbridge we defined, which is a perspective view of the site's history, and a densely planted forest of trees providing solace and rest in the greenery as a symbol of hope for a better future.

A grid-based footbridge together with flooring around Potocki Palace connects various elements of the project, referencing the historical urban structure. Projected footbridge is constructed from recycled materials, highlighting the commitment to responsible resource usage. The structure relies on sturdy foundations while harmoniously blending with the surrounding environment.





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TUTORS:
Anna Maria Wierzbicka, PhD, Eng. Arch. Prof. WUT
Pawel Trębacz, PhD, Eng. Arch.
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Filip Strzelecki, Msc, Eng. Arch.

CONSULTATIONS
Kinga Zinowiec-Cieplik - PhD. Eng. - Landscape Architecture
Ewelina Gawell - PhD, Eng. Arch.- Construction
Alicia Szmelter - PhD, Eng. Arch. -History of Urban Development

STUDENTS:
Natalia Trzaskowska - Eng. Arch.
Natalia Andrzejak - Eng. Arch.
Nelli Markhai - Eng. Arch.
Kamila Chodoła- Eng. Arch.
Bartosz Ligwiński- Eng. Arch.
Natalia Okruszek- Eng. Arch.

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competition work

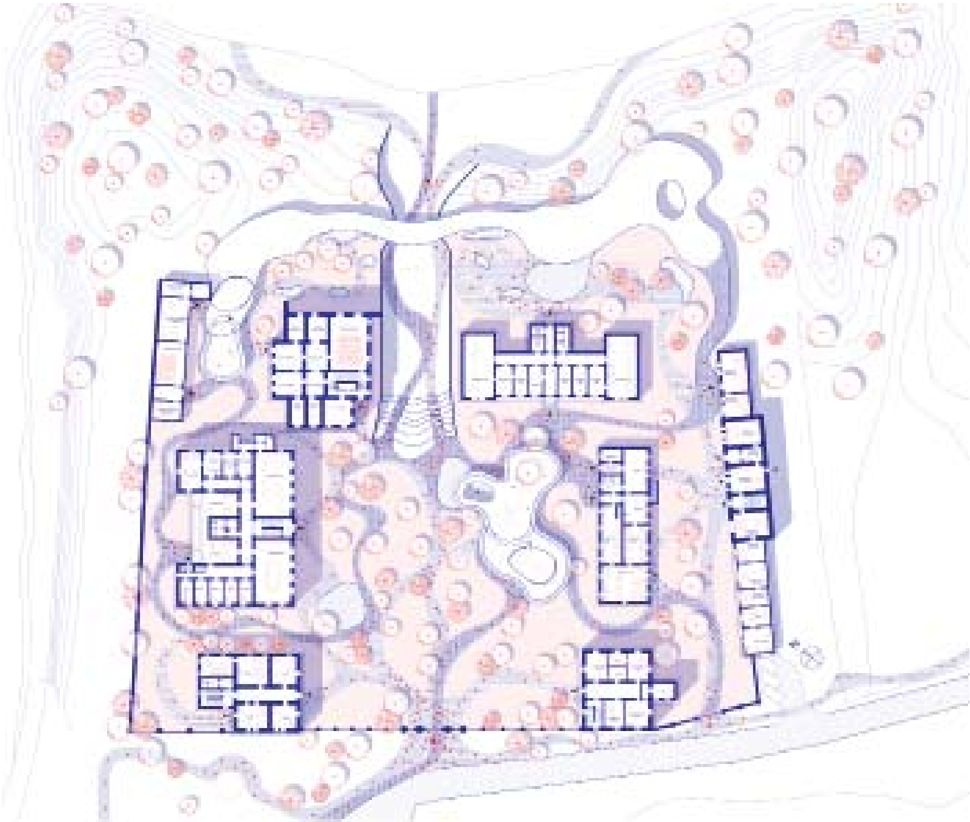
CONTRAST

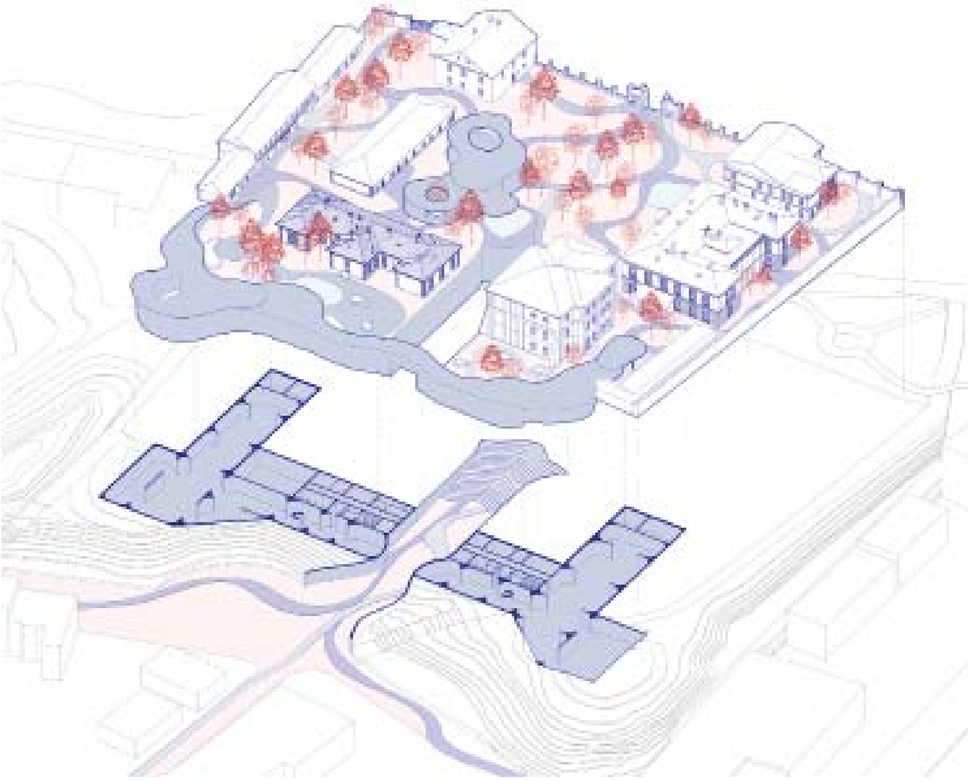
The project involves creating two grids, based on which the underground part, pavilions, and landscaping are designed. The rectilinear grid originates from the arrangement of walls of the existing structures on the Potocki palace grounds. The construction and division of the underground part are based on their extensions. Additionally, although the pavilions have an organic shape, they also use the same structural grid.

The organic grid has its origins in our analyses, through which, using the Grasshopper program, we determined the most optimal connections between key points of the site. By marking entrances to the site and buildings, as well as significant locations, we obtained a grid resembling the functioning of an ant colony. Paths, squares, and pavilion shapes were determined based on this grid.

In addition to the existing main entrance, we are also designing an entrance to the complex from the northeast, where visitors are welcomed from the city by a park passage leading to the amphitheater. The partially covered seating leads us through stairs to the level of the gardens.

The functions already established in the existing buildings, such as exhibition halls, workshops, and a gastronomic area, remain unchanged. All these functions are expanded in the pavilions and the underground part, providing greater possibilities for creating scenarios for various events. The new construction blends into the existing fabric, connecting it through contrast. Instead of material or physical connections, we have used ideological connection.





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Ewelina Gawell - PhD, Eng. Arch.- Construction
Alicia Szmelter - PhD, Eng. Arch. -History of Urban Development

STUDENTS:
Karolina Padło - Eng. Arch.
Małgorzata Bonowicz - Eng. Arch.
Joanna Kasica - Eng. Arch.
Marta Miszczak- Eng. Arch.
Julia Lipińska- Eng. Arch.
Szymon Pawelczuk- Eng. Arch.

Warsaw University of Technology
Faculty of Architecture
Specialisation -A3 Architecture of Technology and Structures- Context and Meaning
Master's degree sem. 3/11 WUT

competition work

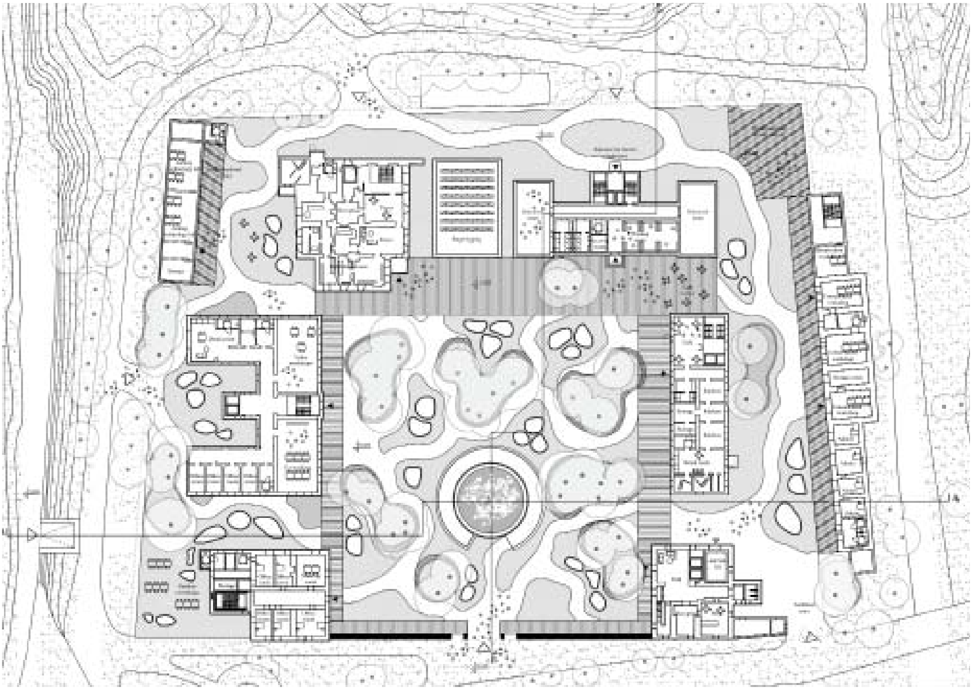
RETURN TO THE ROOTS

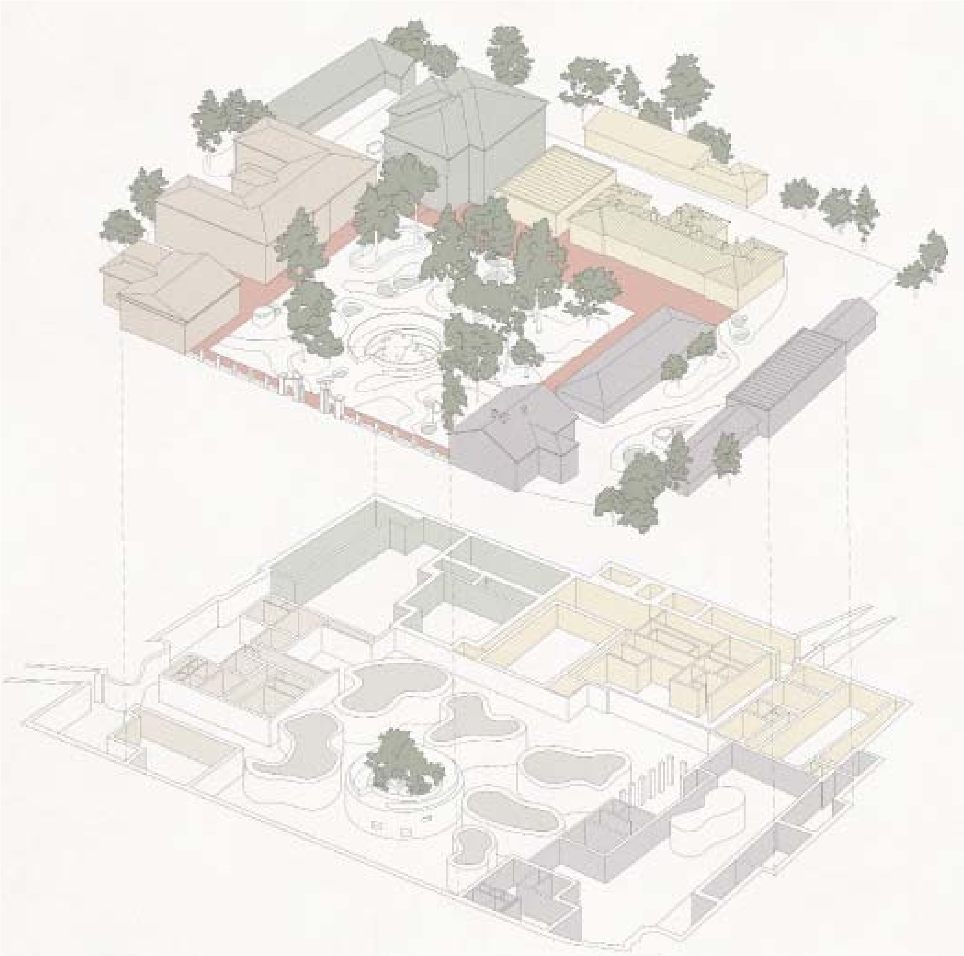
The project aims to enhance the space surrounding Potocki Palace by integrating historical elements with environmentally conscious design principles. Following the New European Bauhaus approach, the focus is on beauty, sustainability, local adaptability, accessibility, and safety. The key concept involves creating an underground space around the roots of existing trees, utilizing rammed earth walls to enclose and organize the area. This innovative underground section will serve as a central hub accessible through a circular ramp designed for comfort and disability access.

All existing buildings will maintain their historical appearance at ground level, with underground connectivity to accommodate various events simultaneously. The underground space will feature skylights, ventilation, and integrated off-road infrastructure. The revitalized green space will include meandering paths, benches, and native plantings. A wooden terrace adjacent to existing buildings will serve as a communication space, accommodating exhibitions, cafes, and other functions.

The underground extension prioritizes exhibition spates, a theater accessible from -1 level, chamber performance areas, cafes, workshops, conferences, and multifunctional rooms. An infopoint, changing rooms, and toilets are also included. To democratize the space, the establishment's fence will be removed, creating continuity with the nearby park. The historic entrance gate will be retained as a symbol of the site's history and tradition.

Materials such as timber, rammed earth, rubble concrete, steel, sandstone, recycled brick, and terazzo are chosen for sustainability and a 'reuse' ethos. The theater's structure comprises screwed steel elements with a milky glass facade, conveying a non-invasive yet functional aesthetic. The cantilevered ramp leading to the underground space features rammed earth walls, non-slip coating, and glass railing. Various elements of the underground extension buildings will utilize recycled materials.





THE FREEDOM PAVILION 2023

TUTORS
Anna Maria Wierzbicka, PhD, Eng. Arch. Prof. WUT
Kinga-Zinowiec-Cieplik, PhD, Eng. Landscape Arch.
Maciej Kaufman, Msc, Eng. Arch.
Szymon Kalata, Msc, Eng. Arch.

CONSULTATIONS
Ewelina Gawell - PhD, Eng. Arch.- Construction
Mariusz Wrona - Msc, Eng. Arch.- Construction
Paweł Trębacz - PhD, Eng. Arch.- Urban planning

Warsaw University of Technology
Faculty of Architecture
Specialisation - A3 Architecture of Technology and Structures- Context and Meaning
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Uniwersytet Warszawski
New European Bauhaus

STUDENTS
Jasmina Aboulker - Eng. Arch.
Weronika Adach - Eng. Arch.
Natalia Andrzejak - Eng. Arch.
Małgorzata Bonowicz - Eng. Arch.
Kamila Chodoła - Eng. Arch.
Roxana Dziurowic - Eng. Arch.
Julia Jędrys - Eng. Arch.
Joanna Kasica - Eng. Arch.
Anna Kieloch - Eng. Arch.
Bartosz Ligwiński - Eng. Arch.
Julia Lipińska - Eng. Arch.
Maciej Makuszewski - Eng. Arch.
Nelli Markhai - Eng. Arch.
Marta Miszczak - Eng. Arch.
Maria Mitrzak - Eng. Arch.
Natalia Okruszek - Eng. Arch.
Karolina Padło - Eng. Arch.
Szymon Pawelczuk - Eng. Arch.
Aleksandra Snopkowska - Eng. Arch.
Natalia Trzaskowska - Eng. Arch.
Maria Wito - Eng. Arch.

In 2023, the Freedom Pavilion emerged from the creative minds of both male and female students and lecturers from the Faculty of Architecture at the Warsaw University of Technology. This circular wooden structure, a symbol of peace and solidarity with Ukraine, was a result of the A3 specialization - Architecture of Technology and Structure, Context, and Meaning. Open to the public until the end of December 2023, the Pavilion stood tall in the Royal Łazienki Park.

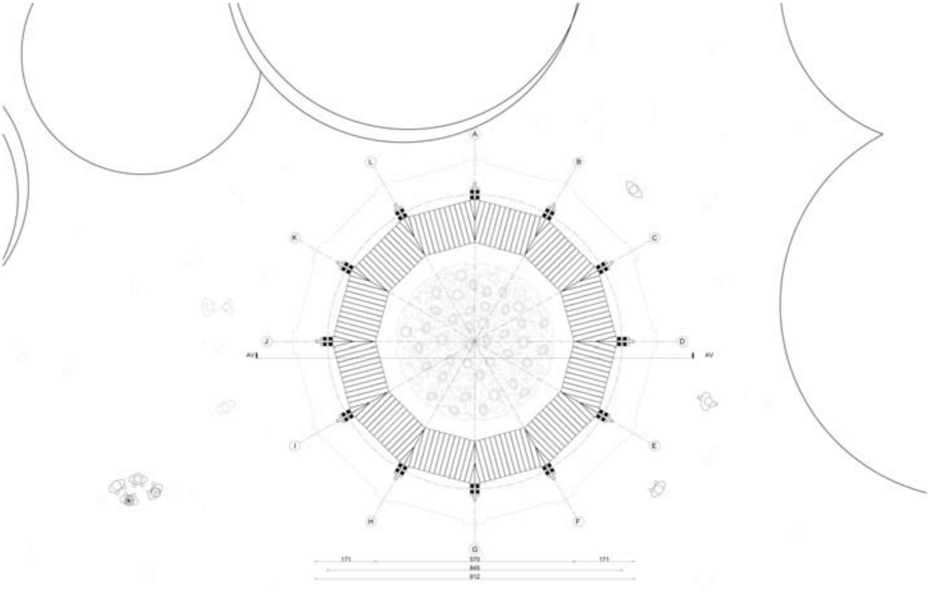
The genesis of the Freedom Pavilion was woven into the annual event "stawiamy_", spearheaded by Prof. Anna Maria Wierzbicka. The focus of this year's project was to echo the freedom of Ukraine and advocate for global peace through an innovative architectural design. This endeavor was also deeply intertwined with the International Scientific Conference "Architecture Challenges - Rebuilding Ukraine", showcasing solidarity with the nation. Positioned in the Royal Łazienki Park, the Pavilion encapsulated hope and unity.

Throughout the academic year of 2022/2023, students were grouped into ten teams, dedicating weeks to brainstorming, designing, and prototyping. Each team of specialists, comprising ten individuals, crafted their own unique vision for the pavilion, aiming to encapsulate the essence of freedom through their architectural prowess.

Implementing a narrative methodology, the creators delved into various facets of the project, including place, time, narrative, ideas, and references, to ensure a cohesive story. This marked the debut of this methodology in the project's execution phase, bridging theoretical work from the university to tangible reality. Notably, the authors themselves erected the Pavilion in the Royal Łazienki Park, a testament to their dedication.

Today, the Pavilion stand nów in 2024, along the Vistula River Boulevards, with the creators envisioning its impact stretching across continents. Honored with an award for the best architectural project in the landscape category in the USA, the Pavilion continues to inspire and captivate viewers worldwide.

Comprising twelve identical trusses forming a roof resembling a funnel, the Pavilion's interior features white strips of material serving as seating or swings. Sunflowers and millet adorn the space, mirroring the colors of the Ukrainian flag. The Pavilion's architecture aims to foster a sense of equality, with sunlight casting a spotlight on the symbolic garden of hope within. The interplay of light and materials creates a reflective ambiance, inviting users to contemplate. Through its circular structure and thoughtful design, the Pavilion serves as a poignant reminder that unity can triumph over adversity, as explained by its creators.



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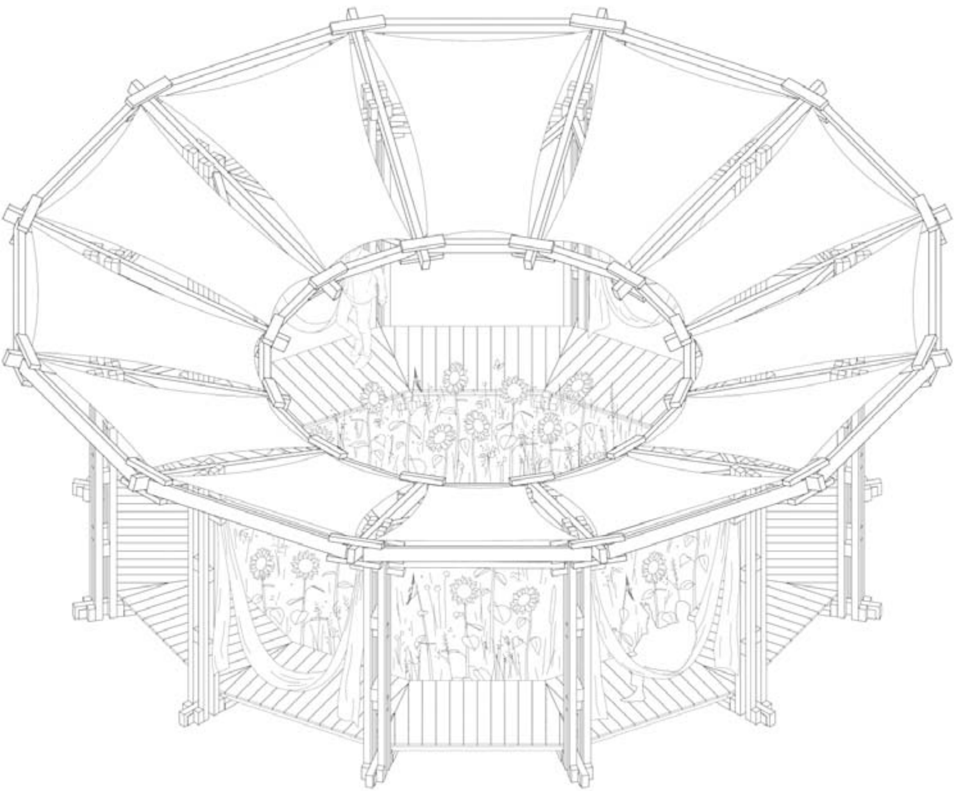

Photography by: Krzysztof Koszewski

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Photography by: Bartosz Kucharski

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WE STAND FOR THE FUTURE PAVILION 2024

TUTORS
Anna Maria Wierzbicka, PhD, Eng. Arch. Prof. WUT
Maciej Kaufman, Msc, Eng. Arch.
Szymon Kalata, Msc, Eng. Arch.
Kinga-Zinowiec-Cieplik, PhD, Eng. Landscape Arch.

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Ewelina Gawell - PhD, Eng. Arch.- Construction
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Paweł Trębacz - PhD, Eng. Arch.- Urban planning

Warsaw University of Technology
Faculty of Architecture
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Uniwersytet Warszawski
Instytut Łukasiewicza
New European Bauhaus

STUDENTS
Alicja Bakalarska - Eng. Arch.
Paulina Cieśla - Eng. Arch.
Stanisław Dawidziuk - Eng. Arch.
Maria Hofman - Eng. Arch.
Zofia Jemioło - Eng. Arch.
Anita Karczmarczyk - Eng. Arch.
Konrad Kmiecik - Eng. Arch.
Michał Komorowski - Eng. Arch.
Patrycja Kuczyńska - Eng. Arch.
Maria Kuryłowicz - Eng. Arch.
Natalia Małolepsza - Eng. Arch.
Zofia Pabiańczyk - Eng. Arch.
Szymon Panek - Eng. Arch.
Przemysław Sasin - Eng. Arch.
Grzegorz Staroń - Eng. Arch.
Julia Stepanow - Eng. Arch.
Mikołaj Szafrański - Eng. Arch.
Michał Szczepanek - Eng. Arch.
Grzegorz Środa - Eng. Arch.
Bartłomiej Urbanowski - Eng. Arch.
Natalia Wnukowska - Eng. Arch.
Katarzyna Wroczek - Eng. Arch.
Marta Zawadka - Eng. Arch.

For students of the A3 Architecture Technology and Structure specialization at the Faculty of Architecture, Warsaw University of Technology, the summer semester 2023/2024 was held under the slogan “materials of the future”. The pavilion they built in the Royal Łazienki Park is an expression of the possibilities behind the use of modern technology in architecture. The facility will remain open to the public until the end of December 2024.

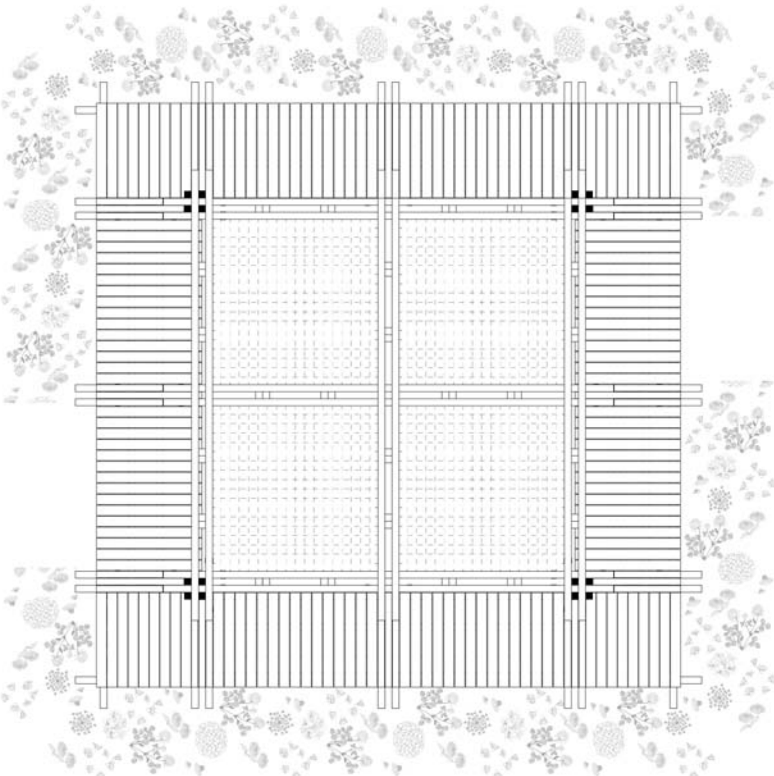
The idea for the Pavilion was born as part of an initiative called we put_, implemented by prof. Anna Maria Wierzbicka. During the summer semester, students of the Specialization have the opportunity to go through the entire construction process - from the first sketches, through self-construction - to the ceremonial ribbon cutting. The main theme of this year’s edition was to present the topic of innovative use of building materials, both traditional ones - such as wood, and new ones - such as mycelium. The technology for producing building elements from mycelium, which is still at an experimental stage, is becoming more and more popular among manufacturers and architects around the world. Its wide application in industry includes, among others: furniture design, packaging production, also have insulating properties. Mycelium, grown on dead organic matter (e.g. construction wood), can be a link that completes the life cycle of a building. It also has a zero carbon footprint. This year’s edition of we place_ was an opportunity to experiment with this new material.

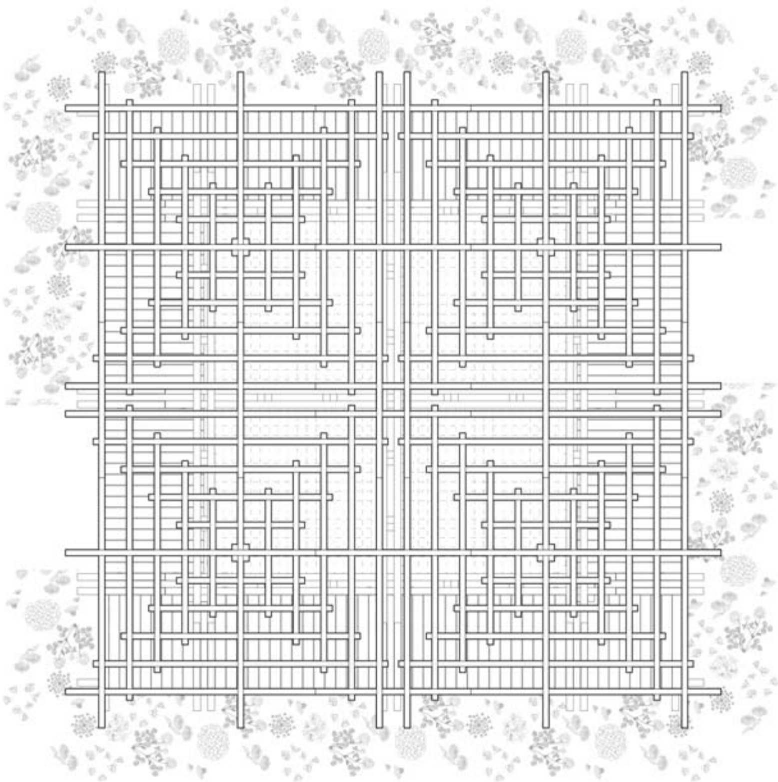
The students were divided into 10 teams, each of which developed its own, original concept of the pavilion. Each team had the same goal, namely to present as clearly as possible the wide range of possibilities offered to designers by organically shaped forms, and how to reconcile contemporary issues of sustainable development with the implementation of buildings. The wooden elements used in the design refer to the tradition of using natural materials in design.

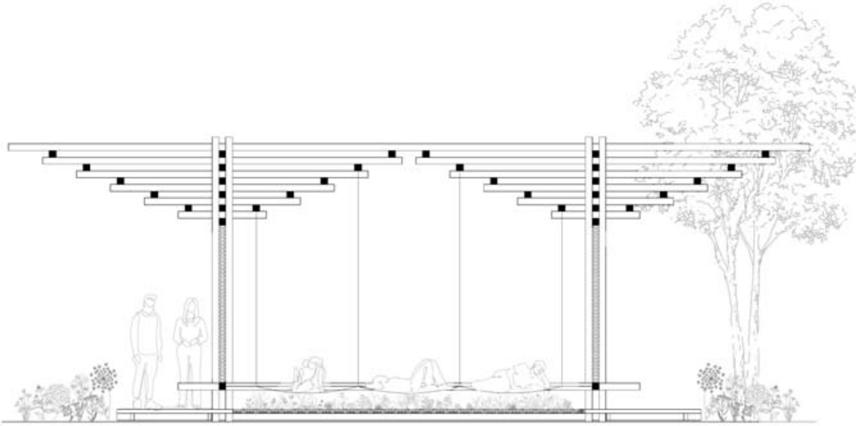
Continuing the success of the first edition of the initiative, we put_, the most interesting concept, was implemented by students in the beautiful scenery of the Royal Łazienki Park in Warsaw. The idea of shaping resulted in a form with a characteristic, openwork structure. The pavilion enriches the park landscape with its organic structure, and thus does not dominate over the facilities located in its immediate vicinity.

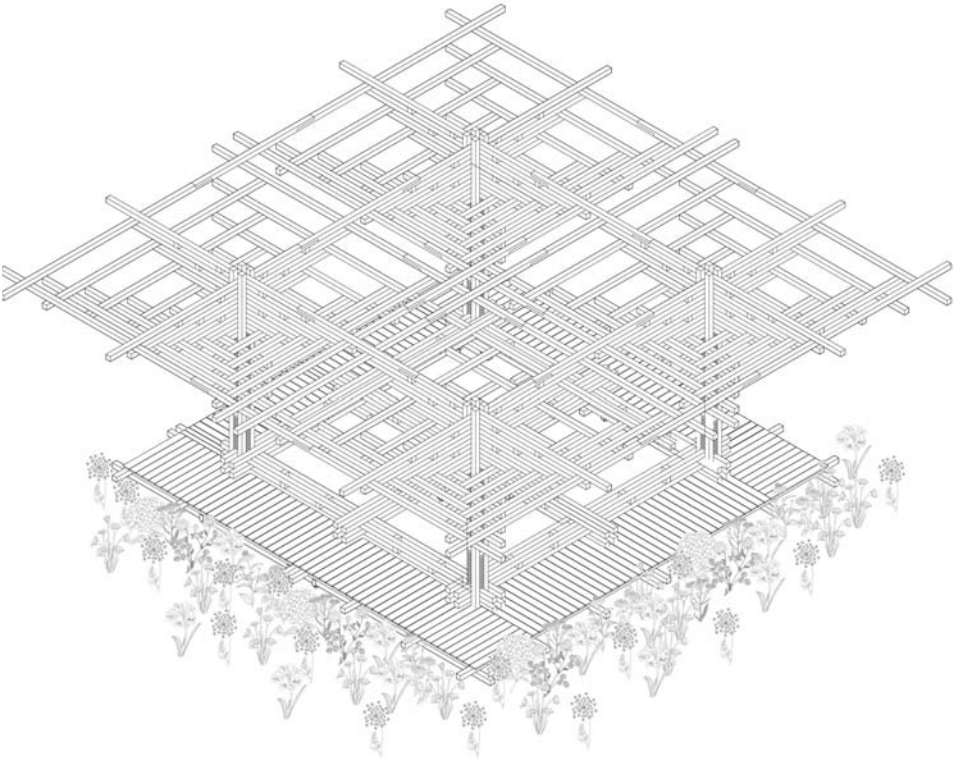
Based on four identical, openwork modules, the pavilion, both in the ground and roof parts, constitutes a coherent whole in terms of form shaping. Its geometric shape refers to the structure of the mycelium fruiting bodies. Its functionality and the complexity of its integrated form constitute a place of rest and contemplation for walkers and visitors to the Royal Łazienki Park.

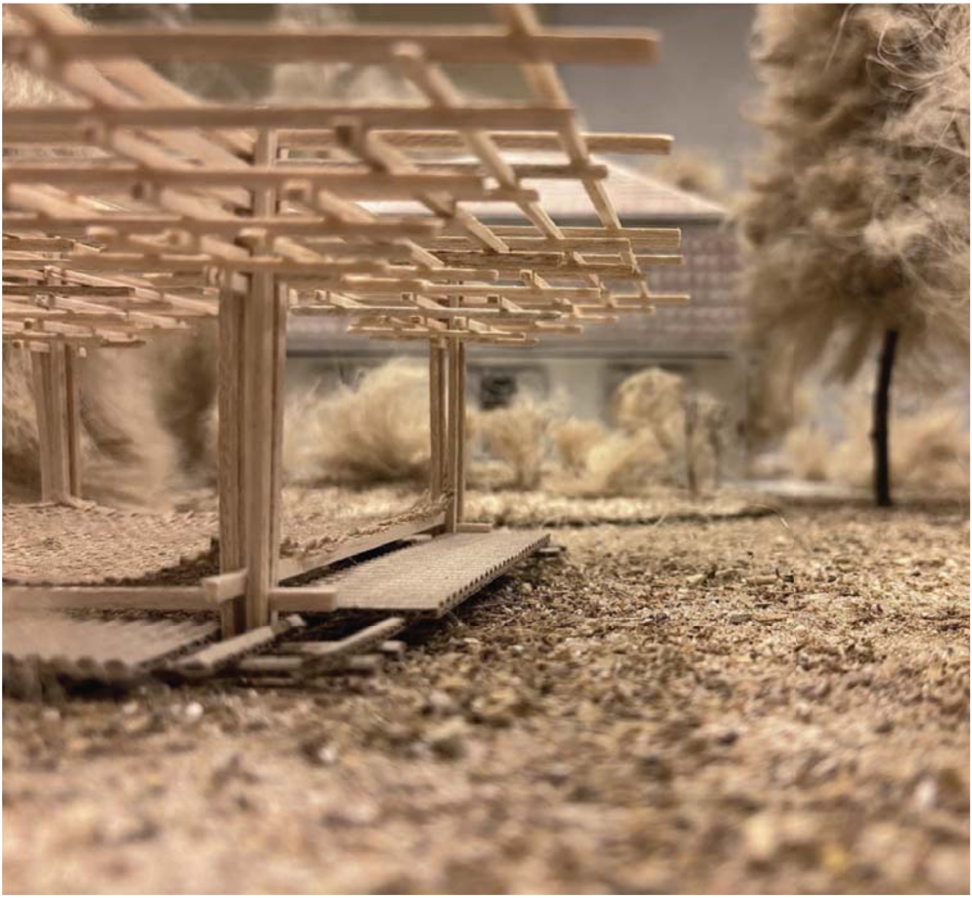
Today, the Pavilion is the embodiment of a modern vision of architecture, harmoniously co-functioning with the historical fabric of the city. Bathed in a carefully designed complex of greenery, it complements the park space with a modern vision of shaping space for people. Thanks to the variety of functions as well as the boldly shaped form, the students proved that in the design process we are only limited by our own imagination.











MYCELIUM MATERIAL – FUTURE HOME PROJECT

POZNAN UNIVERSITY OF TECHNOLOGY
FACULTY OF ARCHITECTURE

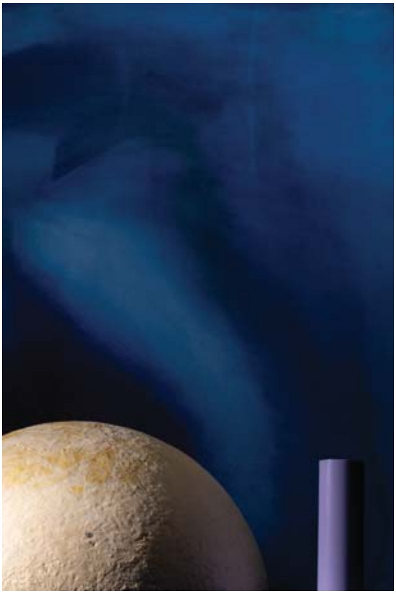
Agata Bonenberg
Professor, Director of the Institute of Interior Design and Industrial Design

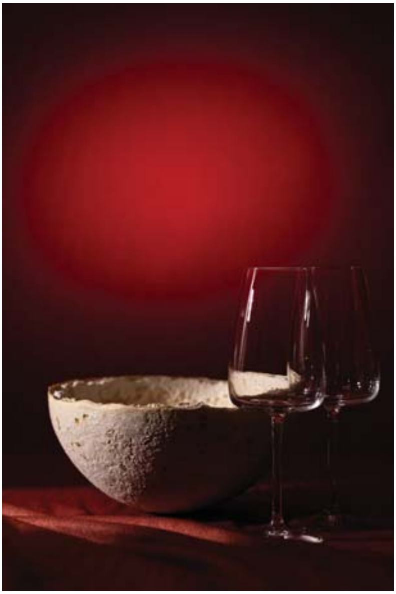
Concept and photo arrangement by:
Prof. Dr. Hab. Eng. Arch. Agata Bonenberg

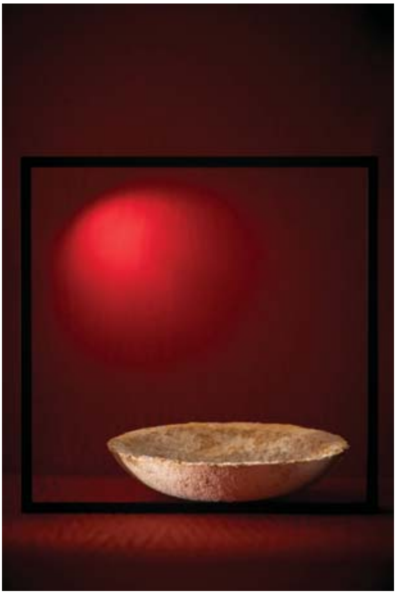
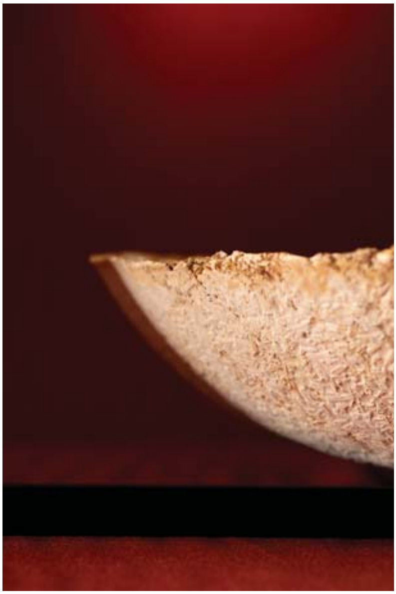
Photography by:
MA Krzysztof Ślachciak

The artistic and scientific project "Mycelium Material – Future Home Project" is dedicated to the application of mycelium-based composites in everyday, practical contexts. For the past three years at the Institute of Interior Design and Industrial Design at Poznan University of Technology, we have been studying the physical, and biological properties of this material. We were interested in the economic and commercial side of its application. The presented project results are the first artistic exploration presenting the aesthetic and compositional outcomes of using mycelium-based composite in everyday objects. The photos depict simple utility objects made from mycelium-based composites in the context of diverse materials and fabrics that evoke the atmosphere of living spaces, and interiors close to humans. We achieve the effect of intimate everyday life through color, composition, and lighting in conjunction with mycelium – the material of the future.





MYCELIUM MATERIAL – FUTURE HOME PROJECT

POZNAN UNIVERSITY OF TECHNOLOGY
FACULTY OF ARCHITECTURE

Agata Bonenberg
Professor, Director of the Institute of Interior Design and Industrial Design

Arrangement and photography by:

Daniela Bukowska,
Wiktoria Ciszak
Magdalena Domagalska
Daria Kachan
Weronika Kijek
Oliwia Konieczna
Sandra Kostuś
Aleksandra Kowalska
Karolina Kozłowska
Oliwia Kozłowska
Agnieszka Musielska
Julia Osuch
Ida Pacer
Karolina Prodlik
Nela Salwin
Iryna Sidaruk
Milena Sielewicz
Aleksandra Skolimowska
Wojciech Stawiarski
Agata Walczak-Górka
Adrianna Wawrzyniak
Wiktoria Włodarska
Joanna Zając

Under the guidance of the Home Staging course instructors at Poznan University of Technology:

Prof. Dr. Hab. Eng. Arch. Agata Bonenberg
MA Krzysztof Ślachciak, MA Weronika Wlazły

The photo sequence was taken as part of a photo session by Interior Architecture students at the Faculty of Architecture at Poznan University of Technology during the Home Staging course, preparing properties for sale. The goal of the photo session was to create arrangements with furniture and decorations to evoke a sense of belonging and homely warmth. Using objects made from mycelium-based composites in home staging is highly recommended. Due to the changing aesthetics of decorations, the ecological character of styling artifacts is essential; disposing of decor elements that are out of fashion or have fallen out of trend is environmentally neutral. This contrasts with non-renewable materials available in chain stores promoting interior fast fashion, often used in styling photo sessions. The widespread use of mycelium composite objects in home furnishings promotes products with reduced carbon footprint.



Ladies and Gentlemen,

Architecture is constantly striving to respond to the challenges of modern times. One such challenge is creating buildings using innovative materials. This theme, in the context of the future, has become the leitmotif of the Second International Scientific Conference - Architecture of Challenges. I am delighted that it was possible to organize this scientific event for the second time, an idea that originated at the Faculty of Architecture of the Warsaw University of Technology. I want to thank the Dean of the Faculty, Dr. hab. inż. arch. Krzysztof Koszewski, for this opportunity.

I would also like to thank our co-organizers: the Director of the Royal Łazienki Museum in Warsaw, Dr. Marianna Otmianowska, whose support has enabled us to continue this fruitful cooperation and host participants and speakers at the prestigious venue, the Palace on the Water in the Royal Łazienki Park. The gardens of Warsaw's Royal Łazienki once again opened up to the event with the construction of the 'Stawiamy na Przyszłość' Pavilion [We stake on the future], designed as part of the A3 Technology and Structure - Context and Meaning specialization in the Department of Architectural and Urban Design (Faculty of Architecture - WUT) under my direction.

The Academy of Fine Arts in Warsaw joined the group of co-organizers this year. I would like to thank the Rector of the Academy, Prof. Błażej Ostoja Lniski, and the Vice-Rector for External Cooperation and Promotion, Prof. Prot Jarnuszkiewicz, for their involvement in the organization of the event and for making the Czapski Palace available for the conference proceedings.

Another excellent conference co-organizer is the National Institute of Architecture and Urban Planning. I want to thank the Director of the Institute, Prof. Bolesław Stelmach, for his organizational support of the conference.

The size and importance of this event are evidenced by the valuable partnerships established last year and continuing with: the Kiev National University of Construction and Architecture (KNUBA), the Zaporizhia Polytechnic National University, the Lviv Polytechnic National University, The National Academy of Fine Arts of Ukraine, the National Union of Architects of Ukraine, the Association of Polish Architects (SARP), and the Urban Jungle Agency. I would like to thank the new partner of the conference, the Lukasiewicz Research Network. I would also like to thank Dr. Hubert Cichocki, President, for continuing this cooperation with this initiative. Thanks to research contacts with the Łódź Institute of Technology, it was possible to produce a very interesting, and I believe, future-proof material: mycelium bricks, which were used in the construction of our pavilion this year. I would particularly like to thank Dr. hab. inż. Katarzyna Ławińska, for her substantive support.

I look forward to your continued cooperation in future scientific, architectural, or other initiatives to strengthen our friendly relations.

The conference has received the privilege of Honorary Patronage from the Rector of the Warsaw University of Technology, Prof. Krzysztof Zaremba. I would also like to express my great gratitude to the Ministry of Culture and National Heritage, the Ministry of Science and Higher Education, and the Polish Investment and Trade Agency for joining the group of Honorary Patrons.

I want to thank all members of the Scientific Committee who also agreed to take care of the content of the conference this year - they devoted their time and shared their knowledge and valuable experience.

This year, thanks to the organisational cooperation within the NAWA project (National Agency for Academic Exchange), we were able to invite our partners from Ukraine from Lviv Polytechnic - for this opportunity, I would like to express my sincere thanks to the Vice-Dean for Students and International Exchange from the Faculty of Geodesy and Cartography, dr hab. inż. Krzysztof Bakuła, and the Directors of the NAWA Programme – Dr. Grzegorz Gryziak, and Dr. Dawid Kostecki.

The preparation of the conference and this publication would not have been possible without the invaluable work of many people. I want to express my sincere thanks to the entire Organizing Committee for their efficient and effective cooperation: Professor Konrad Kucza-Kuczyński, for the authorship of another wonderful poster dedicated to the conference; Professor Karolina Tulkowska-Słyk; Ewa Rombalska from the National Institute of Architecture and Urban Planning; and Doctors Maria Arno, who coordinated the preparations and acted as Secretary, Artur Filip, Ewelina Gawell, Renata Jóźwik, Anita Orchowska, Hubert Trammer, Paweł Trębacz, Justyna Zdunek-Wielgołaska, and Kinga Zinowiec-Cieplik. I would also like to thank Architects Magdalena Duda, who coordinated with a group of scientists from Ukraine, Szymon Kalat, Maciej Kaufman, Jakub Pieńkowski, Filip Strzelecki, and Małgorzata Nowak-Pieńkowska. Additionally, I would like to thank architects Martyna Rowicka-Michałowska for her assistance with the graphic design of the conference and Martyna Kędrzyńska for preparing the conference packages sponsored by Deloitte.

I would also like to thank the co-leaders of the specialization project A3 Architecture of Technology and Structure - Context and Meaning: the architects Maciej Kaufman and Szymon Kalata, and the consultants, especially Dr. Kinga Zinowiec-Cieplik, as well as the students of the Faculty of Architecture who, within the framework of their chosen specialization, were involved in the design and construction of the Pavilion 'Stawiamy na Przyszłość'. I would also like to thank the Flora Development Company, Mr. Dominik Różański, and Mr. Maciej Sobieski, for their confidence in the project, their sponsorship, and all their help. I would like to thank Hilti for donating the tools, Ramirent for providing the equipment, and Urban Jungle for helping to promote the project.

The organisation of this project was financially supported by Flora Development (main sponsor), Deloitte and the Ministry of Culture and National Heritage. Thanks to these Donors, the conference could take place in this format and we could also host numerous delegations from Ukraine. Thank you immensely for this support.

Similarly, I would like to thank the Media Patrons, who this year were Architektura & Biznes, Architektura-Murator, and The Warsaw Branch of the Association of Polish Architects (OW SARP), thanks to whom the conference received professional-wide publicity.

I want to thank the students who cooperated in constructing the Pavilion and the volunteers who helped operate the conference. In the specialty group were: Alicja Bakalarska, Paulina Cieśla, Stanisław Dawidziuk, Maria Hofman, Zofia Jemioło, Anita Karczmarczyk, Konrad Kmiecik, Michał Komorowski, Patrycja Kuczyńska, Maria Kuryłowicz, Natalia Małolepsza, Zofia Pabiańczyk, Szymon Panek, Przemysław Sasin, Michał Szczepanek, Julia Stepanow, Mikołaj Szafrański, Grzegorz Staroń, Grzegorz Środa, Bartłomiej Urbanowski, Katarzyna Wroczek, Marta Zawadka, Natalia Wnukowska.

Finally, I would like to express my sincere thanks to all the Participants of this year's conference, who are close to the concerns of architecture and the future, and who, in the best possible way, within the scope of their competencies, by signing up for participation, contribute to the co-creation of a better sustainable reality.

dr hab. inż. arch. Anna Maria Wierzbicka,
Professor of Warsaw University of Technology

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Anna Maria Wierzbicka

Professor at the Faculty of Architecture, Warsaw University of Technology.

Head of the Department of Architectural and Urban Design.

Supervisor of PhD students with dissertations distinguished by the scientific council of the Faculty of Architecture at Warsaw University of Technology.

Recipient of the NEB - ProModSe grant for the project “Standardization of settlements for refugees in Lviv”.

Initiator and leader of the project to construct the “Stawiamy…” pavilion at the Royal Łazienki Museum, planned for 2023.

Author of three books and 40 publications in the field of architecture and semantics.

Specialist in prefabrication, design of housing for displaced persons, sacred and monumental architecture, and spatial semantics.

Collaborator with the Polish Academy of Sciences and National Institute of Architecture and Urban Planning.

Recipient of numerous awards and distinctions in the field of architecture.

Leader of Specialty A3 (Architecture of Technology and Structure - Context and Significance) at the Faculty of Architecture, Warsaw University of Technology.

Supervisor of many distinguished master’s and engineering diplomas.

Active advocate for gender equality in the scientific community, especially in engineering professions.

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