

INTERNATIONAL SYMPOSIUM  
**30 & 31 OCTOBER 2017**

# THERMAL STANDARDS IN ARCHITECTURE

REFLECTING ON THE GLOBALISATION OF PASSIVE CLIMATE CONTROL

ACCADEMIA DI ARCHITETTURA, MENDRISIO,  
UNIVERSITÀ DELLA SVIZZERA ITALIANA (SWITZERLAND)  
PALAZZO TURCONI (AULA LEZIONE T 1.02)

ORGANISED BY

the Swiss National Science Foundation Professorship for Architecture (Accademia di architettura, Mendrisio), in collaboration with the Institute for Constructive Design (School of Architecture, Design, and Civil Engineering, Zurich University of Applied Sciences, Winterthur)

Prof. Dr. Sascha Roesler (Università della Svizzera italiana)  
Dr. Sabine von Fischer (Zurich University of Applied Sciences)  
Dr. Madlen Kobi (Università della Svizzera italiana)

DAY 1 – 30 OCTOBER 2017

Welcome address, Prof. Riccardo Blumer / 14:00 – 14:15

I. THERMAL UNIVERSALITY

Prof. Sascha Roesler, The Legacy of Passive Climate Control / 14:15 – 14:45  
Dr. Sabine von Fischer, Concepts and Contexts of Energy Efficiency / 14:45 – 15:15  
Coffee Break / 15:15 – 15:45  
Jörg Lamster, Sustainable Goals versus Standardised Temperatures / 15:45 – 16:15  
Prof. Elisabeth Shove, The Comfort of Standards and Standards of Comfort / 16:15 – 16:45  
Discussion / 16:45 – 17:30

DAY 2 – 31 OCTOBER 2017

II. THERMAL STANDARDS AND THE ARCHITECT

Prof. Jonathan Sergison, Solid Buildings with Solid Thermal Standards / 09:00 – 09:30  
Andreas Hofer, More than Housing: The Holistic Approach / 09:30 – 10:00  
Discussion / 10:00 – 10:30  
Coffee Break / 10:30 – 11:00  
Prof. Muck Petzet, How to create a DIY Certification System / 11:00 – 11:30  
Prof. Astrid Stauer, Culture of Building + Energy = Energy Culture / 11:30 – 12:00  
Discussion / 12:00 – 12:30  
Lunch / 12:30 – 14:00

III. THERMAL GOVERNANCE AND THE CITY

Prof. Andrew Witt, Urban Solar Design / 14:00 – 14:30  
Dr. Giulia Romano, Energy Efficiency and Thermal Insulation in Urban China / 14:30 – 15:00  
Discussion / 15:00 – 15:30  
Coffee Break / 15:30 – 16:00  
Lionel Epiney, Thermal Regulations in Santiago de Chile / 16:00 – 16:30  
Prof. Emma Street, The (Re)Scaling of Regulatory Governance / 16:30 – 17:00  
Response, Dr. Madlen Kobi / 17:00 – 17:15  
Final Discussion, all participants / 17:15 – 18:00

Thermal standards exert an ever-increasing impact on architecture. What used to be a minor issue in planning processes a mere three decades ago has become a rigid determinant in the design practice of architects. Recent building legislation has begun to limit the spectrum of possible solutions to the extent that thermal standards increasingly govern the concept, structure and form of buildings. The imperative to insulate building envelopes with little regard to maintaining a diversity of microclimates in the interior is just one prominent example. These developments can be traced to how thermal standards have been triumphed as a silver bullet by Western societies on their path towards energy transition and sustainable architecture.

“Green goes mainstream” (Raymond J. Clark / Peter Ellis) has in particular seen a proliferation of thermal standards, regulations and labels. Agencies like the US-American LEED, the British BREEAM, the German Passivhaus or the Swiss Minergie, 2000-Watt Society, and SNBS offer certifiable solutions for thermal comfort in combination with the promise of sustainability in architecture and for cities. These “green-mainstream” standards are successors to the passive rationale of the bioclimatic architecture of the 1970s, promoting “the use of architecture as a primary energy device” (American Institute of Architects, 1978).

Today, worldwide comfort in buildings increasingly relies on the import and export of thermal standards. This has resulted in their global circulation and a competition between the various agencies promoting them. However, such standards emerge out of specific local cultural circumstances and architectural traditions. This area of conflict between a globalised rationality and the need for local adaptation is the subject of the conference. Based on case studies from Switzerland and various international contexts, the conference examines the ways in which the global circulation of thermal standards affects and translates into local design and building practices.

The conference addresses thermal standards by following an implementation-oriented and multi-disciplinary approach. “Regulations only exist in and through practice” (Imrie / Street

2011) and the researcher needs to follow them “through society” (Latour 1988). Thermal standards result from complex social negotiation processes involving actors from government departments, research institutions, investment companies and architectural offices. As a result, the circulation and promotion of standards are driven by architectural, political and economic agendas. The impact of translating thermal standards into building techniques hence extends beyond the mere single house to encompass whole urban contexts and the entire global challenge of sustainability. The conference will be held in three panels followed by a roundtable discussion.

I.  
**THERMAL UNIVERSALITY**

Panel I explores the underlying assumptions and objectives of thermal standards. The panelists discuss the current implementation of thermal knowledge as emerging from globally oriented architectural practice, whereby thermal comfort has become a measurable standard calculated by heating, cooling, ventilation, air-conditioning experts. This panel offers an overview on the guiding of overall concepts for regulating indoor microclimates such as “passive climate control”, “energy efficiency”, “comfort” and “sustainability”. Further, it addresses the problem of industry standards of thermal comfort in as far as they potentially conflict with the aims of social, economic and ecological diversity.

II.  
**THERMAL STANDARDS AND THE ARCHITECT**

Panel II inquires into the ambiguous relationships between architects and thermal standards and regulations. Although this combination can undoubtedly promote engagement, at the same time it can also diminish a sense of responsibility in that goals are delegated to set norms and certifying institutions. The participants of this panel critically discuss their experiences with certified and non-certified build-

ing practices in terms of the autonomy of the architect. Place-based, low-tech thermal solutions challenge the omnipresence of global thermal standards through a direct engagement with local climatic contexts.

III.  
**THERMAL GOVERNANCE AND THE CITY**

Panel III reflects on thermal governance as part of a broader understanding of thermal regulations in urban contexts. While scrutinising the role of thermal standards at the building scale, architects and urban planners encounter new challenges at the neighbourhood and the city scales, which represent the predominant forms of organisation in today’s urbanised societies. At the heart of the epistemological transformation of energy efficiency is the “city climate”, entailing new methods of thermal governance. To this end the panel questions whether the energy-source supply of cities can be taken simply as a private matter.

# I. THERMAL UNIVERSALITY

Chair: Madlen Kobi

## THE LEGACY OF PASSIVE CLIMATE CONTROL

Prof. Sascha Roesler, Università della Svizzera italiana (CH)

Today’s thermal standards succeed to the rationale of bioclimatic, passively regulated architecture and related traditions of using architecture as a thermally mitigating structure. In my talk I will address the issue of passive climate control as globally spread and cross-cultural knowledge. Historically, the driving force behind the scientification of passive climate control has been a twofold individualism, as emerged in postwar American and European societies. On the one hand is an individualism originating with middle-class living standards in the new American suburbs after the Second World War, and on the other hand is an individualism coined by the counter-culture of the 1960s and 1970s. Both these forms of individualism limited their focus to an understanding of architecture as a means of surviving and adapting to the environment around the building – with various implications for the elaboration of passive climate control and of thermal standards. Since then, a pronounced suburban momentum has governed both our comprehension of climate control and of sustainability at large. Today, this focus on individual buildings and self-sufficiency has come to constitute a shortcoming, both in terms of passive climate control as a concept and in terms of the global aspirations of current thermal standards.

## CONCEPTS AND CONTEXTS OF ENERGY EFFICIENCY

Dr. Sabine von Fischer, Zurich University of Applied Sciences (CH)

When sustainable planning and construction entered mainstream architecture in the 1990s, it took the form of a call for regulation. For criteria to be relevant to building practice, they needed to be quantifiable. As a consequence, benchmarks for technical installations, especially the performance of thermal insulation and HVAC, were introduced in building codes more readily than for larger social or economic settings. Over time, the actors changed from being local pioneers to global brands; and in the design of the thermal environment, the experience of the (thermal) environment gave way to calculations by external bodies. Overall, climatic design lost the cultural impact inherent in holistically conceived concepts. Climate in building standards thus often came to first be conceived as a problem of the energy efficiency of parts, and only later was considered in terms of the larger situation. Many of these standards spread globally, being imported and exported, and have been applied in climatic contexts remote from those for which they were conceived.

By comparing the increases – and recently also decreases – of primary energy uses in different countries and geographic regions with the emergence of different thermal standards in architecture, the presentation provides a historical framework from which to question the validity of foregrounding energy efficiency in discourses on sustainability.

## SUSTAINABLE GOALS VERSUS STANDARDISED TEMPERATURES

Jörg Lamster, studio durable / Lucerne University of Applied Sciences (CH)

The 2006 report of the IPCC, co-authored by Al Gore, made it obvious that the world has a climate problem. It was followed in 2008 by the global economic crisis, involving the crash of banking institutes and the collapse of the US real estate market. In response to these dual developments, low interest rates and subsidies for the energy equipment of buildings were introduced. At the same time, existing energy standards were tightened and new standards were developed. As a consequence, energy requirements are increasingly resolved via technological solutions. For marketing reasons, these measures have been accompanied by terms such as “comfort” and “energy efficiency”. On closer inspection, however, it is clear that these slogans are misnomers, and that often the opposite is the case – technology does not solve problems sustainably, rather it raises new problems.

Our work, both as an office and at the university, involves trying to identify ways to scrutinise and reduce the use of technology, and in some cases to make it obsolete. We understand the planning of sustainable buildings as a search for simple and appropriate solutions. Which uses of technology makes sense? Which do not? What do alternative solutions look like? What scope do different energy standards provide for project-specific solutions? And are our buildings currently equipped to deal with overall global warming?

## THE COMFORT OF STANDARDS AND STANDARDS OF COMFORT

Prof. Elisabeth Shove, University of Lancaster (UK)

People have reported being comfortable at a remarkably wide range of temperatures, so how is it that most of us spend most of our time in a relatively fixed mono-climate of around 22 degrees C? There is nothing natural about this temperature, and maintaining this “standard”, around the world, is exceptionally resource intensive. In this talk I discuss the role of design and engineering standards as instruments through which social conventions are made and shaped. The mistake of equating temperature with comfort justifies further investment in delivering “comfortable conditions” more efficiently or with less energy. This is to overlook the scope for re-defining comfort itself, and for working towards much more variable and much less standardised conjunctions of clothing, buildings, people and heating/cooling technologies. At the same time, it is important to recognise the comfort and reassurance that standards provide and their role in property markets and especially in the commercial office sector. I end by reflecting on the dilemmas that follow, including the risks and challenges of using standards to promote energy demand reduction.

# II. THERMAL STANDARDS AND THE ARCHITECT

Chair: Sabine von Fischer

## SOLID BUILDINGS WITH SOLID THERMAL STANDARDS

Prof. Jonathan Sergison, Università della Svizzera italiana (CH)

The level of thermal insulation in a building is not immediately apparent from the outside, but it is generally perceived in terms of environmental comfort. Thermal insulation contributes to the atmospheric character of a building in a subtle way. In our practice, the thermal requirements of each project are addressed by meeting or improving upon the requirements of building codes and regulations, whilst considering economic constraints but also assessing the architectonic character we wish a building to have, and the atmospheric qualities it might hold. None of these factors can be considered independently from the others.

We have all experienced the unsettling feeling of knocking on an external wall that is formed from insulated render and evokes the same sense of impoverishment as a hollow plaster-boarded internal wall: these are elements of a building that should feel solid rather than fragile. My contribution will draw upon the experience of working on many projects and in very different circumstances, and explore how we have managed these demands.

## MORE THAN HOUSING: THE HOLISTIC APPROACH

Andreas Hofer, Archipel Zurich (CH)

The process of developing an entire neighbourhood with housing for 1,200 residents and workspace for 150 people for the housing association mehr als wohnen (2007–2015) triggered a unique discussion on sustainability, concerning a far larger scale than the single-house unit. As a real-life laboratory, the formerly industrial Hunziker site in the Leutschenbach area in northern Zurich offers not only living and working spaces; beyond this, it is an experimental platform for testing various technologies, materials, products and energy concepts.

Since the move-in date in 2015, multiple research projects have evaluated the performance of the buildings in terms of energy efficiency and acceptance of the respective systems in place, including comparing the various Swiss and international standards set by different agencies and brands. A preliminary conclusion is that not only the delivered energy for heating, warm water and ventilation, but also the embodied energy and the energy consumed for household appliances and for mobility can be considerably reduced when the overall idea is conceived holistically, and when it is communicated and facilitated from the first day the site operates as a living neighbourhood.

## HOW TO CREATE A DIY CERTIFICATION SYSTEM

Prof. Muck Petzet, Università della Svizzera italiana (CH)

Sustainability is a complex endeavour: the harmony of the three intersecting circles of society, economy and ecology with their overlapping and often conflicting qualities seems nearly impossible to achieve. In this dilemma we find relief in easily understandable and measurable qualities such as the “efficiency” of buildings. “Saving energy” seems to be the most obvious strategy in “saving the planet”. Most of the established certification systems, for instance the Minerergie Standard, are premised on this basic “truth”, thus neglecting the more complex fields of embodied energies or the “soft” and unpredictable factors of behaviour.

We believe that it is both necessary and possible to redefine and reinvent these tools, making them understandable and easily applicable. We think that rather than simply adhering to requirements and fulfilling given standards, the task of the architect should be to juggle with rules and challenge regulations. For our students to be able to understand what “sustainable” really means, we believe that it is crucial for them to develop their own values and criteria. In our master’s course “Sustainable Design LAB” we have developed a method to create a strictly personal “do-it-yourself certification system”, involving six simple steps, by which the students were empowered to certify their own design work undertaken during the semester.

## CULTURE OF BUILDING + ENERGY = ENERGY CULTURE

Prof. Astrid Stauffer, Zurich University of Applied Sciences (CH)

The increasing shortage of resources and climate change mean that the framework for architecture is shifting, impacts that are also taken account of in the work undertaken by architectural practices as well as the teaching and research at the Institute for Constructive Design at the ZHAW. Our search is for material, structural and spatial concepts that are appropriate to our time and age, and we seek to mediate the manifold requirements of building in writing, drawing and building. Technical expertise must be integral to the work of the architect, and we ourselves are keen to potentiate low-tech concepts that rely on traditional climatic techniques. These evolve from and are related to the typology, the volume, the orientation and the material properties of a building.

In opposition to the imperative custom to adopt solutions that rely on short-lived technological installations, we pursue thermal concepts that come from and live with the architecture of a building, in lifecycles appropriate to an idea of architecture as cultural heritage and in keeping with a sense of social, economic and ecological responsibility. In the work of our office and in teaching the next generation of architects, we aim to promote low-tech architectural approaches that both moderate the effects of climate change and encourage values from the culture and tradition of architecture.

# III. THERMAL GOVERNANCE AND THE CITY

Chair: Sascha Roesler

## URBAN SOLAR DESIGN

Prof. Andrew Witt, Harvard Graduate School of Design (USA)

Partially catalyzed by computational techniques, designers have recently adopted increasingly scientific methods, instrumentation and even nomenclature in the development of technically ambitious projects, including those around solar and thermal performance. Consciously or not, this situation continues a history of design research, dating to at least Frederick Kiesler’s 1937 Laboratory for Design Correlation, which transformed the design studio into a laboratory. One of the most ecologically ambitious of these labs was Ralph Knowles’s Natural Forces Laboratory, which developed some of the earliest geometries of urban solar regulation.

During the 1960s and 1970s, drawing on influences as diverse as radical geography, crystallography, war games, structuralist dimensions of sociology, and of course the emerging concerns of ecology, Knowles developed an eclectic reshaping of the role and practice of the architect around the demands of solar access. During this period, Knowles proposed his specific constitution of the design laboratory, complete with a re-equipment of the designer’s key tools and implements. Reciprocally impacting building and city form, Knowles’s novel Solar Envelope method proposed a quasi-legal framework for resource access and urban form. The Natural Forces Laboratory combined physical simulation of ecological factors with proto-computational methods of territorial discretization, and quantified performance to create a new vision of what a designer could do and be.

## ENERGY EFFICIENCY AND THERMAL INSULATION IN URBAN CHINA

Dr. Giulia Romano, University of Duisburg-Essen (D)

In China, energy efficiency and thermal insulation in buildings do not share the same level of importance that they do in Western countries. Despite the introduction of a policy targeting energy conservation in the early 2000s and the establishment of energy efficiency policies aimed to demonstrate China’s engagement in the global battle against climate change, buildings themselves have been barely addressed in these policies. Even when measures have been introduced by central and local governments, among them the application of thermal insulation in new buildings, in practice Chinese cities are – with some exceptions – still far from seriously tackling the question of energy efficiency. This presentation aims to highlight these issues, as well as the challenges faced in more consistently applying building codes and thermal standards. This is undertaken by providing an overview of the phenomenon of urbanisation in China, a review of the significant historical policy decisions impacting on the current situation, and an analysis of the relevant design and construction practices, as well as of the challenges in applying thermal standards and measures for energy efficiency in buildings.

## THERMAL REGULATIONS IN SANTIAGO DE CHILE

Lionel Epiney, Università della Svizzera italiana

The actors involved in the definition and implementation of thermal regulations, such as scientists, policy-makers, experts and bureaucrats, all have many different agendas as to how to deploy energy efficiency strategies. Based on this, as means to modernise building stock, the regulations (and/or standards) produced are artefacts and the result of compromises, be it economic, technical or social. Focusing on passive climate control, I will present the case of Santiago de Chile, a city facing many environmental problems such as low air quality and poor indoor thermal comfort. Recently, Chile’s government, along with the private sector, has drawn up a programme of energy transitions, fostering improvements of building performance. Being cross-cultural objects incorporated in a global market, thermal performance’s best practices are transnational and not necessarily locally informed. This can sometimes lead to an omission of the existing cultural or organisational issues when importing a standard to a local context. However, expertise and codes are constructed from knowledge based on empirical studies, and their implementation takes place in a given site at a given time. Across various scales of governance, my aim is to trace this construction of thermal standards (voluntary or legally binding), finishing with an examination of their impact on the urban fabric of Santiago.

## THE (RE)SCALING OF REGULATORY GOVERNANCE

Prof. Emma Street, University of Reading (UK)

Regulatory standards seeking to order urban life have existed for millennia. Standards take on a range of forms, from the socio-cultural codes embedded within vernacular built forms, to more prescriptive standards such as formalised building regulations. Regardless of form, regulations tend to be thought of as value-neutral “objects” rather than as socio-institutional and political interventions in the design and development process that serve to delimit and define the scope and activities of design professionals and shape the lives of those who inhabit built environments. The paper reflects on the challenges involved in regulating thermal performance, linking this to wider questions such as the scale at which regulations are imposed, and lines of responsibility and risk attendant to the regulation of built environments.

**LIONEL EPINEY** is an architect and PhD student at the USI Mendrisio, Switzerland. He is a qualified architect with a Master of Sciences ETH in Architecture, currently involved in Dr. Sascha Roesler’s research “The Urban Passive House”. His engagement in analysing the dynamics between city climate, socioeconomic conditions and regulations in the housing production of Santiago de Chile emerges partially out of his experience working at Alejandro Aravena (elemental). As a PhD student interested in the contemporary city of the Global South, more precisely in modes of thermal governance, Lionel explores concerns in urban transformations, energy transitions, standards and globalisation.

**SABINE VON FISCHER** is an architect with an interest in the history of science and technology. Her design and writing have been featured in journals, newspapers and academic books. She is research associate in EnergyCulture in Architecture at IKE-ZHAW, the Institute for Construction Research at the Zurich University of Applied Science. Her current research tackles the standardization of energy and climate regulations, as well as acoustic photography, records of energy measurements and the tools involved to represent this data.

**ANDREAS HOFER** holds a diploma in Architecture from ETH Zurich and is one of the founders and principals of Archipel in Zurich, a consulting and planning office focussed on cooperative housing, low-cost construction and the city as the site of political contestation, economic interests and cultural expectations. He engages in project development for innovative, community-based housing, such as „Kraftwerk1“ und „mehr als wohnen“, both in the city of Zurich. Publications and teaching on topics of sustainable urban development and the future of housing.

**MADLEN KOBI** is a social anthropologist and postdoctoral researcher at the Academy of Architecture at the Università della Svizzera Italiana in Mendrisio, Switzerland. Her main research and teaching fields are urban anthropology, architectural anthropology, waste anthropology and urban space use with a regional focus on China. In her current research, she explores everyday climate-related practices in high-rise buildings in Chongqing (China).

**JÖRG LAMSTER** holds a Diploma in Architecture from the University of Fine Arts of Hamburg and a Master in Industrial Engineering from HSLU Lucerne. He is the founder and principal of Durable Planung und Beratung, Zurich, an office for planning and consultation in sustainable building construction. He teaches strategic building renovation, sustainability and building physics at HSLU Lucerne and material ecology at the University of Vaduz, and is member of two SIA commissions (standard SIA 112/1:2017 on sustainability in building construction; KNU commission for sustainability and the environment).

**MUCK PETZET** is a German architect, curator and teacher. Muck Petzet Architekten has offices in Munich/Berlin and a portfolio of about 250 projects, ranging from small interventions up to an urban scale. Muck Petzet’s extensive engagement with transformation projects set the basis for his development of a “minimal intervention - transformation theory” and his dedication to propagate a reevaluation of existing buildings as a valuable resource for our future through lectures, exhibitions and publications. He taught at Vaduz University and as visiting professor at TU Munich. Since 2014 he is professor for sustainable design at USI.

**SASCHA ROESLER** is an architect and theorist. His work focuses on the crossovers between architecture, ethnography and science studies. He is currently professor for architecture and theory at the Accademia di architettura in Mendrisio (Switzerland), with an emphasis on the theory and history of passive climate control in urban contexts. Sascha holds a doctorate from ETH Zurich and he previously worked as a senior researcher and academic coordinator at the Future Cities Laboratory of ETH in Singapore. His publications include a history of the ethnographic research conducted by modern architects (Weltkonstruktion, Berlin 2013) and a volume on the transformation of a colonial settlement in Casablanca (Habitat Marocain Documents, Zurich 2015).

**GIULIA C. ROMANO** is Postdoctoral Researcher at the Institute of East Asian Studies of the University of Duisburg-Essen and Research Associate at the Centre de Recherches Internationales (CERI) of Sciences Po-Paris. She completed her PhD studies at Sciences Po-Paris, focusing on the transfer of concepts of sustainable urban development from Europe to China. She obtained a B.A. degree in Chinese Language and Literature (University of Paris VII-Denis Diderot), a M.A. degree in European Studies and a B.A. in International Relations (Faculty of Political Sciences of the University of Turin). Her research focuses on the circulations of models of governance and on the introduction of methods for residents’ participation in urban planning in Chinese cities.

**JONATHAN SERGISON** graduated from the Architectural Association School of Architecture in 1989 and gained professional experience working for David Chipperfield and Tony Fretton. Together with Stephen Bates, he founded Sergison Bates architects in London in 1996, and in 2010 a second studio was opened in Zurich. Sergison Bates architects have built numerous projects worldwide and the practice has received many prizes and awards, and has been extensively published. Jonathan Sergison is particularly interested in urban questions and the conditions of the contemporary European city, especially the role housing might play in this changing context. He has taught at a number of schools of architecture and was Visiting Professor at ETHZ in Zurich, EPFL in Lausanne, AHO in Oslo and Harvard GSD. Since 2008 he has been Professor of Design and Construction at the Accademia di Mendrisio, Switzerland.

**ELIZABETH SHOVE** is Professor of Sociology at the University of Lancaster and director of the DEMAND (Dynamics of energy, mobility and demand) research centre. She has written about the history of comfort and how that changes with more recent work in DEMAND also dealing with the role of standards as “carriers” of conventions and practices. Besides her book Comfort, Cleanness and Convenience: the Social Organization of Normality (Oxford: 2003), she published articles on comfort, norms and energy consumption in journals such as Journal of Material Culture, Energy Research & Social Science, Building Research and Information, or the Journal of Consumer Policy.

**ASTRID STAUFFER** lives in Zurich and is founder and principal of Stauffer&Hasler Architects in Frauenfeld and Zurich. She holds an Architecture Diploma from ETH Zurich and established her own practice with Thomas Hasler in Frauenfeld in 1994. She is head of the Institute for Constructive Design (IKE) at the Zurich University of Applied Sciences (ZHAW) since 2015 and, together with Thomas Hasler, professor at the technical university of Vienna since 2011, after their joint visiting professorship at ETH Zurich from 2002-2004, and at EPFL Lausanne 2007-2011. Recipient of the prestigious Prix Meret Oppenheim in 2015, numerous publications.

**DR. EMMA STREET** is Associate Professor in Planning and Urban Governance at Henley Business School, University of Reading, U.K. Her research focuses on the sociology-economic and political values that inform the way we design, plan and use urban space. She is particularly interested in the role regulations and policy play in producing the built environment and is currently involved in research projects on urban regeneration, governmental reforms to the English planning system, and recently completed the cycle800M project which looked at urban mobility in the context of wellbeing and ageing.

**ANDREW WITT** is an Assistant Professor in Practice in Architecture at the GSD, teaching and researching in the cultural relationship of science and design.

He is also co-founder, with Tobias Nolte, of Certain Measures, a Boston/Berlin-based office for design science. He was previously Director of Research at Gehry Technologies and a director at GT’s Paris, France office, where he solved complex geometric challenges for clients including Gehry Partners, Ateliers Jean Nouvel, UN Studio, and Coop Himmelb(l)au. His research on the relationship between scientific epistemologies and design has been recognized with a Fellowship from the Canadian Centre for Architecture and Graham Foundation grant. He has lectured widely, including at Yale, Princeton, MIT, The Bartlett, The Berlage, Stanford, UCLA, Berkeley, ETH, and EPFL, and his research has been published in venues such as Log, AD, Surface, Space, Linear Algebra and its Applications, and Linear and Multilinear Algebra. He received an M.Arch (with distinction, AIA medal, James Thayer Scholarship, Frederick Sheldon Travelling Fellowship) and an M.Des (History and Theory, with distinction) from the GSD.