Urban Science Workshop Series
26 September – 6 October 2023

Opening and Keynote Lectures
Tuesday, 26 Sept 2023
Theatrette, Level 2, CREATE Tower, 1 Create Way, S138602

Strategies to harness the science of cities as complex systems

If we think of the city as a system-of-systems, it helps us understand that some problems are quickly resolved if we can react fast enough, without impacting other systems. However, some challenges, such as decarbonising cities, planning for the long term, and making cities more liveable take place over a long time and involve a multitude of sectors and actors. As such, these are complex problems span across temporal and spatial scales of time, space.

Cities need to develop long-term strategies, yet city managers need to be able to run a city on a day-to-day basis, without ossifying status-quo solutions into legacy systems. The ability to set viable transition pathways from the now to a desired state in the future, as well as bring everyone along, is key.

How then, can city leaders go about solving complex problems, without doing everything, everywhere, all at once?

Eminent urban scientists Luis Bettencourt, Michael Batty, and URA Group Director (Research & Development), Chiu Wen Tung will be sharing their thoughts on harnessing science and big data to solve complex problems in cities. A moderated panel discussion will follow, featuring urban practitioners and scientists.

Keynote Speakers

Prof. Luis Bettencourt
Mansueto Institute for Urban
Innovation, University of Chicago

Prof. Michael Batty
Centre for Advanced Spatial
Analysis, University College London

Mr. Chiu Wen Tung
Group Director, Research &
Development
Urban Redevelopment Authority

CENTRE for
LiveableCities
SINGAPORE

Day 1
Tuesday, 26 September 2023
Theatrette, Level 2, CREATE Tower, 1 Create Way, S138602

9:30 – 10:00   **Registration & Tea**

10:00 – 10:10   **Opening Address**
Prof Lim Khiang Wee
Former Executive Director, NRF CREATE

10:10 – 11:10   **Keynotes**
Prof Luis Bettencourt (University of Chicago)
Prof Michael Batty (University College London)
Mr Chiu Wen Tung (URA)

11:10 – 12:30   **Panel Discussion & Q&A**

Strategies to harness the science of cities as complex systems

Moderator:
Mr Huang Zhongwen (SNDGO)

Discussants:
Prof Luis Bettencourt (UChicago)
Prof Michael Batty (UCL)
Mr Chiu Wen Tung (URA)
Prof Cheong Siew Ann (NTU)
Dr Srilalitha Gopalakrishnan (SEC FCL Global)

12:30 – 13:30   **Networking (Light Lunch)**

CENTRE for
LiveableCities
SINGAPORE

Day 2
Wednesday, 27 September 2023
CLC Training Room, The URA Center, 45 Maxwell Road #08-01, S069118

Co-organised by **NTU** and **CASA UCL,** this session will dissect complex urban systems and explore methods and models including network analysis to understand the social and cultural heritage aspects of cities and the relationship with behavioral dynamics.

13:00 – 13:30
Registration

13:30 – 14:45
Social Dynamics on Complex Urban Networks: Cultural Heritage and Gentrification

A/Prof Cheong Siew Ann (NTU)

Complexity arises from the interactions over space and time between individuals within an urban backdrop. Significant patterns of interactions define the social fabric of our urban societies as well as us culturally. The basis of cultural heritage is always intangible, but how tangible cultural heritage emerges because these are places and artifacts that strengthen intangible cultural heritage. To appreciate the value of interactions, and how urban plans and policies can become aware of this cultural value and enhance it, Sustainable Heritage Impact Factor Theory (SHIFT) can be applied. Using Tiong Bahru as a specific case study of cultural heritage, this study assesses how Tiong Bahru is transformed from an old and impoverished community into a vibrant community with improved amenities through a series of urban renewal exercises. we found the urban renewal of Tiong Bahru was led by two waves of demographic changes that triggered changes in home prices and rents across the whole of Tiong Bahru and may explain some of the changes to its commercial landscape.

14:45 – 16:00
Urban Complex Systems: Models and Methods

A/Prof Chew Lock Yue (NTU)

An urban system has the hallmark of a complex system. It is an open system that interacts with the environment, exhibits emergent behavior, and self-organises as it adapts to changing circumstances. This lecture discusses examples of urban systems from the context of a complex system and the current research landscape of complexity science on these systems. The goal is to discern the key scientific paradigms that best represent complex systems, focusing on two aspects: models and methods. Models are theoretical, mathematical, or computational constructs used to give meaning to the observed dynamical behavior of the complex-system-of-interest. Whereas, methods are technical approaches that serve as scaffold to the model concerned. Using research in social mobility, urban agglomeration, and epidemic spreading, the relevance of these models and methods in the studies of urban complex systems are evidence where these variegate models can come together to provide a framework of understanding for urban complex systems.

16:30 – 18:00
Multiscalarity in Urban Systems

Prof Elsa Arcaute (CASA UCL)

Processes in cities create patterns that give rise to hierarchical relationships between their elements. The processes can be modulated via top-down interventions, and such interventions can be decisive for the observed outputs. Nevertheless, the scale at which these interventions are performed, are not always obvious. In this lecture we look at commuting networks, and dive into the role of diversity at different scales. Such a framework allows to identify regional characteristics, these can be defined by specialisation in economic activity, the range of skills of individuals, and the functional complementarity between cities.

CENTRE for
LiveableCities
SINGAPORE

Day 3
Thursday, 28 September 2023
Theatrette, Level 2, CREATE Tower, 1 Create Way, S138602

Co-organised by **CNRS@CREATE,** this workshop introduces participants to the key concepts of Hybrid AI in modelling practices, such as in digital twins for cities, to further advance and inform progress towards human-centric smart cities. Participants will be invited to a live demonstration of DesCartes Augmented Marina Bay Twin, using hololens technology.

9:30 – 10:00   **Registration & Tea**

10:00 – 10:30   **Empowering Cities Digital Twins with Hybrid AI**
Prof Francisco Chinesta (ENSAM)

By combining physics-based and data-driven models, as well as extremely fast and accurate diagnosis, prognosis and decision making can be performed. These advanced tools are being successfully applied in critical urban systems and environmental simulations.

10:30 – 10:45   **Human and Society Centric Smart Cities**
Prof Vanessa Evers (University of Twente & Nanyang Technological University)

10:45 – 11:00   **Smart Sensing for durable Cities**
Ms Pauline Le Borgne (Cetim Matcor)

11:00 – 11:15   **Predicting for Optimal Planning in Emergency Situations**

11:15 – 11:35   **Q&A**

11:35 – 12:00   **"DesCartes Augmented Marina Bay Twin": Introduction and Demonstration**
Prof Francisco Chinesta (ENSAM)
Mr Daniele Di Lorenzo (ENSAM)
Mr Victor Champaney (ENSAM)
Mr Angelo Pasquale (ENSAM)

The hololens and live demo can be tested by interested participants

CENTRE for
LiveableCities
SINGAPORE

Day 3
Thursday, 28 September 2023
SDE 4 Forum, Level 5 SDE 4, 8 Architecture Dr, S117356

NUS Cities is a multi-disciplinary, open and inclusive collaborative platform for education, research, and advisory services on Cities. This session draws on the NUS research communities, such as urban analytics lab, to share on methods, models and tools to tackle various urban challenges, leading to the overall outcomes of sustainability, resilience, and liveability.

13:00 – 13:30 **Registration & Tea**

13:30 – 14:00 **Introduction to NUS Cities**
Prof Cheah Kok Ming (NUS Cities)

14:00 – 14:30 **Spatial (urban form) resilience in Hong Kong and New York City**
Dr Darren Nel (LKYSPP & NUS Cities)

While there is a growing acceptance of urban resilience within the urban discourse, there is still very little understanding of how the physical form of cities impacts their ability to adapt to changing circumstances, and therefore their resilience. This presentation provides a synoptic overview of the results of a study that integrated the disciplines of urban morphology and urban resilience through the use of urban science to develop a novel framework and accompanying methodology for assessing the spatial adaptive potential of cities and identifying the urban forms that promote spatial resilience.

14:30 – 15:00 **How the Downtown Line affects traffic congestions and housing prices**
Dr Dai Fangzhou (NUS Cities)

The Singapore Underground Road System (SURS), which was first considered in the 1980s to cater for increasing traffic growth in the city centre, and it was de-safeguarded in August 2017, as it is considered to be no longer needed because of the improvement of public transit system and the change of land use policies. In this study, we apply difference-in-differences models to investigate how the DTL affects traffic congestion and housing prices in the surrounding areas of the SURS as well as the intersection areas of the SURS and the DTL.

15:00 – 15:30 **AI in Urban Analytics**
Dr Filip Biljecki (NUS Urban Analytics Lab)

The talk will present recent research efforts on urban and geospatial modelling at the research group NUS Urban Analytics Lab, which focuses on the use of AI in urban analytics and understanding the usability of emerging datasets and crowdsourcing. The Lab spearheads a holistic and intertwined research agenda that covers the entire geospatial process in the urban realm: from advancing means to acquire data and standardising it to developing new use cases and unlocking value with AI & analytics.

15:30 – 17:00 **Net Zero Building: Video Presentation and Tour of SDE4**
Mr Wisely Ong (NUS Cities)

Ms Mavian Tay (NUS Cities)

Ms Young Lee (NUS Cities)

Day 4
Friday, 29 September 2023
Singapore ETH Centre, CREATE Tower, 1 Create Way #06-01, S138602

Co-organised by **Singapore ETH Centre Future Cities Laboratory Global,** this session introduces participants to the Future Cities Lab and Future Resilient Systems programmes and share the engagement platforms (e.g., dashboards) as planning support tools. This workshop will also present participants with a hands on demonstration of models and tools such as Digital Urban Climate Twin (DUCT) and City Energy Analyst (CEA) tool.

9:30 – 10:00 **Registration & Tea**

10:00 – 10:30 **Introduction to Future Cities Lab and Future Resilient Systems**
Dr Srilalitha Gopalakrishnan (SEC FCL Global)

Dr Alberto Costa (SEC FRS)

10:30 – 11:00 **Engagement Platform - Overview**
Mr Sean Eu (SEC FCL Global)
Presentation of the integrated dashboard developed by FCL to visually communicate the research content developed under the FCL program. The session will also highlight the different widgets embedded within the dashboard to explore and find content of interest within the FCL research program.

11:00 – 12:00 **Case Studies to demonstrate the use of Planning Support Tools**
Presentation by FCL researchers on the range of planning support tools and methods being explored within the different modules.

Spatial Network Analysis at one-north
Ms Anjanaa Srikanth (SUTD and SEC FCL Global)
The presentation highlights the use of Spatial Network Analysis methods in understanding pedestrian accessibility and occupancy in multilevel networks at one-north.

Transport planning for uncertain futures
Dr Qiming Ye (SEC FCL Global)

Sea-City Interface
Dr Zheng Xing (SEC FCL Global)
The presentation highlights the development of a framework of parametric simulation to identify the building energy-efficient retrofit strategy considering the surrounding urban microclimate.

CENTRE for
LiveableCities
SINGAPORE

Day 4
Friday, 29 September 2023
Singapore ETH Centre, CREATE Tower, 1 Create Way #06-01, S138602

13:30 – 14:00
Grow Your Own Microgreens Using Solar PV

Dr Shi Zhongming (SEC FCL Global)

This session will introduce a family of three tools to support Singapore in achieving its 30 by 30 goal by growing microgreens on Singaporeans' balconies. The three tools are (1) Building-Integrated Agriculture (BIA) Tool, (2) Grow-Your-Own-Greens APP, and (3) Self-Watering Robot DIY Tutorial.

14:00 – 14:30
Cooling Singapore: Digital Urban Climate Twin Explorer

Dr Heiko Aydt (SEC FCL Global & Cooling Singapore)

A Digital Urban Climate Twin (DUCT) is a digital representation of a city, incorporating computational models of all relevant components that influence the urban climate. This allows a DUCT to simulate the potential impact of changes to the urban environment on the urban climate. The Singapore-ETH Centre built a DUCT for Singapore as part of the Cooling Singapore 2.0 project.

14:30 – 15:00
Urban Energy Systems Analysis

Dr Shi Zhongming (SEC FCL Global)

The City Energy Analyst (CEA) Tool is an urban building simulation platform and one of the first open-source initiatives of computation tools for the design of low-carbon and highly efficient cities that combines knowledge of urban planning and energy systems engineering in an integrated simulation platform. This allows studying of the effects, trade-offs, and synergies of urban design options and energy infrastructure plans.

15:00 – 15:30
InfraRisk

Dr Beatrice Cassottana (SEC FRS)

This session presents an open-source simulation platform called 'InfraRisk' to simulate network-wide effects of disaster-induced infrastructure failures and subsequent post-disaster restoration. Developed in Python, the platform contains several modules that model infrastructure networks, hazards, the consequences of these hazards on urban networks and the subsequent economic losses.

15:30 – 16:00
### Cities Knowledge Graph Programmatic Plot Finder

Dr Pieter Herthogs (SEC FCL Global)

The Cities Knowledge Graph team has developed a demonstrator called the Programmatic Plot Finder, which demonstrates the potential of knowledge graph technologies to support synthesis in city planning. In this demo application, we focus on supporting site search for planners, and retrieval of institutional regulatory knowledge.

16:00 – 17:00
Tea Break and Open Demo Sessions
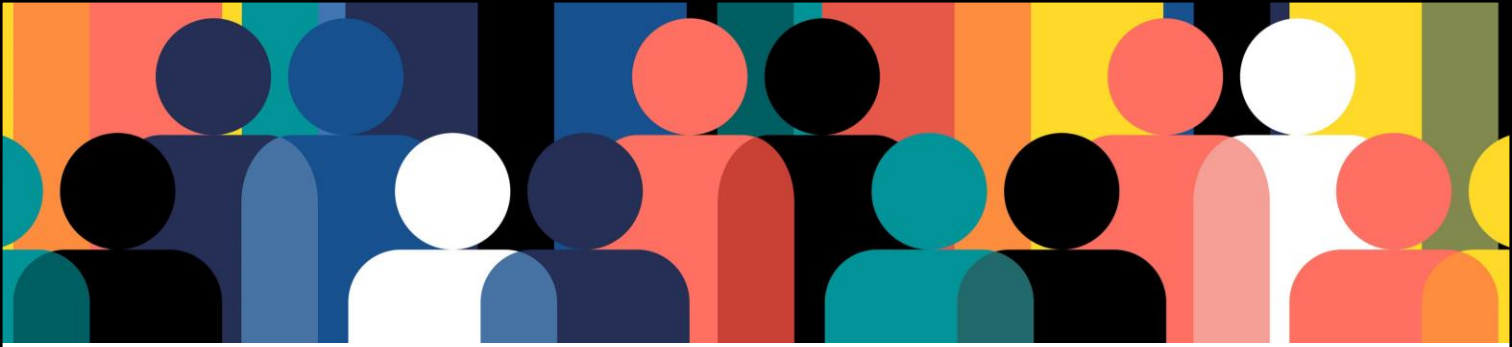
CENTRE for
LiveableCities
SINGAPORE

Day 5
Monday, 2 October 2023
CLC Training Room, The URA Center, 45 Maxwell Road #08-01, S069118

Co-organised by **Singapore ETH Centre Future Cities Laboratory Global**, the lecture and demo sessions will focus on methods and frameworks from the ongoing Dense and Green Cities research. The sessions will answer the questions of WHY, WHAT and HOW we are pursuing the research of Dense and Green Cities in FCL Global. Prof Thomas Schroepfer's lecture will address the aspects of WHY and WHAT questions. The subsequent presentations by the researchers will demonstrate the HOW aspects.

9:30 – 10:00	**Registration & Tea**

10:00 – 10:40   **Dense and Green Cities: Emerging Models for Sustainable Urban Development**
Prof Thomas Schroepfer (SUTD & SEC FCL Global)

10:40 – 10:55   **Architecture and Urban Design Performance**
Ms Anjanaa Srikanth (SUTD & SEC FCL Global)

10:55 – 11:10   **Environmental Performance**
Dr Lei Xu (SEC FCL Global)

11:10 – 11:25   **Social Performance**
Dr Gao Tongchaoran (SEC FCL Global)
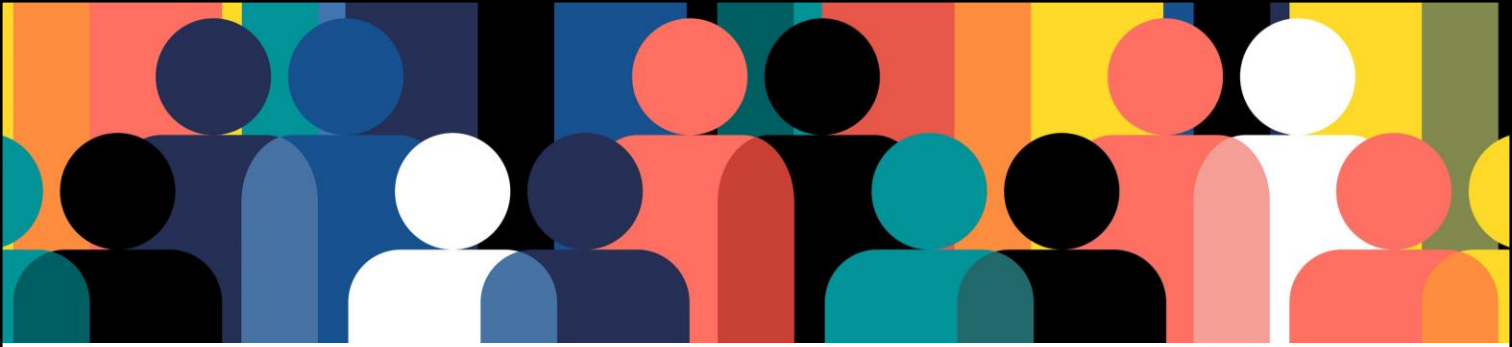
11:25 – 11:40   **Ecological Performance**
Dr Srilalitha Gopalakrishnan (SEC FCL Global)

11:40 – 12:00   **Q&A**

CENTRE for
LiveableCities
SINGAPORE

Day 5
Monday, 2 October 2023
CLC Training Room, The URA Center, 45 Maxwell Road #08-01, S069118

Co-organised by **URA**, this workshop focuses on the theme "How should the practitioner and research community work together to build and mature M&S capabilities for knowledge generation and application?" The session starts by introducing agency's work in applying system-of-systems approach in model building to inform urban planning and decision making. A panel discussion is convened to understand challenges faced by agencies and research communities and followed by group discussions to co-create solutions addressing these challenges.

13:00 – 13:30	**Registration & Tea**
13:30 – 13:35	**Session Introduction** *Dr Alvin Chua (URA)*
13:35 – 14:05	**Planning with/for Complexity and Uncertainties** *Ms Lee Chin Yee (URA)*
14:05 – 14:25	**Designing a User Application to Support Land Use and Transport Integration (LUTi) Planning** *Dr Xie Litian (URA)* *Mr Baskaran Narayanan (LTA)*
14:45 – 15:05	**Anthropogenic heat calculation in CS 2.0** *Dr Jordan Ivanchev (TUMCREATE)*
15:05 – 15:25	**Energy Assessment in SITEM** *Dr Muhamad Azfar Ramli (IHPC)*

15:25 – 17:25

Panel Discussion "How should the practitioner and research community work together to build and mature M&S capabilities for knowledge generation and application?"

Moderator:
Ms Elly Chiu (Accenture)

Panelist:

Mr Ching Tuan Yee (URA)

Mr Mak Keng Seng (LTA)

Dr Muhamad Azfar Ramli (IHPC)

Dr Jasmine Lau (SEC)

Prof Sing Tien Foo (NUS)

A/Prof Lynette Cheah (SUTD)

CENTRE for
LiveableCities
SINGAPORE

Day 6
Tuesday, 3 October 2023
CLC Training Room, The URA Center, 45 Maxwell Road #08-01, S069118

These workshop sessions focus on conceptual frameworks and tools useful for urban planning. Prof Long Ying will elaborate that the New City Science is critical in transforming cities. Dr John Sweeney will expose participants to the urban participatory futures workshop, a gamification technique of foresight exercise for long-term planning. Dr Philip Rode applies a different lens, hyperlocal, in planning.

9:30 – 10:00
Registration & Tea

10:00 – 12:00
The New City Science: Technologies, data, city evolution, and application

A/Prof Long Ying (Tsinghua University)

In recent years, the Fourth Industrial Revolution, which relies on the convergence of computers and communications, is now transforming our cities with a range of disruptive technologies such as artificial intelligence, big data, and the mobile Internet. Then the new city science including both the new science of cities and the science of new cities is emerging and co-evoluting. This session will elaborate efforts on both the new science of cities and the science of new cities, together with their application showcases in developing future cities.

13:00 – 13:30
Registration & Tea

13:30 – 15:30
Urban Participatory Futures: A Game for Using Foresight to Create Impact

Dr John Sweeney (Westminster University)

In this workshop participants will get to know an open-source game built to inspire and provoke. Learn to play the "Our Futures" game to take on 21st-century challenges and develop out-of-the-box ideas for developing participatory futures. The game "Our Futures" was designed to help us collectively explore answers to the above question and pose those we have not considered. To help us expand our horizons of how we conceive participatory futures and design more inclusive and impactful participatory futures for us all. This workshop provides an overview of research on participatory futures, including global cases, and, most importantly, offers a hands-on opportunity for participants to play, localise, and mutate our futures.

16:00 – 17:00
Hyper Locality in Planning

Dr Philipp Rode (London School of Economics)

Can cities be hyperlocal? A high share of voluntary local trips without city-wide access restrictions in terms of travel time, costs and other mobility service parameters may be quite desirable. Clearly, any constraints in accessing the wider city and having to stay local with limited local opportunities is socially and economically problematic. A high share of longer, regional trips – or hypermobility – may not be something a city-region wants to aspire to. This contribution considers how contemporary compact city planning is operationalising ideas like the 15 min city paradigm while recognising the importance of city-wide access and integration.

CENTRE for
LiveableCities
SINGAPORE

Day 9
Friday, 6 October 2023
MND Function Room, 5 Maxwell Road #23-00 MND Building, S069110

These workshop sessions presents strategies for decarbonising cities. Prof Arno Schlueter introduces an analytical tool called City Energy Analyst for urban based decision making. Prof Carlo Ratti and Mr Luca Bussolino will present the concept 'Cool Heart' Singapore based on the award winning project 'Hot Heart' for Helsinki.

13:00 – 13:30
Registration & Tea

13:30 – 13:40
Closing Address
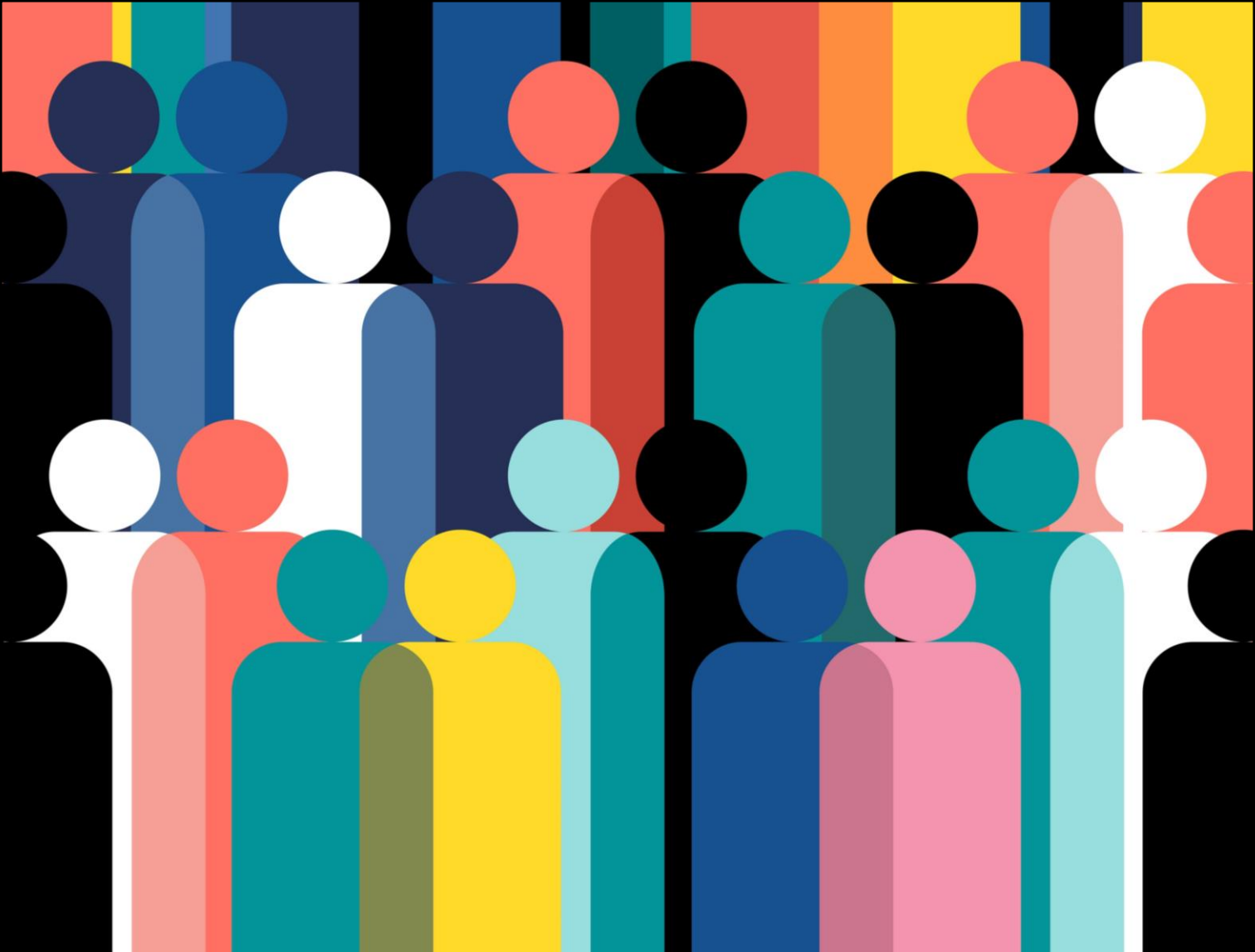*Mr Hugh Lim (Executive Director, CLC)*

13:40 – 15:40
Integrating Energy and Emissions in Urban Design Decisions

*Prof Arno Schlueter
(ETH Zurich)*

The workshop's first part offers an in-depth exploration of key topics, highlighting the critical nexus between energy use, urban program, form and technology. To illuminate these concepts, real-world case studies from two distinct urban contexts – Switzerland and Singapore – will be presented, showcasing how differing urban design decisions impact energy consumption and emissions profiles. The second part of the workshop takes a practical approach to the integration of energy and emissions considerations in urban design. Participants will be introduced to cutting-edge analytics toolsets tailored for evidence-based decision making in urban planning. The focal point of this segment will be the "City Energy Analyst," a software that facilitates the integration of energy systems and emissions data into the urban design process. Through a walkthrough, participants will experience the modeling and design process and interactively discuss potentials, challenges and insights gained. Looking forward, the workshop will touch upon the horizon of data-driven and machine-learning based analytical methods. To illustrate the design perspective, this outlook will be enriched by design examples from Master student projects from ETH Zürich focused on urban retrofit and densification in Zurich. These real-world projects will showcase how analytics-driven strategies can be practically implemented to achieve sustainable urban transformation.

16:00 – 18:00
"Cool Heart" for Singapore

Mr Luca Bussolino (Carlo Ratti Associati)
Prof Carlo Ratti (MIT Media Lab)

CENTRE for
LiveableCities
SINGAPORE

Singapore government agency officers, industry practitioners, academic faculty, and research fellows may register via

https://go.gov.sg/urban-science-2023

Registration closes on 8 September 2023, Friday

**Urban Science Workshop Series
is jointly organised by:**

Centre for Liveable Cities
Urban Redevelopment Authority
Singapore ETH Centre Future Cities Laboratory Global
NRF CREATE

Supported by:

NTU, SUTD, NUS Urban Analytics Lab, NUS Cities, CNRS@CREATE, IHPC, TUMCREATE, CASA UCL, London School of Economics, Tsinghua University, Westminster University, ETH Zurich, University of Chicago Mansueto Institute and MIT Media Lab

CENTRE for
LiveableCities
SINGAPORE