Applied Urban Modelling 2020 (AUM2020): Modelling the New Urban World

Online global workshop, 28 January 2021

Session particulars

Hosted by Martin Centre for Architectural and Urban Studies, University of Cambridge
(working version 3.1 updated on 27 January 2021)

Session 1: City analytics (1)

Speaker Location(s) and time

Speaker Location(s): Oceania
UK time: 3-5am (GMT)
Local time: 2-4pm (GMT+11 / Sydney)

Session outline

1. Familiar strangers and urban analytics: mapping, measuring and monitoring
   Jonathan Corcoran (The University of Queensland)

2. Vertical Land Use Mix and Industrial Ecosystem
   Hoon Han (University of New South Wale)

3. Polycentric urban growth and evolving access to jobs and social infrastructure: the role of new data sources, and implications of unexpected extreme events (e.g. COVID-19)
   Somwrita Sarkar (University of Sydney)

Convenor: **Christopher Pettit (University of New South Wales)**
Discussant: **Sharon Biermann (University of Western Australia)**
Host: **Ying Jin (University of Cambridge)**

Bios of speakers, discussants and chair

Jonathan Corcoran 	is Professor of Human Geography at the School of Earth and Environmental Sciences, The University of Queensland https://sees.uq.edu.au/profile/9224/jonathan-corcoran
Hoon Han 	is Associate Professor and Director of City Planning Program at the University of New South Wale https://www.be.unsw.edu.au/staff/associate-professor-hoon-han
Somwrita Sarkar 	is Senior Lecturer at School of Architecture, Design and Planning, The University of Sydney https://www.sydney.edu.au/architecture/about/our-people/academic-staff/somwrita-sarkar.html#collapseprofileprojects
Christopher Pettit 	is Professor and the inaugural Chair of Urban Science at the University of New South Wales https://cityfutures.be.unsw.edu.au/about-us/our-profiles/christopher-pettit/
Sharon Biermann 	is Professor and Director of the Planning and Transport Research Centre (PATREC), hosted at the University of Western Australia https://research-repository.uwa.edu.au/en/persons/sharon-biermann

Ying Jin 	is a University Reader in Architecture and Urbanism at Dept of Architecture, University of Cambridge, and Lead Convenor of the AUM symposia since 2011 https://www.arct.cam.ac.uk/people/yj242@cam.ac.uk

Abstract (Jonathan Corcoran)

SHORT ABSTRACT:

Our everyday urban lives often entail encountering a familiar stranger – this is someone who we recognise but have never spoken to – a phenomenon known to hold important social benefits. The emergence of large scale big data sources present new and exciting opportunities as well as computational challenges through which we can both capture and measure familiar strangers across metropolises. This presentation will draw on one source of big data – a large transit smart card database –and reveal how familiar stranger encounters are important in shaping opportunities for crime within the context of a transit environment.

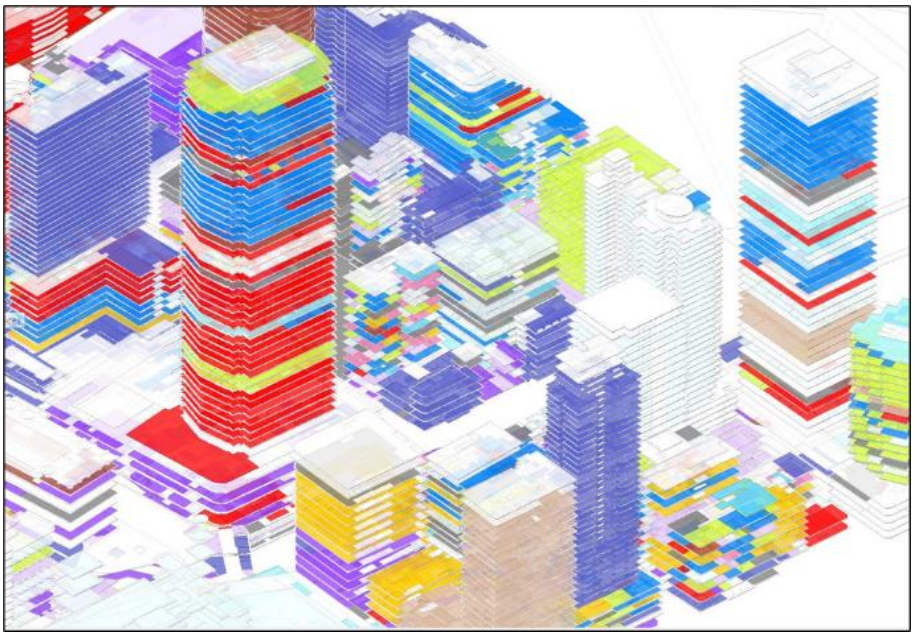
READ MORE:

Urban environments are a complex myriad of places that we routinely share with our fellow urbanites through daily

travel. It is within these places we routinely frequent that we may encounter people we recognise but have never spoken to – the so called, familiar stranger. In 1972 well-known sociologist Stanley Milgram conducted a study of familiar strangers on a train platform, his findings highlighted that 89 percent of the people surveyed recognised at least one other individual (Milgram, 1972). A rich scholarship in the social sciences highlights that familiarity confers a suite of important social benefits in its capacity to nurture a sense of common identity, trust and shared understandings of behavioural expectations (Jacobs, 1992; Gehl, 2011). As such it follows that the capacity to map, model and monitor the location, timing and intensity of familiar strangers across places that comprise an urban setting it an important first step to understanding environmental settings conducive of this relation and ways in which to exploit its social utility.

The emergence of large scale big data sources present new and exciting opportunities as well as computational challenges through which we can both capture and measure familiar strangers across metropolises. Scholar have begun to seize this opportunity have begun to enumerate familiar stranger in transit environments including China (Zhou et al., 2018), Singapore (Sun et al., 2013), Andorra (Leng, 2018) and Brisbane (Zahnow et al., 2020). We argue that the enumeration of big data must be coupled with a comprehensive theoretical framework to understand the social value of FS in the context of a transit network and society more broadly. It is hoped that this study adds to a growing interest in this area and goes some way to seeding new avenues of enquiry that seek to unpack the social meaning and value of familiar stranger encounters – an everyday phenomenon that are rather silently embedded with our daily travel experiences.

Abstract (Hoon Han)



Economic restructuring has significantly affected the industrial ecosystem and land use planning in world cities. Over the past decades urban planners, industrial ecologists and economic geographers investigated a sustainable form of

industrial ecosystem in certain regions by examining a group of companies, or industry clusters, coordinate their resource management and inter-related activities to maximise collective economic and environmental benefit (Ashton, 2009). For instance, the death of certain industries (e.g. labour-intensive manufacturing) from global economic restructuring, with declining post-industrial towns, and the emergence of technological innovation replacing conventional jobs by automation and specialised jobs by AI have both led to new forms of industrial ecosystem in global cities.

Some urban scientists and geographers in the study area interpreted industrial ecosystem within the broader context of agglomeration economy and comparative advantage of one industry over the others. They defined industrial ecosystem as complex systems which dynamic interactions among industrial actors and exogenous forces cause relational structures to develop and evolve over time, and in a long term it is adjustable to the system's sustainability. Existing studies in industrial ecosystem focus on patterns of horizontal land or industrial mix in certain regions or precincts.

There is limited understanding of vertical mixed use within high rise buildings such as office buildings, particularly in CBDs where high rise buildings are built on the use of valuable and constrained land.

Abstract (Somwrita Sarkar)

SHORT ABSTRACT:

Ease of access to jobs, a well-balanced accessibility profile between residential/housing profiles and labour markets, and ease of access to basic social infrastructure (e.g. schools, hospitals, libraries, parks etc.) is critical to liveability and community wellbeing in well-functioning cities. In this talk, I present work that brings together new big data sources, combined with traditional ones, to develop new analytic methods for measuring polycentric urban growth, fine spatio-temporal scale population estimation based on on-going building activity in rapidly growing cities followed by accessibility computations to jobs, labour, and developing social infrastructure in these fast-changing urban areas. I will discuss the importance of these new data sources for fast planning and monitoring of urban growth and polycentric development, how extreme unexpected events such as COVID can unexpectedly affect modelling and estimation processes, with a view to thereby developing more adaptive, responsive, and resilient models and algorithms.

READ MORE:

Social and community infrastructure is critical to the effective functioning of rapidly growing urban areas. However, in some urban and policy contexts such as Australia, rapid building activity, residential development, and population growth lead at a rapid and spatially bursty pace, whereas the delivery of social infrastructure lags behind. Further, while rapid residential development occurs at peripheries of large cities, jobs might continue to concentrate in established centres. This affects the efficiency, equity and liveability aspects of fast changing urban areas, as poor accessibility to jobs or to social infrastructure translates to a poorly functioning city. In a continuing large-scale project on relating urban growth and polycentric development to measuring performance of urban areas, we use very fine scale accessibility computations to jobs, labour, and social infrastructure as an enabling analytic tool. We work with

new data sources at very fine spatio-temporal scales (e.g. GeoScape building footprints of approximately 15 million data points across Australia 2019-2020, Open Street Map data, and 2019 median speed links on every road link across Australia), combined with traditional data sources (e.g. mesh block level census data). New analytic methods and indices are developed to track and evaluate polycentric urban development, estimate population at fine spatio-temporal scales, and compute access to jobs, labour, and social infrastructure in rapidly growing urban areas at the peripheries of large Australian cities. The importance of these new data sources in enabling a reliable and fast evidence-base for planning and policy is discussed. In addition, the role of extreme but unexpected events like COVID that can suddenly affect local population and demographic change is discussed, with a view to reflecting upon how analytic methods based on big data research can aid in the design of more adaptive, responsive, and resilient models and algorithms.

Session 2: City analytics (2)

Speaker Location(s) and time

Speaker Location(s): China
UK time: 5-7am (GMT)
Local time: 1-3pm (GMT+8 / China)

Session outline

1. Growing Trend of New First-Tier Cities in China through Big Data: Breakthrough, Diversity and Innovation
   Jieling Che (The Rising Lab, China Business Network)

2. Hangzhou's "city brain": a bureaucratic reform about to come?
   Frank Zhao (Shanghai MetroData Tech)

3. The Practice of Community Governance on Shuangjing International Sustainable Development Community Pilot Based on New Urban Science
   Haokun Fu (Beijing UrbanXYZ Technology Co., Ltd)

Convenor: **Qizhao Mao (Tsinghua University)**
Discussant: **Haixiao Pan (Tongji University)**
Host: **Tianren Yang (University of Cambridge)**

Bios of speakers, discussant and chair

Jieling Che 	is the Consulting Director at the Rising Lab, China Business Network https://www.cbnweek.com/topics/10
Frank Zhao 	is a project manager at Shanghai MetroData Tech https://www.metrodata.cn/

Haokun Fu 	is the Director of Planning Consulting Department at Beijing UrbanXYZ Technology Co., Ltd. http://www.urbanxyz.com/
Qizhi Mao 	is Professor of Urban Planning and Design and Associate Dean in the School of Architecture at Tsinghua University http://www.arch.tsinghua.edu.cn/info/FUrban%20Planning%20and%20Design/1761
Haixiao Pan 	is Professor of Urban Planning at the College of Architecture and Urban Planning, Tongji University https://upd-caup.tongji.edu.cn/phx/list.htm
Tianren Yang 	is a postdoctoral research associate in urban modelling at the University of Cambridge and a co-Convenor of AUM2020 and several past AUM symposia https://www.arct.cam.ac.uk/people/tianren-yang-1

Abstract (Jieling Che)

SHORT ABSTRACT:

In the past five years, the Rising Lab of CBN has established a new set of evaluation system to select fifteen 'New First-Tier Cities' according to commercial, transport, consumption, demographic, infrastructure data that derived from the internet. These ranked cities are regarded as the sample of Chinese cities in the new era, representing the characteristic urban forms, the trendy lifestyles, as well as the surging economic power.

READ MORE:

We will describe the development trend of these 'new first-tier cities' by three key words: Breakthrough, Diversity, and Innovation.

The first key word 'Breakthrough' is evident in the rapid rise of the big cities located in the West of the country. Represented by Chengdu, Chongqing and Xi'an, these cities act as transport hubs and have witnessed a constantly increasing level of influence and attractiveness in the past five years. They embrace commercial prosperity, social life vitality and relying on the urban activity by the various venues and infrastructure.

Second, 'Diversity' refers to the differentiation of the development modes that can be seen from these cities. For example, Chengdu and Chongqing largely rely on social media to facilitate city branding through short video like Tik Tok; Hangzhou, Xi'an and Changsha have created strong commercial brands that are able to reactivate local streets and mall. Apart from these, cities such as Hefei, Dongguan and Foshan are ranked because of their outstanding performance of innovative industry.

Third, we view 'Innovation' as the driving force of urban development. Today, innovative enterprises are demonstrating a pattern of agglomeration from single cities to city clusters. Besides, as can be seen from Tianjin, Dongguan and Suzhou, these new first-tier cities with strong innovation and relatively low living costs are gradually taking over the traditional first-tier cities to become the prioritized choices for the young generation.

Abstract (Frank Zhao)

SHORT ABSTACT:

China officially has put "smart cities" as part of its national strategy in 2013. In the past seven years, we can see the constructions of smart cities in every region of the country. This short presentation will focus on Hangzhou's "city brain" project as a case study.

READ MORE:

Hangzhou started its "city brain" project in 2016. Five years have passed, the "city brain" has become a model project consistently praised by the Central Government. What is the "city brain"? What has the project accomplished so far? Are there any problems?

This short presentation will review the history of the "city brain." Explain the unique organizing structure of the "Hangzhou Model." We will provide examples of the smart applications/services that have been using. We will also point out the shortcomings and obstacles of the "city brain."

In the end, we argue there has to be a bureaucratic reform for the "city brain" to nourish completely. So do China's smart cities in general. Moreover, once the "city brain" reaches its full potential, we might witness another "Moses - Jacobs" or even a "planned - market" debate.

Abstract (Haokun Fu)

SHORT ABSTRACT:

In 2019, Shuangjing Neighbourhood, Chaoyang District, Beijing was selected as the UN-Habitat International Sustainable Development Pilot Community, which is the first community-level pilot in China. To achieve the Polit purpose, under the support of the Community Duty Planner, Shuangjing carried out an implementation plan including 18 action projects and attempted to apply New Urban Science Theory and urban analytics methodology in Community Governance. Within a year, several accomplishments are generated and several improvements in the level of sustainable development in Shuangjing is highly recognized. The talk focuses on the community practice Shuangjing Subdistrict, Chaoyang District, Beijing.

READ MORE:

In 2019, Shuangjing Neighbourhood, Chaoyang District, Beijing was selected as the UN-Habitat International Sustainable Development Pilot Community, became the first neighbourhood-level pilot in China.

As the Community Duty Planer of Shuangjing Neighborhood, Beijing UrbanXYZ Technology Co., Ltd. has been deeply involving in the practice of sustainable community governance in Shuangjing. The plan of action was divided into few stages. In the beginning, the project group conducted a systematic big-data evaluation to examine the level of sustainability of Shuangjing according to the standard of SDG11 (Sustainable Development Goals 11: Make Cities Inclusive, Safe, Resilient and Sustainable). Based on the result, the project group concluded an implementation plan, which involves 18 action projects and covers the variable aspects of community governance, including Neighbourhood Renewal, Livelihood Security, Collaboration & Participation, and Refined Management. The action projects effectively responses the requirement of SDG11.

Afterwards, the project group carried out the 18 projects one by one. They developed a system platform of smart governance to support the improvement of refined governance. The New Urban Science Theory and urban analytics methodology are vitally attempted in the project. Also, in the aspect of refined management, they installed several mobile environmental monitoring sensors on law enforcement duty cars. The sensors could perceive the abnormity of PM2.5 and PM10, odours, and noises on the street. The perceived data efficiently support the urban management department to solve the environmental problems. In the aspect of neighbourhood renewal, the project team designed the public space based on the simulation result on MaaS with NetLogo, which significantly improved the utility of the space.

Within a year, Shuangjing Neighbourhood has been obtained the remarkable achievement and deservedly received the certificate of the UN-Habitat International Sustainable Development Pilot Community in November 2020. Based on the result of annually urban evaluation criteria, several improvements in the level of sustainable development in Shuangjing are recognized. especially “planning and public participation”, “environmental governance” and “public space”.

The talk will go over the major practices of community governance in Shuangjing Neighbourhood, focuses on the smart governance specifically.

Session 3: Urban transport in societal context

Speaker Location(s) and time

Speaker Location(s): Japan and South East Asia
UK time: 7-9am (GMT)
Local time: 4-6pm (GMT+9 / Japan) and 2-4pm (GMT+7 / Bangkok)

Session outline

1. Economic growth, urbanisation, motorisation and environment nexus – An international perspective
   Yoshitsugu Hayashi (Chubu University)

2. New-Normal Residential Preference in Bangkok
   Varameth Vichiensan (Kasetsart University)

3. Modeling of interactions between land use and transport from a behavioral and psychological perspective – Research overview
   Junyi Zhang (Hiroshima University) and Baoxin Zhai (Tongji University & Hiroshima University)

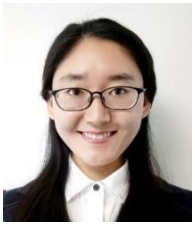
4. A Sufficiency based Spatial-temporal Planning for Daily Activity-travel Supporting New Normal for Flexible Working
   Witsarut Achariyaviriya, Yoshitsugu Hayashi and Hiroyuki Takeshita (Chubu University)

5. Spatial Scenarios of Urban Core Functions under the Railway Extension: Case of Bangkok, Thailand
   Masanobu Kii (Kagawa University) and Varameth Vichiensan (Kasetsart University)

6. Lifestyle changes and transport – land use innovation in Bangkok
   Apiwat Ratanawaraha (Chulalongkorn University)

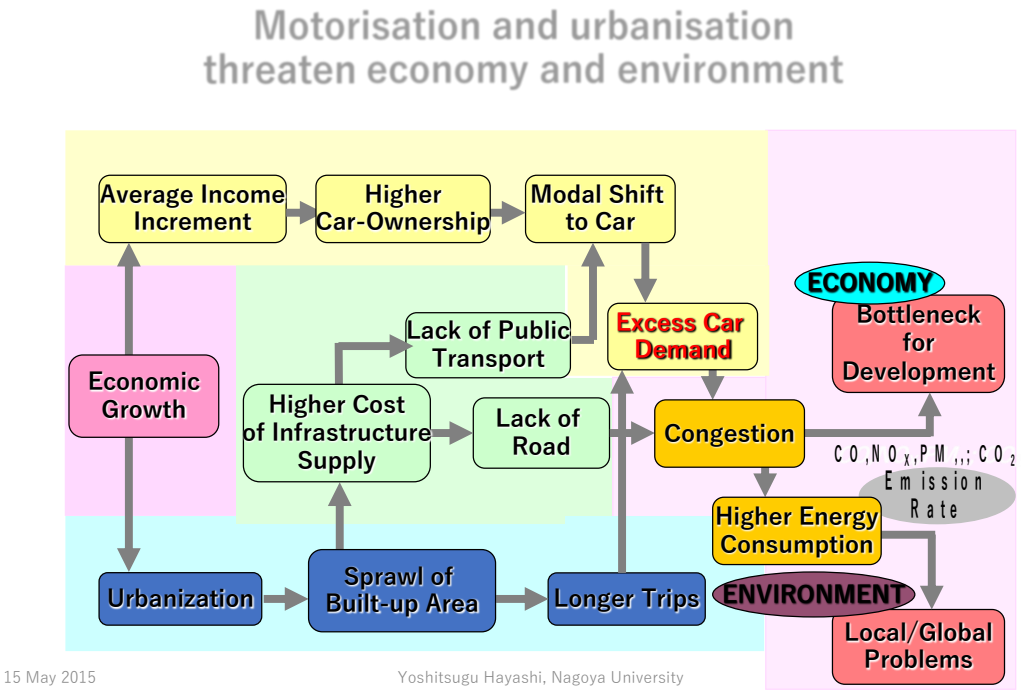
Convenor: **Yoshitsugu Hayashi (Chubu University)**
Discussant: **Kazuki Nakamura (Meijo University)** and **Hiroyuki Takeshita (Chubu University)**
Host: **Ying Jin (University of Cambridge)**

Bios of speakers, discussant and chair

Yoshitsugu Hayashi 	is Professor of Chubu University, Japan and President of WCTRS (World Conference on Transport Research Society) https://www.chubu.ac.jp/english/faculty/profile/e58c884102c72ef784f23209024797be2c274bed.html
Varameth Vichiensan 	is an Associate Professor and head of Center for Logistics Engineering Technology & Management, Faculty of Engineering, Kasetsart University http://pirun.ku.ac.th/~fengvmv/people.htm
Junyi Zhang 	is Professor at the Graduate School for International Development and Cooperation, Hiroshima University https://seeds.office.hiroshima-u.ac.jp/profile/en.0eca0b2f387646e6520e17560c007669.html
Baoxin Zhai 	is a Doctoral student at Tongji University https://www.researchgate.net/profile/Baoxin_Zhai
Witsarut Achariyaviriya	is from the Department of Constructional Engineering, Chubu University https://www.researchgate.net/profile/Witsarut_Achariyaviriya
Masanobu Kii 	is Professor at the Faculty of Engineering and design, Kagawa University https://www.researchgate.net/profile/Masanobu_Kii

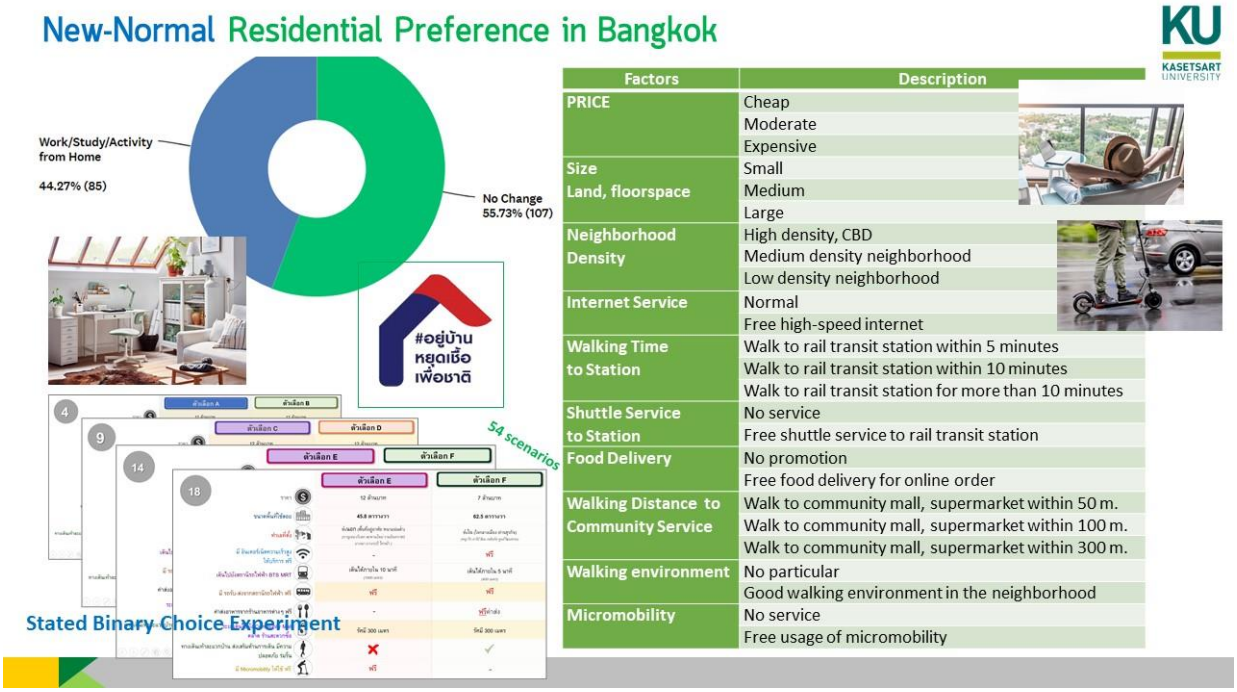
Apiwat Ratanawaraha 	is Assistant Professor at the Department of Urban and Regional Planning, Chulalongkorn University in Bangkok https://www.rockefellerfoundation.org/profile/apiwat-ratanawaraha/
Ying Jin 	is a University Reader in Architecture and Urbanism at Dept of Architecture, University of Cambridge, and Lead Convenor of the AUM symposia since 2011 https://www.arct.cam.ac.uk/people/yj242@cam.ac.uk
Kazuki Nakamura 	is Associate Professor at the Department of Civil Engineering, Meijo University https://kyoinjoho.meijo-u.ac.jp/search/profile/en.ca59624ec9d42d68.html
Hiroyuki Takeshita	is a Senior Assistant Professor for Special Programs, Chubu University https://www.researchgate.net/profile/Hiroyuki_Takeshita

Abstract (Yoshitsugu Hayashi)



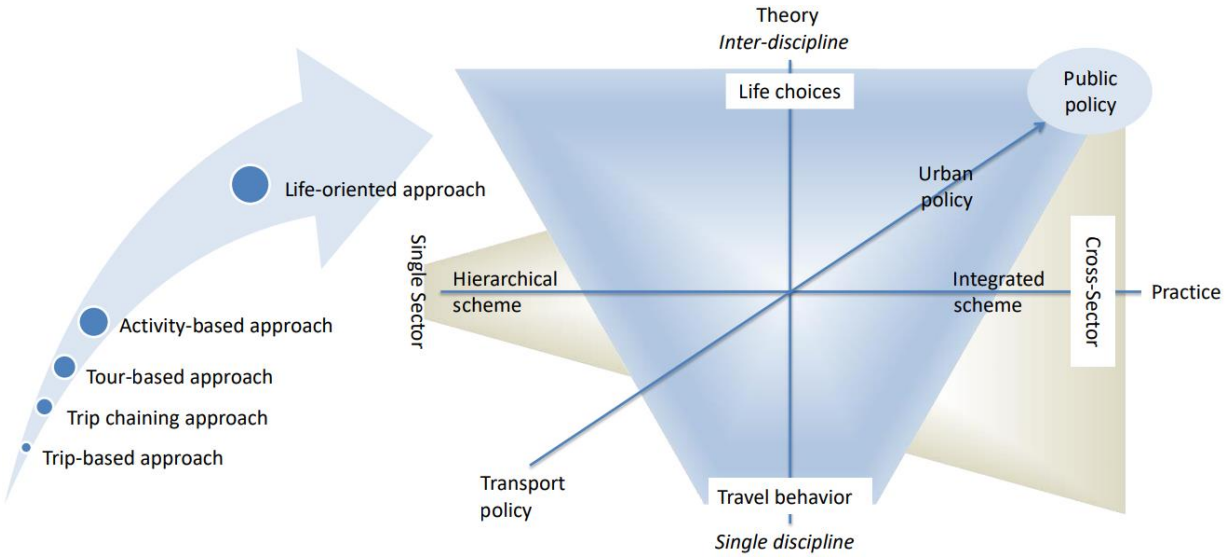
In land use – transport planning, we need to recognise which economic development stage we are in and how the next era will be. Economic growth triggers urbanisation, namely population increase in cities caused by migration from rural areas. Economic growth also increases personal income which promotes the motorisation. The speed of car ownership growth is usually much faster than road infrastructure improvement because cars are much cheaper than the cost of constructing and maintaining the road space for a car to run. This simple mechanism creates serious traffic congestion, economic loss, air pollution and greenhouse gas. However, it is not well recognised by politicians and policymakers in many countries. The implications of the mechanism mentioned above will be discussed in the presentation.

Abstract (Varameth Vichiensan)



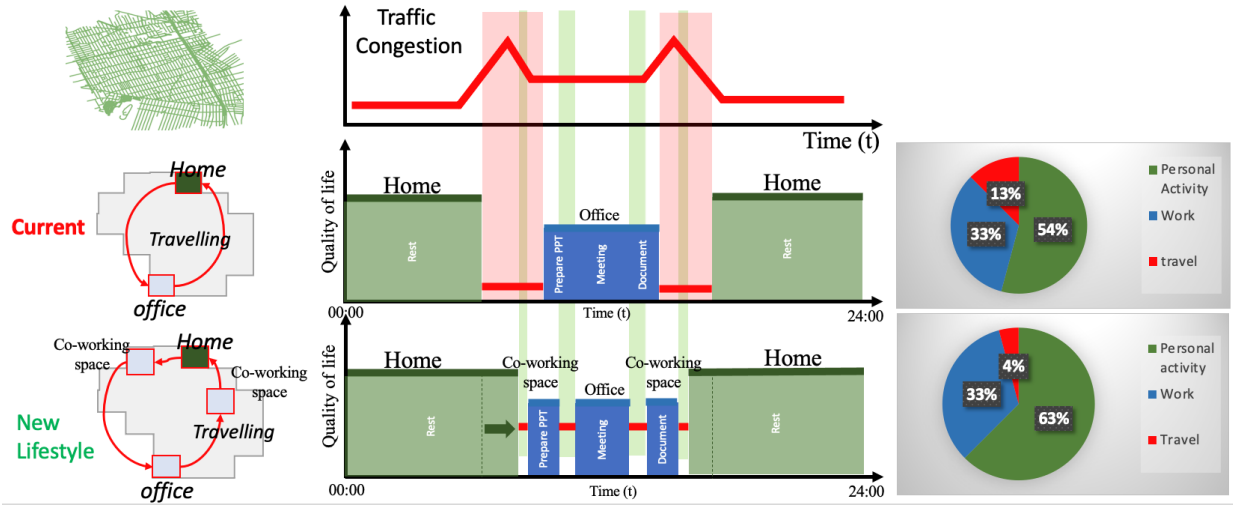
Because of the coronavirus pandemic, more people are spending time at home, where they adapt to do more various activities such as work, learn, enjoy relaxing than before. A questionnaire survey on residential preference were conducted with valid 164 respondents. It is found that nearly half of them changed and had their main activity done at home. Having extra time for doing activities that were not possible in the pre-COVID19 period are favored. This lifestyle change likely influences change in residential preference. The objective of the study is to examine factors that influence residential choices in which the respondents have experienced COVID-19 pandemic situation. Variation of preferences among different respondents having different socioeconomic characteristics and tastes or attitudes are also examined. Binary choice situation was experimented based on stated preference. 3 choice tasks were conducted for each respondent. House attributes are price, size, and location. Amenity or service attributes are free high-speed internet, free food delivery, free shuttle bus to railway station, and free micromobility. Locational attributes are proximity to railway station, proximity to neighborhood or local shops, and the neighborhood walking environment. The result of multinomial logit models reveals different preference for different income group, e.g., walking environment is preferable for high-income group while neighborhood or local store is desired for medium-income group.

Abstract (Junyi Zhang)



This research reviews existing studies to explore further possibilities of modelling land use and transport interactions from a behavioral and psychological perspective. First, we describe travel behavior in the context of the built environment, summarize features of travel behavior decision-making, and overview researches on social psychology related to travel and other behaviors in life. Second, associations between travel behavior and other life choice behaviors (residential behavior, work, household budget, energy consumption, health, neighborhood, education and learning, household life, leisure and recreation) are illustrated, linking with social psychological research. Third, research based on the life-oriented approach for addressing the interactions between land use and transport is introduced, especially focusing on multiple self-selection issues, life-course interactions, and multiple behavioral changes. Finally, some key findings and future research issues are summarized.

Abstract (Witsarut Achariyaviriya)



SHORT ABSTRACT:

Many megacities in the world, especially Bangkok, are facing severe congestion in road traffic and public transport, particularly during peak hours. This situation causes worsen the quality of life and emissions causing air pollution and climate change. Applying ICT-based solutions to reform people's activities and travels is an alternative solution. Mobility as a Service (MaaS) is one of the solutions that persuade people to use public modes of transport. However, the transport mode shift means of the MaaS concept is not enough to mitigate peak-hours congestion, which the source of the problem is caused by people's activities such as traditional 9-to-5 working. Therefore, ICT can be utilized to induce not only transport mode shift but also workplace shift and working time shift in terms of the daily activity-travel planning service

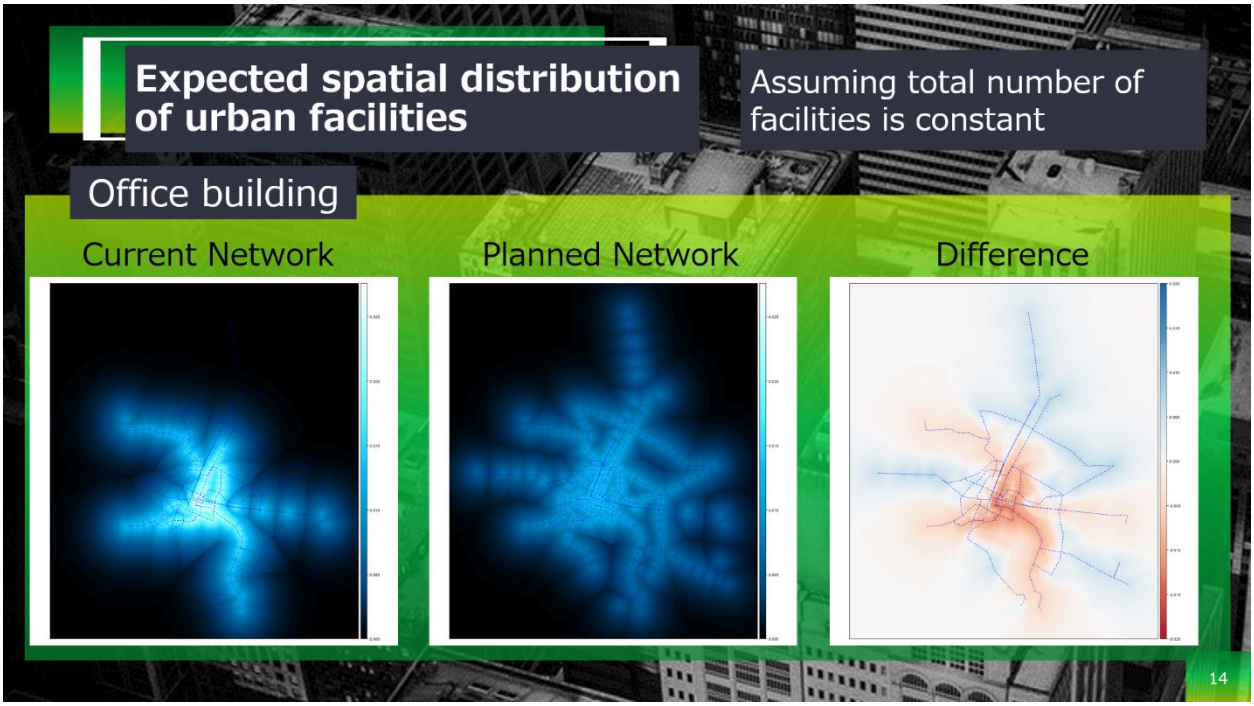
READ MORE:

For a long time, the government has expanded roads and railways to relieve traffic congestion. But still cannot solve the problem completely. This way began to enter a dead-end due to the limited land area and also budget. The traveling behavior of people using personal cars is ineffective and non-sense to encourage. Shifting people to a public transportation system is one of the solutions, reducing the burden on transport infrastructure and the environment. Recently, the MaaS concept has been introduced. This concept aims to shift from personally owned modes of transport towards public modes and shared modes of transport by providing an integrated system of transport modes and related services via ICT platform to afford maximum convenience for users. It has been pilot tested and implemented in many countries, which reveals that MaaS has the potential for shifting people to public transport.

However, it is only a partial solution for changing traveling behavior limited to consideration of transport modes. As long as people's activity places and timings remain unchanged, travel demand at peak-hour is still high, resulting in unnecessary social cost and worsen people's quality of life. During the peak hours of the day, there are a large number of people traveling, including public transport, in which government and service providers need to procure massive land for right of ways for railways and roads, additional transport operation staff, and numerous facilities (such as station, buses, train cars, etc.) enough for the passenger volume and the social distancing. But off-peak hours, those resources are not fully utilized, and many opportunity costs are created.

Therefore, the flexible working lifestyle that people can design or partially design their workplaces and timings has the potential to solve the peak traffic congestion problem. To enable this new normal lifestyle, an ICT-based system like activity-travel planning and recommendation has the capability to accelerate lifestyle shift from traditional 9-to-5 working to flexible working by allowing flexible input of activity's place and/or timing conditions that system can provide alternative place or timing for higher utility.

Abstract (Masanobu Kii)



SHORT ABSTRACT:

The city center is an essential component of urban structure that rules urban activities. In Bangkok, Thailand, the railway network is expanding that is expected to affect the city center locations. In this study, we estimate the effect of public transport network on the accumulation of three types of urban core facilities based on the spatial statistical approach, that leads to the future perspective of locations of those facilities. As a result, the expected number of facilities in the current urban core in Bangkok decreases and the number of facilities at stations on the planned network increases under certain conditions.

READ MORE:

The location of the center of the city is one of the essential components of urban structure that rules urban activities including economy, transport, and social interactions. A city center is a significant place of those activities where people, information, and traffic are concentrated, and most of the world's large cities are facing severe congestion problems. Bangkok in Thailand is one of those cities facing the worst level of traffic congestion and high rise of land rent at the city center. In Bangkok, the urban core functions like financial services and hotels for business conventions are highly concentrated at the city center that causes massive traffic flow into the area for commuting, business trips, as well as private activities including shopping and tourism. Since the opening of the first urban railway BTS in 1999 and the consequent provision of the other railways, the worst road congestions had been avoided by the modal shift from road transport to railways. However, those improvements stimulate the further agglomerations of the urban core functions and construction of those facilities in the spheres of the train station which causes further traffic flow into the existing urban cores and congestions on both roads and trains.

Thai government endorsed the Mass Rapid Transit Master Plan (MMAP) in Bangkok Metropolitan Region in 2010 that designates 8 routes 556km by 2029. Currently, 124km are in service and 169km are under construction. As experienced in the other countries, provision or extension of the railway line is expected to induce urban development along the line and increase the access to the connecting stations to the other railways. When this accessibility improvement is enough high to attract demand for the railway users, it will induce the location of urban functions. The accumulation of these functions will form the sub-center. Therefore, the future construction of a planned railway network may trigger the emergence of new urban cores that would possibly disperse the concentrated activities on the existing urban core and may contribute to alleviating the congestion at the current city center.

Our purpose in this study is to 1) capture the effect of public transport networks on the accumulation of urban function in the city center and 2) estimate the future perspective of urban cores induced by the construction of a planned railway network based on the captured mechanism. To represent the effect of the public transport network, first, we employ network centrality indices in graph theory. Using the indices, we quantify the centrality of each station for the current and planned railway network. Second, we quantify the spatial accumulation of urban function based on the Point of Interest data for urban services. Third, we analyze the effect of network centrality of the stations on locations of urban services considering the decay of centrality effect on the location by distance. Finally, we estimate the future perspective of urban core locations under the planned railway network in MMAP.

BACKGROUND READING:

Kii, M., Peungnumsai, A., Vichiensan, V. and Miyazaki, H., 2019, December. Effect of Public Transport Network on Urban Core and the Future Perspective in Bangkok, Thailand. In *2019 First International Conference on Smart Technology & Urban Development (STUD)* (pp. 1-5). IEEE. DOI: 10.1109/STUD49732.2019.9018769

Abstract (Apiwat Ratanawaraha)

Urban life in Bangkok is currently undergoing a multitude of drastic changes due to a suite of socio-demographic, technological, and economic factors. In this talk, I will present key findings from an ongoing research project entitled “The Futures of Thai Urban Life,” including key drivers of change, baseline future, and alternative scenarios of urban life in the city. I will then discuss the implications for transport-land use planning in the megacity.

Session 4: Modelling methods (1)

Speaker Location(s) and time

Speaker Location(s): Europe
UK time: 9-11am (GMT)
Local time: 10-12am (GMT+1 / Switzerland and Sweden) and 11am-1pm (GMT+2 / Finland)

Session outline

1. Validating disaggregate models at an aggregate scale in a case study of mobility tool ownership in Switzerland
   Tim Hillel, Janody Pougala, Patrick Manser, and Wolfgang Scherr (École polytechnique fédérale de Lausanne (EPFL), Switzerland)

2. Healthy, resilient, livable cities? Evidence from Helsinki's 2018-19 heatwaves
   Athanasios Votsis, Reija Ruuhela, and Hilppa Gregow (Finnish Meteorological Institute)

3. Circular Economy meets Smart Cities: A general data model for waste flows in city regions
   Jonathan Cohen and Jorge Gil (Chalmers University of Technology)

4. Preparing offices for the age of distributed work. Evaluating the impacts of flexible designs in coping with the uncertain future demand for office space
   Claudio Martani, Noemi Fiorot, Andrea Gonzalz, Bryan T. Adey, and Joris Van Wezemael (ETH Zürich)

Discussant: **Michael Batty (University College London)**
Host: **Jamil Nur (University of Cambridge)**

Bios of speakers, discussant and chair

Tim Hillel 	is a postdoctoral researcher in the Transportation and Mobility Laboratory, EPFL https://people.epfl.ch/tim.hillel/?lang=en
Janody Pougala 	is a Doctoral assistant at the Transportation and Mobility Laboratory, EPFL https://personnes.epfl.ch/janody.pougala/?lang=en
Patrick Manser 	is from Swiss Federal Railways (SBB) https://scholar.google.com/citations?user=EYJkHbwAAAAJ&hl=de
Wolfgang Scherr 	is a product manager at SBB CFF FFS, Switzerland https://www.linkedin.com/in/wolfgangscherr/?originalSubdomain=ch
Athanasios Votsis 	is a Senior Researcher in the Finnish Meteorological Institute https://en.ilmatieteenlaitos.fi/cv-athanasios-votsis

Reija Ruuhela 	is a Senior Climate Expert in the Finnish Meteorological Institute https://en.ilmatieteenlaitos.fi/cv-reija-ruuhela
Hilppa Gregow 	is the Head of Unit (Weather and Climate Change Impact Research) in the Finnish Meteorological Institute https://en.ilmatieteenlaitos.fi/cv-hilppa-gregow
Jonathan Cohen 	is a Ph.D. candidate in Urban Informatics and Analytics at the Chalmers University of Technology https://www.chalmers.se/en/staff/Pages/Jonathan-Cohen.aspx
Jorge Gil 	is Assistant Professor in Urban Analytics and Informatics at the Chalmers University of Technology https://www.chalmers.se/en/staff/Pages/jorgegi.aspx
Claudio Martani 	is a Research Associate at the Infrastructural Management Group (IMG) in the Institute of Construction and Infrastructure Management of the ETH Zürich https://im.ibi.ethz.ch/en/people/lecturers/dr-claudio-martani.html
Noemi Fiorot	is a Master student in civil engineering at the ETH Zürich

Andrea Gonzalz 	is a Lecturer at the Department of Civil, Environmental and Geomatic Engineering, ETH Zürich https://irl.ethz.ch/people/person-detail.MjU3OTM2.TGlzdC8xNzM4LC0xMzk1OTgzMDM3.html
Bryan T. Adey 	is the Professor for Infrastructure Management, and the head of the Institute for Construction and Infrastructure Management, ETH Zürich https://im.ibi.ethz.ch/en/people/prof-dr-bryan-adey.html
Joris Van Wezemael 	is Associate Professor at the Department of Architecture, ETH Zürich https://doz.arch.ethz.ch/pd/vanwezemael.html
Michael Batty 	is Chairman of the Management Board of the Centre for Advanced Spatial Analysis (CASA) and Bartlett Professor of Planning (Emeritus) at University College London https://www.ucl.ac.uk/bartlett/casa/prof-michael-batty
Jamil Nur 	is a post-doctoral fellow at the Martin Centre for Architectural and Urban Studies at the University of Cambridge https://sites.google.com/site/jamilnurscpo/home

Abstract and background reading (Tim Hillel)

SHORT ABSTRACT:

This talk presents the estimation and validation of a new mobility-tools ownership model which explicitly models the interactions between individual and household-level decisions. We focus in particular on the how we validate the fully disaggregate modelling approach against aggregate spatial control totals, through applying the model to a synthetic population for Switzerland.

READ MORE:

Mobility behaviours are highly dependent on access to individual and shared mobility tools, including vehicles, driving licenses, and public transport subscriptions. It is therefore essential to accurately predict the ownership of mobility tools in order to ensure behavioural representivity in agent-based transport simulations. As part of a collaboration with the Swiss Federal Railways (SBB), we have recently implemented a new approach for predicting mobility tool availability, which models the interactions between individual and household-level decisions. Our method estimates sequential logit models of driving license, car, and public transport subscription ownership, using a machine learning assisted specification approach. This allows for a much deeper understanding of mobility tool availability at an individual and household level, allowing for the simulation of shared household mobility resources in the next generation of activity-based transport models.

In this talk, we will present our work to apply and validate this methodology as part SBB's nationwide microscopic agent-based transport model, SIMBA MOBi. The methodology is first applied to a new dataset combining individual and household level socio-economic details from the Swiss Mobility and Transport Microcensus (MTMC) with zonal level accessibility and parking data. The estimated model is then applied to a full-scale synthetic population for Switzerland. Empirical market counts are collected for every sequential model step, at different levels of aggregation, from regional (zonal) to national level. This approach enables formal external validation of the full modelling process (i.e. the application of the new ownership model to the synthetic population) against real-world control totals. The results show that our methodology is able to accurately represent the trends in mobility tool ownership within a synthetic population, though certain outliers which exist due to localised cultural differences are not well predicted. A low-level recalibration is then applied to ensure representivity of the results at high spatial resolution.

Abstract and background reading (Athanasios Votsis)

SHORT ABSTRACT:

Heat extremes are indicated by the IPCC as one of the key climate change impacts for cities around the world, whereas their inadequate treatment in the planning and management of the built environment has implications for urban resilience and livability. We present a study of the 2018-19 heatwave events in the Helsinki metropolitan region, discussing their spatiotemporal progression and vulnerability and exposure implications. We subsequently discuss that popular sustainability strategies can have pronounced conflicts with heatwave resilience, calling for a wider discussion on health, resilience, and livability in urban planning.

READ MORE:

Temperature extremes—along with human health and epidemiology issues, flooding, drought and water scarcity—have been indicated by the IPCC as the key climate change risks in cities and urban regions [1]. The frequency of their occurrence is expected to increase in numerous cities around the world, whereas the spatial patterns of their occurrence in the built environment have significant implications for numerous sustainability domains. Some examples are energy use and performance of buildings, mortality across different population groups, and emergency preparedness and disaster relief. Moreover, unequal exposure and vulnerability to temperature extremes across demographic groups has direct links to the UN's notion of systemic resilience [2]. As a result, cities are increasingly interested in including heatwave and urban heat island effect considerations into their planning process, often as part of climate adaptation-mitigation planning.

However, several sustainability targets have pronounced conflicts with heatwave resilience. Dense built environments are associated with increased mortality during heatwaves [3]; energy efficiency targets often result in dwelling stocks that are dangerous during heatwaves; nature-based solutions have dubious effects on less privileged citizens [4-5]; whereas bottom-up resilience and adaptation solutions, such as more flexible and informal concepts of urban space, have key conflicts with how real estate markets and planning institutions work. The ongoing COVID pandemic has also highlighted urban planning dilemmas that have pronounced similarities with heatwave dilemmas: built environments that are planned to be sustainable can suddenly emerge as unhealthy, non-resilient and unlivable, especially considering vulnerable groups such as the elderly and the poor.

In this presentation, we present evidence from the 2018-19 heatwaves in the Helsinki metropolitan region. We track the spatiotemporal evolution of the events and show that, while land use and density are important, other meteorological parameters—coastal dynamics and wind patterns in our case—bring older notions of climate architecture once more to relevance. Next, we use spatially disaggregate demographic data to discuss unequal exposure and vulnerability to the two heatwave events, detectable in a city that has been planned with social welfare and equality in mind. We conclude by returning to the aforementioned conflicts between heatwave resilience and other sustainability targets, raising attention to the need for a wider discussion on (a) the scope and evaluation criteria of planning and management of the built environment and (b) the possibilities that applied urban modelling might synergize with urban microclimate modelling [6].

BACKGROUND READING:

[1] Revi A et al. (2014). Urban areas, in Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects [Field CB et al. (eds.). Cambridge University Press, 535–612.

[2] Together 2030 Global Advocacy Group (2018). Sustainable, resilient and inclusive societies – the path towards transformation. Together 2030 written inputs to the UN High-Level Political Forum on Sustainable Development (HLPF) 2018.

[3] Sera F et al. (2019). How urban characteristics affect vulnerability to heat and cold: a multi-country analysis. Int. J. Epidemiology 48(4): 1101–1112.

[4] Blok A (2020). Urban green gentrification in an unequal world of climate change. Urban Studies. First published online January 21, 2020.

[5] Anquelovski I et al. (2016). Equity impacts of urban land use planning for climate adaptation: Critical perspectives from the Global North and South. J. Plan. Educ. Res. 36(3): 333–348.

[6] Masson V et al. (2020). City-descriptive input data for urban climate models: Model requirements, data sources and challenges. Urban Climate 31.

Abstract and background reading (Jonathan Cohen)

SHORT ABSTRACT:

Research is needed to understand how Circular Economy strategies can be applied to territorial planning and more important what will the trade-offs be of embracing such paradigm. The aims of this project are to explore how secondary resources (waste) flow in city-regions can be modeled, and to develop tools of analysis to assess the performance in terms of re use of waste materials. The focus of the presentation will be the general data model developed to handle waste flows in cities illustrated in a series of real-world cases.

READ MORE:

Local actors are crucial to meet the Sustainable Development Goals (SDGs), and Circular Economy (CE) strategies have the potential to tackle several of those SDGs. Research is needed to understand how these concepts can be incorporated into Urban and Reginal Planning and more importantly, what are the tradeoffs of adopting Circular Economy Strategies. This PhD project focuses on the flow of secondary resources (waste) in city-regions. As a result of an initial literature exploration, three knowledge gaps were identified: (i) in relation to information management, standardization and capture; (ii) in relation to localized key performance indicators (KPIs) and (iii) in relation to models and scenario building. Progress in these three components is crucial to understand how resources could be better utilized.

This project has been divided into 4 main components to address these challenges and contribute in the knowledge domain that intersect between Urban and Spatial Planning, Circular Economy and Spatial Data Science and Analytics. One main assumption of this project is that in order to improve the efficiency of material usage and reduce the damage to the environment, the flow of materials in any city-region need to be managed and the process of digitalization plays a major role. Digitalizing information and storing it using a general data model will provide a common knowledge base to explore scenarios and assess the performance of city-regions in terms of re-use of secondary resources. The processes of digitalization and standardization of information are key enablers to develop tools of analysis and localized KPIs.

Progress on the General Data Model of Waste Flows (GDMWF) will be presented at the conference. In this opportunity we will show how the data model can hold different data sources at different geographical scales. Given the complexity and diversity of the urban waste flow system, having a general data model is perceived as a necessary step towards building a robust agent-based model to simulate and calculate Key Performance Indicators (KPIs) of the system.

The GDMWF captures the relationship between different actors involved in the waste system: generation, transportation, transformation, storage and re-usage. Departing from a conceptual model that includes the basic

components of how waste flows in a city-region, a Unified Modelling Language (UML) class diagram is used to describe the system. Interviews with key actors related to (i) Municipal, (ii) Industrial and (iii) Construction Waste are used to validate and test the potential use of such model through a set of test cases. The interviews help to understand the different challenges that these local agencies face.

In parallel, these interviews contribute to advance the second stage of the project: data acquisition and processing. Obtaining data from local authorities helps to validate the formal model by understanding if more attributes are needed and where they should be contained.

The opportunity to present the general data model and how it can be used for different cases is important to receive valuable feedback, before moving forward to the scenario building and agent-based simulation phase.

Abstract and background reading (Claudio Martani)

SHORT ABSTRACT:

The potential growth in the home-office working mode poses a large uncertainty on the future demand for office space. Flexible offices can help limiting the negative effect of this uncertainty by allowing future changes of use, though they often cost more than traditional offices. To ensure that the investment in flexibility is proportioned to the risk it minimizes, the real options method is used in this work for modelling the uncertainty of future demand for office space and estimating its effect on stakeholders in the long-term. The method is tested on an example mixed-tenants office building in Zurich.

READ MORE:

The demand for office space is subject to a large uncertainty in the medium to long term, due to the growing momentum of home-office working mode. The COVID-19 crisis has proved that an extended use of the home-office working mode is possible, thanks to videoconferencing technology. Further, it is potentially even advantageous, reducing workers commuting time. To which extent this will become a trend after the pandemic it is though uncertain. What is certain is that, in case of a large transition to a home-office working mode, the current fixed configuration of most offices does not guarantee an adequate use of space. Co-working spaces might be better suited in the future to cope with a more distributed working mode. Though, these solutions are not adequate at present to accommodate the existing demand for traditional offices.

Flexible office configurations could help overcome the limitations of any rigid design (i.e. either fix traditional offices or fix co-working spaces) by postponing the final decision on the use until more information on needs becomes available. An example of a flexible design space might include offices predisposed to be easily converted into co-working spaces, or even into other uses (e.g. in residential units), depending on the future evolution of the demand for space. Such flexibility (i.e. the embedded options to convert the use of spaces) can facilitate the building owner, tenants and users, as well as the wider society in maximizing their benefits, while the needs to accommodate evolve. However, it must be considered that building flexible offices often requires substantial investments, i.e. embedding options to be triggered in the future can be expensive.

To ensure that these investments are made wisely, i.e. that the net benefit of all involved stakeholders are maximized, the use of the real options method is explored in this work, which allows modelling the uncertainty of

future demand for office space and simulating scenarios to estimate the effect of alternative designs in the long-term. The method is tested on an example mixed-tenants office building in Zurich for which ten designs are proposed and the triggering logic modelled. The designs have various degrees of flexibility and the triggering logic mimic the decisional criteria of a real owner. The results show that, under the investigated circumstances, a flexible design with movable walls to enable a periodic conversion of the unrented offices into co-working spaces, and with parceled technical elements to allow the conversion of long unrented offices into residential units, is the optimal decision for all involved stakeholders over the building's life. Conclusions on the strengths and limitations of using the real options method in this context are then drawn and an outlook of the envisioned future developments offered.

Session 5: Critical issues under rapid urbanisation

Speaker Location(s) and time

Speaker Location(s): India
UK time: 11am-1pm (GMT)
Local time: 4.30-6.30pm (GMT+5:30 / India)

Session outline

1. Reconceptualising Sustainable Mobility - The Housing Transport Nexus
   Darshini Mahadevia (Ahmedabad University)

2. Public Transport Accessibility and Planning Policy
   Bhargav Adhvaryu (Ahmedabad University)

3. Conceptualizing Slums and Cities as Networks: Implications for Urban Planning and Public Health
   Amit Patel (University of Massachusetts Boston)

4. India's Urban Water Infrastructure: Need for Policy on Permeability
   MS Raghavendra (Centre for VENUS & Ashoka School of Planning and Architecture)

5. Addressing Energy Consumption in India's Housing Infrastructure
   Shweta Manchanda (School of Planning and Architecture, New Delhi)

6. Technology as a Tool for Rapid Adaptive Response in Building Design and Construction
   CS Raghuram (Trilogue Studio and C R Narayana Rao Consultants)

Discussant: **Marcial Echenique (University of Cambridge)**
Host: **Steve Denman (University of Cambridge)**

Bios of speakers, discussant and chair

Darshini Mahadevia 	is Professor and Associate Dean (Arts) at the School of Arts and Sciences, Ahmedabad University https://ahduni.edu.in/academics/schools-centres/school-of-arts-and-sciences/faculty/darshini-mahadevia/

Bhargav Adhvaryu 	is a Professor of Urban Analytics, Sustainability, & Policy at the Amrut Mody School of Management, Ahmedabad University https://ahduni.edu.in/academics/schools-centres/amrut-mody-school-of-management/faculty/bhargav-adhvaryu/
Amit Patel 	is Assistant Professor of Public Policy and Public Affairs at the University of Massachusetts Boston https://www.umb.edu/faculty_staff/list/amit_patel
MS Raghavendra 	is the Founding Director of Centre for Vibrant Efficient Networked Urban Settlements (VENUS) and the Director at the Ashoka School of Architecture and Planning, Hyderabad http://centreforvenus.org/director.html
Shweta Manchanda 	is Associate Professor of Architecture at the School of Planning & Architecture, New Delhi https://spa.irins.org/profile/97340
CS Raghuram 	is a Partner at Trilogue Studio and Director at C R Narayana Rao Consultants https://www.linkedin.com/in/c-s-raghuram-a610b4114/?originalSubdomain=in

Marcial Echenique 	is Professorial Fellow of Churchill College and Emeritus Professor of Land Use and Transport Studies at the University of Cambridge https://www.arct.cam.ac.uk/people/me15@cam.ac.uk
Steve Denman 	is a Research Associate at the Martin Centre for Architectural and Urban Studies at the University of Cambridge https://www-smartinfrastructure.eng.cam.ac.uk/directory/steven-denman

Abstract and background reading (Darshini Mahadevia)

SHORT ABSTRACT:

Sustainable Mobility requires reconceptualising from not just transport perspective but also housing perspective. Many cities in the global South, due to speculative land markets, have seen proliferation of low-income settlements or government assisted low-income housing programmes located in the peri-urban areas. Many residents of these low-income settlements are dependent on work opportunities available in the central parts of the cities, where they were informally living, but have either been pushed out due to development programmes or have been relocated in formal low-income housing on the urban periphery/ peri-urban areas. Hence, both housing policies as well as transport projects influence their access to employment and other opportunities in the cities. There is a Housing-Transport nexus that determines particularly the accessibility of low-income households and hence it should form the central part of reconceptualising 'Sustainable Mobility' in the cities of the global South, including in India. This presentation, drawing from multiple primary studies undertaken in Ahmedabad, will establish these linkages and argues for a shift in policy paradigm with regards to Sustainable Mobility.

BACKGROUND READING:

Coelho, K., Mahadevia, D. and Williams, G., 2020. Outsiders in the periphery: studies of the peripheralisation of low income housing in Ahmedabad and Chennai, India. *International Journal of Housing Policy*, pp.1-27.

Dhar, S., Mahadevia, D. and Tiwari, G., 2016. Conceptualising sustainable low carbon urban transport in India. *Transportation Research. Part D: Transport and Environment*, *44*, pp.234-238.

Mahadevia, D. and Mukhopadhyay, C., COVID-19 and the public transport conundrum in India. https://doi.org/10.3828/tpr.2020.78

Abstract and background reading (Bhargav Adhvaryu)

SHORT ABSTRACT:

Rapid urbanisation is a key factor in overstressing the public urban infrastructure systems in developing countries. A public transport system of a city is one of its vital urban infrastructure systems. Good public transport enhances connectivity and mobility, especially for lower income groups allowing them to better participate in the labour market, eventually fostering economic growth and social equity. Therefore, it is important for cities in developing countries to ensure the best possible public transport system given its limited resources.

To improve public transport system, the first step is to measure the level of accessibility offered by the current system. Public Transport Accessibility Level (PTAL) is a tool to measure accessibility at various location in a city and spatially visualise it. Thereafter, PTAL maps when superimposed with population density and land use (both current and forecast/modelled), provide useful guidance in adjusting both public transport and land use in unison to create better integration.

Based on studies measuring PTAL for six Indian cities: Ahmedabad, Surat, Lucknow, Hubli-Dharwad, Raipur-Naya Raipur, and Chennai, we discuss key applications and lessons for planners and policymakers. These include guiding future public transport investments, enhancing the urban plan-making process by integrating transport and land use decisions, better in-forming the parking policy, improving residential location choice, optimising supply locations of affordable and low-cost housing, and better understanding the mobility needs of the urban poor. Application of PTAL to formulation of modelling inputs to SIMPLAN type what-if planning models is also discussed.

BACKGROUND READING:

Shah, J.S. and Adhvaryu, B., 2016. Public transport accessibility levels for Ahmedabad, India. *Journal of Public Transportation*, *19*(3), p.2.

Adhvaryu, B., Chopde, A. and Dashora, L., 2019. Mapping public transport accessibility levels (PTAL) in India and its applications: a case study of Surat. *Case Studies on Transport Policy*, *7*(2), pp.293-300.

Adhvaryu, B. and Patel, M., 2019. Is Public Transport in Ahmedabad Inclusive?. *Economic & Political Weekly*, *54*(8), p.17.

Abstract and background reading (Amit Patel)

SHORT ABSTRACT:

The COVID-19 pandemic has brought renewed attention to informal settlements and the planning and policy failures that they represent. In this paper, we reflect on the impacts of both the pandemic and the public health responses on lives and livelihoods of slum residents to draw lessons for future of urban planning and public health policies. In particular, we offer a framework that integrates principles of slum health with the ‘new science of cities’ to inform both short-term pandemic responses and enable long-term planning to make our cities healthier, resilient, and equitable

for all.

The radically different view of slums and cities goes beyond a place-based paradigm and conceptualizes cities as a set of many overlapping and interacting networks of various stakeholders. There are three commonalities that ties slum health agenda with the new science of cities: i) the central role that both the paradigms assign to collective action of a variety of stakeholders, ii) heightened attention to data and indicators with the current explosion of urban measures from a range of sources, and iii) treatment of cities as complex adaptive systems that calls for bottom-up approaches to urban planning and public health interventions. This view is in sharp contrast with current approaches to curb the spread of COVID-19, which have largely remained top-down and place-based in India.

To advance this transdisciplinary framework, we consider four key networks as building blocks for our model that are particularly important for slum health in the light of the pandemic and the current preemptive measures: 1) networks within slum communities; 2) networks between slum and non-slum communities; 3) networks that enable flows of goods and services in a city; and 4) migration networks comprising places of origin and destinations. We examine each of these networks to assess what they mean for slum health in the context of the current pandemic and beyond. To contrast these networks against their close equivalent in traditional planning systems, we provide the differences in pandemic responses that directly stem from the way cities and slums are conceptualized in both the systems. We hope that this proposed shift in paradigm of conceptualizing a city as set of networks will require us to rethink both slum health and urban planning and its implications for research and practice.

BACKGROUND READING:

Patel, A. and Shah, P., 2020. Rethinking slums, cities, and urban planning: lessons from the Covid-19 pandemic. *Cities & Health*, pp.1-3.

Abstract (MS Raghavendra)

The Government of India has made considerable progress in providing piped water to all households, both rural and urban. India's expanding human settlement system of nearly 650,000 villages, and 8,000 towns and cities presents unique challenges and opportunities in providing piped water to all. The recently announced target of 'piped water for all' by the Government of India in 2019 presents yet another opportunity to serve water sustainably.

Even as the avowed target of piped water to all is a work in progress, India will be better served should her cities and towns also actively plan for long-range water security, and enhance linkages between urban planning and development of water infrastructure.

The presentation discusses challenges in urban water service delivery, underscores need for planning of water security and management, and summarises advantages of attaining coherence in city and infrastructure planning.

The principles of permeable city planning, where various layers of the city built and unbuilt fabric are rendered porous and permeable to absorb, retain, and harvest water, are introduced. Improving permeability will reduce recurrent energy and substantive capital costs on drawing and pumping freshwater from afar, and improve overall long-term sustainability of human settlements.

The presentation also discusses the need for a Policy on Permeability City Planning, and likely co-benefits of the

proposed Policy on other infrastructure sectors and liveability.

Abstract and background reading (Shweta Manchanda)

SHORT ABSTRACT:

The building sector in India has an important role to play in achieving carbon emissions reduction and providing energy security for its power infrastructure across sectors. This sector consumes over 30% of the total electricity in the country annually of which about 75% is used in residential buildings and has been rising consistently over the years. Among the reasons, increased use of air-conditioning in homes for thermal comfort is an important reason contributing to this rapid increase in the electricity use in residential buildings. It is expected that the demand for energy in the housing sector will continue its exponential growth with improvement in household incomes and will become the dominant contributor of electricity consumption nation-wide owing to increased electricity consumption.

This presentation charts the launch of a new energy code by the Ministry of Power as an important regulatory measure for ushering energy efficiency in the housing sector given the current and anticipated rapid growth in the residential building stock. It notes the importance of building design and modelling to comply with the code and predict consumption outcomes and also highlights the significance of broader based analytical studies for adjusting thermal comfort metrics used to formulate the codes themselves as well as to improve liveability and health outcome in the buildings in general. The presentation especially emphasises the need for addressing the above issues for the existing building stock which comprises a large bit neglected section of the housing sector.

BACKGROUND READING:

Steemers, K. and Manchanda, S., 2010. Energy efficient design and occupant well-being: Case studies in the UK and India. *Building and environment*, *45*(2), pp.270-278.

Abstract and background reading (CS Raghuram)

SHORT ABSTRACT:

Technology in Building Design and Construction has the ability to aid in quick response in India, whether it be in providing modular housing for the growing urban population or in addressing the need to create infrastructure quickly to tackle a pandemic. The presentation explores two case studies.

With rising urban populations across all economic strata, the demand for affordable housing constantly exists. The availability of such housing within an acceptable time frame and quality is always in question across India. Delays due to approvals, labour shortage, material price fluctuation are common. By exploiting prefabricated construction technologies, hitherto used for industrial or commercial buildings, modular housing units are assembled using Light Gauge steel frame. The modularity, reduced dependence on manual labour and scale of construction makes the units affordable and available quickly. The current project providing 3000 housing units through the Kerala LIFE

Mission will be examined.

Quick calibrated responses are imperative during the outbreak of a pandemic. Building healthcare facilities from ground up is a time-consuming process. Existing hospitals may already be geared towards general and specialised care and suddenly increasing capacity is challenging. Technology offers the possibility of retrofitting existing large facilities such as convention centres, marriage halls, sports facilities and exhibition halls into makeshift wards for the emergency treatment and easy isolation of patients. Prefabricated partition systems, demountable ceilings and new generation construction materials and systems allow for modular planning, seamless retrofitting, quick installation of independent exhaust and supply air systems and isolation as needed. The proposal for such a makeshift ward in Pune will be studied.

BACKGROUND READING:

'Coronavirus Pandemic: Making Safer Emergency Hospitals' with video link at
https://www.youtube.com/watch?v=Nzs3AwffK-Q&feature=youtu.be

Session 6: The world's metropolitan regions: overview and case studies

Speaker Location(s) and time

Speaker Location(s): Africa and Latin America
UK time: 1-3pm (GMT)
Local time: 4-6pm (GMT+3 / Kenya) and 8-10am (GMT-5 / Colombia)

Session outline

1. The global state of metropolis: An overview
   Rafael H. Forero H (UN-Habitat)

2. Improving metropolitan management in Latin America: The cases of Colombia, Bolivia and El Salvador
   Maria Tellez Soler (Policy, Legislation and Governance Section, UN Habitat)

3. Improving metropolitan management in Africa: The case of Cameroon
   Professor Nguendo Yongsi (tbc) / Frederic Happi (UN-Habitat)

Discussant: **Remy Sietchiping (Chief of the Policy, Legislation and Governance Section, UN-Habitat)**
Host: **Ying Jin (University of Cambridge)**

Bios of speakers, discussant and chair

Rafael H. Forero H 	is an Urban Policy, Governance and Metropolitan Expert at the UN-Habitat https://urbanpolicyplatform.org/rafael-forero/
Maria Tellez Soler 	is a Metropolitan Development Consultant at the UN-Habitat https://urbanpolicyplatform.org/maria-tellez/

Nguendo Yongsi 	is the President-Elect of International Society for Urban Health (ISUH) https://isuh.org/ep-04-h-blaise-nguendo-yongsi-phd/
Frederic Happi 	is a Programme Officer at the UN-Habitat http://urbanpolicyplatform.org/frederic-happi-mangoua/
Remy Sietchiping 	leads the Policy, Legislation and Governance Section within the Global Solutions Division (GSD) of UN-Habitat https://urbanpolicyplatform.org/remy/
Ying Jin 	is a University Reader in Architecture and Urbanism at Dept of Architecture, University of Cambridge, and Lead Convenor of the AUM symposia since 2011 https://www.arct.cam.ac.uk/people/yj242@cam.ac.uk

Session abstract

Rising population and uncontrolled urban land consumption rates have been responsible for the rise of bigger and denser cities and metropolises. In 2020 there are 1934 metropolises with more than 300,000 inhabitants representing approximately 60% of the world's urban population. At least 2.59 billion people live in metropolises in 2020 which is equivalent to one third of the global population. 34 metropolises have surpassed 10 million inhabitants; while 51 have a population of 5 to 10 million; 494 of 1 to 5 million; and 1355 of 300,000 to 1 million.

Metropolises of the 21st century are characterized for having strong interdependencies from economic, social, and environmental perspectives which need to be managed in an integrated way, based on functional territories and across both jurisdictional boundaries and the urban-rural continuum. UN-Habitat integrative approach for metropolitan management involves local, sub-national and national governments participation in metropolitan governance, metropolitan policies and legislation, metropolitan planning, and metropolitan finance and economics.

This session will showcase both the more recent numbers and figures on global and regional metropolitan trends and, some Latin American and African cases on how UN-Habitat has supported metropolitan management from the improvement of legal frameworks, planning instruments and governance systems at supra-municipal scales.

Session 7: New modelling frontiers

Speaker Location(s) and time

Speaker Location(s): UK
UK time: 3-5pm (GMT)
Local time: 3-5pm (GMT / UK)

Session outline

1. Challenging policies that prohibit public transport use: travelling with pets as a case study
   Corinne Mulley (University of Sydney)

2. Land use and transport modelling for COVID-19 mitigation
   David Simmonds (David Simmonds Consultancy and Heriot-Watt University)

3. The model failed to forecast the result of M25 motorway widening
   David Metz (University College London)

Discussant: **Marcial Echenique (University of Cambridge)**
Host: **Mingfei Ma (David Simmonds Consultancy and University of Cambridge)**

Bios of speakers, discussant and chair

Corinne Mulley 	was the inaugural Chair of Public Transport at the Institute of Transport and Logistics Studies at the University of Sydney https://www.sydney.edu.au/business/about/our-people/academic-staff/corinne-mulley.html
David Simmonds 	is the Director at the David Simmonds Consultancy (DSC) and Honorary Professor at the Heriot-Watt University https://www.davidsimmonds.com/people

David Metz 	is an honorary professor in the Centre for Transport Studies at UCL https://www.ucl.ac.uk/civil-environmental-geomatic-engineering/people/prof-david-metz
Marcial Echenique 	is Professorial Fellow of Churchill College and Emeritus Professor of Land Use and Transport Studies at the University of Cambridge https://www.arct.cam.ac.uk/people/me15@cam.ac.uk
Mingfei Ma 	is a senior consultant at David Simmonds Consultancy Ltd https://www.davidsimmonds.com/people

Abstract (Corinne Mulley)

Modern life requires increasingly complex and diverse travel behaviour. We attend multiple destinations for multiple purposes, and trips are chained together as households negotiate the demands and opportunities presented by cities. A successful public transport system should accommodate this complexity. This presentation takes parts from a number of different data sources to explore how and why there are barriers to the implementation of a public transport policy designed to accommodate one specific, but surprisingly common, user need: travel with dogs. Public transport systems are governed by policies that are made both for and by the cultural context of the populations and cities they serve and the presentation demonstrates the way public transport policy is linked to aspects of national culture. Using the public transport policies regulating the carriage of dogs on public transport as a case study, The Hofstede framework of national cultural dimensions is used to reveal associations between public transport policy and culture. It reveals that allowing dogs on public transport is related to national cultures that are more conservative, with a long term orientation and an acceptance of hierarchies. The presentation concludes with how this might be transferable to other aspects of public transport policy and practice, particularly as it fights to compete with the comfort and convenience so often afforded by the private car.

Abstract (David Simmonds)

[Abstract to come]

Abstract (David Metz)

[Abstract to come]

Session 8: Modelling method (2)

Speaker Location(s) and time

Speaker Location(s): Europe
UK time: 5-7pm (GMT)
Local time: 5-7pm (GMT / UK) and 6-8pm (GMT+1 / Italy and Switzerland)

Session outline

1. Synthetic population generation using GANS and expert knowledge
   Gael Lederrey, Tim Hillel, and Michel Bierlaire (École polytechnique fédérale de Lausanne (EPFL), Switzerland)

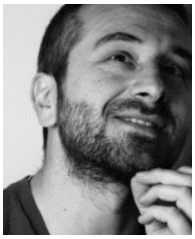
2. High-resolution air temperature mapping in data-scarce areas by means of low-cost mobile measurements and machine learning
   Ahmed H. M. Eldesoky (Università Iuav di Venezia), Nicola Colaninno (Politecnico di Milano) and Eugenio Morello (Politecnico di Milano)

3. Building and validating modular urban transportation models using scientific workflow systems
   Juste Raimbault and Michael Batty (University College London)

Discussant: **Ying Jin (University of Cambridge)**
Host: **Kaveh Jahanshahi (University of Cambridge)**

Bios of speakers, discussant and chair

Gael Lederrey 	is a Ph.D. student in the TRANSP-OR laboratory at EPFL https://scholar.google.ch/citations?user=aEC3fjcAAAAJ&hl=en

Tim Hillel 	is a postdoctoral researcher in the Transportation and Mobility Laboratory, EPFL https://people.epfl.ch/tim.hillel/?lang=en
Michel Bierlaire 	is Professor of School of Architecture, Civil and Environmental Engineering, EPFL https://people.epfl.ch/michel.bierlaire
Ahmed H. M. Eldesoky 	is PhD student in Urbanism at the Università Iuav di Venezia https://www.linkedin.com/in/ahmed-h-eldesoky-3167b0162/
Nicola Colaninno 	is Research Fellow at Politecnico di Milano and adjunct Professor in Analysis of the City and Territory http://www.labsimurb.polimi.it/about-2/people/nicola-colaninno/
Eugenio Morello 	is Associate Professor in Urban Design at Politecnico di Milano http://www.labsimurb.polimi.it/about-2/people/eugenio-morello/

Juste Raimbault 	is a Research Fellow in the UCL Faculty of Mathematical and Physical Sciences https://www.ucl.ac.uk/bartlett/casa/people/dr-juste-raimbalt
Michael Batty 	is Chairman of the Management Board of the Centre for Advanced Spatial Analysis (CASA) and Bartlett Professor of Planning (Emeritus) at University College London https://www.ucl.ac.uk/bartlett/casa/prof-michael-batty
Ying Jin 	is a University Reader in Architecture and Urbanism at Dept of Architecture, University of Cambridge, and Lead Convenor of the AUM symposia since 2011 https://www.arct.cam.ac.uk/people/yj242@cam.ac.uk
Kaveh Jahanshahi 	is currently working part-time as senior research associate at the University of Cambridge https://www.bennettinstitute.cam.ac.uk/about-us/team/kaveh-jahanshahi/

Abstract and background reading (Gael Lederrey)

SHORT ABSTRACT:

Agent-based simulations used for land-use and transportation modelling rely on accurate virtual representations of the population of interest. They typically make use of synthetic populations generated from sample data which is assumed to represent the population of interest.

In this work, we present a new methodology for synthetic population generation, which allows expert knowledge to be combined with powerful, flexible deep learning methods. Our approach, called the Directed Acyclic Tabular GAN (DATGAN), uses a Directed Acyclic Graph (DAG) to allow the modeller to specify complex dependencies between synthesised variables in the population.

READ MORE:

Agent-based simulations used for land-use and transportation modelling rely on accurate virtual representations of the population of interest. Typically, it is not possible to obtain detailed socio-economic data for the full population, and even in cases where this is possible, it may be undesirable to make use of real-world data for privacy and security reasons. As such, agent-based simulations typically make use of synthetic populations generated from sample data which is assumed to represent the population of interest. Population synthesis has traditionally been carried out using statistical methods such as Iterative Proportional Fitting (IPF) (Beckman et al., 1996; Auld et al., 2009) or simulations such as Markov Chain Monte Carlo (MCMC) simulation (Farooq et al., 2013; Casati et al., 2015). However, in recent years, deep generative models, such as Generative Adversarial Networks (GANs), have been shown to outperform standard methods (Garrido et al., 2019; Badu-Marfo et al., 2020).

In this work, we present a new methodology for synthetic population generation, which allows expert knowledge to be combined with powerful, flexible deep learning methods. Our approach, called the Directed Acyclic Tabular GAN (DATGAN), uses a Directed Acyclic Graph (DAG) to allow the modeller to specify complex dependencies between synthesised variables in the population. These dependencies are then used as an input into Long Short-Term Memory (LSTM) neural network cells within a GAN, to produce accurate and representative population samples. This extends the state of research from existing GAN-based solutions, where arbitrary sequential dependencies are used.

BACKGROUND READING

Badu-Marfo, G., Farooq, B., & Paterson, Z. (2020). Composite Travel Generative Adversarial Networks for Tabular and Sequential Population Synthesis. arXiv preprint arXiv:2004.06838.

Beckman, R. J., Baggerly, K. A., & McKay, M. D. (1996). Creating synthetic baseline populations. Transportation Research Part A: Policy and Practice, 30(6), 415-429.

Casati, D., Müller, K., Fourie, P. J., Erath, A., & Axhausen, K. W. (2015). Synthetic population generation by combining a hierarchical, simulation-based approach with reweighting by generalised raking. Transportation Research Record, 2493(1), 107-116.

Choupani, A. A., & Mamdoohi, A. R. (2016). Population synthesis using iterative proportional fitting (IPF): A review and future research. Transportation Research Procedia, 17, 223-233.

Farooq, B., Bierlaire, M., Hurtubia, R., Flötteröd, G. (2013). Simulation based population synthesis. Transportation Research Part B: Methodological, 58, 243-263.

Garrido, S., Borysov, S. S., Pereira, F. C., & Rich, J. (2019). Prediction of rare feature combinations in population synthesis: Application of deep generative modelling. arXiv preprint arXiv:1909.07689."

Abstract (Ahmed H. M. Eldesoky)

SHORT ABSTRACT:

Understanding urban micro- and local climates requires the availability of air temperature information at an effective spatial and temporal resolution. This study aims at providing such information to inform urban design and planning practices in a data-scarce, arid area. The objective is to produce accurate air temperature maps at a high spatial resolution for an entire city using air temperature data, collected from low-cost mobile measurements; different spectral indices, retrieved from freely-available satellite imagery; spatial analysis techniques; and random forest regression models. Thereafter, we explore the spatial variability of air temperature and quantify the urban heat island intensity.

READ MORE:

With heatwaves becoming more severe and frequent across many parts of the world, the interest in better understanding the urban micro- and local climate phenomena has been growing both in research and city planning practices. However, observing air temperatures in the urban canopy layer (beneath the roof level) has been always limited by the availability and spatial coverage of air temperature data from weather stations at screen-height level. Furthermore, setting up a meteorological network of fixed weather stations can be expensive or not possible in some locations. Alternatively, mobile measurements combined with remotely-sensed data from satellites, spatial analysis and modelling techniques, can offer promising opportunities for urban micro- and local climate mapping at an effective temporal and spatial resolution. In particular, the random forest (RF) regression—a non-parametric machine learning model—is among the most investigated modelling techniques recently and has proven high predictive performance when using mobile measurements.

In this study, we used air temperature data, collected from low-cost mobile measurements, and different spectral indices, retrieved from freely-available satellite imagery, to build RF models and estimate screen-height air temperature at a high spatial resolution. The aim is to test the effectiveness of the approach in providing relevant urban climate information for urban design and planning in a data-scarce, arid area where, to our knowledge, no such information is available. The case study is a desert city within the greater Cairo region (Egypt), namely the Sixth of October.

In particular, a total of four automobile-based measurement trips were carried out on three different days (both daytime and nighttime) during September 2020, under suitable meteorological conditions of low nebulosity and low wind speed. The trips were conducted using a relatively low-cost wireless weather sensor with GPS (PS-3209), manufactured by PASCO, to measure the ambient air temperature (among other 18 different measurements) at a one-second interval along a predefined route that crosses different land uses/covers and morphologically different built areas. The temperature sensor has an accuracy of ± 0.2 °C and 0.1 °C resolution, and it was mounted on top of the car at a screen-height level. The collected temperature data were first processed to: (1) correct for the cooling/warming that occurred during the trip; (2) remove the effect of elevation changes; and (3) exclude measurements recorded when the car speed was very low/high (below 15 km/h and above 60 km/h). Next, the processed temperature data were combined with multiple spectral indices, derived from Landsat 8 OLI (Operational Land Imager) imagery, to build RF models. The indices were chosen from the literature so that they depict the

specific surface properties of arid regions. Furthermore, to account for spatial autocorrelation in the RF models, we have performed focal statistics calculations, using different buffer distances, on each of the spectral indices. Finally, the obtained RF models were used to produce continuous air temperature maps for the entire city to explore the spatial variability of air temperature and quantify the urban heat island intensity.

Abstract (Juste Raimbault)

SHORT ABSTRACT:

Large scale urban transportation models such as four-step models require the integration of heterogenous data and the coupling of sub-models which can already be consequent in terms of complexity. Therefore, such integrated models are difficult to transfer, reproduce, and validate. We propose a modular and reproducible approach based on scientific workflow systems to build and validate such models. We illustrate it by coupling different open-source components within workflows to construct a four-step transportation model applied to all functional urban areas in the UK, and discuss its application to health indicators within public transport in the context of the COVID-19 crisis.

READ MORE:

Urban transportation models such as four-step models, and more generally land-use transport interaction models, require the integration of heterogenous data and the coupling of various submodules with possibly high levels of complexity. This raises issues on the one hand for their implementation, transferability and reproducibility, and on the other hand for their validation which requires large scale numerical experiments to validate the submodules and the whole models. This work proposes to tackle both issues by leveraging modularity and transparency for the construction of large urban models in a modular way, using scientific workflow systems to couple the different components of models and to launch numerical experiments for their validation.

More particularly, we demonstrate this approach by building a modular four-step multimodal transportation model using only open-source projects. We couple together the MATSim model (MATSim Community) to simulate the transportation system, the SPENSER model (University of Leeds) for the generation of synthetic population, the QUANT model (University College London) to estimate spatial interactions, and the spatialdata library (OpenMOLE Community) for data preparation. The model is integrated into the DAFNI facility (https://dafni.ac.uk/) which provides a scientific workflow system for model integration and coupling, direct access to relevant open datasets, visualisation functionalities, and access to a High Performance Computing infrastructure.

The model is run on all functional urban areas in the UK. We show first results of numerical experiments comparing the use of the spatial interaction model with a null model to generate transport demand. We also study the role of stochasticity on model outputs, and show that spatial configuration has a significant influence.

To illustrate the reproducibility of our approach, we sketch the construction of the model with the OpenMOLE workflow engine, which provides a scripted workflow engine and methods to calibrate and validate simulation models, and suggest advanced numerical experiments for the validation of the coupled model.

We finally discuss ongoing developments on the application of this model to the development of health indicators within public transportation, and more particularly linking transportation and work-from-home policies with effective

densities in public transport which provide potential exposure indicators in the context of the COVID-19 crisis.

Session 9: Modelling urban activities

Speaker Location(s) and time

Speaker Location(s): North America
UK time: 7-9pm (GMT)
Local time: 2-4pm (GMT-5 / US East Coast)

Session outline

1. How do car-lite policies impact housing mobility choices? A LUTI microsimulation analysis
   Rounaq Basu and Joseph Ferreira (Massachusetts Institute of Technology)

2. Spatio-temporal Demand Modelling for On-Demand Transit Services
   Nael Alsaleh and Bilal Farooq (Laboratory of Innovations in Transportation (LiTrans), Ryerson University)

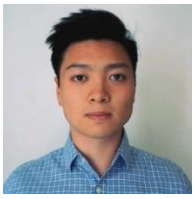
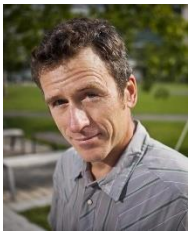
3. Sensitivity analysis of housing market simulation
   Xiaohu Zhang and Joseph Ferreira (Massachusetts Institute of Technology)

4. Temporally explicit models of firm behaviour
   He He and P. Christopher Zegras (Massachusetts institute of Technology)

Convenor and Discussant: **Joseph Ferreira (Massachusetts Institute of Technology)**
Host: **Ying Jin (University of Cambridge)**

Bios of speakers, discussant and chair

Rounaq Basu 	is a Ph.D. candidate in the Department of Urban Studies and Planning at the Massachusetts Institute of Technology. https://www.researchgate.net/profile/Rounaq_Basu2
Joseph Ferreira 	was the founding director of the Planning Department's Computer Resource Lab and is now head of Urban Information Systems https://dusp.mit.edu/faculty/joseph-ferreira

Nael Alsaleh 	is a Ph.D. candidate in Transportation Engineering at Ryerson University https://litrans.ca/team/alsaleh-n/
Bilal Farooq 	is an Associate Professor at Ryerson University. He is the Founding Director of Laboratory of Innovations in Transportation (LiTrans) https://litrans.ca/team/farooq-b/
Xiaohu Zhang 	is a postdoctoral associate at the Massachusetts Institute of Technology https://fm.smart.mit.edu/smart-technical-and-non-phd-staff/
He He 	is a Doctoral candidate at Massachusetts Institute of Technology https://www.researchgate.net/profile/He_He23
P. Christopher Zegras 	is Professor of Transportation and Urban Planning in the Dept. of Urban Studies and Planning at MIT http://czegras.scripts.mit.edu/web/

Ying Jin 	is a University Reader in Architecture and Urbanism at Dept of Architecture, University of Cambridge, and Lead Convenor of the AUM symposia since 2011 https://www.arct.cam.ac.uk/people/yj242@cam.ac.uk

Abstract and background reading (Basu Rounaq)

SHORT ABSTRACT:

Transformative technologies like automated vehicles, and emerging services like mobility-on-demand and ride-sharing, are changing the ecosystem of urban mobility. Land use-transport interaction (LUTI) models provide appropriate platforms to test the impacts of such services on cities. Although these services are purported to have mixed effects on cities, there is a general consensus that these services will increase accessibility. We approach the 'car-lite' policy through this lens of increased accessibility, and base this study in the city-state of Singapore. Different study areas are chosen in a manner similar to the differences-in-differences approach, in order to tease out the effects of initial neighborhood vacancy rate, vehicle-free behavior, and tight markets on policy impacts. We also design different scenarios that represent varying market reactions to the policy, and compare them to a baseline where the car-lite policy is never implemented. Study areas that are initially less 'tight' (i.e., have higher vacancy rates and lower vehicle-free rates) are found to have significantly larger transitions to vehicle-free behavior. Additionally, our finding of accessibility-induced gentrification speaks to the importance of considering the endogeneity in housing and mobility choices while formulating policies that may seemingly feel relevant only to the transportation realm. Providing appropriate mixes of housing typologies with adequate affordable housing, in addition to restricting car use for higher-income car-owning households, are suggested as strategies for designing car-lite neighborhoods.

READ MORE:

New mobility services (e.g. ridehailing and bikesharing) and vehicle technologies (e.g. electric, hybrid, and automated) have expanded the choice set of individuals and offered ways to improve access to various opportunities. The holy trinity of 'shared, on-demand, and automated' services is expected to change the socio-spatial fabric of cities. How they will do so remains an area of active research, where the lion's share of attention has been given to the impact of new mobilities on changes in activity-travel patterns. Few have focused on nearer-term pathways to changes in land use and longer-term urban choices (e.g. residential location, mobility holdings, etc.). Land use-transport interaction (LUTI) models provide an appropriate platform for examining longer-term reactions to accessibility improvements brought about by emerging mobility services. However, current state-of-the-practice LUTI models have been critiqued for not being flexible enough to adapt to the rapidly changing mobility landscape and not being heterogeneous enough to capture widely varying reactions to new technologies, policies, and regulations (e.g. telecommuting). In this study, we demonstrate how to address some of these concerns using our state-of-the-art (and

still under active development) LUTI model – SimMobility. First, we present the overall structure of SimMobility, wherein longer-term urban decisions are tightly integrated with more medium-term activity-travel choices using various measures of accessibility. Next, we propose methodological improvements that introduce the complexity necessary to model heterogeneity. In particular, the value of decoupling renters and owners into two separate housing markets (with appropriate transitions) is discussed with respect to modeling the widely different tradeoffs between housing and mobility expenditures made by owners and renters. We then test this framework through an application of studying 'car-lite' neighborhood pilots in Singapore. Emerging mobility services are assumed to provide local accessibility improvements within select neighborhoods that have been selected for initial pilot programs by the city. We design multiple scenarios that represent varying market reactions to the 'car-lite' policy, and compare them to a baseline where the policy is never implemented. Six different study areas are selected using different neighborhood measures (e.g. vacancy rate and vehicle-free rate) to tease out the relationship between initial neighborhood characteristics and intended policy outcomes. Additionally, we highlight how unintended side-effects (such as accessibility-induced gentrification) may dampen the potential effect of the 'car-lite' policy in reducing private car ownership and use. This study speaks to the importance of considering endogeneity in housing and mobility choices within LUTI models, and while formulating policies that may seem relevant only to the transportation realm. Enabling 'car-lite' transitions may require support from housing policies that provide appropriate supply of mixed-rate housing, in addition to restricting car use, especially for higher-income car-owning households.

BACKGROUND READING:

Basu, R. and Ferreira, J., 2020. Planning car-lite neighborhoods: Examining long-term impacts of accessibility boosts on vehicle ownership. *Transportation research part D: transport and environment*, *86*, p.102394.

Abstract and background reading (Nael Alsaleh)

SHORT ABSTRACT:

In this study, we use the operational on-demand transit (ODT) data collected from Belleville's pilot project to perform temporal analysis of the users' waiting time, fleet size, and the trips distribution, develop origin and destination patterns, and investigate the relationship between the demographic characteristics and the ODT trip production and attraction levels. Moreover, we present trip production and distribution models for the ODT service using four machine learning algorithms. Based on our findings, we further provide some useful policy recommendations to the operators and municipalities for sustainable planning, design, and operation of new as well as ongoing ODT projects.

READ MORE:

The COVID-19 pandemic has dramatically reduced the demand of regular fixed-route public transit services. Thus, affecting the efficiency, sustainability, and the operating cost of the transit systems. Hence, there is a strong need to find innovative and sustainable alternatives for the current fixed-route public transit services. One economically viable approach in low density areas is to convert the regular fixed-route public transit service into an on-demand transit (ODT) service. ODT dynamically updates its schedules and operating routes based on the real-time spatio-temporal demand the system receives. One of the first ODT services was introduced in Belleville, Ontario, in September 2018, where a late-night fixed-route public transit line was converted to an on-demand service as a pilot project.

In this study, we use the operational ODT data collected from Belleville's pilot project from September 2018 till May 2019 to perform temporal analysis of the users' waiting time, fleet size, and the trips distribution, develop origin and destination patterns, as well as investigate the relationship between the demographic characteristics and the ODT trip production and attraction levels. Moreover, we present trip production and distribution models for the ODT service based on the dissemination areas' demographic characteristics and the available trip information using four machine learning algorithms, namely Random Forest (RF), Bagging, Artificial Neural Network (ANN), and Deep Neural Network (DNN). Based on our findings, we further provide some useful policy recommendations to the operators and municipalities for sustainable planning, design, and operation of new as well as ongoing ODT projects.

Our results reveal that most of the frequent users of Belleville's ODT service have the same pattern of movement, travelling form commercial neighbourhoods to residential neighbourhoods and around the same time (between 11:00 pm-11:45 pm), which may suggest that they used the ODT service to return home from work or shopping. 39% of the trips were found to have a waiting time of 15 minutes or less, while 28% of trips had a waiting time of 15-30 minutes. Our findings also show that the random forest algorithm has the highest accuracy among the other algorithms in predicting the ODT trip production at 63%, whereas the ODT trip distribution model is best described by the deep neural network algorithm with 70% prediction accuracy. Both models are most affected by the month of the year and the day of the week variables. Furthermore, the population density has a higher impact on the ODT trip production levels than the other demographic characteristics followed by the working age percentages and median income characteristics. On the flip side, the distribution of the trips depends on the demographic characteristics of the destination area more than the origin area.

We believe that such an exercise in the early days of ODT is extremely useful for the understanding of the issues specific to ODT and developing new research on the topic. It is useful for the agencies wanting to deliver new pilots, as well as it is useful to enhance the performance of the ongoing ODT projects.

BACKGROUND READING:

a) Sanaullah, I., Alsaleh, N., Djavadian, S. and Farooq, B., 2020. Spatio-Temporal Analysis of On Demand Transit: A Case Study of Belleville, Canada. *arXiv preprint arXiv:2012.02600*.
b) Alsaleh, N. and Farooq, B., 2020. Machine Learning Based Demand Modelling for On-Demand Transit Services: A Case Study of Belleville, Ontario. *arXiv preprint arXiv:2010.15673*.

Abstract and background reading (Xiaohu Zhang)

SHORT ABSTRACT:

This work is thus conducted to examine the sensitivity of the housing market portion of SimMobility—an agent-based micro-simulation platform of land use and transportation interactions that simulates daily housing market bidding. Using a calibration for Singapore, it confirms that the model can be calibrated with reasonable parameters that lead to dynamic equilibrium under constant demand and supply conditions. The market response is sensitive to the ratio of supply and demand but relatively insensitive to initial conditions.

READ MORE:

Advances in technology have made it computationally feasible to simulate travel decisions and relocation at individual and building scale. Modelling daily housing market behavior can avoid ecological fallacy issues associated with batch adjustment of demand and supply, and it becomes more desirable than annual or even monthly aggregate adjustment to the supply and demand because the latter is ineffective to capture the impact of market shocks. However, such disaggregated systems are prone to stochastic variation and can be sensitive to parameter changes. In disaggregated simulations, as the spatial or temporal analysis unit increases, the variability also becomes larger. The sensitivity issue, although crucial, is least investigated in the urban simulation field. This work is thus conducted to examine the sensitivity of the housing market portion of SimMobility—an agent-based micro-simulation platform of land use and transportation interactions that simulates daily housing market bidding. Using a calibration for Singapore, it confirms that the model can be calibrated with reasonable parameters that lead to dynamic equilibrium under constant demand and supply conditions. The targeted awakening and choice set models add more realism and induce more competition but also lead to higher market volatility. The market response is sensitive to the ratio of supply and demand but relatively insensitive to initial conditions. A 'burn-in' period of 6-12 months is recommended before using model simulations to calibrate parameters and compare simulated scenarios. Spatial heterogeneity of sensitivity is observed across planning areas. The uneven competition in sub-markets results in different levels of volatility in space. Also, a spillover effect is observed when relatively attractive types of housing are depleted in particular planning districts. The sensitivity analysis not only quantifies parameter choices that lead to a stable model, but also deepens our understanding of model mechanisms.

Abstract and background reading (He He)

SHORT ABSTRACT:

We present a new dynamic microsimulation model of firm hiring and firing decisions. Our disequilibrium approach explicitly models hiring and firing rates, allowing us to simulate employment expansion and contraction over time and space. We derive a tractable likelihood function for estimation of the model and conduct a parameter recovery exercise with synthetic data to verify the feasibility of the approach. We are now in the process of collecting datasets to apply the model to the Greater Boston Area.

READ MORE:

In this study, we develop a dynamic disequilibrium microsimulation model of firm's hiring and firing decisions. Despite being one of the main drivers of urban development, firms have received relatively little academic attention in urban modelling. Consequently, their behaviour in urban models tends to be crude, lacking sound underlying theory, or implemented ad hoc. Furthermore, the bulk of existing firm modelling efforts pertain to location decisions, whereas studies of the employment size or hiring/firing decisions are much less common. Another frequent shortcoming of existing urban models is their simplistic treatment of time. Equilibrium models and choice models estimated on cross-sectional data are useful for comparative statics. However, they do not provide insight on dynamics or systems that are not in equilibrium - a limitation often glossed over in urban modelling. The lack of sophistication in firm modelling and overreliance on equilibrium assumptions severely limits the confidence we should place in existing models of firm behaviour. This is especially pertinent in times of economic volatility or rapid growth, such as during the COVID-19

recession and following recovery.

To address these gaps, we develop a model of firm hiring and firing. Our goal is to formulate a theoretically founded model of the decision process rather than merely fit data to outcomes. Specifically, we assume that firms maximise profits. However, they cannot instantly achieve optimal outcomes, i.e. equilibrium. Instead, they hire and fire employees over time to minimise foregone profit. In other words, equilibrium is latent in the model, determining the direction of development. The rate of hiring/firing is determined by the strength of the feedback signal, i.e. the foregone profit or the distance between current conditions and equilibrium. Following these assumptions, we derive an analytically tractable likelihood function for the number of hires/fires over an observation period, which we can use to estimate the model parameters.

We conduct a parameter recovery exercise to verify the feasibility of the approach. We generate synthetic data with known underlying parameters according to the hypothesised process and then attempt to recover the underlying parameters from the dataset through estimation. The complexity and form of the likelihood function favor a Bayesian estimation approach, i.e. a Markov Chain Monte Carlo (MCMC) algorithm that iteratively samples from the posterior distributions of the parameters. We find that we can consistently recover the original parameters and that estimation times are not prohibitive. Having completed the proof-of-concept, we are now assembling the necessary datasets to estimate models for the Greater Boston Area. Specifically, we are looking to examine how firms in different sectors respond to economic volatility and spatial heterogeneity in accessibility and agglomeration.

Session 10: The economics of cities

Speaker Location(s) and time

Speaker Location(s): Trans-Atlantic
UK time: 9-11pm (GMT)
Local time: 4-6pm (GMT-5 / Toronto) and 1-3pm (GMT-8 / South California)

Session outline

1. Development of an Integrated Land Use and Transportation Model for Planning Deep Decarbonization in the Greater Toronto Metropolitan Region, Canada
   Saeed Shakib, Jason Hawkins, Mark Purdon, and Khandker Nurul Habib (University of Toronto)

2. Simulating urban negotiations using agent-based modelling: the case of Section 106 negotiations in UK
   Aya Badawy, Nuno Pinto, and Richard Kingston (University of Manchester)

3. Parameter estimation for an integrated choice model of daily activity scheduling
   Janody Pougala, Tim Hillel, Rico Krueger, and Michel Bierlaire (EPFL)

4. Spatial Implications of Telecommuting
   Andrii Parkhomenko (University of Southern California) and Matthew Deventhal (Claremont McKenna College)

Discussant: **Jamil Nur (University of Cambridge)**
Host: **Li Wan (University of Cambridge)**

Bios of speakers, discussant and chair

Saeed Shakib 	is a Ph.D. candidate at the Department of Civil & Mineral Engineering, University of Toronto https://www.researchgate.net/profile/Saeed_Shakib3

Jason Hawkins 	is a Ph.D. candidate at the Department of Civil & Mineral Engineering, University of Toronto https://www.researchgate.net/profile/Jason_Hawkins6
Mark Purdon 	is an Assistant Professor at the École des sciences de la gestion at the Université du Québec à Montréal (UQAM) https://uqam.academia.edu/MarkPurdon
Khandker Nurul Habib 	is the Percy Edward Hart Professor in Civil & Mineral Engineering at the University of Toronto https://civmin.utoronto.ca/home/about-us/directory/professors/khandker/
Aya Badawy 	is a Ph.D. researcher at the Spatial Policy and Analysis Lab, University of Manchester https://manchester.academia.edu/AyaBadawy
Nuno Pinto 	is a Lecturer in Urban Planning and Urban Design at the School of Environment, Education and Development, University of Manchester https://www.research.manchester.ac.uk/portal/nuno.pinto.html

Richard Kingston 	is Professor of Urban Planning and Geographical Information Science (GISc) in the School of Environment Education and Development, University of Manchester https://www.research.manchester.ac.uk/portal/richard.kingston.html
Janody Pougala 	is a Doctoral assistant at the Transportation and Mobility Laboratory, EPFL https://personnes.epfl.ch/janody.pougala/?lang=en
Tim Hillel 	is a postdoctoral researcher in the Transportation and Mobility Laboratory, EPFL https://people.epfl.ch/tim.hillel/?lang=en
Rico Krueger 	is a postdoctoral researcher in the Transportation and Mobility Laboratory, EPFL https://people.epfl.ch/rico.krueger/?lang=en

Michel Bierlaire 	is Professor of School of Architecture, Civil and Environmental Engineering, EPFL https://people.epfl.ch/michel.bierlaire
Andrii Parkhomenko 	is an Assistant Professor of Finance and Business Economics, University of Southern California https://www.andrii-parkhomenko.net/
Matthew Deventhal 	is an Assistant Professor at the Robert Day School of Economics and Finance at Claremont McKenna College https://www.cmc.edu/academic/faculty/profile/matthew-delventhal
Jamil Nur 	is a postdoctoral fellow at the Martin Centre for Architectural and Urban Studies at the University of Cambridge https://sites.google.com/site/jamilnurscpo/home
Li Wan 	is University Lecturer at Dept of Land Economy, University of Cambridge, and a co-Convenor of AUM2020 and several past AUM symposia https://www.landecon.cam.ac.uk/directory/dr-li-wan

Abstract and background reading (Saeed Shakib)

SHORT ABSTRACT:

This paper presents on the development of a land use and transportation integrated (LUTI) model for the Greater Toronto Metropolitan Region (also known as the Greater Golden Horseshoe: GGH) and its application to evaluating policy scenarios for low-carbon transportation. Road transportation and residential land use account for 29.3% and 13.2% of the GHG area emissions produced in Ontario . The paper focuses on objectives of model development, demonstration of the implications for the GGH region of adopting regional climate plan targets, and the challenges in providing the data requirements for developing a large-scale LUTI model based on the TRANUS modeling platform.

READ MORE:

This paper presents on the development of a land use and transportation integrated (LUTI) model for the Greater Toronto Metropolitan Region—also known as the Greater Golden Horseshoe (GGH)—and its application to evaluating policy scenarios for low-carbon transportation. Road transportation and residential land use account for 29.3% and 13.2%, respectively, of the GHG area emissions produced in Ontario.[1] The paper focuses on objectives of model development for the GGH region, application of the model towards planning for the reduction of GHG emissions per vehicle miles traveled in the GGH region, and the challenges in providing the data requirements for developing a large-scale LUTI model based on the TRANUS modeling platform. Our paper has implications for the decarbonization of the transportation sector in that it gauges the replication in Canada of policy provisions in California known as regional climate plan targets. A recognized global leader in the fight against climate change, as part of the California's suite of climate policies, metropolitan regions are required to use such LUTI models to demonstrate conformity with regional climate plan targets, which require metropolitan regions in California to demonstrate that their transportation plans will allow them to reduce GHG emissions per vehicle mile traveled.[2]

Transportation-related actions that might reduce GHG emissions per vehicle mile traveled include encouraging as many existing drivers as possible to switch to transit, cycling, and walking; developing new communities alongside public transit with transit-supportive densities; helping households shift to ultra-low and zero-emission vehicles; reducing emissions from goods movement; integrating transit planning and land use planning to maximize GHG reductions, and integrating climate change adaptation considerations into infrastructure decision-making. TRANUS provides a platform for considering these policies within a consistent theoretical framework of transportation, land use, and spatial economics. The intention of adopting TRANUS for analysis is to use a practical LUTI package similar to models being used in California and consider both technical challenges with reconstituting the model in a new locality as well as scenario analysis to decarbonizing the transportation sector of the GGH region.

The GGH faces challenges in meeting its decarbonization goals in transportation and land use. Coordination is required between municipal and regional planning agencies. The GGH has a large central city (Toronto), representing about

---

[1] Environment and Climate Change Canada (2020), "National Inventory Report 1990-2018: Greenhouse Gas Sources and Sinks in Canada."

[2] Giuliano G, Kim S-O and Mallet Z (2020) Regional Planning and Climate Change Mitigation in California, Joint Clean Climate Transport Research Partnership (JCCTRP), Montreal; https://ww2.arb.ca.gov/our-work/programs/sustainable-communities-program/regional-plan-targets

37.2% of the total population, with a high transit ridership and relatively high population density. This proportion can be compared with the lower proportion for San Francisco (12.6% of MPO population) and Los Angeles (22.2% of MPO population) of California, meaning that these central cities have a lower influence on decarbonization. However, across the GGH, auto mode share is comparable with the San Francisco MPO (ABAG) at 81%[3] and 84%[4], respectively. Similarly, both regions have a high proportion of land zoned for single-family detached dwellings, with important ramifications for transportation and residential GHG emissions[5]. In the City of Toronto, 57% of residential land is zoned for single-family residential. The development of the GGH regional LUTI model will help planners understand the challenge of replicating regional climate plan targets and the technical challenges of incorporating such a modeling effort into existing planning processes in the GGH region.

Abstract and background reading (Aya Badawy)

SHORT ABSTRACT:

Section 106 negotiations have been a means to secure affordable housing in UK. In August 2020, the Government proposed the abolition of this mechanism due to its uncertainty, inconsistency and delays, and there has been a heated debate on the issue since then. The research presents two agent-based models that simulate S106 negotiations with different levels of complexity. The aim is to understand the process of negotiation, hence contribute to the debate.

READ MORE:

In the 1990 Town and Country Planning Act in UK, Section 106 states that developers should make contributions towards affordable housing if they want the Local Planning Authority (LPA) to permit their private housing developments. At the same time, LPA should be willing to negotiate those contributions lest they affect the economic viability of the developer. It is a form of capturing land value uplift which is applied with some differences in several other countries beside the UK.

The problem is that S106 negotiations are complex, inconsistent, and they cause delays in the delivery of housing. The Government argues that more stability is now needed in planning especially the COVID-19 pandemic. Last August, a White Paper was published proposing the abolition of S106 negotiations and replacing it with a national non-negotiable fixed tariff, called the National Infrastructure Levy. Since then, a debate has been going among stakeholders on which would be better: to negotiate affordable housing or not.

To contribute to this debate, S106 negotiations should be thoroughly understood. Studies so far have only taken a qualitative approach by conducting interviews and analysing challenges. The Cambridge Centre for Housing and Planning Research has conducted several studies in this topic. This has helped practitioners understand the problem

---

[3] Metrolinx, “Metrolinx Regional Transportation Plan.”

[4] CARB, “2018 Progress Report: California’s Sustainable Communities and Climate Protection Act.”

[5] Nichols and Kockelman (2015), “Urban Form and Life-Cycle Energy Consumption: Case Studies at the City Scale.” Journal of Transport and Land Use, 8(3): 1-15.

better. However, those studies have not explained how stakeholders negotiate or how their behaviour may affect the outcome of the negotiation.

Thus, my research approaches the problem with a novel approach using computer simulation. It develops two agent-based models that simulate S106 negotiations. The first model uses reactive agents to represent the developer, Local Planning Authority (LPA) and Housing Association who negotiate on the percent of affordable housing, the tenure mix, and the affordable sale price. The model runs several experiments to understand the likelihood of each stakeholder to achieve his target. The second model represents the same stakeholders but with Belief-Desire-Intention (BDI) agents. Here, the agents have cognitive capabilities. They select negotiation strategies based on their perception of the situation and not randomly as in the first model. They can also suggest other alternatives to solve the problem, like compensating with money or providing the affordable units off-site. Both models are implemented in GAMA platform. I am planning to present the design and implementation of the first model and the current progress of the second.

Abstract and background reading (Janody Pougala)

SHORT ABSTRACT:

This talk presents the estimation of a choice model of daily activity schedules, which integrates the discrete dimensions of the activity scheduling process (activity participation, activity scheduling, location choice, mode choice) in a single random-utility framework. We use data from the 2015 Swiss Mobility and Transport Microcensus (MTMC) to show how the approach can be used to estimate model parameters and draw likely schedules for different individuals from a continuous distribution.

READ MORE:

Daily activity patterns, which include the timings and locations of the activities completed by an individual in a day, can be used to derive high-resolution disaggregate travel demand. This approach is used in agent-based urban simulations used for transportation and land-use modelling. Traditional activity-based models rely on applying a sequence of individual choice models to generate daily activity schedules. Whilst these models can output the detailed activity schedules required for agent-based simulation, their sequential nature does not allow for feedback between model layers and therefore cannot capture the complex trade-offs in real-world scheduling behaviour.

Recent work by the Transport and Mobility Laboratory at EPFL has established a novel activity-based modelling approach built on first principles that assumes that individuals schedule their days in order to maximize their overall utility. This approach allows the different discrete dimensions of the activity scheduling process (activity participation, activity scheduling, location choice, mode choice) to be combined in an integrated optimisation framework, which can be used to draw likely schedules from a continuous distribution.

In this talk, we present a new approach to estimate model parameters for the daily activity scheduling framework by formulating a discrete choice model over a choice-set of considered daily schedules. The nature of the choice problem presents several new challenges for the parameter estimation; in particular the highly combinatorial nature of the possible choice set and the lack of data describing unchosen alternatives. We explore two different

methodologies for choice-set generation from recorded schedules: the Metropolis-Hastings algorithm and a heuristic algorithm based on maximising the D-efficiency score. We then show how these choice-sets can be used to estimate model parameters using maximum likelihood estimation. The approach is demonstrated using a case-study of selected travel diaries from the 2015 Swiss Mobility and Transport Microcensus (MTMC).

Abstract and background reading (Andrii Parkhomenko)

If the 2020 surge in working from home became permanent, how would the distribution of jobs and residents within and across U.S. cities change? To study this question, we build a quantitative spatial equilibrium model of job and residence choice with commuting frictions between 4,502 sub-metropolitan locations in the contiguous U.S. A novel feature of our model is the heterogeneity of workers in the fraction of time they work on-site: some workers commute daily, some always work at home, while others alternate between working on-site and remotely. In a counterfactual where remote work becomes more common, residents move from central to peripheral areas within cities, and from large coastal to small interior cities, on average. The reallocation of jobs is less monotonic, with increases both in peripheral locations and in the highest-productivity metropolises. Agglomeration externalities from in-person interactions are crucial for welfare effects. If telecommuters keep contributing to productivity as if they worked on-site, better job market access drives considerable welfare gains, even for those who continue to commute. But if productivity declines in response to the reduction in face-to-face interactions, wages fall and most workers are worse off.