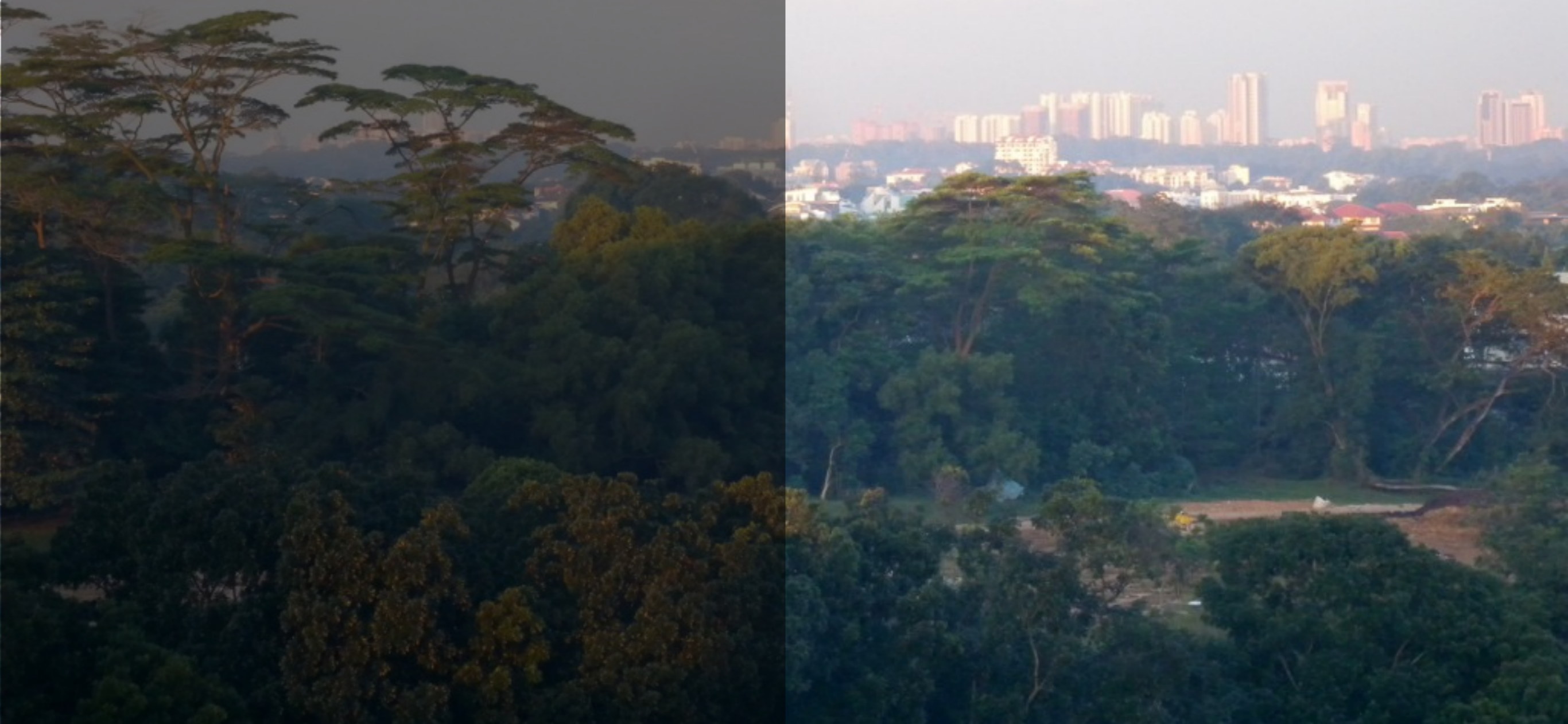


Future Cities Preface



Abstract

What is a city? What is an urban system? Do we understand these most complex man-made artefacts in their entirety? Why do people move into cities? When do they prefer to stay in rural areas? Do cities need skyscrapers? Are there cities without density or are there dense settlements without being a city? Some cities are liveable for the majority, others just for a few. As we enter the first urban century, we start to realise that today's cities are not sustainable, no matter from which side we look at them. Prerequisites for their transformation towards **liveability**, sustainability and resilience are better knowledge and ability to change. Understanding the city and knowledge about the city should be the base for change. As we begin to realise that cities are not neutral objects, but that people define the city, the mobile citizen gains a central role in the definition of the future city.

With regard to cities, the development in different parts of the world is moving in radically different directions. Cities in the tropics will grow strongly in the coming decades: overall, the number of new inhabitants is expected to increase by 3 times the population of Europe today in the next 30 years. But who is planning those cities? To enable people to do so, it is necessary to develop new University programmes which in an integrated and holistic way will transmit the knowledge to understand the city, to transform it, to plan it, to design it, to build it, to manage it and to constantly adapt it. The **Future Cities Laboratory** in Singapore and Zurich is conducting fundamental research into

this area and also prepares concrete proposals to change existing urban structures towards a higher level of sustainability.

A new understanding of the city: The Future Cities Laboratory

At the beginning of the second decade of the 21st century, networks of urbanised centres are the predominant framework of life in Europe, the United States, South America and Oceania. While in Africa and Asia a majority of the population still lives in the non-urbanised countryside, the urban population is growing much faster, through higher birth rates and internal migration, and is expected to exceed the rural population by 2050. Thus, the urban framework of living will dominate the coming centuries. As a consequence, the urban theme has moved to the top of the agenda of elite universities, industries, and agencies. Governments such as the one of Singapore have made the future of the city, in particular the future of the liveable city, one of the **national central themes**. Global Think Tanks, such as the **Santa Fe Institute** in New Mexico, explore the topic of the city as a complex system in-depth.

The urbanisation of the rapidly emerging countries of the 21st century, as societal and scientific phenomenon, urgently needs fundamental research. This is the main reason why **ETH Zurich** has founded in 2010 the Future Cities Laboratory, as an integrated and multidisciplinary design and research centre in Singapore and Zurich. The Future Cities Laboratory is looking for

realistic approaches, techniques and methods to increase the sustainability of cities. It integrates research results from fields of science that are crucial for the next generation of city planners, city builders and city managers to know about.

In order to better understand the city, theory, experiment, and simulation need to work hand-in-hand. *Theory* entails research on the reality, the planning, and the implementation of the city; *Experiment* includes the conduction of Design Research Studios, with the city as a living laboratory; **Simulation** is needed to make the invisible visible and to test and visualise future scenarios.

Three years after its launch, the Future Cities Laboratory in Singapore and Zurich operates with more than 200 people from 31 nations. Among those are 50 Ph.D. students, 25 Postdoctoral Researchers, 13 Principal Investigators, 35 Design Research Studio Master Students and 5 management involved persons, as well as the academic partners of the **National University of Singapore** (NUS) and the **Nanyang Technological University** (NTU). All together, these researchers are beginning the development of a new **city science**, by the combination of theory, experiment and simulation.

Building on the model of the urban metabolism, on the stocks and flows approach and on complex systems theory, the Future Cities Laboratory, in addition, explores experimental possibilities, such as pre-specific modelling and a **quantum city** approach. The research operates on 3 integrated scales: small – building

and building technology; medium – neighbourhood and city; and large –hinterland and territory. 10 research modules and 3 assistant professors work on the influential and decisive parameters water, material, energy, design, capital, landscape, density and information.

Context versus universality

Throughout the entire book, there will be a distinction between universally accepted facts and context-based information and facts. Universally accepted facts and methods can be transported without causing confusion or damage between cultures, countries, and climates, as they apply to all cities and urban systems. They are only a few. Context-based information and facts refer to a specific location, in a specific climate and must be used with great care as a base for design decisions in other places. Cities and buildings are not context-free objects and therefore must not be just **copied**. The boundary between context-based and universally applicable theory is not rigid, and as our knowledge about cities increases, we will be able to expand both the set of universally accepted design support theories and facts as well as the locally important information and knowledge. The universally applicable information is depicted by the global symbol.

New ways to plan the city

City planning means different things in different parts of the world. And many of the fastest growing cities even evolve without

planning in the traditional sense. While the development in Europe and the United States is stagnating, the cities north and south of the equator are expanding as rapidly as European and North American cities did 150 years ago. Yet since then, the world's population has grown by a factor of 6, and the global networking amongst the urban centres has increased significantly. The interactions between cities are massive, compared to those in Europe and North America in the 19th and 20th century. Asian cities, such as Singapore, have recognised and developed city planning, as a crucial part of the development of the entire nation. The idea is to become the leading centre in Southeast Asia, with the highest satisfaction of the inhabitants. In 2012, the Singapore Minister of Trade and Industry **Lee Yi Shyan** asks: "How can we urbanise while maintaining harmony – socially, economically and environmentally? How do we balance short-term needs with long-term demands? How do we ensure that we can go on building cities, while retaining a healthy environment for our children and grandchildren?"

The Future Cities Laboratory looks at city planning from different perspectives. On the territorial scale, the architects and urban designers **Marc Angélil and Franz Oswald** conduct research on the symbiotic relation between cities and their regional and global Hinterland, in Brazil and Ethiopia. Territorial Architect and Designer **Milica Topalovic** concentrates on the interconnections between Singapore and its Hinterland, which includes Malaysia and Indonesia, but which, in reality, is global. Also in a territorial

scale, transportation planner **Kay Axhausen** simulates the effects of **mobility** and the increasing number of cars and other vehicles, as well as the emerging links between mobility and urban design. In the neighbouring Jakarta and along the Ciliwung River, the landscape architect **Christophe Girot** and the hydrologist **Paolo Burlando** try to understand and plan for the territorial importance and the local functions of water as natural and development elements. The urban sociologist Christian Schmid works with comparative methods in the rapidly growing urban centres north and south of the equator to discover common phenomena and solutions for the densification of cities.

New ways to build the city

Cities, seen as physical expressions of urban systems, consist of people, buildings, infrastructure, and moving parts. The urban system extends above and below ground. Above ground, buildings are the objects that are most associated with cities. Every single building in a city contributes to its future success or failure with regard to sustainability, and therefore the building physicist **Hansjürg Leibundgut** and the architect **Arno Schlüter**, concentrate on **Low Exergy** housing and office buildings for the tropics. Architect and building technologist **Sacha Menz** compares housing typologies in Switzerland, Singapore, and China. To construct these buildings in the future with high precision and longer life cycles, **Fabio Gramazio and Matthias Kohler** teach their students how to program robots for the

automatic, non-standardised digital production of high-rises. Building scientist and preservation specialist **Uta Hassler**, and her group, focus on material flows, on historic aspects of quarters originating in different times and on the development of the city of Singapore. Expanding this team, the urban planner and architect **Kees Christiaanse** leads another team that deals with the revitalisation of city quarters and also explores the new role of the airport as an integrated part of the new city. With the explicit goal of saving valuable resources and reducing CO2 output in the production of building materials, **Dirk Hebel** introduces regional material, such as bamboo, which in specific parts of the world could partially become, under certain conditions, a substitute of concrete in construction.

New ways to manage the city

Cities consist of more continuous parts and more dynamic parts. In the constant development between continuity and change, it is necessary to build innovative methods and instruments for a dynamic city management. Already the master plans for a city and the resulting buildings should be seen through the eyes of the city life-cycle management, and the city administration has to be composed in a way that it can implement well-founded requests from the population. Rules and building regulations will play an important role in the future to manage the city. **Alex Lehnerer** is planning a centre for urban rules, that could formulate planning guidelines for the new city. As interaction environment for those who are participating in the building and the management of the

city, as well as for the safe deposit of all information related to a city, the **Simulation Platform** of the Future Cities Laboratory with the Value Lab Asia represents the technical foundation. Information originates from data. This data stems from historical records, but also nowadays increasingly from real-time and online sources, crowd sourcing and social media. Integrating them carefully in the Simulation Platform will lead to context sensitive knowledge databases for the management of future cities.

Future cities

It is already clear now, that the future city will not be designed and built based on hierarchies, formalisms, or mathematics, but will originate from a dynamic system including global relations and local force fields. This view of the future city is already reflected in the organisation of the Future Cities Laboratory, which closely networks on the one hand in-depth disciplinary research and on the other hand disciplines like design or sciences. Depending on the topic, the leadership of emerging synergy projects will rest with the research module that has the highest competence in this field of interest and might change throughout the project. The first example is the common work on the historic Rochor quarter in Singapore, where tradition and future are at stake. A second example is the Jakarta Ciliwung project, in which several research modules of the Future Cities Laboratory cooperate with the University of Jakarta on the concrete redevelopment of a Kampung, in order to improve the situation of the slums in a sustainable way. A third example is the design and

construction of the city of Nestown in Northern Ethiopia. All three examples have in common that research, development and implementation are closely working together in the rapidly growing regions around the equator, with the common goal to achieve urban sustainability.

The cities of the future will differ from each other much more than those of the present, because they emerge in a globally networked consciousness and with having the knowledge of the importance of sustainability. They will increasingly take into account the participation of people as well as the climatic and economic context. This requires that the teaching of city planning and urban design needs to be revisited and renovated fundamentally, and must be adjusted to the degree of knowledge that has been created from the research related to the city. To this end, the Future Cities Laboratory develops a new curriculum for those students, in different parts of the world, who will lead the planning, the construction, the redevelopment and the management of future cities. The new curricula will influence education in the West, but possibly even more education in Asia and Africa, because these curricula will hopefully eliminate the discrepancy between the needs of cities in those continents and the solutions that were traditionally offered in the West.

At the beginning of the 21st century, the majority of the fastest-growing cities are in Asia and Africa. In the very near future, the majority of the population in the world will not only be housed in

cities, but in Asian and African cities. As a result, the knowledge of the development of cities and of urban-rural systems is crucial for students worldwide.

The patterns and recipes of the past will be replaced by new patterns and blueprints that are under development in the Future Cities Laboratory in Singapore and Zurich. Those blueprints will differ significantly from city to city even in similar climate zones. They will differ even more from cooler climates to tropical climates.