THE FUTURE ENVELOPE #13

USER CENTRED FACADES

CONFERENCE ON BUILDING ENVELOPES

FACULTY OF ARCHITECTURE TU DELFT (NL)

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THE FUTURE ENVELOPE 13

User Centred Facades

edited by
Ulrich Knaack,Tillmann Klein, Alejandro Prieto Hoces & Thaleia Konstantinou

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2628 BL Delft
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http://www.bk.tudelft.nl

Editors
Ulrich Knaack u.knaack@tudelft.nl
Tillmann Klein t.klein@tudelft.nl
Alejandro Prieto a.i.prietohoces@tudelft.nl
Thaleia Konstantinou t.konstantinou@tudelft.nl

Layout & Cover design
Usch Engelmann usch@uschengelmann.com

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10:15 - 10:25	**Welcome & intro**	Ulrich Knaack & Tillmann Klein
10:25 - 11:25	**Session 1 - User Comfort**	
	David Keyson	OfficeVitae, NL
	Philomena Bluyssen	TU Delft, NL
	Shady Attia	U.Liege, BE
11:30 – 12:45	**Session 2 - Engineered Performance**	
	Jaap Wiedenhoff	ABT, NL
	Paul Carew	Buro Happold, DE
	Rudi Scheuermann	ARUP, DE
	Mauro Overend	TU Delft, NL
13:25 - 14:50	**Parallel Sessions | Thematic Discussions**	
15:00 – 16:00	**Session 3 - Technology & User Interface**	
	Thijs Biersteker	Woven Studio, NL
	Michael Drass, Heiko Mertel	M&M Network-Ing | HeikoMertel, DE
	Hans Zwaanenburg	VMRG, NL
16:05 – 17:05	**Session 4 -User Centred Design**	
	Olivia Guerra-Santin	TU Eindhoven, NL
	Carlo Battisti	Living Future Europe, IT
	Astrid Piber, Ren Yee	UNStudio | UNSense, NL

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INTRODUCTION

Tillmann Klein, Ulrich Knaack

Over recent years, we have observed new trends in building envelopes towards a more user-centred design. Topics such as sustainable solutions have been widely discussed, but ultimately, it is the use of buildings that is the primary goal of building activity. We believe that technological development and processes need to embrace the user of a building to come to new innovative solutions.

The conference addresses topics such as User Comfort, Engineering Performance, Technology and User Interfaces and finally, the Design and Co-creation of Façades.

'User-Centred Façades' aims at answering the following questions: What are the trends that determine the future of the building envelope? How can we understand the impact that façades have on user comfort and wellbeing? Which technological solutions enable the best interaction of façade and user? How can the user get involved, and how can we design new processes to support co-creation?

During the 13th edition of the annual conference, thirteen international speakers from research, industry, management and design will share their experience and visions of the future building envelope; distributed along four thematic sessions:

Session 1 – User Comfort

Session 2 – Engineered Performance

Session 3 – Technology & User Interface

Session 4 – User Centred Design

David Keyson

David Keyson is a distinguished Antoni van Leeuwenhoek professor in Smart Products and Environments at the Department of Industrial Design at the Faculty of Industrial Design Engineering. He leads research in the area of sustainable living and work. His research aims to foster wellbeing combined with energy and CO2 reduction in the built environment while contributing to living lab design methods. His educational work focusses on applications for interactive technology for societally impactful designs. Over the past decade, he has acquired and led multiple EU and NWO projects and is active in the Climate Knowledge Innovation Community.

Prior to joining TU Delft, David worked at Philips Research as a senior research scientist in media and multimodal interaction and prior to that as a human factors engineer at Xerox in California. He holds a PhD from the Technical University of Eindhoven in Perception and Technology and a Master's of Science in Ergonomics from Loughborough University.

David co-founded the TU Delft spinoff Office Vitae in late 2016. The start-up focusses on vitality at work in the context of sustainability. He heads the section Design Conceptualisation and Communication of the Department of Industrial Design.

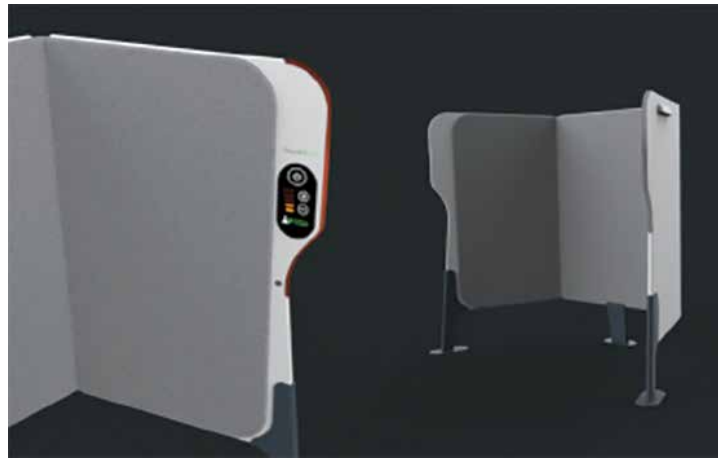
REDUCING $C0_2$ EMISSIONS VIA SMART LOCAL HEATING

David Keyson
OfficeVitae

ABSTRACT

Buildings are responsible for approximately 40% of energy consumption and 36% of CO2 emissions in the EU. Currently, about 35% of the EU's buildings are over 50 years old, and almost 75% of the building stock is energy inefficient, while only 0.4-1.2% of buildings, depending on the country, is renovated each year.

This talk demonstrates how the need for fossil fuel ambient heating in current office buildings can be reduced in the interim, given the use of presence-aware local infrared heating panels at the workplace. Reports on pilot studies showing the cost trade-off modelling, comfort impact, potential CO2 reduction, and controlled user studies to define the design criteria for the prototype smart panels will be presented.



Philomena Bluyssen

Prof. dr. Philomena M. Bluyssen received her building engineering degree in 1986 at the Technical University of Eindhoven, and in 1990 her PhD at the Technical University of Denmark with a thesis on 'Air quality evaluated by a trained panel'. After working as researcher with TNO for more than twenty years, where she coordinated, among others, several European projects on optimisation of indoor environment quality and energy use, she was appointed full Professor Indoor Environment in 2012 at the Faculty of Architecture and the Built Environment of the Delft University of Technology in Delft. At the TU Delft, she initiated the SenseLab, a semi-lab environment partly open to the public, sponsored by 25 companies and organisations, at which she recently performed research on airborne transmission of exhaled aerosols. In 2019 Bluyssen was appointed Visiting Professor at Feng Chia University in Taichung, Taiwan. Bluyssen is member of the (inter)national organisations TVVL, REHVA, ASHRAE, ISIAQ and CIB. She is co-founder of the Dutch ISIAQ chapter and was the first president of ISIAQ.nl. She has contributed to and/or authored more than 250 publications and has been invited as guest, distinguished or keynote lecturer at several conferences and universities. For 'The Indoor Environment Handbook: How to make buildings healthy and comfortable' she received the prestigious Choice Outstanding Academic Titles of 2010 Award.' Her book 'The Healthy Indoor Environment – How to assess occupants' wellbeing in buildings' was published in 2014 and received the IDEC 2016 Book Award.

AIRBORNE TRANSMISSION OF SARS-COV-2, DISTANCING, MASKS, AND VENTILATION MEASURES

Philomena Bluyssen
TU Delft

ABSTRACT

Since the first outbreaks of COVID-19, the question is what is needed to minimise transmission of SARS-CoV-2 indoors. SARS-CoV-2 has three possible transmission routes: 1) direct transmission of virus-carrying droplets when in close vicinity by coughing, sneezing or talking; 2) indirect transmission via deposited or transmitted infectious droplets via surfaces; 3) airborne transmission through small, virus-carrying airborne droplets (also named 'aerosols') emitted by infected individuals.

The measures adopted are physical distancing of individuals to reduce direct transmission of mainly large infectious droplets and cleaning surfaces, washing hands and sneezing/coughing in the elbow to reduce indirect transmission. For people who need to or tend to come close to (possibly) infected persons, personal protective equipment is used (e.g. facial masks and protective gloves).

For the third mode of transmission, i.e. airborne transmission, the use of 'proper' ventilation measures has been recommended to decrease the risk. This presentation will discuss airborne transmission and measures to reduce transmission.

Shady Attia

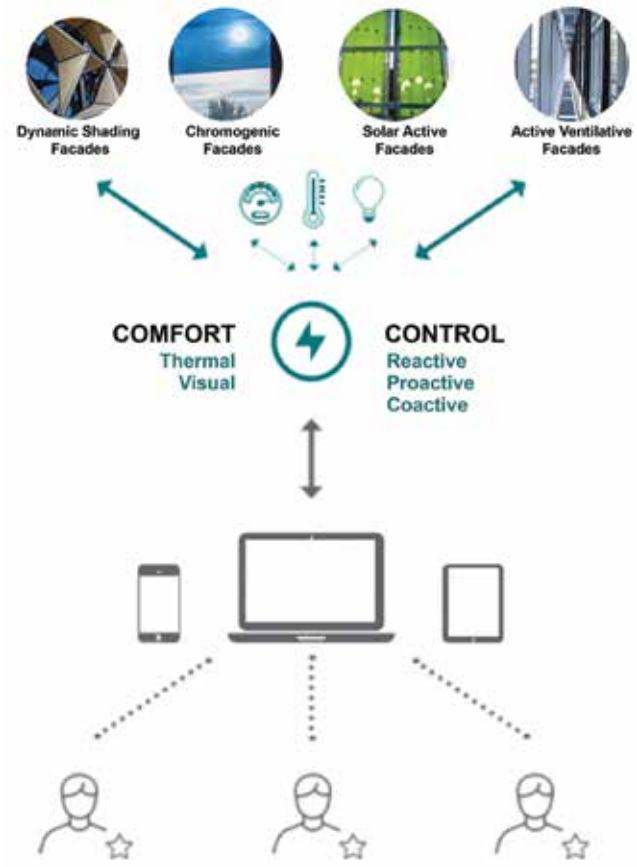
Prof. Shady Attia is an architectural engineer and Professor of Sustainable Architecture and Building Technology at the University of Liège, Belgium. He is a faculty member of the United States Green Building Council. He heads the Sustainable Building Design Lab founded in 2014. The lab activities are focused around design decision support of high-performance buildings and user-centred advanced façades. The lab is focused on integrative sustainable design and performance monitoring, addressing users' interaction in relation to energy efficiency, thermal comfort, and indoor environmental quality.

USER CONTROL OF ADAPTIVE FAÇADES: OBSERVATIONS FROM CASE STUDIES ON USERS' INTERACTION

Shady Attia
U.Liege

ABSTRACT

Many factors influence user control of adaptive façades. Depending on the façade technology's nature, users objectives can be competing with comfort requirements or energy-saving objectives. In practice, this causes conflicts and end up in low user satisfaction and interaction. Despite the importance of user interactive feedback, most control strategies rely on regulated feedback based on temperature or illuminance sensors and model-based control strategies. There are almost no practical approaches to balance energy efficiency targets and at the same time empower users allowing them to personalize the control of adaptive façades.



This presentation shows observations from different case studies with dynamic solar shading and chromogenic glazing façades to understand this gap. Our post-occupancy evaluations in office buildings dataset is analyzed to define and compare the common control strategies and evaluate users' interaction with dynamic façades. The presentation suggests clustering adaptive façades users according to the usage intensity and preferences patterns. The presentation provides insights and recommendations about the importance of stimulating overriding feedback features for adaptive façades

Jaap Wiedenhoff

Jaap Wiedenhoff started his career as an MEP engineer. He distinguished himself by a thorough open-minded first-principles approach. This rapidly evolved to leading large, multi-disciplinary design teams on complex projects across the world with some of the most renown architects of our time. Today his passion still is to find elegant solutions for complex issues, both for business and design. His understanding of human needs, physics and appreciation for nature has helped shape some of the most healthy, comfortable, and sustainable buildings and built environments. His ultimate driver has been and still is the simple question, put to him by Alvaro Siza 20 years ago, 'What is wrong with the indoor environment in buildings? Why can they not simply feel like a fresh, pleasant spring forest?'

Jaap also founded Quake, the Oosterhoff group Innovation center. Quake develops tools and strategies, innovations and knowledge to create a built environment that has to deal with the energy transition challenges, climate change and adaptation and material shortages. Quake takes an anti-disciplinary view on (technical) infrastructure, public space, cities, districts and buildings. It is the result for society that counts; immersive environments that are ecologically, economically and societally optimized

COMFORT AND HEALTH AFTER THE ENERGY CRISIS, PLAYTIME.

Jaap Wiedenhoff
ABT

ABSTRACT

Façades centred around users, not energy, will look completely different than façades today. In all likeliness, they will look more like the modernist façades from the thirties.

Today, we see the prices of sustainable energy dropping faster and faster. Within the coming 15 years, the 'real' price of sustainable energy, as a percentage of income, will be below the 1970-level. With a sustainable energy supply for all, the question will be: what exactly is sustainable?

This leads to the question of what is comfortable, what is healthy living?

It certainly does not mean houses designed like a tea-cosy covered with a plastic bag, with just enough ventilation to make sure you don't die in them. Sarcasm aside, the fact is that, over the last 30 years, we have been engineering buildings for specifications rather than designing them for humans. So do we really know what is good for humans? We have only just begun to understand this a little bit; until very recently, the common belief was that what is comfortable is healthy. With this, comfort was essentially defined as a steady-state energy balance. It is only in the last years that we have started to understand a few phenomena that shed another light:

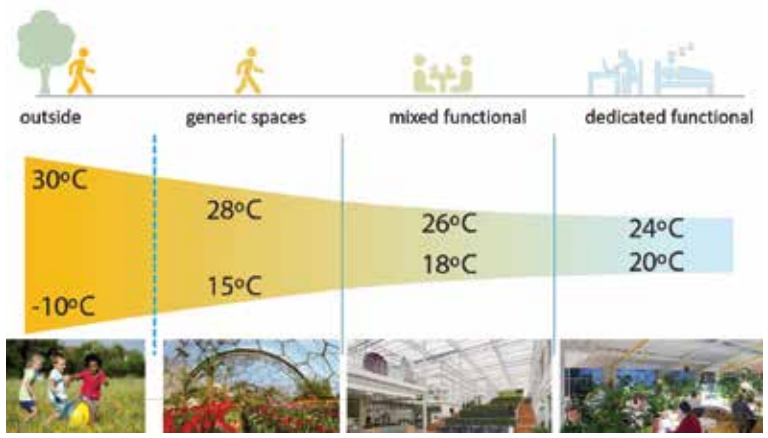
- We have a very advanced climate regulatory system in our body, we can train it, and it becomes better, or we can let it grow lazy
- Temporary thermal discomfort actual leads to a better metabolic system, even helping to reduce overweight

Still, this growing understanding has not yet found its way into specifications, requirements, and design goals. Is that only because it is more difficult than simple numbers for specification? We should design to excite, to delight, and we must dare to stop believing simple calculations and start dealing with the complexity in design that we have now. We have the knowledge, we have the tools. And

best of all, it will make our buildings less complex, less material and technology-heavy.

What does this have to do with façades?

Today's façades are discrete boundaries that separate us from our natural outdoor environment to create a surrounding that is supposedly comfortable, or at least not too uncomfortable, with minimal heating and sometimes cooling energy. Tomorrow's façades will be focused on humans in a holistic manner, creating a continuous, healthy and comfortable, beautiful transition between different architectural spaces, formerly known as inside and outside.



Paul Carew

Paul joined Buro Happold's office in Berlin as Associate Director in 2018. Before, he worked as a building services engineer in South Africa and for BuroHappold in London with a focus on heating, ventilation, and air-conditioning. He then attended coursework in Sustainable Energy Engineering at the Royal Institute of Technology in Stockholm, Sweden. After spending a semester lecturing building physics and comfort strategies at the School of Architecture at Universidade Austral, Chile, he founded PJCarew Consulting. PJC provided consulting services focusing on sustainable design, specialising in passive and low-energy design, integrating architectural and building systems aspects.

Paul has extensive experience in multiple building typologies, including mixed-use, commercial, and public buildings. The scale varies from single building to master planning. Services include energy comfort, water and wastewater systems. Within challenging budget, maintenance, construction, climate and socio-economic contexts, he has managed to establish innovative engineering solutions by going back to first principles, holistic thinking and early design input. Paul is regularly invited as a guest lecture and keynote presenter to share this experience.

INSIDE IS THE NEW OUTSIDE – BRINGING SOLAR SHADING ELEMENTS INTO THE BUILDING

Paul Carew
Buro Happold

ABSTRACT

Traditionally, solar control is dealt with by either external shading elements, performance in the glazing through coatings or integrating physical elements into the glazing make-up, reducing the quantum of vision panel or a combination of these. These strategies stem from an approach that is priority-driven by structural requirements, the pragmatics of water and windproofing, and energy performance. User comfort is not ignored, but the focus typically lies on view, daylight and glare. Designers are understandably biased towards solutions and approaches that fall within their respective area of competence.

What would façades look like or be made of if we changed this focus/bias? Start with an extended user comfort target and draw input and understanding from a broader range of professionals?

This presentation explores these questions, drawing on Paul's project experience as a context. Paul's work considers to what extent and under which conditions internal blinds/curtains can provide the required occupant comfort, considering thermal comfort, external views and glare control. To what extent would this influence traditional façade elements and mechanical systems?

Paul will present the process and design and measurement tools he has developed in collaboration with Navid Hatefnia for this purpose.

Rudi Scheuermann

Rudi Scheuermann is Director and Global Leader Building Envelope Design at Arup.

As an architect and engineer, he has built up the building envelope design and numerous specialist disciplines, including building physics, fire protection, materials, lighting design and acoustics in Arup's German office. His focus lies on a multidisciplinary design of sustainable and energy-efficient building envelopes.

In recognition of his achievements, he was appointed Arup Fellow in 2014.

Rudi Scheuermann studied architecture at the University of Karlsruhe and later completed a research study in Bath, England, with a Master's degree in architecture in membrane constructions. He has worked for architectural and engineering practices in Germany, the Netherlands, Great Britain, and the USA.

CITIES ALIVE: GREEN BUILDING ENVELOPES

Rudi Scheuermann
ARUP

ABSTRACT

In ever denser cities, the space for "green infrastructure" such as parks, green recreational spots and trees in street canyons is being depleted. What is often considered and belittled as "green architectural decoration" is, however, an important element in our built environment that must not be underestimated. Besides the many health and well-being aspects resulting in significant stress relief for human beings, there are a number of effects that have a serious influence on the micro-climate in our built environment and the sustainability of building operation.

The reduction of urban up-heating (heat island effects) and the filtering of fine dust in the streets where people move about are just two of the most critical aspects. Reduced noise levels can be an additional benefit if green infrastructure is applied in the right way.

The idea of "Cities Alive: Green Envelope" is to investigate and pursue the initiative of "Cities Alive: Rethinking Green Infrastructure", started by Tom Armour, to offer additional areas in the form of building envelopes and provide the dense inner city with surfaces for effective and applied green infrastructure. These roof

and façade areas aim to improve the environment by replacing a significant amount of the ground on which cities have been built in dense urban agglomerations. Suppose we imagine that we could replace 30% of the total sealed areas of cities by offering about 20-25% of the buildings and making use of about 20-25% of each building envelope, i.e. façade and roof areas. In that case, we could achieve significant benefits to improve the micro-climate in cities.

Indeed, if we consider that plants grow on substrates which also contributes to dampening the inner city traffic noise, we create an environment of cooler and cleaner air with less noise. This benefits people in cities, but also within buildings, as improved conditions allow for extended periods of natural ventilation, thus reducing the amounts of energy required for cooling all year round. In addition, it gives building occupants more freedom to control their individual environment by means of healthier and more beneficial natural ventilation. Furthermore, green envelopes can be applied to both existing and new buildings, and therefore the overall improvements to the micro-climate of cities can be much reinforced, as the majority of the built fabric consists of existing buildings of considerable age. Activating them to contribute to improved and more sustainable performance is an important aspect in the design of existing cities. Additional benefits such as better stormwater management avoiding flood risks, improved biodiversity, significant absorption of CO_2 etc. will follow.

But the real focus for us at Arup is on improving and providing healthier, more pleasant living conditions for a better and more comfortable existence for human beings in cities. And we feel that making the benefits measurable is an important aspect of bringing individually considered effects together, being able to quantify rather than just qualify benefits as a whole. The outcome allows a clearer cost-benefit analysis to put cities and their building authorities, and also developers and investors, in a position to understand that investment in green infrastructure – as an important element of the built city environment – is no longer just "architectural decoration", but an essential, urgently needed element to improve the sustainable operation of buildings with lower energy consumption, and much improved and significantly healthier living conditions for cities' inhabitants.

Mauro Overend

Mauro is Professor of Structural Design & Mechanics at TU Delft. He is a chartered engineer with several years of consulting engineering, teaching and research experience in the fields of structural engineering and façade engineering. His research and teaching interests are the interfaces of structural engineering, materials engineering and building physics which underpin the performance of glass building envelopes and sustainable structures in general. Mauro is passionate about interdisciplinary collaboration, both in teaching and research. He has won several international awards, and his work has found applications in international design standards and in some of the most challenging buildings globally.

NOVEL TECHNOLOGIES FOR SEAMLESS OCCUPANT-FAÇADE INTERACTION

Mauro Overend (speaker)
TU Delft
A. Luna Navarro, M.C. Allen
University of Cambridge

ABSTRACT

Dynamic façade technologies provide unprecedented opportunities for creating exciting, high-performance buildings. For example, automated shading and smart glazing can mitigate undesired solar heat gains and glare, while automated façade openings can provide desired levels of ventilation. Used wisely, they could reduce energy demand in buildings and provide personalised comfortable indoor environments, leading to improvements in health, well-being, and productivity. The principal challenge in this field how to capture capturing high-resolution data on occupant multi-domain satisfaction/dissatisfaction in an unobtrusive and cost-effective manner. Capturing this data would allow us to actuate the smart technologies to the maximum effect i.e. to achieve energy-efficient and customised, occupant centred buildings.

In this presentation, we showcase our latest IoT-enabled solutions for a seamless occupant-façade interaction, where data is collected with higher frequency and less intrusively than in traditional methods. In particular: (i) the Building Impulse Toolkit (BIT), a prototype IoT system for capturing the holistic and transient influence of façades on IEQ and occupants; and (ii) FACE2FACE (F2F), a novel control system designed for adaptive façades, which uses facial movements and wearables to detect glare conditions.

The results from a 9-month deployment of BIT in a real-world office are then reported and discussed. In particular, the capabilities and limitations of the BIT prototype in 1) capturing the influence of the façade on IEQ in space and time; 2) monitoring occupant environmental discomfort and satisfaction and in a non-disruptive manner; 3) monitoring occupant interaction with the façade. Finally, the field-deployment data was used to benchmark MATELab, a flexible office-like environment for the research & development of smart façade technologies. This deployment represents an important step towards understanding how to shape seamless interaction strategies between occupants and smart facades that can inform the design and operation of the occupant-centred and resource-efficient buildings of the future.

Thijs Biersteker

Thijs Biersteker creates interactive awareness installations about the world's most pressing issues.

His work seamlessly combines scientific research and new technologies to deliver an empowering experience that is accessible both intellectually and technologically. His immersive art installations, often described as eco or awareness art, turn the impact of climate change, air pollution, ocean plastic, diversity, data misuse into a tangible experience. Using a fluid mixture of data, nature, kinetic motion, water, digital visualisations, analogue elements, the virtual and real worlds.

Biersteker currently holds a teaching position at the Delft University of Technology (NL).

He has won awards like the prestigious Lumen prize for digital art, got nominated for the Stars Prize from Ars Electronica, and the New Technology Art Award and has exhibited at Fondation Cartier pour l'art contemporain Paris (FR), Today Art Museum (CN), Stedelijk Museum Amsterdam (NL),Science Gallery Dublin (IE), SXSW (USA), Science Centre Kuwait (KW), Mu Gallery (NL) and has been featured in Wired, New Scientist, Financial Times, and Discovery Channel.

Thijs Biersteker is founder of Woven Studio, a sustainable art studio that works together with universities, scientists, research groups, museums and architects to communicate their scientific facts in an experiential way.

HOW SCIENCE AND ART CAN CHANGE THE WORLD

Thijs Biersteker
Woven Studio

ABSTRACT

Award-winning ecological artist Thijs Biersteker will take us on a fact safari, exploring how he collaborates with scientists and universities to bring the facts about environmental issues alive through interactive art installations.

He will take us through his work, where he seamlessly combines scientific research and new technologies to deliver an empowering experience that is accessible both intellectually and technologically.

Thijs is Fellow at the VU Amsterdam and lectures at TU Delft; his work has been shown around the world and featured in various media from Wired to the Financial Times and from the Guardian to Donald Duck.

'Econtinuum' (2020)
Commissioned by Next Museum.
In collaboration with Stefano Mancuso.

Michael Drass

Michael Drass studied Civil Engineering at the University of Applied Sciences Mainz with particular focus on new joining technologies in timber engineering. After his studies, he worked as a research assistant at the Institute of Structural Mechanics and Design (ISM+D) at TU Darmstadt for five years. In the context of his PhD, Dr Drass worked on the topic “Constitutive Modelling and Failure Prediction of Silicone Adhesives in Facade Design”.

After his PhD, he founded the start-Up M&M Network-Ing with his colleague Dr Michael A. Kraus, a firm combining topics of artificial intelligence, nonlinear mechanics, and constructive glass engineering. Furthermore, Dr Drass is still working at ISM+D as a Post-Doc.

Heiko Mertel

Heiko Mertel has a civil engineering background and is founder of and consultant at heikomertel.com. He has a long history in high-profile building envelopes. He worked for the seele Goup as Managing Director at iconic skin and was responsible for development, design, finance, HR, project management, fabrication, client relations and acquisition. Heiko Mertel is well experienced in steel, glass and aluminium façade structures and developing new façade types. As a project director and senior project manager, he worked on different high-profile roof and façade projects. Heiko Mertel studied Civil Engineering at the University of Applied Sciences in Coburg and University of Hertfordshire, UK, and gained comprehensive experience on various large-scale projects working with global companies like Bovis Lend Lease. The main focus of his practice is sustainability, new technologies, and methodologies.

AI-CONTROLLED CYBER-PHYSICAL FAÇADE

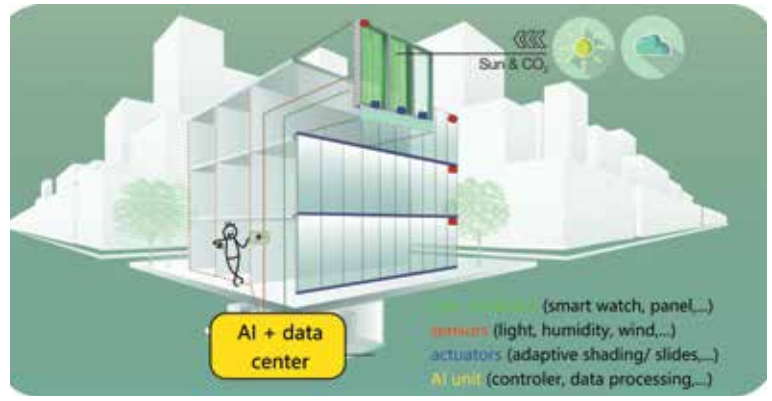
Michael Drass
M&M Network-Ing

Heiko Mertel
HeikoMertel

ABSTRACT

The façade is a designed, often representative part of the visible shell (envelope or outer skin) of a building. In general, a building envelope is a closed geometric structure representing the physical separation between the inner and outer environment of a building. It comprises all the components of a building that close it from the outside. The outer envelope is a barrier against rainfall, outside air, outside temperature, noise, and radiation. The building envelope protects the internal facilities and installations together with the structural members and supports air conditioning. During the conception and engineering of façades, not only great attention is paid to the functionality of the façade, but also a significant focus is placed on gracefulness and innovative design.

According to the author’s view, however, the focus should not only be on the design and the classical requirements of the envelope but rather on the interaction of the façade with the user as well as their health and well-being inside the building. Here, the focus is specifically on adaptive control of the façade, for example via light-directing slats, to maximize the well-being of the users. Global radiation, energy input and light illumination can be regarded as indicators of high user comfort. The methods of artificial intelligence together with a digital representation (“digital twin”) of the structure and components of a façade can be connected to form a



smart control loop with user-feedback to simultaneously maximize user demands while minimizing environmental impact such as energy consumption. Using the example of the façade of the Glass Competence Centre (GCC) at the Technical University of Darmstadt, a concept is presented with a façade system that meets the criteria listed above. In addition, details of the planning and the principle of the façade element are presented, as well.

Hans Zwaanenburg

Hans Zwaanenburg is General Director / Managing Director at the Association of Metal Windows and Facade Industry (VMRG). The VMRG has approximately 100 members (façade builders) and more than 100 partners (suppliers); being developed into an organisation that, with its affiliated members and partners, represents almost the entire industry. The VMRG is an active member of the European façade branch associations FAECF and EuroWindoor.

Hans has experience in the façade and building industry. He has a Master in Business Administration from the Radboud University, a Master's degree in Marketing from the Eindhoven University of Technology and is an architectural engineer. He serves the VMRG as Managing Director since 1 September 2018. Within the VMRG, he is actively involved in the projects Circular Façade Economy, the Façade Identification System Cirlinq and the Façade Service Application FaSA. He is also involved in the European branch organisations FAECF and EuroWindoor.

ROADMAP TO PRODUCER RESPONSIBILITY IN THE CIRCULAR FAÇADE ECONOMY

Hans Zwaanenburg
VMRG

ABSTRACT

In the context of the Transition Agenda for the Circular Façade Economy, the entire construction sector must reduce primary raw materials consumption by 50% by 2030 and be 100% circular by 2050. This means that façade construction also faces a major sustainability challenge. The reason for the VMRG to play an active role within the Circular Façade Economy, together with complementary branches, with the objective of arriving at an integrated, inclusive system for the façade is a chain agreement. In the Circular Façade Economy, producer responsibility is central; therefore, the VMRG façade builders are also actively involved.

The VMRG makes every effort to close the cycle (returning metal from the façade back into the façade), which will increase the positive effect on environmental performance. The industry is doing this by, among other things, introducing circular business models from "recycling" and "façade with buy-back guarantee" to "façade as a service". Together, the companies separate metal products from a façade as diligently as possible and ensure that the products and materials are returned for new façades. The tools used for this purpose are the façade identification system Cirlinq, developed together with the VMRG, and the façade service application FaSA.

Olivia Guerra-Santin

Olivia Guerra-Santin PhD is Assistant Professor at the Chair of Smart Architectural Technologies at the Department of the Built Environment in Eindhoven. She has previously worked at the Welsh School of Architecture at Cardiff University, The Hague University of Applied Sciences and the Faculty of Industrial Design Engineering at TUDelft.

With her research, Olivia aims to design and evaluate energy-efficient and healthy environments. Her expertise involves user-centred research and design methods, building monitoring and performance evaluation, and the use of Living Labs for socio-technical research. Her topics of interest include building management and control, occupants' behaviour, and building performance. To date, she has participated in a number of research projects on monitoring performance in the Netherlands, the UK, and Spain. At TU/e, Olivia participates in the research program AI in the Built Environment.

She is interested in developing design and evaluation approaches and methodologies that make use of building monitoring data in an efficient and ethical manner. She is currently researching the possibilities given by emerging technologies and data-driven methods to support more efficient building management and behavioural change.

USER-CENTRED RESEARCH AND DESIGN TO INCREASE ENERGY PERFORMANCE

Olivia Guerra-Santin
TU Eindhoven

ABSTRACT

Low or zero-energy renovated buildings are associated with high costs and long payback periods. In theory, these buildings are more energy-efficient and comfortable, but research has shown that vast differences exist between the expected and actual buildings performance. These differences affect the implementation and upscaling of these type of renovations (i.e. uncertainties in the return of investment) and can have significant consequences on the quality of life of buildings' occupants (raising energy costs leading to fuel poverty, poor indoor environment caused by lack of ventilation or low indoor temperatures, etc.). Furthermore, rebound effects can affect the carbon emission reduction targets on a national and European level. The actual performance of these buildings is often unpredictable due to the uncertainty caused by occupant behaviour.

The so-called building performance gap has been attributed to both technical-related and occupant-related factors. The effects of occupants' behaviour are difficult to predict and overcome, given that these factors have multiple causes and consequences on the building performance. The main user-related challenges in the field of building performance are 1) financial uncertainties in the investment of low-carbon technologies due to unpredictable actual energy savings; 2) higher energy use than expected during occupancy due to rebound effects; 3) lack of building control due to users not understanding the building systems or as an effect of their actions; and 4) users actual requirements not being considered during building design. These challenges increase uncertainties during the design and financing of buildings and contribute to higher than expected energy consumption.

The building occupant related uncertainties can be reduced by using more accurate user data (e.g. user profiles) during building design or planning of renovation activities and by designing technologies and systems that answer to the specific needs of the building users.

This presentation will focus on current research being conducted on the IEBB project: Data-driven Optimization of Renovation Concepts.

Carlo Battisti

Carlo Battisti holds a degree in Civil Engineering from Politecnico of Milan and has about twenty years of experience in construction companies. Master of Management and Organizational Development at MIP International Business School. Certified Project Manager IPMA®. LEED®, Living Future and WELL Accredited Professional. USGBC® and WELL Faculty™.

Since 2009, he has been working with IDM South Tyrol (Italy) as an innovation manager in the Business Development department, where he facilitated a "Façades Working Group" in 2012-2019. He also developed and directed the first three editions of "FACE | Façades Architecture Construction Engineering", a comprehensive training program on complex building façades.

From 2010 to 2011, he worked with the Energy and Environment Cluster of Trentino as manager of the business unit for sustainable products. From 2015 to 2016, he was the co-owner of a startup focused on LEED consulting.

Since 2017, Carlo is working with Eurac Research as Chair and Project Manager of the COST Action 16114 RESTORE (REthinking Sustainability TOwards a Regenerative Economy).

Since 2018, he is European Executive Director for the International Living Future Institute and now President at Living Future Europe. LFE's mission will accelerate the change and provide needed direction towards a regenerative design transition in Europe.

CONNECTING PEOPLE AND NATURE. THE ROLE OF THE ENVELOPE IN A REGENERATIVE APPROACH

Carlo Battisti
Living Future Europe

ABSTRACT

The building and construction industries determine, by and large, how residents interpret their surroundings and the built environment. As such, it is vital to re-engineer our cities and towns to correspond more directly to the natural landscapes they inhabit. By reconfiguring how we think of such spaces, architects, engineers, planners, and contractors can create buildings that generate their own energy and wean buildings off the fossil fuel economy.

The International Living Future Institute (ILFI) is a nonprofit that works on building an ecologically minded, restorative world for all people. Using principles of social and environmental justice, ILFI seeks to counter climate change by pushing for an urban environment free of fossil fuels. ILFI runs the Living Building Challenge and several other programs: the Living Product Challenge, the Living Community Challenge, and the Reveal, Declare and Just labels. These programs develop a green framework for living in a 21st-century world. Living Future Europe (LFE) is the nonprofit association championing ILFI's programs in Europe.

The Bullitt Center, Seattle, WA, USA (Photo courtesy: the International Living Future Institute)

The Living Building Challenge is the world's most rigorous standard for green buildings. Living Buildings strive for net-zero or net-positive energy, are free of toxic chemicals and lower their energy footprint many times below the generic commercial structure. While LBC 4.0 continues the standard's mission of visionary, but attainable building goals, it also recognises that not all projects face the same challenges or share in the same opportunities. Regenerative design should be attainable to everyone, everywhere. With 4.0, ILFI created a streamlined approach focused on maximising positive impacts specific to the project's place, community, and culture.

VanDusen Botanical Garden Visitor Center, Vancouver, CAN (Photo courtesy: Carlo Battisti)

ILFI has seen a demonstrated need among the Living Building Challenge community for Biophilic Design resources that can take practice from theory to reality. While progress has been made to communicate what Biophilic Design is and to demonstrate why it is crucial to a Living Future, very little has been established around the process of how to achieve it. ILFI's Biophilic Design Initiative aims to broaden the adoption of Biophilic Design among the design community, building owners and cities.

The building envelope can play a fundamental role in reconnecting people with nature, combining high performances to effectively address the climate emergency with a user-centred design strategy focused on achieving human comfort. How can we make use of the inherent "connecting" feature of the envelope in our design and construction process to include more nature in our buildings, reconnecting ourselves with her in the end?

The Biophilic Map - hosted by the ILFI's Biophilic Design Initiative - is a database for case studies which have implemented Biophilic Design at the core of their design process. The map recognises exemplary projects in articulating and applying Biophilic Design principles to the built environment. A few examples of case studies and design choices from this database will be described where the envelope has been key to achieve the overall regenerative result.

Phipps Center for Sustainable Landscape, Pittsburgh, PA, USA (Photo courtesy: the International Living Future Institute)

Living Building Challenge 4.0

Astrid Piber

Since joining UNStudio in 1998, Astrid Piber, now a partner at the firm, has been in charge of several large-scale design projects globally. She has worked on numerous projects from the initial urban study and competition phase through to realisation.

Balancing public and cultural aspects in relation to commercial parameters is a common denominator in most of Astrid's projects, as is creating a novel approach to mixed-use projects. The interdependency of functional, economic and future-proofing criteria has led to building organisations that go beyond segregated typologies.

Sophisticated place-making strategies have also been part of Astrid's design approach for retail developments, all of which are designed to be inherently contextual while commanding their own unique presence. For Astrid, working with a trans-scalar approach - from large-scale projects to their interiors – , designing to add value through user experience has always been key. Her projects display a holistic approach to buildings and their envelope, connecting the scale of the environment with the scale of the user.

Ren Yee

From his decade-long practical experience with UNStudio as design and project lead in urban, architectural and construction projects, Ren now brings his experience, design and strategic thinking to UNSense (the arch tech company founded by UNStudio). At UNSense, he leads Design/ Strategy, exploring, designing and implementing strategies and technologies to improve people's living conditions and make buildings and cities more humane and healthy.

Embracing a multidisciplinary approach to create site-specific and future-proof concepts, visions and strategies, Ren helps cities to develop (smart) city visions and strategies and advises on the implementation of technologies and sensorial design, often involving a wide range of stakeholders like government bodies, private developers, real estate companies and citizens.

At UNStudio, in his role as Head of Innovation Strategy and Forecasting, Ren established and leads the Futures unit. This strategic design and internal think-tank examines the shifts in how we live, work, learn and move and proposes scenarios and strategies that can enable cities and buildings to transform into those we want to live in, and that will have a positive impact on our planet.

BEYOND ENVELOPING

Astrid Piber
UNStudio

Ren Yee
UNSense

ABSTRACT

Sharing UNStudio and UNSense's continuous endeavour to craft and develop cutting-edge design solutions for building façades, we will present examples that demonstrate how, in recent decades, our façade designs have evolved from thermal building skins to become performative identifiers and communication layers. We will share our human and planet-centric principles and approaches that incorporate various technologies to expand and advance façade design and functionality.

As architects and technologists, we identify a distinct need to invent and guide the application of technology in new, human-centric ways. This approach requires 'inside-out thinking' and an understanding of the façade as both a mitigation layer between the scale of the building and the environment, and as a tech skin around people and spaces. We will discuss the history of the media façade that has led to the expanded potential of the envelope as an urban activator and a communication device capable of informing or prompting human behaviour. We will also discuss how tech-integrated façade design can operate as a user-centred climate mitigator that directly affects both the performance of the building and the well-being of its inhabitants. The examples we will use will include new-builds, remodelling projects and speculative designs.

USER CENTRED FACADES AIMS AT ANSWERING THE FOLLOWING QUESTIONS:

'What are the trends that determine the future of the building envelope?

How can we understand the impact that façades have on user comfort and well-being?

What technological solutions enable the best interaction of façade and user?

How can the user get involved and how can we design new processes to support co-creation?

During the 13th edition of the annual conference, thirteen international speakers from research, industry, management and design share their experiences and visions of the future building envelope.

TU Delft

european facade network

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