

Materials for the Future

Lecture by Mladen Jadric

CAMPUS_Asia Plus::SUAE_Asia 2024 Program_Summer School Workshop, Pusan National University, Korea - CAMPUS_Asia Plus::SUAE_Asia Program_Summer School Workshop 2024

Architecture and Sport

Sustainable Venue Design

Sustainable Architecture in Winter Sports

Building for the Nordic World

Championship in 2031 in

Ramsau am Dachstein

1927 - Bau der Sprungschanze, Norwestbahnhof,
Langlaufbahn, Ausgang, Rodelaufzug, Rodelbahn,
Skiwiese, Sprungschanze, Langlaufbahn



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“The cities everyone wants to live in should be clean and safe, possess efficient public services, be supported by a dynamic economy, provide cultural stimulation, and also do their best to heal society’s divisions of race, class and ethnicity. These are not the cities we live in.”

Richard Sennett:
Building and Dwelling. Ethics for
the City, London 2018.

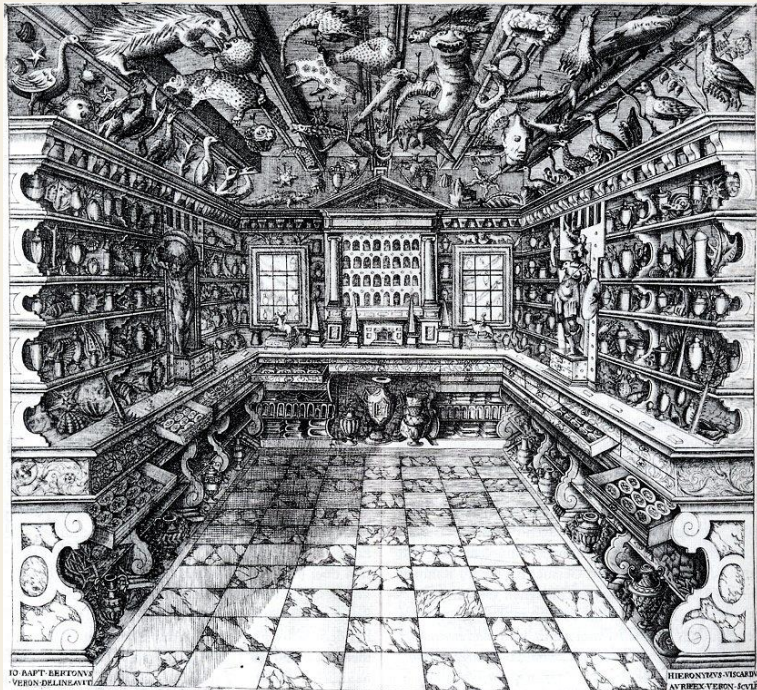


Norilsk's export industry

Materials for the Future

- Material Library

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Museum Wormianum, 1655



Foto: Pixabay, hochgeladen von VHS Wiener Urania

Materials for the Future

- Materialsufficiency

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In the context of sustainability, the control of material flows - the flow of materials through the various phases of a product, from raw materials to production, use and disposal - is essential.

Lightness

Speed

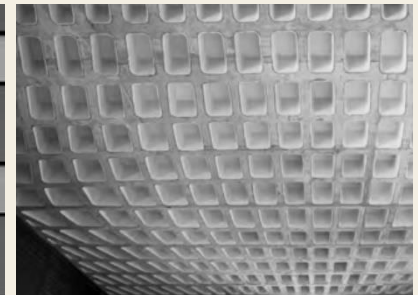
Accuracy

Multilayer

Durability

Consistency

(Umberto Eco)



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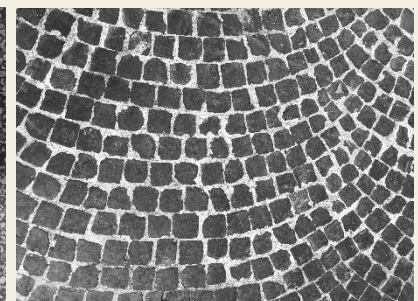
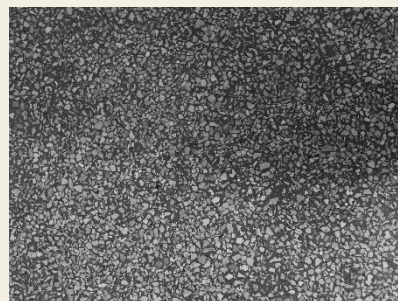
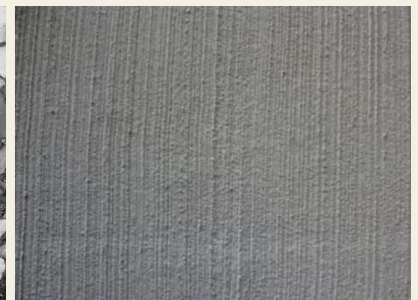
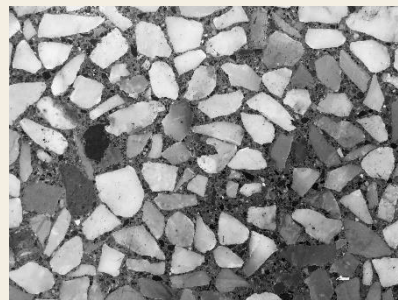
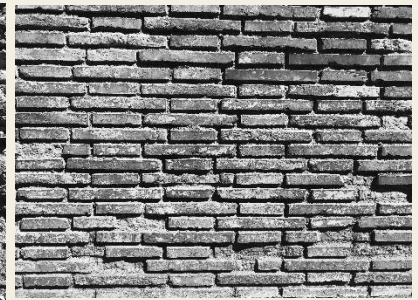
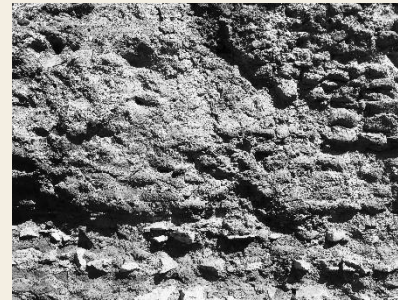


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In times that are increasingly determined by digital production, this research platform examines the production, application and reuse of constructive elements and materials. MATERIAL SUFFICIENCY sheds light on the diverse influences on the material and constructive shape of our world. In a complex design process, where many tasks have to be solved synchronously, the production and interaction of materials will remain an essential element of contemporary architectural language. The focus will be on issues relevant to the contemporary architectural debate and the discourse on future practice defined by environmental conservation premises and based on a historical understanding of the meaning and use of materials and craftsmanship in construction. Furthermore, the relationship of a material to its context, history and building tradition and culture is examined.



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Tabernaemontanus,
Iacobi Theodori, 1687



Herbal book, Hieronymus Bock,
1577

"...A curated knowledge of materials and their constructive application are the basic prerequisites for innovation. The aim is to use more knowledge about materials to promote planning that leads to greater sustainable efficiency and social acceptance, but also promotes health and well-being."

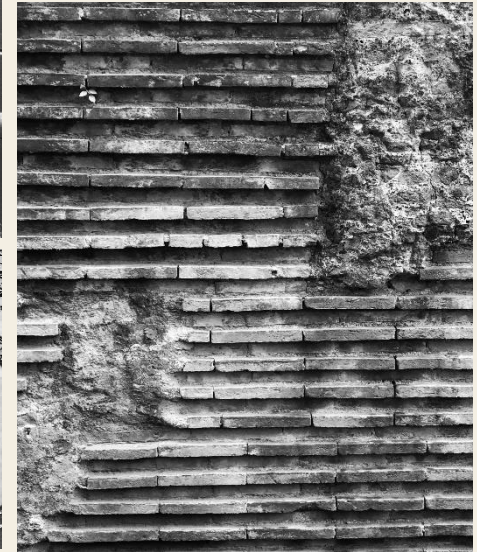
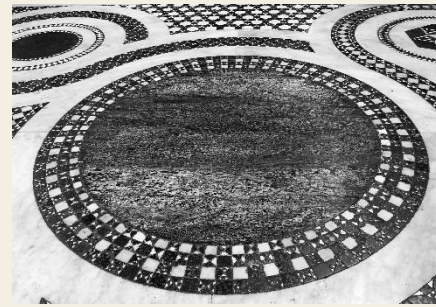
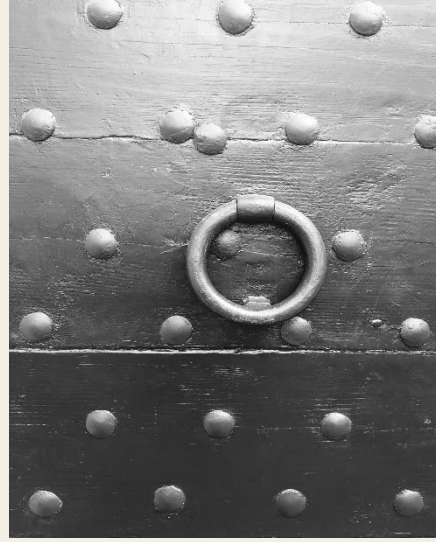
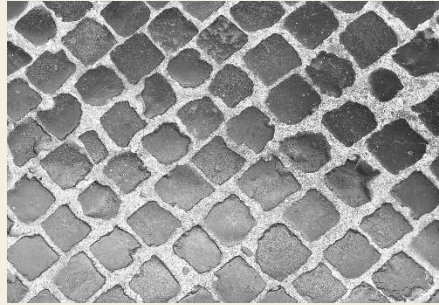
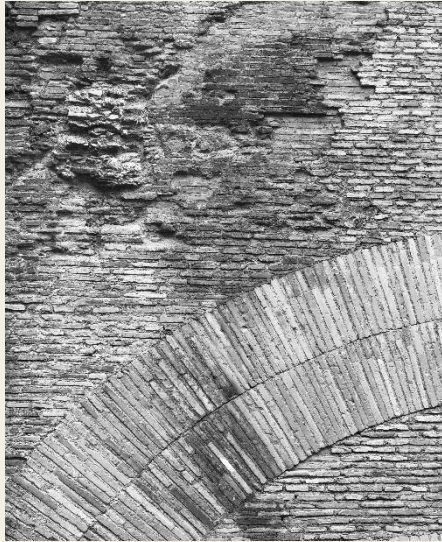


Anselm Kiefer, Census, 1991, steel, lead, glass, peas, and photographs

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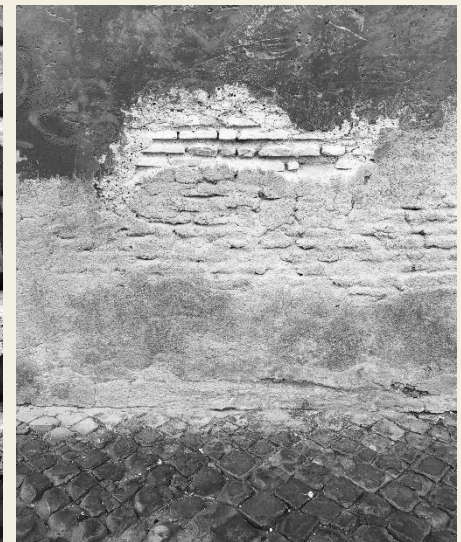
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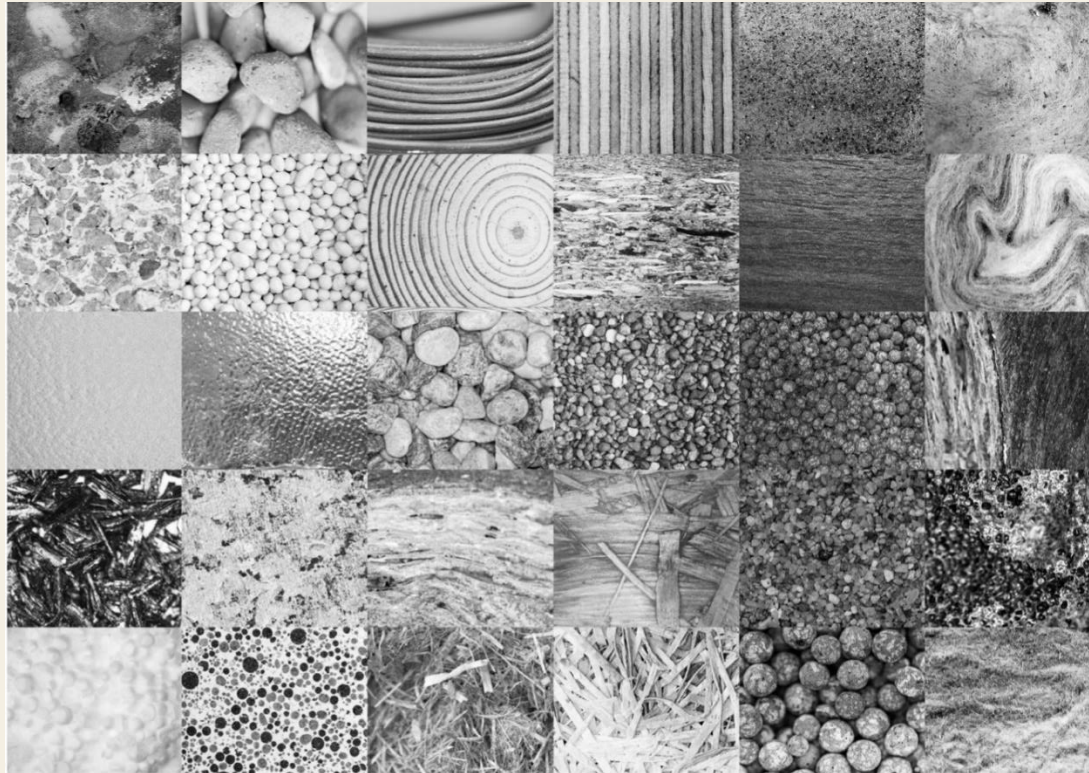
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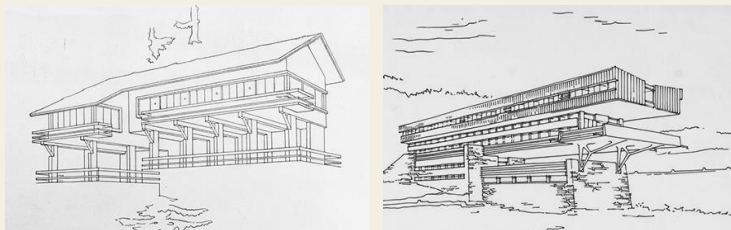
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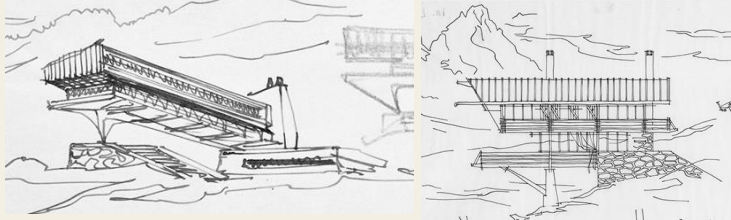


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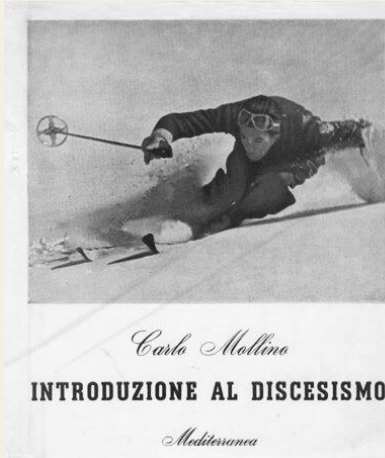
- Carlo Mollino



Carlo Mollino, Lora Totino Fisi Cattanea Agra



Carlo Mollino integrated his alpine buildings harmoniously into the natural environment by using local materials such as wood and stone. His architecture emphasized a functional aesthetic that included practical room layouts and generous window areas. Mollino strove for a symbiosis between building and nature, creating an intense experience for the residents. His philosophy regarded architecture as a sensual experience that emphasizes the beauty of nature and reflects the surroundings.



Mollino, Casa Garelli, Italy



Mollino, Casa Garelli, Italy



Mollino, Lago Nero Sled Station, Sauze d'Oulx, 1946

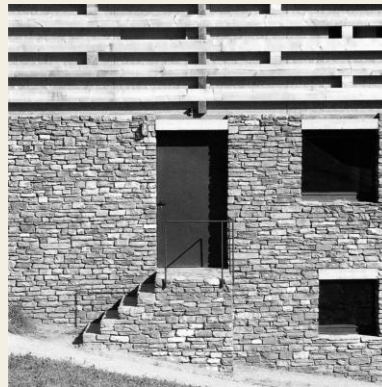
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- Gion A. Caminada & Michael Heinrich

Gion Antoni Caminada is a Swiss architect who is renowned for his work in Alpine vernacular architecture. Caminada's style is strongly inspired by the traditional construction methods and materials of the Alpine region. His work is characterized by a respectful integration into the environment and the use of local materials such as wood and stone.

Michael Heinrich is known for his innovative approach to traditional building and his ability to seamlessly integrate modern architecture into the alpine landscape. Heinrich pursues a holistic approach in which architecture is in close dialog with nature and existing cultural structures.

Their works are examples of how traditional construction methods and modern architecture can be harmoniously combined to preserve cultural heritage and meet contemporary needs.



Gion A. Caminada – Stables and Abattoir, Vrin, Switzerland



Michael Heinrich - Heustadlsuite Taxhof, Bruck, Austria

Materials for the Future

- Peter Zumthor & Bernardo Bader

The Swiss architect Zumthor values materiality and atmosphere. He emphasizes the importance of sensory perception in architecture.

Bader is an Austrian architect who attaches great importance to the connection between architecture and landscape. His work reflects a respectful approach to the local building culture and environment.

Peter Zumthor and Bernardo Bader are important architects who stand out for their unique approach to architecture. Zumthor is known for his sensual, atmospheric spaces, while Bader combines modern architecture with traditional construction methods and regional materials. Both contribute significantly to contemporary architecture by harmoniously combining tradition and innovation.



Peter Zumthor – Houses in Leis, Vals, 2009, Switzerland



Bernardo Bader Architekten – Fußballclub Krumbach, 2000, Austria



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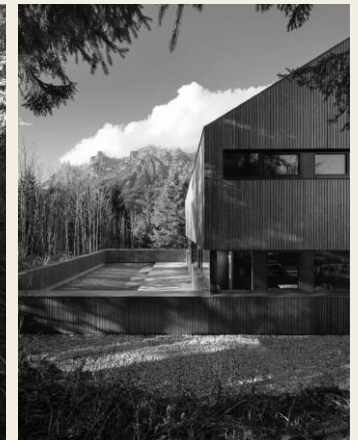
- Burkhalter Sumi & Mladen Jadric

Burkhalter Sumi Architects, now Oxid Architektur, are known for integrating vernacular alpine architecture into their innovative projects. They use traditional materials like wood and stone to create contemporary, functional, and environmentally friendly buildings that blend seamlessly with natural surroundings.



Burkhalter Sumi, House Brunner, Langnau am Albis, 1986, Switzerland

Jadric Architektur's "At Home in the Alps" in Ramsau am Dachstein, completed in 2022, is a standout example of contemporary alpine architecture. The house uses sustainable materials and innovative techniques, featuring a glass facade that integrates the landscape with the interior, combining modern design with traditional alpine elements. This housing project won the BIG SEE Award 2024.



Jadric Architektur, At Home in the Alps, Ramsau am Dachstein, 2022, Austria

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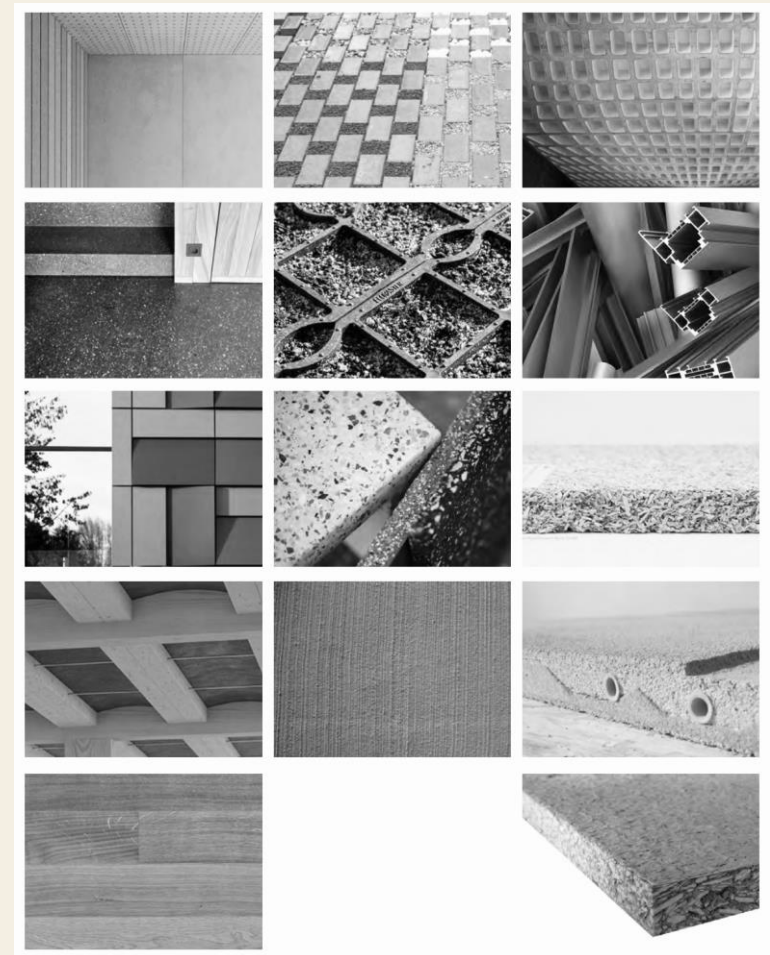
- OFROOM

Motivation

Architecture is lagging behind other sectors in the transformation to a circular, resource-conserving and emission-neutral industry.

OFROOM has been operating at the interface between industry, research and architecture since 2007.

Our continuous work of researching and communicating innovative materials and products for architecture is crystallized in the topic of sustainability. With a newly developed communication tool and a three-day impulse event in Vienna, we are responding to the noticeable urgency of the building turnaround.



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Materials for the Future

- OFROOM

Clay

Climate panel, prefabricated part, wood-clay ceiling, clay lightweight panel, clay floor, clay tiles

Concrete

Clinker-reduced cement, CO2-negative concrete, carbon concrete, weight-reduced concrete ceiling, plastic terrazzo, biochar screed

Insulation

CO2negative blow-in insulation, high-performance insulation boards, high-performance insulating plaster, straw insulation, mineral insulating plaster for renovations

Cradle2Cradle

Panels made from paper sludge, wooden floor, textile (C2C materials that do not fall into any other group, C2C materials are included in every topic)

Facade / glass

Aluminum frame with 75 or 100 % end-of-life aluminum recyclate, renovation system with PV, glass with 40 % less CO2, green facade system, shading

Wood

Deconstructable connecting element, free-form, solid wood with integrated insulation, WPC made from recycled materials, modified wood, lightweight wood panel, system construction

Floor coverings

Highly CO2-reduced carpet, softback carpet, natural fiber carpet, carpet for long renovation cycles, bio-based and recycled materials

Acoustics

High-performance acoustic textile with minimal use of materials, acoustics without fire retardants, recycled material for acoustics, Nawaro for acoustics

Wood construction

Hollow core ceiling, I-beam

Infiltration floor

Retention soil, grass grid, flat roof greening system, open space elements

Solar energy

BIPV - color, transparency, aesthetics

Materials for the Future

- Clay

OFROOM

naturbo clima

naturbo combines the thermal insulation properties of a wood fiber board with a heating system for walls and ceilings. The water-bearing pipes are embedded in clay, which prevents condensation. The system is finished with a clay plaster.



Clay building board from neoClay

Drywall made of clay with environmentally harmonious properties: it is earth and will be earth again at the end of its life. The manufacturing process is energy-saving and the boards are free from harmful substances and formaldehydes.



Wood-clay hybrid ceiling

The newly developed ceiling element consists of wood and clay and is produced industrially for clay-wood system construction. Compared to wood or concrete ceilings, it has the best ecological balance and contributes significantly to a healthy indoor climate.



Rammed earth prefabricated component from Martin Rauch

Rammed earth can be made from any type of excavated earth in the right mixture. With the prefabricated construction method, components are prefabricated in the factory regardless of the weather and the construction time is reduced to a minimum. Clay can be circulated, is low-emission and has a positive influence on the environment.



Materials for the Future

- Concrete

OFROOM

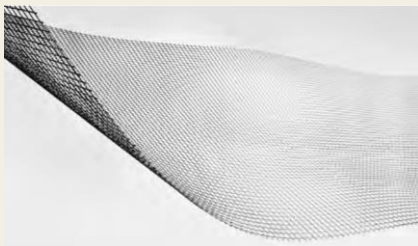
CEM II/C

Thanks to a reduced proportion of clinker, 25% of CO₂ emissions can be saved with a CEM II/C cement. Four suppliers are already delivering in Austria. A new benchmark for a minimum level of responsibility in building with concrete is being established here.



solidian Grid

is a non-corrosive carbon reinforcement mesh for textile concrete with 7 times higher tensile strength than steel reinforcement meshes and a reduction in cement usage of up to 80 %.



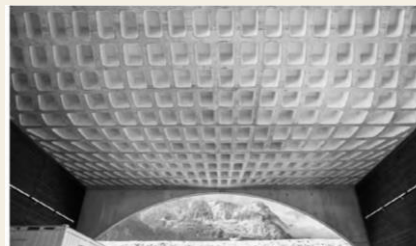
CarStorCrete

15 % of the cement in kimab concrete is replaced by Clim@Add®, an admixture with 96 % technical carbon content, which is obtained as an additional product in wood gas power plants via a pyrolysis process. 1 kg of Clim@Add® binds up to 3 kg of CO₂.



3D printed concrete from Baunit

32.5 % lighter concrete ceilings and thus relevant CO₂ savings: The innovative design with 3D printed displacement bodies minimizes the concrete cubature from a solid slab to a cross-section-optimized cassette slab.



Materials for the Future

- Concrete

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Ground screws from Krinner

RePlace - instead of concrete foundations, ground screws can be used as removable foundations. Soil is protected, biodiversity is preserved and emissions are saved over the entire service life of the foundations.

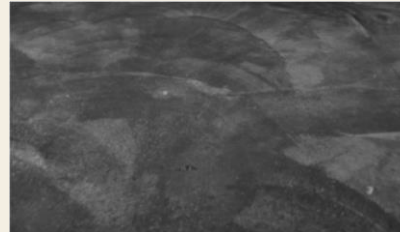


abaton

is a mineral panel with an integrated cooling system. Thanks to the patented component breathing, the abaton panel manages to fall below the dew point cyclically while the surface of the modules remains dry. The panel achieves twice the cooling capacity of conventional surface cooling.

Biochar screed

The screed becomes CO2 neutral to CO2 negative through the addition of biochar. It is suitable as a screed under flooring or sanded/polished as a finished surface.



podCrete

is a concrete admixture and consists of a crack healing agent and nanosilica (silica sol). It bonds with concrete in its pure form and creates a self-healing and creates a self-healing effect, while the silica sol has a compacting effect. With podCrete, concrete floors have a maintenance-free durability of 30 - 50 years.



Materials for the Future

- Cradle to Cradle

OFROOM

HONEXT®

Made from paper waste, the HONEXT® panel is the sustainable, recyclable and innovative alternative to traditional MDF. It is ideal for interior fittings.



Loop by Lindner

is the first fully designed, market-compliant re:use dry screed with life cycle assessment data. Wood or calcium sulphate boards are removed, sorted, processed according to wear and tear and reinstalled.



Cleverpark Silente from Bauwerk Parquet

An oak tree takes 100 years to grow before it is harvested. At Bauwerk Parkett, it is used sparingly only for the visible or wear layer. 4 mm. One oak provides approx. 500 m2 of flooring.



Materials for the Future

- Facade / glass

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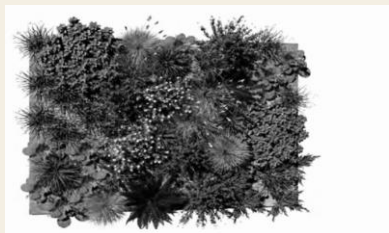
Saint Gobain

is launching the ORAÉ product line, a glass with 40% less CO2 emissions, made possible by a cullet content of 70%, combined with the use of renewable energies in production.



BGreen-It vertical

is a newly conceived façade concept that replaces pre-hung ventilated façades with a living green façade integrated into the building. A special substrate distributes the vertical irrigation and oxygen conditions evenly over the surface.



Hydro CIRCAL 100R

is a world first and the first aluminum alloy for doors, windows and facades with a 100% end-of-life aluminum content and a carbon footprint of only 0.5 kg of CO2 per kg of aluminum.



Flexbricks®

is a customized construction system based on a flexible steel mesh made of recycled material into which various materials are incorporated. The nets are usually fitted with terracotta tiles.



Materials for the Future

- Wood

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Rib Panel

In line with the economical use of resources as an urgent sustainability concept, Hasslacher offers a hybrid beam made of glulam and CLT, which are bonded together. The dimensions are optimized.



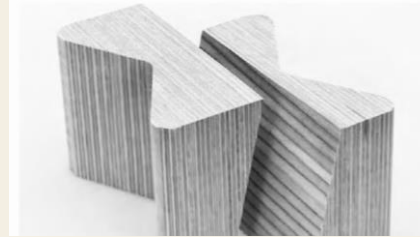
Accoya

Acetic acid anhydride makes Accoya heavier, stronger, more durable and pest-resistant. Pine wood resembles the qualities of tropical wood thanks to the modification. Accoya is suitable for durable, beautiful solutions.



x-fix

The two-part dovetail coupling strip provides form-fit and force-fit connections for large components. Material for window and door surfaces is saved. The connections are detachable.



Decking boards from UPM

UPM decking boards consist of 75% European post-consumer and post-industrial plastic waste, such as labels, and are themselves recyclable. 35 m2 contain around 500 kg of plastic and paper waste. Labels are a high-quality product per se. As fibers, they are dimensionally stable and durable.



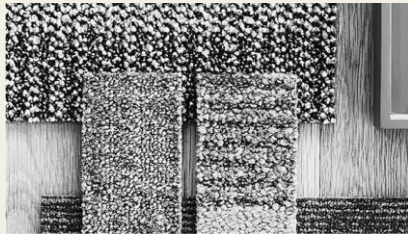
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- Textile

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Interface

With the CQuest™ back construction, Interface creates a CO2-negative footprint in production right up to the factory gate. Bio-based materials and recycled fillers also ensure high quality in the area of material health.



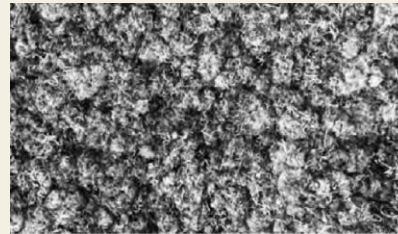
Kvadrat Really

To produce the Really building board, textile waste from the laundry and fashion industry as well as leftovers from kvadrat's own production processes are ground into homogeneous fibers and upcycled into acoustic textile felt.



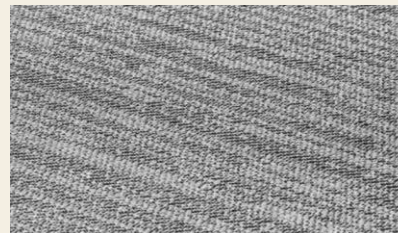
Reval® ball yarn from Fabromont

consists of ECONYL® fibers - a regenerated nylon yarn from carpets and fishing nets, for example. Fabromont processes the fibers into spherical, durable flooring that is dyed without using water.



Strata from 2tec2

The classic vinyl floor is breaking new ground with bio-based material for the top layer and a backing made from 70% recycled material. The material is 100% recyclable and 2tec2 is aiming for a rapid roll-out of the new production to the entire product range.



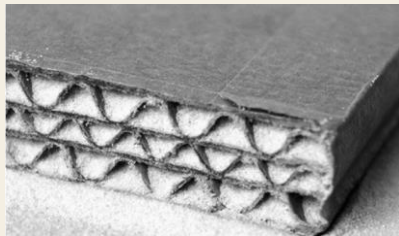
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- Acoustics

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PhoneStar from Wolf - Bavaria

Low tech sound insulation: The PhoneStar panel combines quartz sand and corrugated cardboard. That's it. No additives, no binder, just a vibration process that compacts the sand between the layers of cardboard.



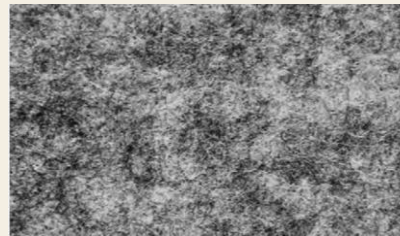
neoStraw Acoustics

is a formaldehyde-free, diffusion-open straw board for interior use made of hemp and minerals with an acoustic effect. neoStraw can be used in various thicknesses as an acoustic solution, for interior finishing and as a furniture board.



bluefibre from sandler

is a durable acoustic panel made predominantly from recycled PET fibers with a low primary fiber content. The company made a conscious decision to produce a product that is flame-retardant and at the same time free from chemical additives.



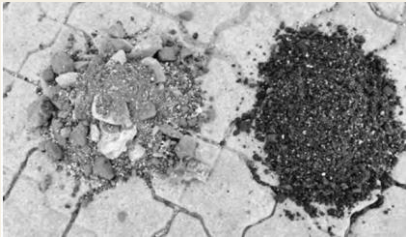
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- Soil

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Drain Garden®

is a largely mineral-based special substrate for green spaces and tree planting, especially for applications in urban areas, building-integrated greening or flood protection.



Helix® GreenRoof

is a complete system for extensive green roofs consisting of pre-cultivated cassettes with integrated rainwater storage and drainage. It can be used on slopes up to 25°. The cassettes are made of recycled plastic. The plants bind fine dust, absorb CO₂, provide evaporative cooling and promote biodiversity.



Ecoraster®

The fillable ground grid preserves the natural soil functions and allows water to seep away. The elements are made from recycled plastic and are easy to install without the need for machinery.



Plantika

The Viennese start-up Plantika offers green roof modules for extensive greening. This can be used locally to meet the growing demand for green spaces to help reduce the exploding summer heat.



Materials for the Future

- Solar

OFROOM

Sunstyle

SunStyle is a photovoltaic system consisting of modules and special installation technology. The functions of a waterproof roof cladding and electricity generation are fulfilled simultaneously. The special aesthetics also allow it to be used in listed buildings.



Avancis

CIGS is one of the most powerful and long-term stable thin-film processes with a high efficiency of 19.8 %. According to the manufacturer, the CO2 emissions of the PV modules are amortized after 550 days.



Materials for the Future

Timber Architecture in Finland



Jetties, Vehmassalmi, Taivassalo, Finland



Mänttää bridge, Yläne; Finland

Alpine architecture is characterized by its integration with the mountainous environment, using local materials such as wood and stone to create structures that blend harmoniously with their natural surroundings. This architectural style emphasizes sustainability, durability, and functionality, often featuring steeply pitched roofs to shed snow and large windows to capture natural light and scenic views. Notable architects like Peter Zumthor and Gion Antoni Caminada have contributed significantly to this field, creating buildings that not only respect but enhance their alpine settings. Through a combination of traditional craftsmanship and modern design principles, alpine architecture fosters a deep connection between the built environment and the rugged, breathtaking landscapes of the mountains.



Old ski-slope, Lahti

Materials for the Future

Timber Architecture in Finland



Finnish pavillon, Brussel's world fair 1958, Reima Pietilä



Chapel, University of Technology Campus, Espo, 1957, Siren



External wall, Finnish pavillon, Seville's world fair, 1992



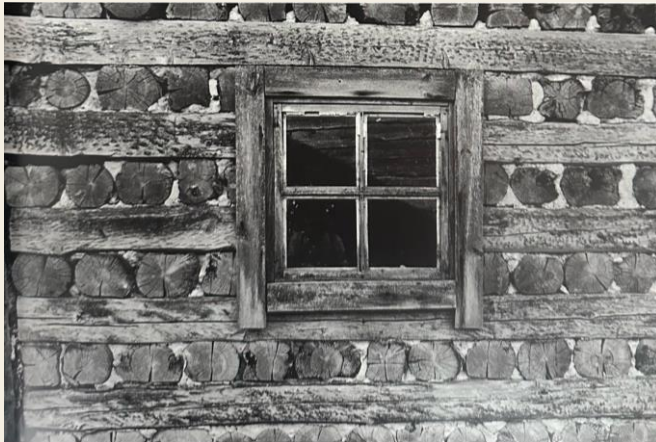
Council-hall roof structure, Säynätsalo, 1952, Alvar Aalto

Materials for the Future

Timber Architecture in Finland



FiHay-barn, Central-Finland



Cow-shed, Central-Finland



Finnish woods, timber

Materials for the Future

Timber Architecture in Finland



Course-centre, Tuohilampi, architect Beng Lundsten



Villa Mairea, Noormarkku, architect Alvar Aalto

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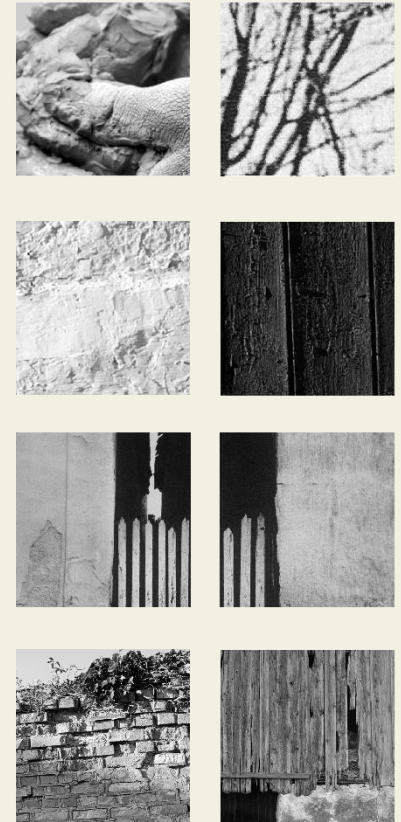
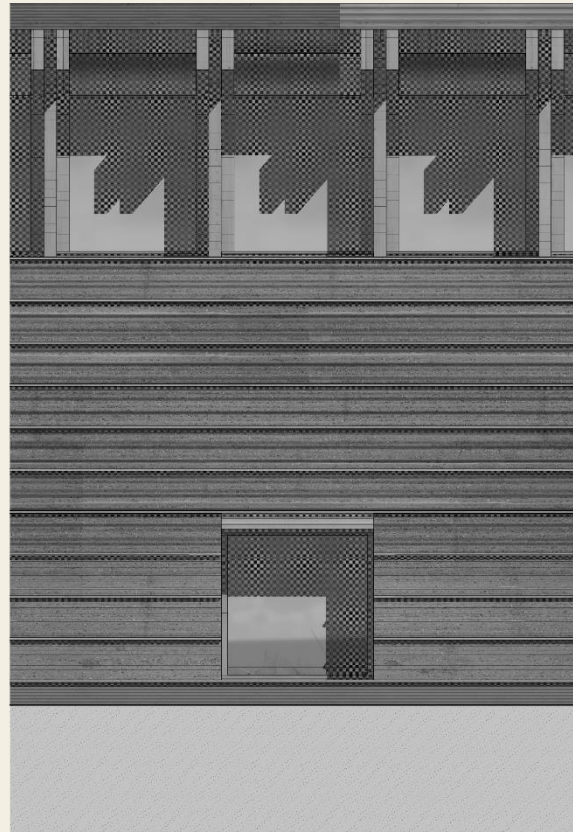
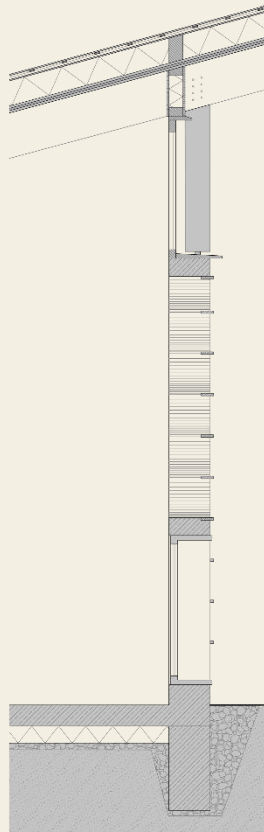
Material Research / TU Wien

Vanessa Beyer

We conducted several experiments with students of TU Wien regarding vernacular typology and construction methods, not limited to the Alpine region. Throughout these experiments, we repeatedly encountered the use of materials such as wood and clay.

“Her architecture is called “anonymous” because its values are common knowledge, accessible and understandable to everyone, and also anonymous because it is never about the names of the individual builders, but always about the forces that shaped this architecture .”

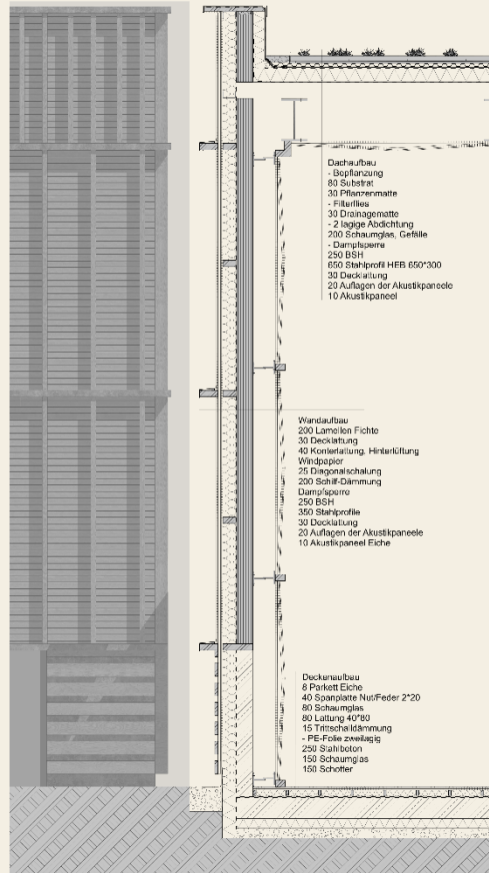
Anonymous architecture, Traudl Windbrechtinger-Ketterer



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Sonja Smaniotto



rau.



glatt.



warm.



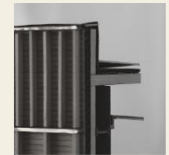
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absorption.



reflexion.



emotion.



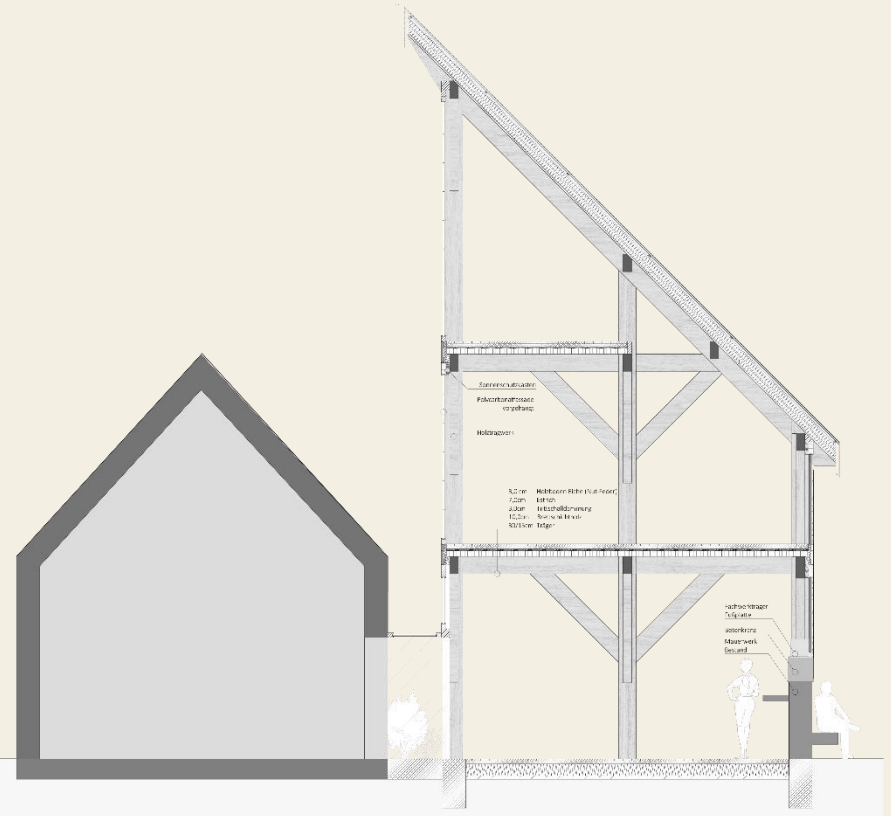
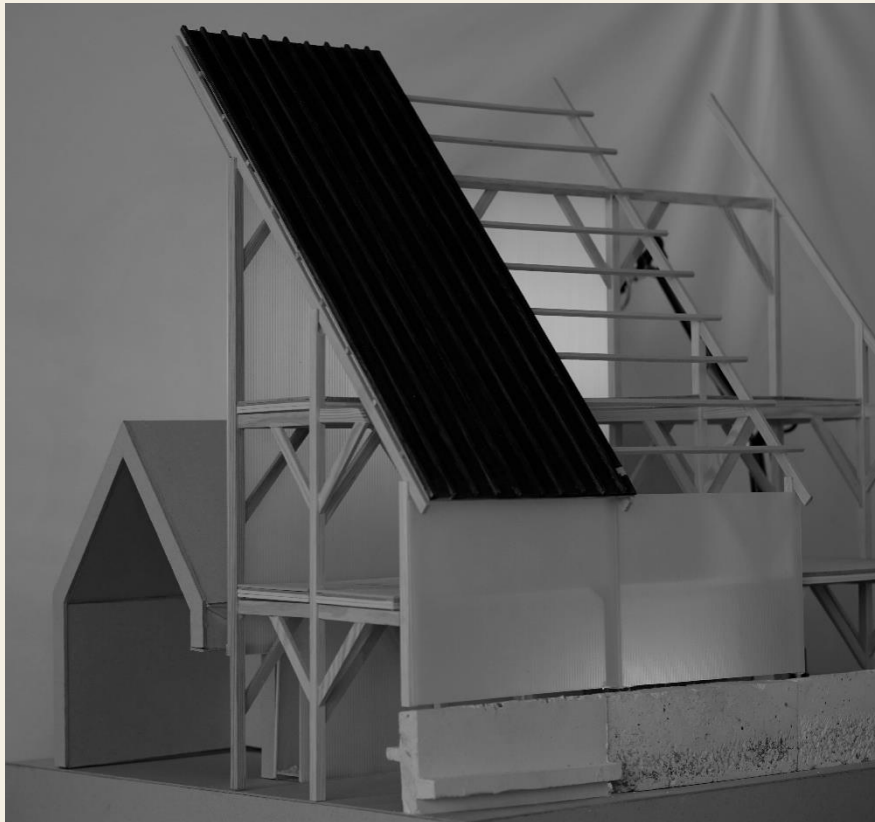
imperfection.



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Material Research / TU Wien

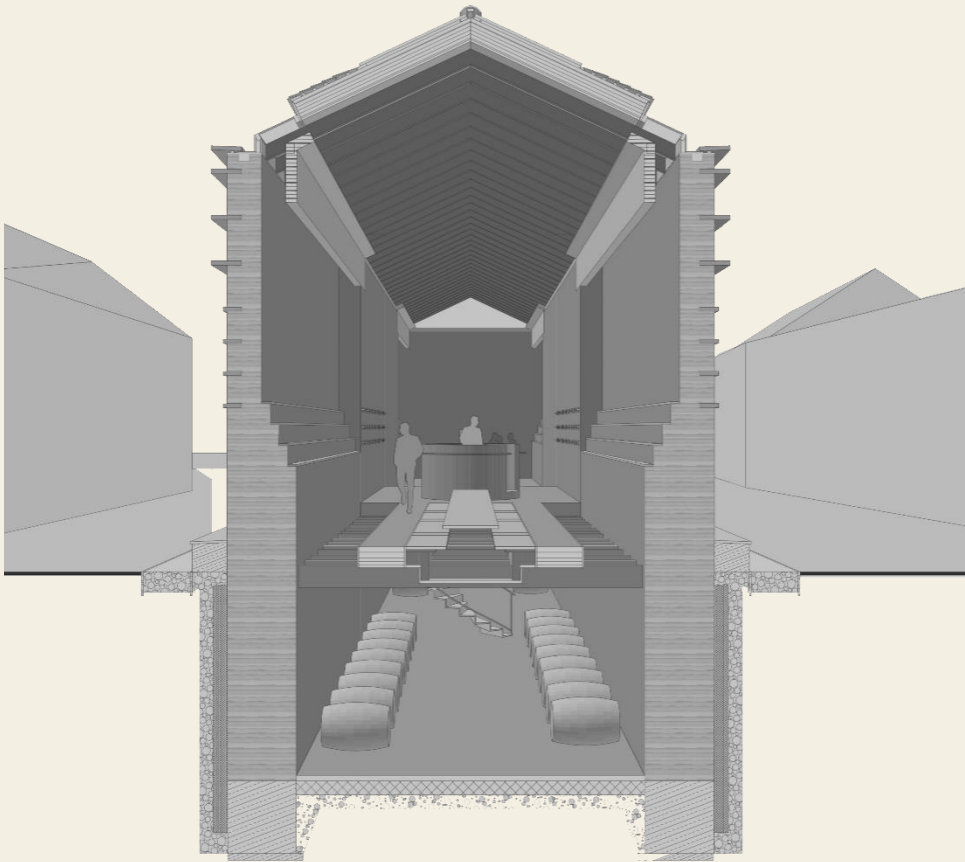
Timon Rametsteiner



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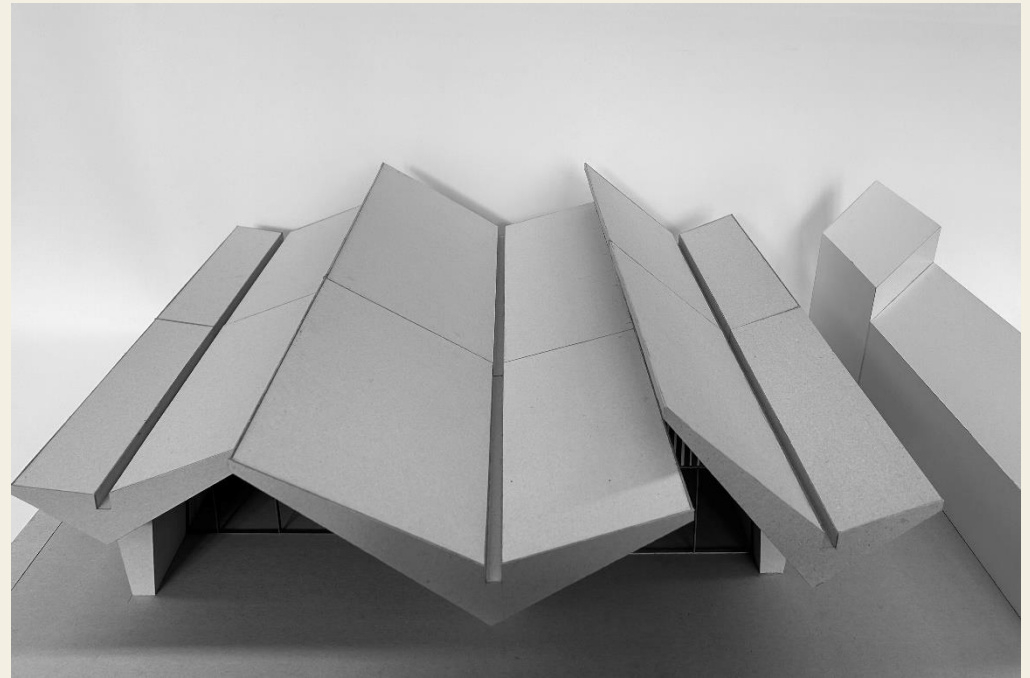
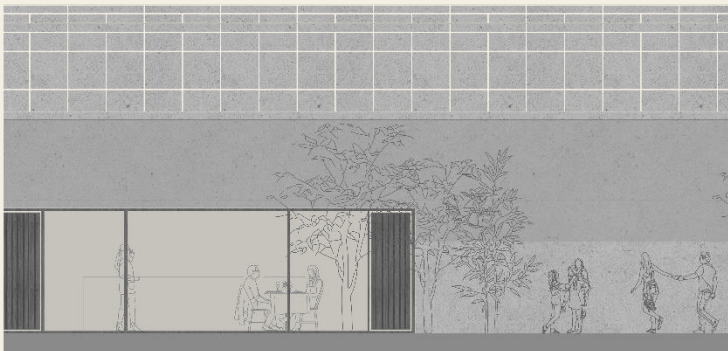
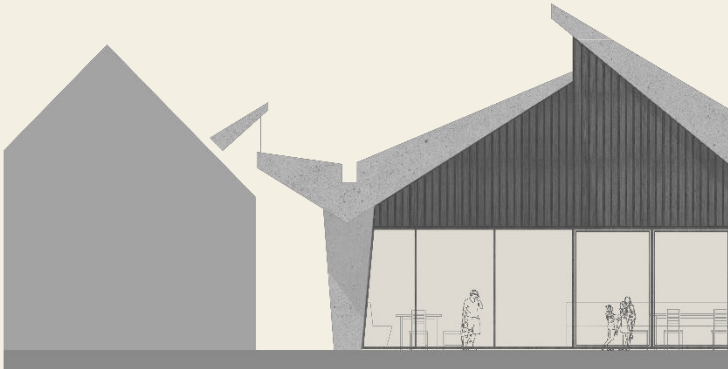
Daniel Junger



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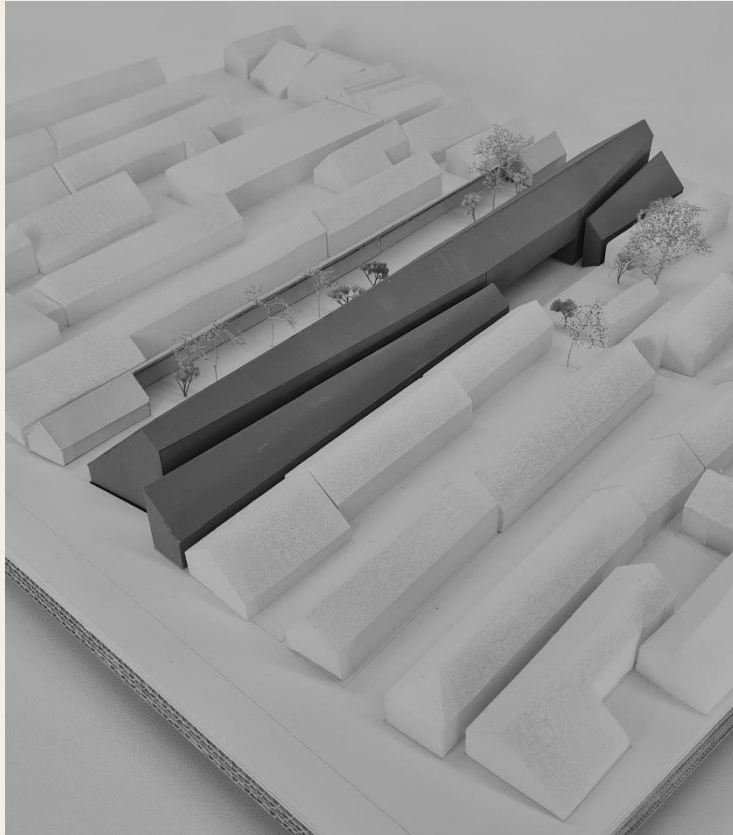
Florian Traugott



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Johanna Hämmerle



Materials for the Future

Vernacular Architecture - Materialsufficiency

Mladen Jadric

Vernacular architecture in Schwarzenberg village in Austria, exemplifies traditional building methods and materials that have been adapted to the local climate and cultural heritage of the region. This style prominently features the use of wood and clay, reflecting the abundant natural resources available in the area. The wooden structures are often characterized by intricate craftsmanship, including decorative carvings and detailed facades. Clay, used in the form of plaster or bricks, adds to the thermal efficiency and aesthetic appeal of the buildings. This approach not only ensures sustainability and harmony with the environment but also preserves the architectural identity and historical continuity of Schwarzenberg.

The vernacular architectural tradition shows us a whole treasure trove of cultural, sociological and religious influences that shape our cultural identity. Over a long period of time, it exerted an influence on both Central European housing models and on living culture in the past centuries.



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Vernacular Architecture - Materialsufficiency

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The architecture in Burgenland and the Alpine region shares numerous similarities, especially in terms of the materials used and the construction method, which are based on the respective natural and climatic conditions.

Materials

In both regions, primarily natural, locally available materials are used.

This includes:

- **Wood:** Wood, stone and clay are the main materials in both Burgenland and the Alpine region. They are valued for their availability, good insulating properties and aesthetic qualities. In the Alps, wood is often used to build chalets and mountain huts, while in Burgenland it is traditionally used for farmhouses and outbuildings.
- **Clay and stone:** In Burgenland, clay and stone are commonly used materials that are known for their thermal properties and sustainability. These materials are also used in alpine areas, especially in combination with wood, to create robust and long-lasting structures.



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Vernacular Architecture - Materialsufficiency

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The architecture in both regions is characterized by a close connection to nature and the surrounding area. This vernacular architecture reflects the cultural and climatic conditions and contributes to the creation of buildings that blend harmoniously into the landscape.

- **Adaptation to the climate:** The construction methods are highly tailored to the climatic conditions. In the Alps, where winters are harsh and snowy, buildings with steep roofs are built to cope with snow loads. In Burgenland, with its milder climate, the buildings are often lower and wider.

- **Sustainability:** Both regions value sustainability and the use of locally available materials. This reduces the carbon footprint and promotes environmentally friendly construction.

- **Cultural Identity:** The architecture reflects the cultural identity of the regions. Traditional construction methods and craft techniques are preserved and combined with modern approaches to create contemporary yet traditional structures.



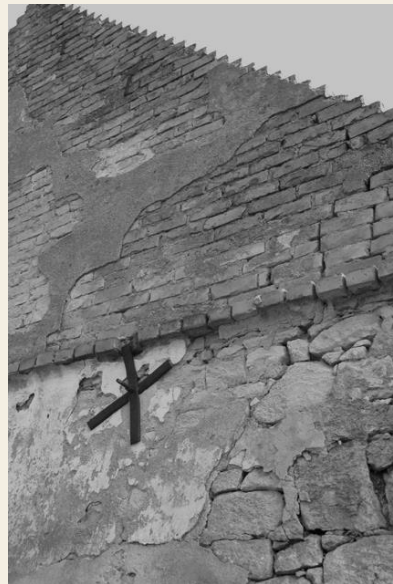
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1. Constructive aspects and space:

The reference to constructive-spatial aspects establishes knowledge about the past and a precise structural and material analysis of the rural house typologies. To examine an architectural work means to understand and apply its essence. The synchronous use of the knowledge and topics gained should form the applied methodology through the combination of materials and practices, sometimes with a high proportion of craftsmanship



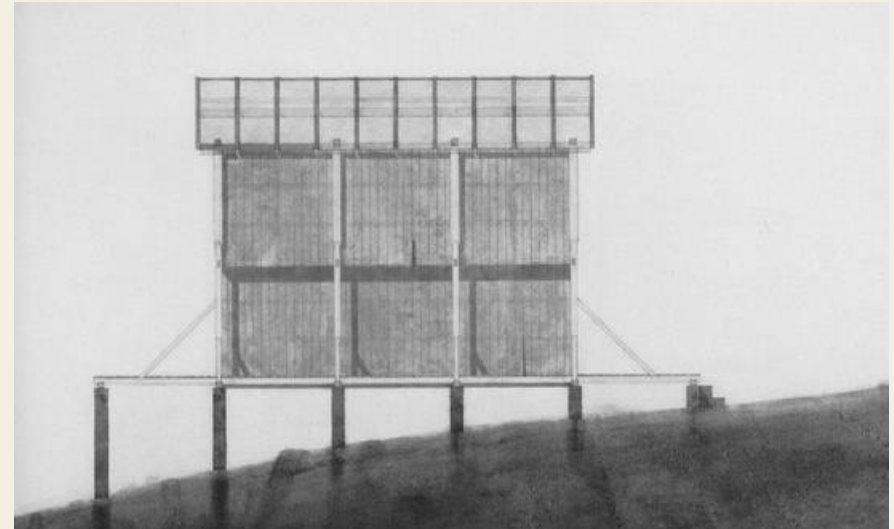
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Roger Boltshauser, House Rauch, Schlins, Austria, 2008



Walter Pichler, House for the Birds

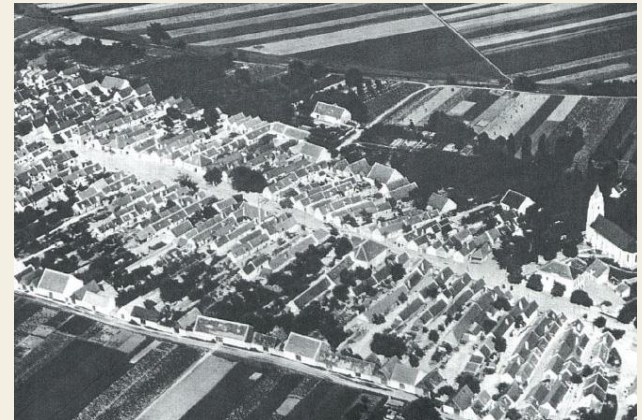
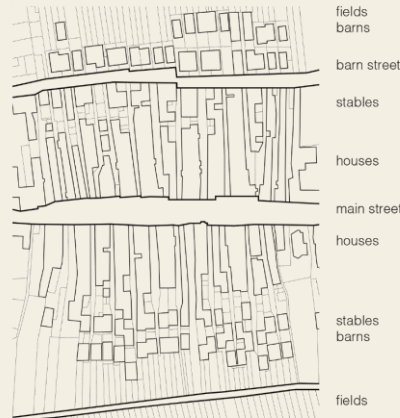
2. Creating a symbiosis

The design then includes a complex examination of content, form, material and construction. The exercise will be dedicated to the emergence of a new material culture of the future - a hard, involved and complex activity.

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Luftbild Burgenland

3. Integration into evolving structures

This emphasizes harmoniously incorporating new architectural projects into existing environments, fostering a respectful dialogue with nature and surroundings. This approach, evident in both the Burgenland and alpine regions, leverages local materials like wood and clay. It respects historical and cultural contexts, creating sustainable, aesthetically pleasing buildings that blend seamlessly into their natural settings.



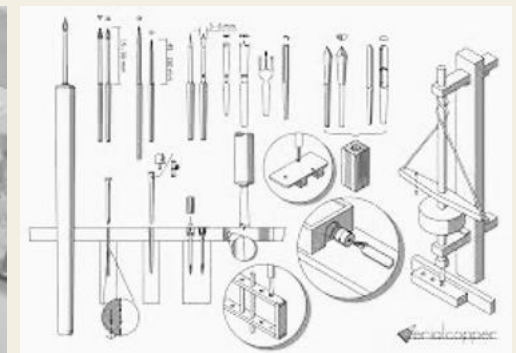
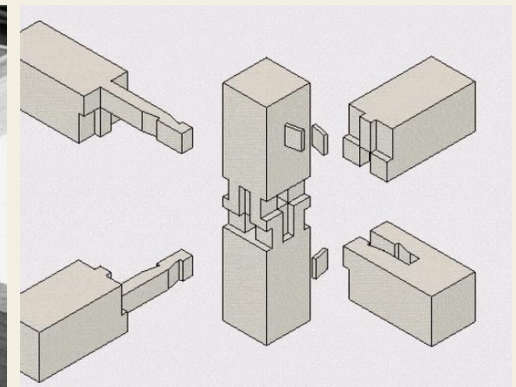
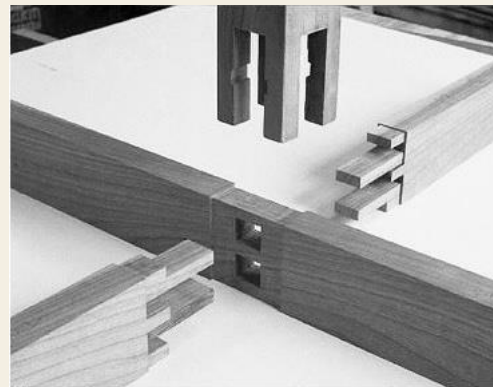
Luftbild Schladming, Martin Huber

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- Materialsufficiency

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In the context of sustainability, controlling material flows - the flow of materials through the various phases of a product, from raw materials, through production, use and disposal - is essential. The movement of all products and by-products generated in the economic process as well as emissions, discharges and waste should be taken into account in a closer look. A curated expert knowledge of the materials, their application and knowledge of the construction is a basic requirement for innovation. The goal is to make knowledge about materials accessible and applicable through improved construction methods, especially through improved planning. Planning, viewed across the entire life cycle, should promote greater efficiency, social acceptance and health and well-being.



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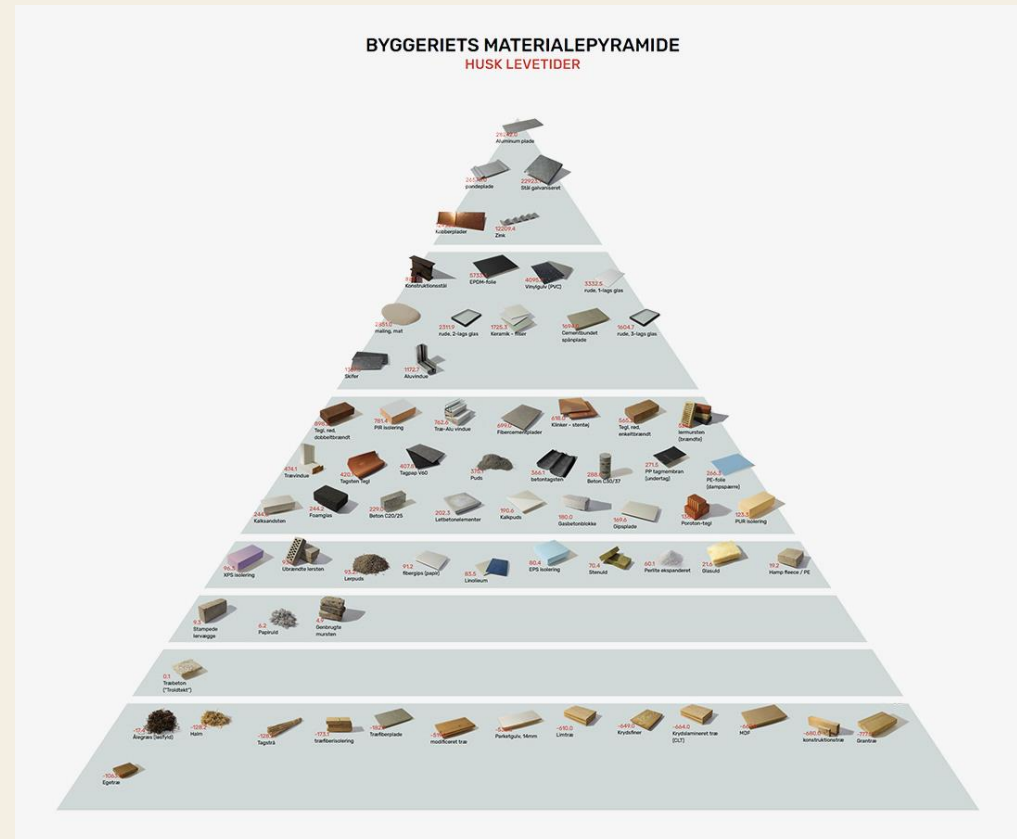
- Material Pyramid

Mladen Jadric

Construction Material Pyramid:

Developed by CINARK at the Royal Danish Academy and Vandkunsten, this tool helps architects understand the CO2 impact of different materials. It provides a visual and interactive way to compare materials based on their environmental impact, promoting more climate-conscious material choices in construction projects.

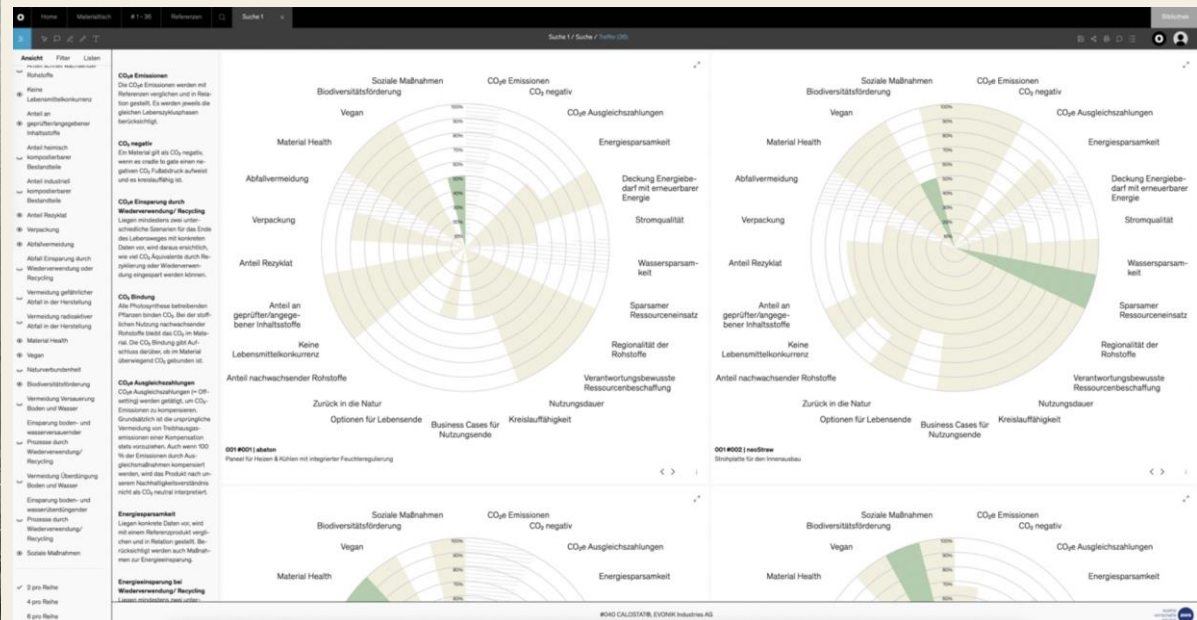
The Construction Material Pyramid uses a visual format similar to the educational food pyramid, showing the CO2 footprints and other environmental impacts of various construction materials. This interactive tool allows users to view and compare materials based on their global warming potential, insulation capacity, load-bearing capacity, and more. It aims to promote more climate-conscious material choices in construction projects by providing a simple and intuitive way to assess the relative sustainability of different materials (Vandkunsten Architects).



Byggeriets Materialepyramide, Husk Levetider, Vandkunsten Architects, 2019

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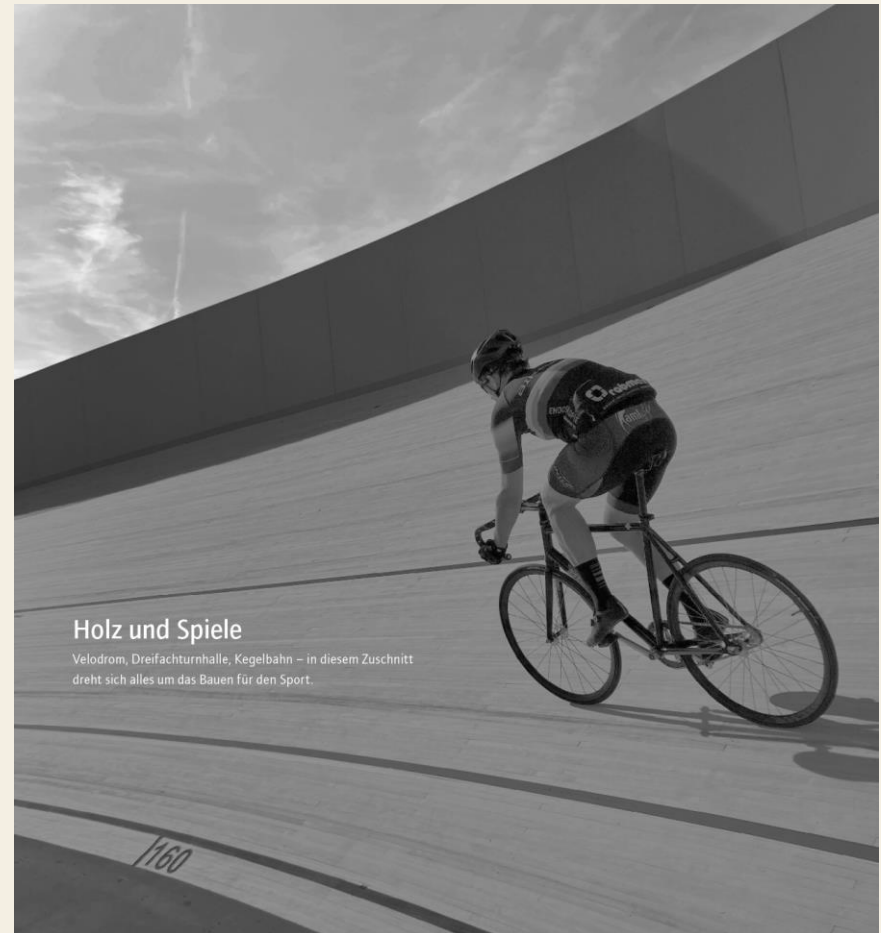


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- Wood and Games

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Building sustainably means building in a way that conserves resources and uses renewable resources raw materials. Sometimes it also means as little as completely new as possible to build and rather to use what already exists. In the next We dedicate ourselves to preserving the existing stock and continuing it existing structures – conversion and further construction in the form of extensions, Implementation and expansion or by converting and activating intermediate spaces and remaining areas. The qualities, advantages and possible uses of timber construction are always in view.



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THANK YOU AND
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