The evolution of architecture, cities and the tools that shape them

What, in essence, is a city? An architectural phenomenon? A natural, biological phenomenon? An economic, cultural or social phenomenon? What are the most appropriate tools for shaping them to become more resilient and sustainable?

Over the May Day long weekend, I drafted a 4000-word paper on the question that attempts to bring these various answers together in novel ways. The paper is aimed at a widely read general science journal and will hopefully help set and publicise the agenda of HKU's new Urban Systems Institute. Clearly, each answer is valid. But the question I pose is 'in essence', which requires thought about both *causal* and *teleological* aspects of the question. How is a city formed, what social and individual purposes does it fulfil, and to what extent is it shaped by pursuit of end-goals?

Our colleague Donn Holohan, Irish architect and designer of the sublime 'Wind and Rain Bridge' and 'Sun Room', recently published a book chapter on the complex relationships between architects (city builders) and their tools. It is a profound bit of prose as beautifully written as Donn's structures. It inspired me in my quest for the essence of the city. Tools, in Donn's piece (reproduced below), shape architecture, are shaped by their makers and users, and in turn shape those who use them. Tools influence how an architect or craftsperson thinks about creating, making and shaping buildings and cities.

Consider a non-teleological, natural science position, that a city is 'caused' by collective behaviour as our species pursues its onward evolutionary journey of survival and adaptation. Then extend the thought to assume that the essential nature of a city is pretty similar to a colony of eusocial insects. A eusocial species is one that displays a social division of labour; for example, the queen bee responsible for reproduction, worker ants, forager ants, attacker termites, and my favourite, the bees that have evolved to hover around the colony entrance at certain times of the day to keep drunken forager colleagues

intoxicated with fermented pollen, from entering the hive and disturbing the social order.

The tools of eusocial species clearly shape their cities. Worker sub-species and symbiotic species co-inhabiting a colony become slave 'tools'. Anatomical 'tools' co-evolve with the colony architecture in evolutionary time. The insect-city itself becomes a tool in the processes of food production and storage, shelter and reproduction. Some species build their own cities and others re-use cities built and abandoned by others. Some aggressive species go to war to secure cities, like humans. Studies of termites have found that the capacity of 'as-found' cities determines the size of a colony, but not in the way you might think. The occupying colonies never max-out on space, but grow to a limiting percentage that always leaves a margin of unused space. Thought to be a resilience strategy, the reserved space allows for a margin of error resulting from unpredictable food availability and other environmental and competitor exigencies. So, the eusocial termite's city architecture, as a tool, directly determines the colony's individual and social dynamics. An extreme extension to Donn Holohan's argument. Here is an extract:

> *It is often easy to underestimate the pervasive impact of the tools we use. In shaping our tools, we in turn are shaped by them. Whether they are material or more abstract, our tools change the way we feel, act and think, and can transform how we relate to the world around us. Architects both understand and construct their world through the device of the plan and section; engineers through the balance of reciprocal forces; and craftsmen through tacit material affinities. Caught within our own individual disciplinary feedback loops we can become inured to the qualities and perspectives embedded within the tools of other practices and cultures. In this context, there is a tendency to assign values to our tools: describing them hierarchically as better or worse. It is perhaps too simplistic to see the evolution of our tools as a linear one. The plotter does not, in fact, supersede the pen; they are different tools, and although they can be used to achieve the same ends, they also offer clearly distinct opportunities. The changing nature and form of the tools we construct are therefore more appropriately framed in terms of a branching continuum, a set of unique potentials rather than a process of obsolescence and replacement. This is not a widely held position: across a developing China, the ongoing and rapid reconstruction and development effort taking place can be seen as an antagonistic process – a conflict between old and new, tradition and modernism, conservatism and progress.*
>
> Holohan, D. (2022). Translating craft. In J. Lin & O. Ottevaera (Ed.). *Embracing uncertainty: Experiments in making from the Chinese countryside* (pp. 118-175). Hong Kong: Applied Research & Design.

Donn's narrative is more teleological, mine more causal, reflecting our contrasting intellectual and professional paradigms. I am as interested in

understanding why and how cities evolve and develop certain functions, as in questions of how we can improve them. Donn is interested in improving them – seeking opportunities to evolve and synthesise new approaches to architectural production derived from a study of both the tacit positions and explicit intelligences embedded in the tools we employ, be they ancient or modern. While it may never be possible to stand against the tide of technological advance and economic imperatives that drives urbanisation, densification, modernisation and with it standardisation, might it be possible to rescue certain ways of doing things from the past to improve the future? Can we redefine craft in the age of automation? Can technology differentiate as well as standardise? Can specificity be mass produced? At the urban planning scale: how do you plan for spontaneity, design the informal, and engineer beauty? How do you steer complex self-organising distributed systems? Like economists, urban planning thinkers have long been interested in a new breed of tools that are capable of shaping the spontaneous social order that we call markets. There is an equivalent new interest in landscape architecture in tools that steer natural spontaneous geomorphological processes to purposefully shape landscape evolution. Practising urban designers, landscape professionals and planners, like architects, tend to think teleologically about the built environment: what tools (technological, conceptual, institutional) can help us deliver the normative purposes of cities more effectively? We tend to teach our students to think of cities in term of the social purpose of environmental, building, city and urban policy design, rather than the evolutionary inevitability of the phenomena they study. What tools will make our buildings, landscapes, cities and neighbourhoods more environmentally sustainable, economically productive, socially harmonious, aesthetically beautiful, functionally efficient, and culturally rich? We can deepen our students' insights into such questions by also drawing their attention to the ways in which solutions are determined, or at least constrained or limited, by tools, and the ways in which tools evolve in response to the limits they impose on solutions. In this sense, every tool, be it a robot, hammer, jig, factory, financial instrument or an anti-poverty policy, has a memory as well as a purpose. Its purpose may turn out to be different from its designer's purpose in making it, and its evolved purpose is likely to be shaped by its cultural memory. There is more determinacy in this line of reason, but it is not necessarily deterministic in the Marxist or Hegelian sense. Creative thinking driven by optimism and a desire to invent a better future needs realism to help it understand why things are as they are. That way, our dreaming, including about how to recreate an urban world of Barcelona-inspired cities, or to resurrect craft architecture with the help of robotics, is more likely to succeed. As Donn Holohan's work shows, and the research of John Lin and Olivier Ottevaere featured in the same book, architectural and urban scholars can help shape the future by carefully analysing how the present has evolved from the past.

Congratulations and thanks to colleagues mentioned below for their ongoing ingenuity, hard work and achievements.

Chris Webster
Dean, FoA

Faculty of Architecture

1. A warm welcome to the following new colleagues, who joined our Faculty in April 2022:

	Dr Guangzhao Chen Post-doctoral Fellow, Division of Landscape Architecture Guangzhao completed his PhD studies at Sun Yat-Sen University in 2020. He is currently assisting Dr Chao Ren in her CRF project on urban climate and machine learning. His research interests focus on land-use/land-cover simulation, climate change, urban climate, remote sensing and GIS.
	Dr Zongshuai Wan Post-doctoral Fellow, Department of Architecture Zongshuai earned his PhD in Structural Engineering at Harbin Institute of Technology in 2020, with his dissertation on morphogenesis and mechanical properties of novel hybrid inflatable structures. He is currently working for Dr Eike Schling's project 'Asymptotic Building Envelope – Simplifying the Fabrication and Assembly of Free-form Construction'. His research interests cover the fields of lightweight structures, form finding, graphic statics, cable-membrane structures, hybrid inflatable structures and cable-net structures.

2. QS World University Rankings by Subject 2022

   - HKU FoA retains its global ranking at 14th in the field of Architecture and Built Environment, while rated 4th in Asia and the best-performing in Hong Kong – we have been consistently ranked in the world's top 15 over the past seven years.

The QS World University Rankings by Subject is a major global league table for higher education. Their rankings are based on analyses of academic reputation, employer reputation and research impact.

More information:
https://www.topuniversities.com/university-rankings/university-subject-rankings/2022/architecture-built-environment

3. URC Small Equipment Grant 2021/22

- has been awarded by the University Research Committee to the following proposed projects to support their equipment for a period of 24 months, from 1 April 2022 to 31 March 2024:

(i) Dr Bin Chen (DLA):

'Modelling Eye-level Green Exposure from Remotely Sensed Bird-view Observations with a Novel 2D to 3D Transformation Framework' (Funding Amount: HK$136,563.50)

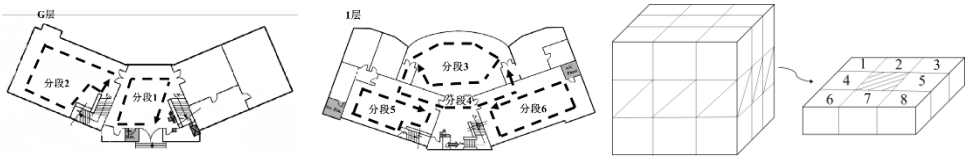
(ii) Dr Jun Ma (DUPAD):

'An Integrated Kit for Digital Twin City and Urban Environment Sensing: from Indoor to Outdoor' (Funding Amount: HK$213,916.00)

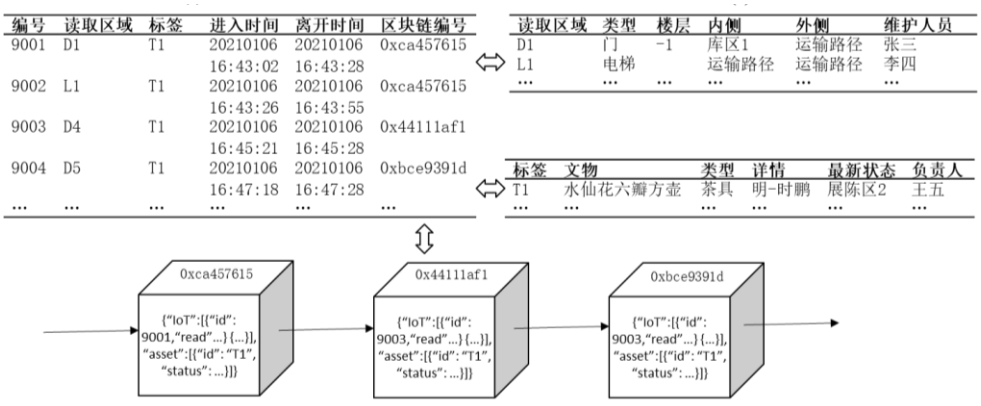
4. New patents

- by a HKU team led by Professor Anthony Yeh (DUPAD) and Dr Frank Xue (REC) have been reported as research output of the project 'Application of Virtual Reality in Guangdong-Hong Kong-Macau Greater Bay Area Heritage Conservation', in collaboration with OKayGIS Company, Shenzhen University, Sun Yat-Sen University, Guangdong Museum, Guangdong Heritage Archaeology Research Institute, and Guangdong Kaizhi Cultural Heritage Conservation Research Institute, under the 2022 Key Areas Research and Development Programs of the Department of Science and Technology of Guangdong Province:

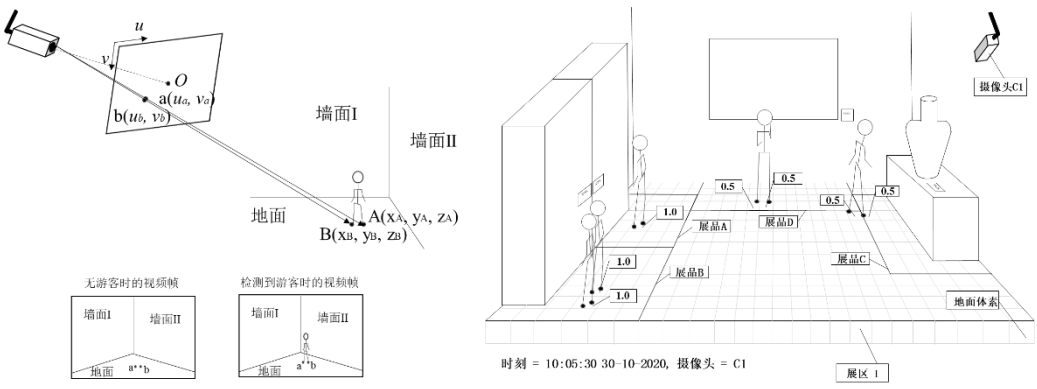
(i) Xue, F., Yeh, A. G. O., Wu, Y. (PhD Year 1 student) and Chen, Z. (PhD Year 1 student). (2022). Indoor 3D Barrier-Free Mapping Based on Lidar Point Cloud and BIM Clash Simulation [基于 LiDAR 點雲和 BIM 碰撞模擬的室內三維無障礙地圖生成方法]. China Patent Filing No.: 202210303655.0; PCT filing pending.



(ii) Xue, F., Yeh, A. G. O., Chen, Z. (PhD Year 1 student), and Zhao, R. (MPhil Year 1 student). A Cultural Relics Traceability System for Museums [一種博物館文物可追溯的方法及系統]. China Patent Filing No.: 202210303663.5; PCT filing pending.



(iii) Xue, F., Yeh, A. G. O., Wu, Y. (PhD Year 1 student) & Yang, Z. (PhD Year 1 student). An Analytics System for Museum Touring Based on BIM and Surveillance Videos [一種基于 BIM 和視頻監控的博物館參觀分析的方法及系統]. China Patent Filing No.: 202210302636.6; PCT filing pending.



The other research output is the '360 Virtual Tours of Heritage Buildings in Hong Kong' website: http://www.dupad.hku.hk/cusup/hkvirtualtour/eng/

5. Hong Kong PhD Fellowship Scheme (HKPFS) and HKU Presidential PhD Scholarship (HKU-PS)

   - have been awarded by the Research Grant Council and HKU respectively, to the following PhD candidates for admissions to academic year 2022/23:

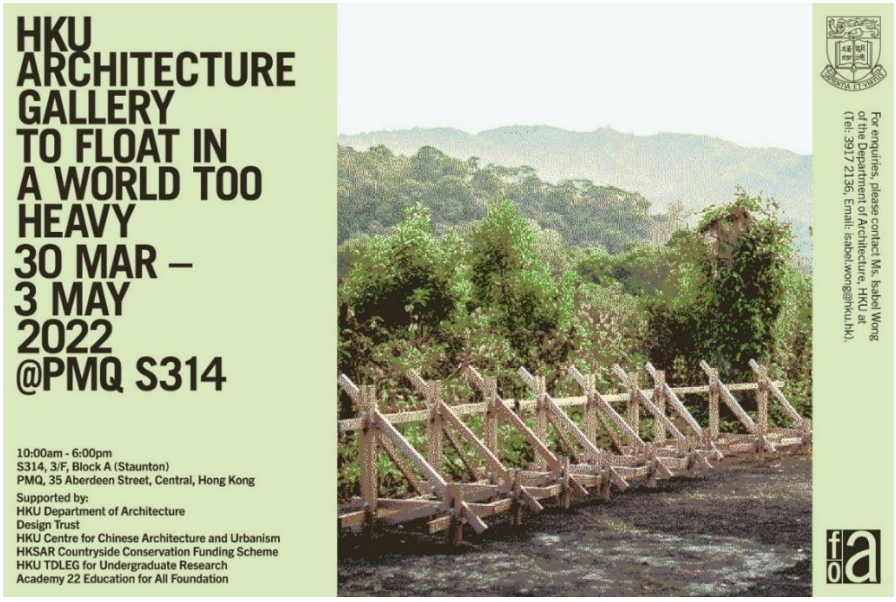
HKPFS and HKU-PS Awardees

Name	**Department**	**Primary Supervisor**	**Co-supervisor**
Mr Quang Cuong DOAN	DUPAD	Dr Xiaohu Zhang	Professor Shenjing He
Mr Jingliang DU	ARC	Professor Weijen Wang	Dr Ying Zhou
Miss Zixin FENG	DUPAD	Dr Yulun Zhou	Professor Shenjing He
Mr James Njiraini GACHANJA	DUPAD	Dr Tianren Yang	Dr Jiangping Zhou
Miss Scarlet Nga Chin TONG	DUPAD	Dr Guibo Sun	Professor Anthony Yeh
Miss Yue ZHANG	REC	Professor Kelvin Wong	Dr Chongyu Wang

Department of Architecture

1. ‘To Float in a World too Heavy’ Exhibition @ PMQ

   - featured works by HKU Architecture students, alumni and faculty members. Inspired by Hong Kong ancient myths, the exhibition was an exploration of animistic beliefs through designs along the seams of land and water, a resurrection of sunken making and living techniques inundated by the heaviness of land in Hong Kong.



   ‘To Float in a World too Heavy’ showcased four works by HKU Architecture students, alumni and faculty members between the seams of land and water in Hong Kong, with a focus on ‘making home in nature’ through design, research, and action. Projects featured in the exhibition served as explorations of the animistic beliefs – that house, a piece of seemingly inert artifact, is actually endowed with life and thought; and home, often a human-centric concept, could be understood beyond the need of humankind.

   The exhibition also presented a series of myths, many from Hong Kong’s deep antiquity, that stroll along the waterfront of the city, forming an interpretive framework for the design works. As Roland Bathes states, ‘However paradoxical it may seem, myth hides nothing: its function is to distort, not to make disappear.’ This exhibition hoped to uncover the making and living techniques which are often overlooked in Hong Kong’s building culture, and to awaken an imagination of the good life in a city that is too often entangled in the congested heaviness of the land.

   Curators: Su Chang and Tianying Li

   Workshop Leaders: Laurene Cen, Jacky Lai, Sherman Lam, Go Yi, Rochelle Yu

Featured Works:

Liquid Homes: Kat O, Tai O, Po Toi O

Su Chang, Ming Rou Hon, Zhu Yalan Julia, Ma Ho Ching Issac

Supported by Design Trust

Field Theater: Kuk Po

Su Chang, Tianying Li with Weijen Wang

Fong Yan Nok Joanna, Iu Shing Chun Chris, Kong Ling Yiu Yoyo, Ku Wun Lucinda, Lau Wing Lam Ally, Law Tsz Hin, Lo Shui Fung Sherman, Mao Yue Yang Lesley, Wong Lok Yu Angel, Wu Wan Sheung Ada, Zhou Yuying Cherrie, Kim Daegeun, Ma Ho Ching, Hon Ming Rou, Pak Hei Nam, Tam Wing Huen Raven, Wong Chung Hei Matthew, Wong Chun Yan Oscar, Zhu Yalan Julia, Liu Yiran, Sherman Lam, Jacky Lai, Tian Mengxiao

Supported by HKU Centre for Chinese Architecture and Urbanism and HKSAR Countryside Conservation Funding Scheme

Project Tombolo: Po Toi

Laurene Cen, Henry Chung, Yi Go, Jacky Lai, Sherman Lam, Vivien Lee, Anson Ng, Rochelle Yu

Supported by Academy 22 Education for All Foundation

A Modernologio Dictionary: Fishing Villages under Covid

Tam Wing Huen Raven, Pak Hei Nam, supervised by Su Chang

Supported by HKU TDLEG for Undergraduate Research

Date: **30 March 2022 (Wednesday) – 3 May 2022 (Tuesday)**

Time: **10:00 am – 6:00 pm**

Venue: **S314, 3/F, Block A (Staunton), PMQ,**
35 Aberdeen Street, Central, Hong Kong

Please visit the official webpage of the HKU Architecture Gallery for more information.

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Division of Landscape Architecture

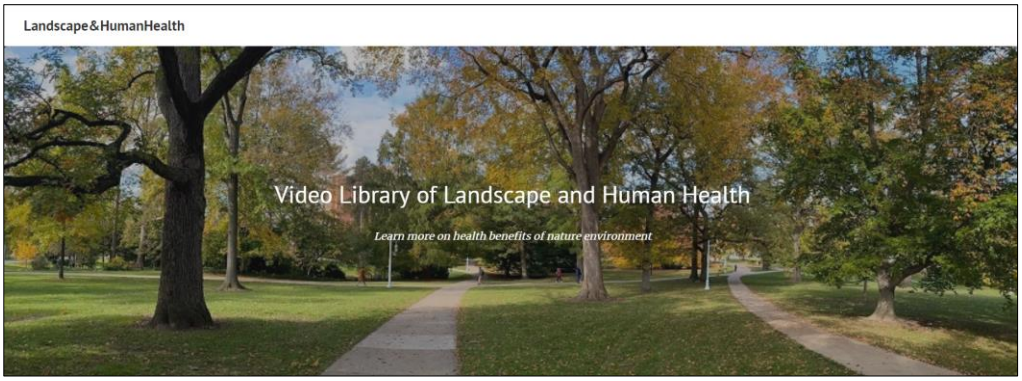
1. Dr Bin Jiang

   - delivered a plenary talk on ‘Urban Landscape & Healthy City’, at the Hong Kong 2022 International Urban Forestry Conference organised by the Development Bureau of HKSAR Government, on 4 March 2022. The lecture was moderated by Mr Mathew Pryor, FoA Associate Dean (Teaching & Learning) and Head of DLA.

- has co-established an online knowledge exchange and educational platform, *Landscape and Human Health*, joined by scholars from the University of Hong Kong, Cornell University, University of Maryland, Texas A&M University, University of Illinois, National Taiwan University, etc., for future collaborations.

  A selection of 10 online lectures are already available for public viewing on the platform:

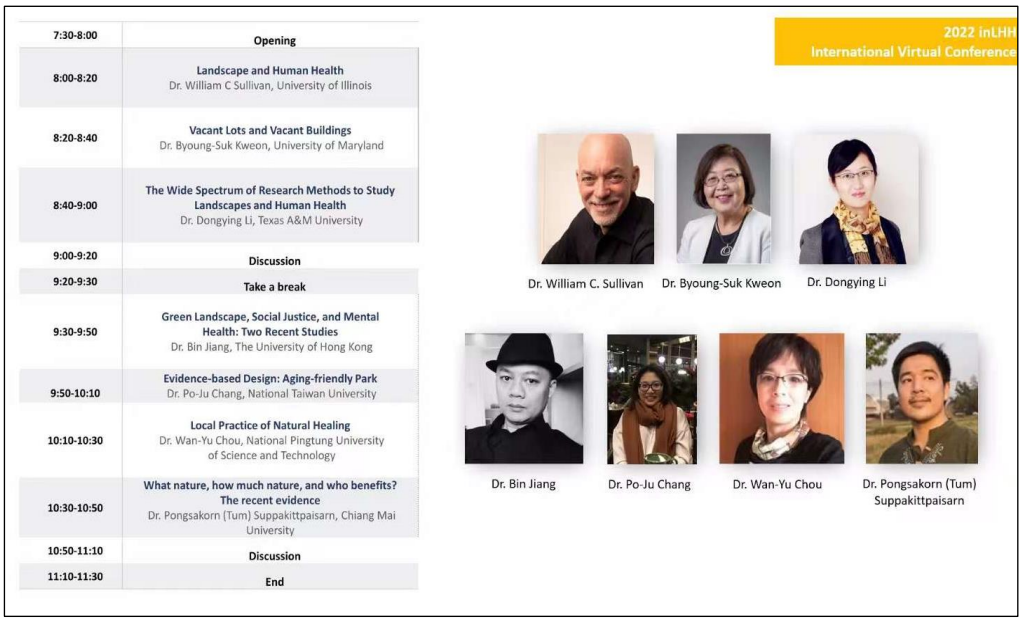
  https://sites.google.com/view/landscapehumanhealthv2/home



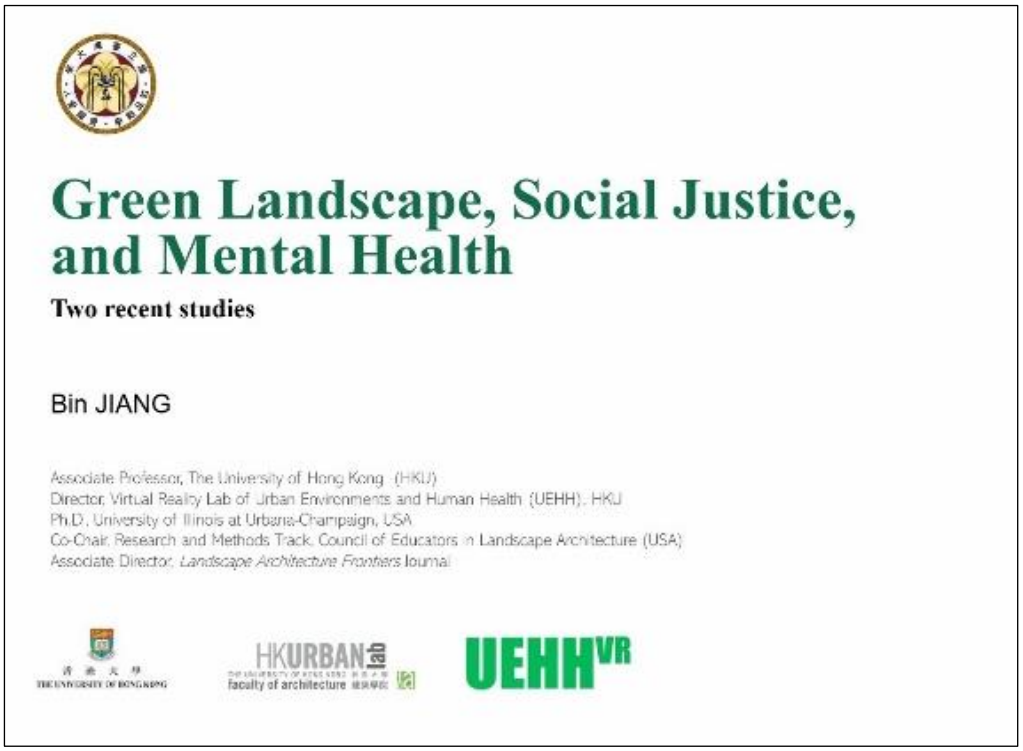
- delivered an online lecture titled ‘Urban Landscape & Healthy City’, for the Department of Geography, Hong Kong Baptist University, on 7 April 2022, as part of the Department’s Public Seminar Series.

- delivered a keynote speech, titled ‘Urban Green Landscape and Mental Health’, at the 2022 Annual Conference of the Hong Kong Association of Therapeutic Horticulture, on 4 March 2022.

- delivered a plenary talk, titled ‘Green Landscape, Social Justice, and Mental Health: Two Recent Studies’, at the 2022 International Landscape and Human Health (inLHH) International Virtual Conference. With the theme of ‘Healthy Landscape and Healthy People: Theory and Research Trend’, this year’s Conference was organised by National Taiwan University and Tunghai University on 11 April 2022.



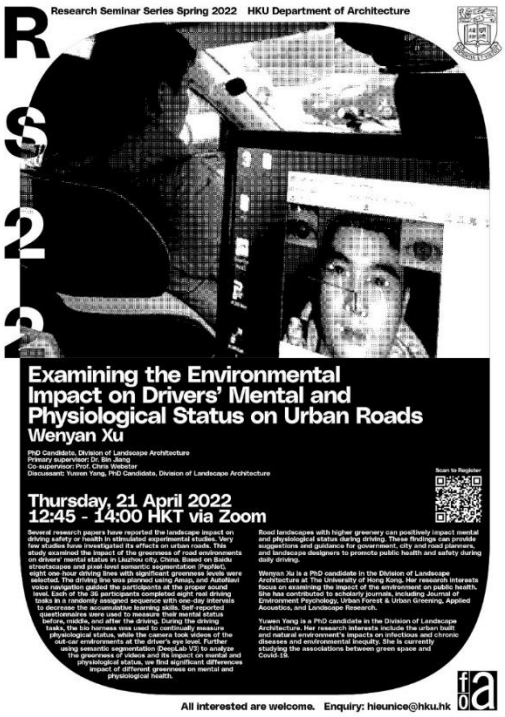
7:30-8:00	Opening
8:00-8:20	Landscape and Human Health Dr. William C Sullivan, University of Illinois
8:20-8:40	Vacant Lots and Vacant Buildings Dr. Byoung-Suk Kweon, University of Maryland
8:40-9:00	The Wide Spectrum of Research Methods to Study Landscapes and Human Health Dr. Dongying Li, Texas A&M University
9:00-9:20	Discussion
9:20-9:30	Take a break
9:30-9:50	Green Landscape, Social Justice, and Mental Health: Two Recent Studies Dr. Bin Jiang, The University of Hong Kong
9:50-10:10	Evidence-based Design: Aging-friendly Park Dr. Po-Ju Chang, National Taiwan University
10:10-10:30	Local Practice of Natural Healing Dr. Wan-Yu Chou, National Pingtung University of Science and Technology
10:30-10:50	What nature, how much nature, and who benefits? The recent evidence Dr. Pongsakorn (Tum) Suppakittpaisarn, Chiang Mai University
10:50-11:10	Discussion
11:10-11:30	End



- was invited to the panel discussion of ‘Landscape Architecture for Health Across the Lifespan’ at the 2022 Annual Conference of the Council of Educators in Landscape Architecture (CELA), where he delivered a talk on ‘Landscapes and COVID-19 Infection’, on 17 March 2022.

2. Miss Wenyan Xu (PhD Year 2 student)

- delivered an online research seminar titled ‘Examining the Environmental Impact on Drivers’ Mental and Physiological Status on Urban Roads’ on 21 April 2022 via Zoom.



***Abstract**: Several research papers have reported the landscape impact on driving safety or health in stimulated experimental studies. Very few studies have investigated its effects on urban roads. This study examined the impact of greenness of road environments on drivers' mental status in Liuzhou city, China. Based on Baidu streetscapes and pixel-level semantic segmentation (PspNet), eight one-hour driving lines with significant greenness levels were selected. The driving line was planned using Amap, and AutoNavi voice navigation guided the participants at the proper sound level. Each of the 36 participants completed eight real driving tasks in a randomly assigned sequence with one-day intervals to decrease the accumulative learning skills. Self-reported questionnaires were used to measure their mental status before, during, and after the driving. During the driving tasks, the bio harness was used to continually measure physiological status, while the camera took videos of the outside environments at the driver's eye level. Further using semantic segmentation (DeepLab V3) to analyse the greenness of videos and its impact on mental and physiological status, we find significant differences in the impact of different greenness on mental and physiological health. Road landscapes with more greenery can positively impact mental and physiological status during driving. These findings can provide suggestions and guidance for governments, city and road planners, and landscape designers to promote public health and safety during daily driving.*

About the speaker

Miss Wenyan Xu is a PhD candidate in the Division of Landscape Architecture at The University of Hong Kong. Her research interests focus on examining the impact of the environment on public health. She has contributed to scholarly journals, including *Journal of Environment Psychology*, *Urban Forest & Urban Greening*, *Applied Acoustics*, and *Landscape Research*

About the discussant

Miss Yuwen Yang is a PhD candidate in the Division of Landscape Architecture. Her research interests include the urban built and natural environment's impacts on infectious and chronic diseases and environmental inequity. She is currently studying the associations between green space and Covid-19.

Date: **21 April 2022 (Thursday)**

Time: **12:45 pm – 2:00 pm**

Venue: **To be held via Zoom**

More information:
https://www.arch.hku.hk/event_/examining-environmental-impact-on-drivers-mental-and-physiological-status-on-urban-roads/

Department of Real Estate and Construction

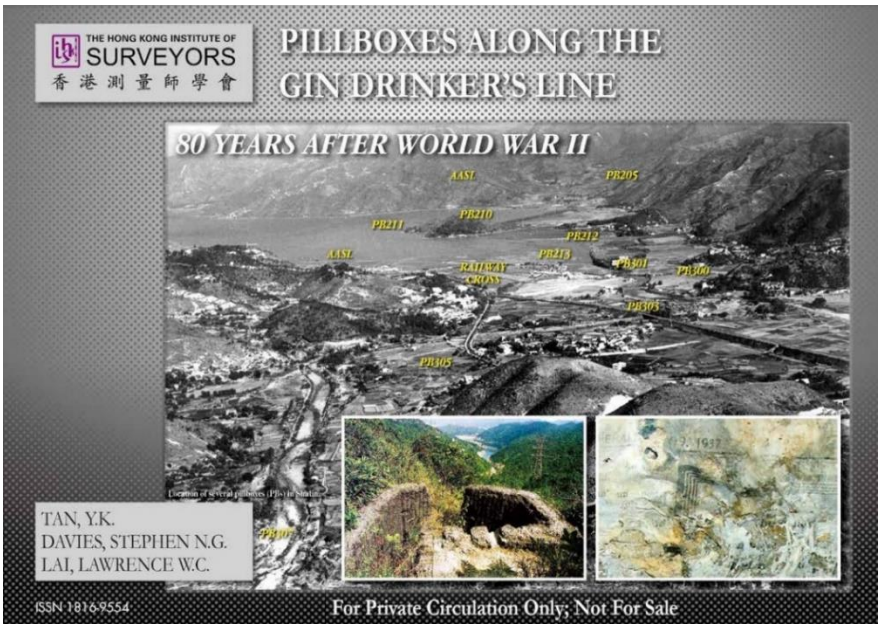
1. REC Research Seminar Series

   - invited Dr Yi Fan of NUS Business School to present her paper titled ‘A Tale of Two Cities: Mainland Chinese Buyers in the Hong Kong Housing Market’, on 13 April 2022 via Zoom.

     More information:
     https://www.arch.hku.hk/event_/a-tale-of-two-cities-mainland-chinese-buyers-in-the-hong-kong-housing-market/

2. Professor Stephen Davies and Professor Lawrence Lai

   - have co-written with Y. K. Tan a Special Issue of Surveying & Built Environment for the Hong Kong Institute of Surveyors (HKIS) Journal, titled *Pillboxes along the Gin Drinker's Line, 80 Years after World War II*. The publication is available for reading on the HKIS website.



3. Honorary Professor Daniel Ho

   - was invited to talk on 'How to ensure drainage at home is healthy during the pandemic?' in the 'LoveHK LoveU (大學 · 大愛)' series co-organised by HKU and Tsz Shan Monastery on 25 April 2022. The video is available on YouTube.

4. Dr Rosman Wai

   - shared her insight on Hong Kong's soon-to-be-demolished Mark IV resettlement blocks from the 1960s, in an interview with Mingpao Weekly published on 8 April 2022.

(Photos: Mingpao Weekly)

Department of Urban Planning and Design

1. 2022 Esri Young Scholars Award

   - DUPAD students have achieved excellent results in this year's Esri Young Scholars Award:

     - Mr CHU Chit Hei, Sebastian (BAUS Year 3)
       Award: 1st Runner-up
       Project: 'Smart Redevelopment'

     - Mr CHAN Chun Ping, Dieter (BAUS Year 3)
       Award: 2nd Runner-up
       Project: 'Charging for the Future?'

     - Mr HUI Chun Yin, Mr LU Zhi Mao and Mr NG Chun Hin (MUA Year 1)
       Award: 1st runner-up (Group Application) and Best Use of Open Data
       Project: 'Urban Renewal of Mong Kok'

     - Ms CHAN Yi Man (BAUS Year 3)
       Award: Best Story Map Design
       Project: 'Development of Smart Environment in Hong Kong'

     For further details on the results announcement, please visit:
     https://web.esrichina.hk/ysa/Result_Announcement.aspx?rmedium=www_esrichina_hk&rsource=/ysa/Result_Announcement.aspx

Centre of Urban Studies and Urban Planning

1. Professor Shenjing He

   - was invited by the Department of Geography and Research Management of The Chinese University of Hong Kong to deliver a research seminar titled 'The Rise of Education-Featured Gated Communities in Chinese Cities: (Re)producing the Enterprising Self via the Entrepreneurial Local State-Capital Nexus', on 14 April 2022 via Zoom.

2. Dr Kyung-min Nam

   - was invited by Kyung Hee University in Seoul, to deliver a seminar titled 'Uneven Population Distribution and Low Fertility: Focusing on the Role of Regional Policy', on 14 April 2022 via Zoom, as part of the University's Brain Korea 21 AgeTech-Service International Seminar Series funded by the National Research Foundation of Korea.

3. Professor Anthony Yeh

   - has published the following paper:

     Qi, Z. X., **Yeh, A. G. O.**, Li, X., & Liu, X. P. (2022). A land clearing index for high-frequency unsupervised monitoring of land development using multi-source optical remote sensing images. *ISPRS Journal of Photogrammetry and Remote Sensing, 187*, 393-421. https://doi.org/10.1016/j.isprsjprs.2022.03.017

***Abstract**: Timely information on land development is critical for preventing illegal construction, which is an increasingly serious problem in rapidly urbanizing countries. Although remote sensing has been widely used to observe land cover change, monitoring land development at a high frequency (e.g., weekly or daily) remains a challenge because of the lack of images with sufficient temporal resolution and methods independent of human supervision. This study developed a novel unsupervised method, namely, land clearing index (LCI)-based method, for monitoring land development at high frequencies. The LCI was proposed by examining the characteristics of the spectral change caused by the land clearing in the initial stage of land development. It is calculated with two images acquired at different times and can be used with an appropriate threshold to detect land development areas. Top-of-atmosphere reflectance (TOAR) data were found to be better than surface reflectance (SR) data for the use with the LCI-based method because the atmosphere effect played a positive role in distinguishing developed land from undeveloped land and suppressing the false alarms caused by the season change in vegetation. The major innovations of the LCI-based method are as follows: 1) applicable to the land development detection between images acquired by different optical sensors to allow for high-frequency detection; 2) can detect land development without training data and human supervision; 3) can detect various types of land development, such as converting farmland for building purposes, urban redevelopment, and land reclamation; and 4) simple, straightforward, and easy to implement. The LCI-based method was tested with different satellite images (Landsat-5, Landsat-7, Landsat-8, and Sentinel-2) for land development detection in nine cities selected worldwide. The average detection accuracy (DA), false-alarm rate (FR), and overall accuracy (OA) were 88.62%, 1.68%, and 98.22%, respectively. Compared with the traditional post-classification comparison based on the random forest algorithm, the LCI-based method produced better results and avoided the time-consuming work on sample selection. The LCI was also tested in each of the cities to detect land development at the various time intervals (5 days, 1 month, 3 months, 6 months, and 1 year) in the different seasons (January to March, April to June, July to September, and October to December). Approximately all the DAs were higher than 90.00%, while the FRs were highly related to the detection interval and ranged from 0.00% to 71.60%. The false alarms were mainly caused by the seasonal change in croplands, natural vegetation, shadows of mountains and buildings, and suspended sediment in the water. An approach was developed to calibrate the detection results of the LCI-based method for false alarm suppression. The false alarms were reduced by as much as 99.98% by reinforcing the LCI-based method with this calibration approach. The testing indicated that the LCI-based method is applicable and reliable for monitoring land development at a short time interval; thus, it is capable of preventing illegal construction*

iLab

1. Professor Wilson Lu

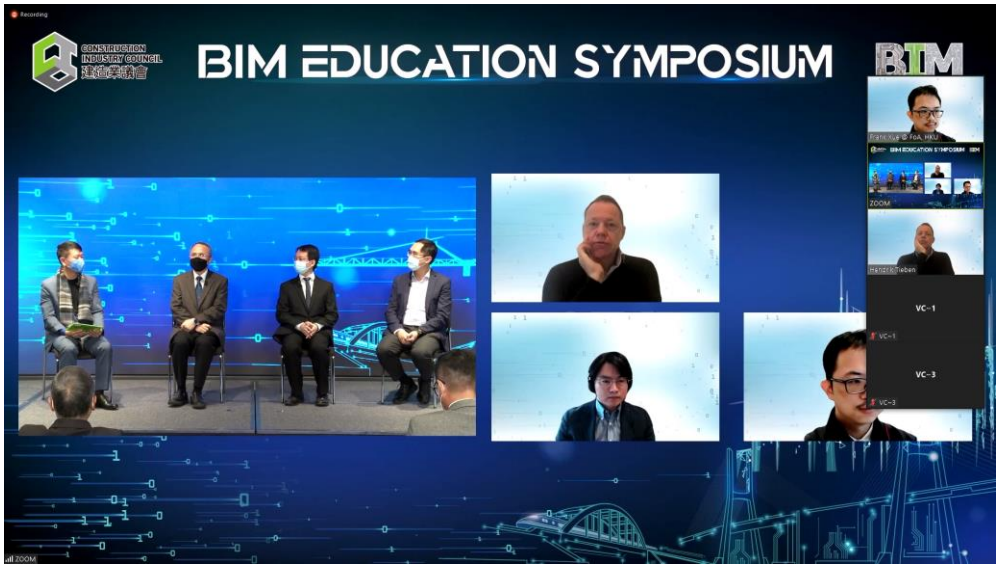
   - was invited by the HKU Faculty of Business and Economics to give a talk on ‘Construction e-Inspection 2.0 in the COVID-19 Pandemic Era: Urgent Needs, Stakeholder Concerns, and a Blockchain-based Solution’, on 19 January 2022, as part of the Business Analytics Industry Seminar Series.

   - served as an external examiner for a PhD thesis titled ‘Effective Construction and Demolition Waste Management Assessment: A Case of Australian Large Construction Companies’, for the School of Built Environment, University of New South Wales (UNSW), Australia.

   - delivered a webinar for the Construction Industry Council (CIC), titled ‘How iLab Makes Contributions to Construction Digital Transformation?’, on 8 April 2022 and as a post-award sharing session following iLab’s winning of the Silver Award in the Organisation Category of the CIC Construction Digitalisation Award 2021.

2. Dr Frank Xue

- has represented FoA to participate in a panel discussion session at the Construction Industry Council's (CIC) BIM Education Symposium 2022 on 25 January 2022.



- has won a Merit Award of Research with **Ms Yijie Wu** (PhD Year 1 student) and **Mr Lingming Kong** (Research Assistant at REC) in the Hong Kong OpenBIM/OpenGIS Award 2022, for their study titled 'Low-cost Digital Twins of Building Assets: Automatic Creation of Photo-realistic openBIM by Integrating Ubiquitous Augmented Reality and 2D CAD Drawings.'

3. Professor Wilson Lu, Mr Liang Yuan (PhD Year 2 student) and Dr Frank Xue

   - received the 2021 Best Paper Award from *Resources, Conservation and Recycling* (JCR IF = 10.204, a top journal in Environmental Sciences), for their research paper:

     Lu, W., **Yuan, L.**, & **Xue, F.** (2021). Investigating the bulk density of construction waste: A big data-driven approach. *Resources, Conservation and Recycling*, *169*, 105480. https://doi.org/10.1016/j.resconrec.2021.105480

     Abstract: *Construction waste contains inert (e.g., construction debris, rubble, earth, bitumen, and concrete) and non-inert materials (e.g., bamboo, plastics, wood, paper, and vegetation), while it is often a combination of the two when it is generated at source. The bulk density of construction waste is the yardstick information for many subsequent waste management efforts. One feasible way to derive the bulk density information is to segregate the mixture of inert and non-inert substances and examine their compositions, but clearly, this is an onerous task. This paper reports a data-driven approach to obtain the bulk densities of inert and non-inert construction waste by analyzing a big dataset of 4.9 million loads of construction waste in Hong Kong in the years 2017 to 2019. It is discovered that the means of bulk density are 336 kg/m3 for non-inert waste, 528 kg/m3 for mixed waste, and 991 kg/m3 for inert waste, and their coefficients of variation are 69%, 43%, and 29%, respectively. The research not only proved our heuristic rules concerning the bulk densities of the three generic types of construction waste, but also articulated, for the first time, their converged means and ranges. The findings can be used in adjusting the admission criteria as adopted in the governmental waste management facilities. Future research is recommended to further narrow down the bulk density ranges to provide more accurate references for construction waste management.*

     The annual Best Paper Awards recognise high-quality, high-impact papers published in *Resources, Conservation & Recycling* (RCR). The awards are selected based on scholarly merits by an Award Committee consisting of members of the Editorial Board. Among the 689 papers

published in RCR in 2021, three research and three review articles were selected by the Award Committee to receive the 2021 Best Paper Awards. The iLab's paper above was selected as one of the three winning 'research articles'.

The research is sponsored by the Environmental Conservation Fund (Project No.: ECF 2019-111) to develop a big data-based 'AI inspector' for gauging inert contents at the off-site construction waste sorting facilities in Hong Kong. The paper is the first step to understand the bulk density of construction waste (CW), with a view to providing a more accountable indicator to gauge the contents of CW truck loads. It aims to improve the operations of the two off-site construction waste sorting facilities in Tseung Kwan O and Tuen Mun, which are a significant part of the construction waste management system in Hong Kong.

4. iLab researchers

- have published the following papers:

(i) **Lu, W. S.**, & **Chen, J. J.** (PDF, REC) (2022). Computer vision for solid waste sorting: A critical review of academic research. *Waste Management, 142,* 29-43. https://doi.org/10.1016/j.wasman.2022.02.009

Abstract: *Waste sorting is highly recommended for municipal solid waste (MSW) management. Increasingly, computer vision (CV), robotics, and other smart technologies are used for MSW sorting. Particularly, the field of CV-enabled waste sorting is experiencing an unprecedented explosion of academic research. However, little attention has been paid to understanding its evolvement path, status quo, and prospects and challenges ahead. To address the knowledge gap, this paper provides a critical review of academic research that focuses on CV-enabled MSW sorting. Prevalent CV algorithms, in particular their technical rationales and prediction performance, are introduced and compared. The distribution of academic research outputs is also examined from the aspects of waste sources, task objectives, application domains, and dataset accessibility. The review discovers a trend of shifting from traditional machine learning to deep learning algorithms. The robustness of CV for waste sorting is increasingly enhanced owing to the improved computation powers and algorithms. Academic studies were unevenly distributed in different sectors such as household, commerce and institution, and construction. Too often, researchers reported some preliminary studies using simplified environments and artificially collected data. Future research efforts are encouraged to consider the complexities of real-world scenarios and implement CV in industrial waste sorting practice. This paper also calls for open sharing of waste image datasets for interested researchers to train and share their CV algorithms.*

(ii) **Lou, J. F.** (PhD Year 2 student), **Lu, W. S.**, **Xu, J. Y.** (PDF, REC), Li, X., & Wang, J. (2022). Nomenclature for offsite construction. *Building Research & Information*, 1-15. https://doi.org/10.1080/09613218.2022.2039586

Abstract: *The global rise of offsite construction has created a compelling need for more efficient information management. This paper reports the development of a nomenclature system for components to enable better information management in offsite construction projects in the digital era. Firstly, criteria for suitable names are derived from current construction practices, other matured naming practices, and information quality requirements. Then, through collaboration with industrial stakeholders to balance different needs and arrive at common understandings, we propose a nomenclature system that confers names upon offsite construction components. The system is validated and refined through a project-level case study and a policy-level focus meeting. The key contributions of this study are to articulate the widespread but rarely explored need for a nomenclature system for offsite construction, to exhibit the criteria for such a system, and to describe the process of development with collaboration with the industry. Future research is encouraged to investigate the optimal component level for a name, develop automatic naming tools, and modify and validate the nomenclature system in other regions.*

(iii) **Lu, W. S., Yuan, L.** (PhD Year 2 student), & **Lee, W. M. W.** (PhD Year 2 student) (2022). Understanding loading patterns of construction waste hauling trucks: Triangulation between big quantitative and informative qualitative data. *Environmental Science and Pollution Research*. https://doi.org/10.1007/s11356-022-19387-5

Abstract*: This research aims to understand the loading patterns of construction waste hauling trucks in Hong Kong and the factors shaping these patterns. It does so by triangulating the analytical results of big data collected from secondary sources and qualitative data from interviews. Firstly, based on the literature review and our engagement with the industry, four hypotheses on the nexus between 'loading pattern' and the factors of (1) vehicle, (2) permitted gross vehicle weight, (3) commodity, and (4) ownership. Then, the hypotheses are tested with combined null hypothesis significance test and effect size measure using 13 million construction waste transportation records. Finally, the results are triangulated with interview data to empirically validate the nexus while providing sensible explanations to them. We find that the four hypotheses are all supported. Distinct loading patterns are presented by different types of (1) construction waste hauling trucks with different (2) permitted gross vehicle weights, (3) types of construction waste transported, and (4) ownership. These findings provide valuable evidence for more targeted interventions, e.g., introducing public policies or hauling operation optimization through the avoidance of excessive underloading or overloading.*

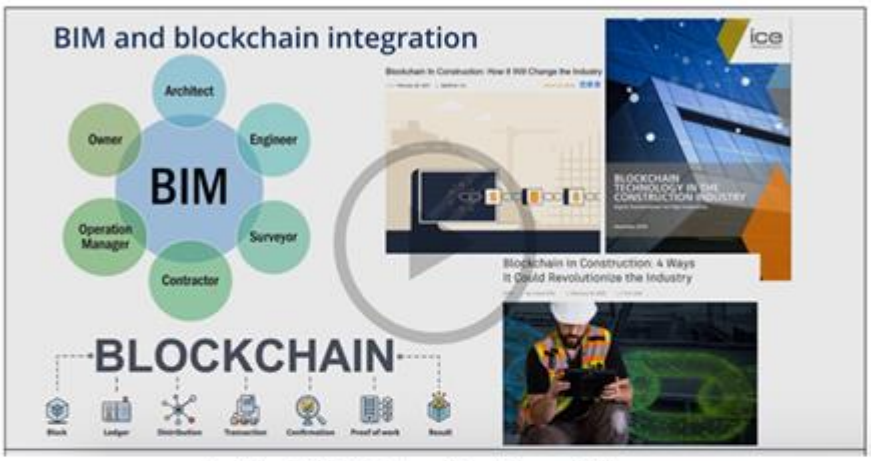
(iv) **Lu, W. S., Wu, L.** (PhD Year 2 student), **Xu, J. Y.** (PDF, REC), & **Lou, J. F.** (PhD Year 2 student) (2022). Construction e-inspection 2.0 in the COVID-19 pandemic era: A blockchain-based technical solution. *ASCE Journal of Management in Engineering*. Accepted.

***Abstract**: Inspection is a crucial construction process ensuring that building works and workers comply with prescribed codes, standards, and building progress. Traditional inspection is characterized by physical effort and onerous paperwork. The emergence of e-inspection 1.0 has meant the adoption of computerized means to ease the burden of paperwork, though physical onsite presence has remained mandatory. The COVID-19 pandemic, however, has made the dispatch of inspectors difficult. This has prompted governments worldwide to explore alternative inspection approaches that harness the latest information anti-tamper and traceability technologies, such as blockchain. In this paper, we refer to these approaches as "e-inspection 2.0". This research reports the urgent need for e-inspection 2.0 to guarantee construction quality, compliance, and progress amid pandemic conditions. Using the design science research method, it then proposes a blockchain-based solution to address authenticity and traceability concerns and facilitate e-inspection 2.0. The system is validated through a case study of a modular construction project in the Hong Kong–Pearl River Delta construction nexus. We find that rigorous technological solutions can render e-inspection 2.0 reliable. However, existing regulations are far from amenable to such inspections. We therefore call for an extension of the pandemic e-inspection 2.0 expediency to common practice in a post-pandemic era through the development of robust technological instruments and the amendment of inspection regulations.*

- The following students passed their PhD examinations in March 2022:

Student Name	**Thesis Title**	**Primary Supervisor**	**Co-supervisor**
Mr Zhikang BAO (passed with excellence)	Developing Circularity of Construction Waste in Emerging Economies: An Environmental Kuznets Curve Approach	Professor Wilson Lu	Professor K W Chau
Miss Hui GUO	From Corporate Social Responsibility to Creating Shared Value: Competitive Strategies for Chinese International Construction Companies on the 'One Belt One Road'	Professor Wilson Lu	Professor K W Chau

- received Honourable Mention from the US Chapter of buildingSMART International, for iLab's buildingSMART International Award 2021 winning entry 'openBIM: Opening the Gate for BIM and Blockchain Integration'.



buildingSMART International Award Winner
Professional Research Category

openBIM: Opening the gate for BIM and blockchain integration

Professor Wilson Lu and his team at The University of Hong Kong presents OBBi (openBIM & Blockchain Integration), a prototype workflow that turns a proprietary BIM into the openBIM IFC format, calculates changes to the IFC model, safeguards only these IFC format changes onto blockchain, and then restores the changes from the blockchain to an IFC or proprietary BIM on the other end. Check out their presentation and full submission on our website, as well as other award-winning projects.

buildingSMART International Awards 2021

Ronald Coase Centre for Property Rights Research

1. Dr Michael Chongyu Wang

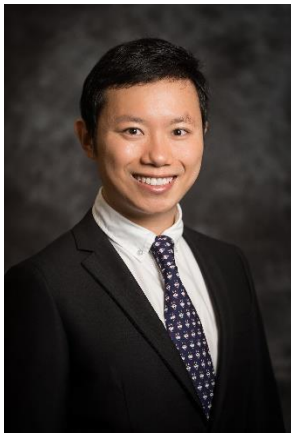
   - has published the following paper with Professor John L. Glascock and Professor Jeffrey P. Cohen of the University of Connecticut.

     Wang, C., Cohen, J. P., & Glascock, J. L. (2022). Geographically overlapping real estate assets, liquidity spillovers, and liquidity multiplier effects. The *Journal of Real Estate Finance and Economics*. https://doi.org/10.1007/s11146-022-09905-0

     ***Abstract**: When liquidity providers for one asset obtain information from other asset prices, this may magnify the (upward or downward) comovement of asset liquidity. It also may yield an illiquidity multiplier (Cespa and Foucault, Review of Financial Studies, 27(6), 1615–1660, 2014). We empirically test the magnitude of this illiquidity multiplier for a sample of U.S. equity real estate investment trusts (REITs) using spatial autoregressive models (Zhu and Milcheva, Journal of Real Estate Finance and Economics, 61(3), 443–475, 2018). We find significant liquidity spillovers among REITs with geographically overlapping real estate holdings. Our findings suggest that the multiplier effect impacts neighboring REITs through cross-asset learning about firm fundamentals. This effect is stronger during market turmoil, after the Decimalization (a source of exogenous variation), and for REITs headquartered in MSAs with less information asymmetry.*

   - discussed China's changing real estate policies in a recent interview with China Echo, a podcast project by HKU Journalism.

     The full interview can be accessed at: https://soundcloud.com/user-81913628/china-echo-season-4-episode-9



Sustainable High Density Cities Lab

1. Dr Jianxiang Huang

   - has the following paper accepted for publication:

     (i) **Huang, J. X.***, Cui, Y. M., Chang, H. L., Obracht-Prondzyńska, H., Kamrowska-Zaluska, D., & Li, L. S. (2022). A city is not a tree: A multi-city study of urban structure and urban life. *Landscape and Urban Planning* (In press).

     Abstract: *Christopher Alexander, a British-American scholar, differentiated an old (natural) city from a new (planned) one by structure. The former resembles a "semilattice", or a complex system encompassing many interconnected sub-systems. The latter is shaped in a graph-theoretical "tree", which lacks the structural complexity as its sub-systems are compartmentalized into a single hierarchy. This structural distinction explains, or perhaps determines "the patina of life" in old urban districts and the lack of such in new ones. Alexander's idea, although widely influential, remains contested in empirical research literature. Subsequent studies failed to distinguish the structural differences between the old and new cities in systematic ways, nor is his hypothesized structure-life relationship verified with statistical rigor. This study aims to test Alexander's urban structural theory under a comprehensive research framework. We translated his constructs and premises into a mathematically testable form. Qualities of urban spatial structure, such as "semilattice", "complex network" and "living structure", were measured using graph-topological indicators computed for street networks. Urban life was measured using a combination of Twitter activities, Point-Of-Interests, and walking trips at the district level. The structure-life relationship was examined using statistical models, after controlling for urban form and socio-demographic confounders including land use, density, block size, parks, income, age, and demographic groups. This research design was implemented in London, New York, Hong Kong, and Gdansk. Our results support Alexander's early works that an old urban district contains more "semilattice" compared with new ones. This quality can be captured by Meshedness Coefficient, a graph-network indicator for semilattice-shaped street network and a strong predictor for urban life. The same cannot be observed for "complex network" with consistency, and we found no independent associations between "living structure" and life, contrary to existing literature. The study shed light on the hidden relationship between urban spatial structure and behavioral evidence in both the virtual and physical world. We uncovered the British-American predilection of Alexander's theory, which matched data closely in London and New York, but less so in Hong Kong and Gdansk, suggesting the need for a locally-sensitive approach. The analytical tools developed can be of value for planning research and practice.*

- has published the following papers:

(i) **Huang, J. X.***, **Hao, T. P.**, **Wang, Y. L.**, & Jones, P. (2022). A street-scale simulation model for the cooling performance of urban greenery: Evidence from a high-density city. *Sustainable Cities and Society, 82*, 103908. https://doi.org/10.1016/j.scs.2022.103908

Abstract: *How much can greenery cool a city remains inconclusive in literature, especially in a high-density city where plants interact with anthropogenic heat from surrounding buildings and traffic. A novel simulation model, the Urban Greenery and Built Environment, was developed to assess the time-varying interactions between plants and anthropogenic heat at street scale. The model has been evaluated using field studies in two parks in Hong Kong. A reasonably good agreement was observed between measured and predicted temperature and humidity. Sensitivity studies were then conducted to compare the cooling performances of greenery in five scenarios under various coverage ratio and climates. By covering 40% of site with greenery, a practical limit, the expected air temperature and UTCI reductions were 0.3 °C, lower than previous estimates due to limited sunlight and ground-level surfaces for planting; the cooling benefits of greenery were predicted to be higher in dry climates and lower in humid ones. In a high-density city, plants converted sensible heat into latent gains at a slower rate than the anthropogenic exhaust heat. Alternative strategies, such as breeze enhancement, water-spray and management of anthropogenic heat discharges were predicted to further help to cool the city by 3.1 °C, 6.8 °C, and 1.8 °C, respectively.*

(ii) Chang, H. L., **Huang, J. X.**, Yao, W. R., Zhao, W. Z., & Li, L. S.* (2022). How do new transit stations affect people's sentiment and activity? A case study based on social media data in Hong Kong. *Transport Policy, 120*, 139-155. https://doi.org/10.1016/j.tranpol.2022.03.011

Abstract: *Urban rail development can increase land value, reduce commute time, and increase accessibility, as reported in the literature. However, little is known about the impact of opening urban rail transit stations on people's sentiment, particularly in the context of large metropolises where population density is significantly high. This paper investigates such impact by studying six new transit stations opened in Hong Kong. People's sentiment and activity in station nearby areas are estimated by tweet sentiment and tweet activity. We use the difference-in-difference model to study the impact of opening new transit stations. Tweet sentiment, tweet activity, tweet content, and footprints of people who visit the station-influenced area 'before and after' the opening of transit stations are analyzed. The results suggest that, in general, the introduction of transit stations causes a positive change in tweet activity, and the change is statistically significant after six months. Regarding tweet sentiment, new transit stations tend to pose a mixed effect in a short-*

term, a positive influence on areas with high-density residential places, yet a negative influence on areas with a large proportion of nature reserve areas. These short-term effects, positive or negative, become not significant in the long term (after twelve months). Our analysis also confirmed that the introduction of new transit stations increased accessibility from (to) other parts of the city to(from) the station's nearby area, which was shown by the expanded locations sustaining users visited. These findings indicate that the urban rail transit system in Hong Kong promotes more active neighborhoods yet does not always promote positive influence on people's sentiment. Further studies are needed to make future urban rail transit systems promoting active and happy neighborhoods. The study is relevant to the Belt and Road Initiative (BRI) in methodologies, data, and findings. The social media analysis method used in this study, including text mining and sentiment analysis, can be easily extended to multiple language analysis for Singapore, Malaysia, as well as other regions in the belt and road plan. The developed tools could contribute to analyzing the influence of cross-country projects on local neighborhoods in the belt and road plan.

(iii) Chang, H. L., Li, L. S.*, **Huang, J**. **X.**, Zhang, Q. P., & Chin, K. S. (2022). Tracking traffic congestion and accidents using social media data: A case study of Shanghai. *Accident Analysis & Prevention, 169*, 106618. https://doi.org/10.1016/j.aap.2022.106618

Abstract: *Traffic congestion and accidents take a toll on commuters' daily experiences and society. Locating the venues prone to congestion and accidents and capturing their perception by public members is invaluable for transport policy-makers. However, few previous methods consider user perception toward the accidents and congestion in finding and profiling the accident- and congestion-prone areas, leaving decision-makers unaware of the subsequent behavior responses and priorities of retrofitting measures. This study develops a framework to identify and characterize the accident- and congestion-prone areas heatedly discussed on social media. First, we use natural language processing and deep learning to detect the accident- and congestion-relevant Chinese microblogs posted on Sina Weibo, a Chinese social media platform. Then a modified Kernel Density Estimation method considering the sentiment of microblogs is employed to find the accident- and congestion-prone regions. The results show that the 'congestion-prone areas' discussed on social media are mainly distributed throughout the historical urban core and the Northwest of Pudong New Area, in reasonably good agreements with actual congestion records. In contrast, the 'accident-prone areas' are primarily found in locations with severe accidents. Finally, the above venues are characterized in spatio-temporal and semantic aspects to understand the nature of the incidents and assess the priority level for mitigation measures. The outcomes can provide a reference for traffic authorities to inform resource allocation and prioritize mitigation measures in future traffic management.*

(iv) Wang, Q., Lin, Z., Niu, J. L., Choi, G. K. Y., Fung, J. C. H., Lau, A. K. H., Louie, P., Leung, K. K. M., **Huang, J. X.**, Cheng, P., Zhao, P. C., Chen, W. Z., Zhang, S., Fu, L. Y., Chan, P. W., Wong, A. H., Tse, H., Wong, S. C. Y., Lai, R. W. M., Hui, D. S. C., Yuen, K. Y. Y., Lung, D. C. & Li, Y. G.* (2022). Spread of SARS-CoV-2 aerosols via two connected drainage stacks in a high-rise housing outbreak of COVID-19. *Journal of Hazardous Materials, 430*, 128475. https://doi.org/10.1016/j.jhazmat.2022.128475

Abstract: *Vertical transmission of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) along a vertical column of flats has been documented in several outbreaks of coronavirus disease 2019 (COVID-19) in Guangdong and Hong Kong. We describe an outbreak in Luk Chuen House, involving two vertical columns of flats associated with an unusually connected two-stack drainage system, in which nine individuals from seven households were infected. The index case resided in Flat 812 (8th floor, Unit 12), two flats (813, 817) on its opposite side reported one case each (i.e., a horizontal sub-cluster). All other flats with infected residents were vertically associated, forming a vertical sub-cluster. We injected tracer gas (SF6) into drainage stacks via toilet or balcony of Flat 812, monitored gas concentrations in roof vent, toilet, façade, and living room in four of the seven flats with infected residents and four flats with no infected residents. The measured gas concentration distributions agreed with the observed distribution of affected flats. Aerosols leaking into drainage stacks may generate the vertical sub-cluster, whereas airflow across the corridor probably caused the horizontal sub-cluster. Sequencing and phylogenetic analyses also revealed a common point-source. The findings provided additional evidence of probable roles of drainage systems in SARS-CoV-2 transmission.*

(v) Wang, Q., Lung, D. C., Chan, P. T., Jia, W., Dung, C. H., Miao, T., **Huang, J. X.**, Chen, W., Wang, Z., Leung, K. M., Xu, P., Lin, Z., Wong, D., Tse, H., Wong, S., Choi, G., To, K., Cheng, V., Yuen, K. Y., & Li, Y. G. (2022). High attack rate in a Tong Lau house outbreak of COVID-19 with subdivided units in Hong Kong. *Interface Focus, 12* (2). https://doi.org/10.1098/rsfs.2021.0063

Abstract: *Poor housing conditions are known to be associated with infectious diseases such as high Coronavirus disease 2019 (COVID-19) incidences. Transmission causes of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in poor housing conditions can be complex. An understanding of the exact mechanism of transmission can help to pinpoint contributing environmental issues. Here, we investigated a Hong Kong COVID-19 outbreak in early 2021 in four traditional Tong Lau houses with subdivided units. There are more than 80 subdivided units of less than 20 m2 floor area each on average. With a total of 34 confirmed COVID-19 cases, the outbreak had an attack rate of 25.4%, being one of the highest attack*

rates observed in Hong Kong, and ranked among the highest attack rates in reported outbreaks internationally. Tracer gas leakage and decay measurements were performed in the drainage system and in the subdivided units to determine the transport of infectious aerosols by the owner-modified sophisticated wastewater drainage pipe networks and the poor ventilation conditions in some subdivided units. The results show that the outbreak was probably due to multiple transmission routes, i.e. by the drainage pipe spread of stack aerosols, which is enhanced by poor ventilation in the subdivided units.

(vi) Wang, Q, Li, Y.*, Lung D. C., Chan, P., Dung, C. H., Jia, W., Miao, T., **Huang, J. X.**, Chen, W. Z., Wang, Z. X., Leung, K. M., Lin, Z., Wong, D., Tse, H., Wong, S. C. Y., Choi, G. K. Y., Lam, J. Y. W., To, K. K. W., Cheng, V. C. C., & Yuen, K. Y. (2022). Aerosol transmission of SARS-CoV-2 due to the chimney effect in two high-rise housing drainage stacks. *Journal of Hazardous Materials, 421*, 126799. https://doi.org/10.1016/j.jhazmat.2021.126799

Abstract: *Stack aerosols are generated within vertical building drainage stacks during the discharge of wastewater containing feces and exhaled mucus from toilets and washbasins. Fifteen stack aerosol-related outbreaks of coronavirus disease 2019 (COVID-19) in high-rise buildings have been observed in Hong Kong and Guangzhou. Currently, we investigated two such outbreaks of COVID-19 in Hong Kong, identified the probable role of chimney effect-induced airflow in a building drainage system in the spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). We injected tracer gas (SF6) into the drainage stacks via the water closet of the index case and monitored tracer gas concentrations in the bathrooms and along the facades of infected and non-infected flats and in roof vents. The air temperature, humidity, and pressure in vertical stacks were also monitored. The measured tracer gas distribution agreed with the observed distribution of the infected cases. Phylogenetic analysis of the SARS-CoV-2 genome sequences demonstrated clonal spread from a point source in cases along the same vertical column. The stack air pressure and temperature distributions suggested that stack aerosols can spread to indoors through pipe leaks which provide direct evidence for the long-range aerosol transmission of SARS-CoV-2 through drainage pipes via the chimney effect.*

Social Infrastructure for Equity and Wellbeing

1. Professor Shenjing He

   - has published the following papers:

   (i) **He, S.**, **Li, C.**, Xiao, Y., & Liu, Q. (2022). Examining neighborhood effects on residents' daily activities in central Shanghai, China: Integrating "big data" and "thick data." *Environment and Planning B: Urban Analytics and City Science,* 23998083221078307. https://doi.org/10.1177/23998083221078307

   ***Abstract**: This research combines "big data" and "thick data" approaches to examine the correlation and causation between residential neighborhood features and people's daily commuting and traveling patterns by integrating two datasets: household survey data and mobile phone data. We focus on "lilong" neighborhoods—a primary form of traditional residential neighborhood in central Shanghai. The characteristics of lilong neighborhoods are assessed using "thick data" from surveys in 105 lilongs, while residents' daily activities are mapped out using "big data" from two weeks of mobile phone usage. We match these two datasets at neighborhood level based on their geospatial references. Four multinomial logistic regression models are developed to examine neighborhood effects on lilong residents' daily activities. Our research confirms the major mechanisms of neighborhood effects and unravels their relative importance in shaping the patterns of residents' daily activities. Conceptually, this study sheds new light on the understanding of how people's life quality and wellbeing are affected by neighborhood characteristics through highlighting the importance of social interactions and the access to/quality of public facilities. Methodologically, incorporating household survey data (thick data) and mobile phone data (big data) is proven to be a novel and effective approach for examining neighborhood effects at a relatively large scale.*

   (ii) Cai, R., **Hu, L.**, & **He, S***. (2022). Policy-driven education-led gentrification and its spatiotemporal dynamics: Evidence from Shanghai, China. *The Geographical Journal*, 00, 1-16. https://doi.org/10.1111/geoj.12440

   ***Abstract**: As a highly sought-after resource by parents, quality schools exert a strong influence on the housing market and other aspects of social life worldwide. Given the long-lasting prominence of education in urban society, scholars extensively explored the interplay between education and housing dynamics and their sociospatial implications, among which the scholarship on education-led gentrification offers a prominent and productive conceptual lens.*

While the literature on education-led gentrification in developed economies is proliferating, little is known about the dynamic linkages between school choice and residential segregation in developing contexts, including China. Drawing on a longitudinal housing transaction (2011–2020) dataset covering 762 residential neighbourhoods in Shanghai, the largest and most developed city in China, this research quantitatively examines the process of gentrification driven by the accessibility to educational resources and its spatiotemporal dynamics. Based on analyses employing hedonic price models and a geographically and temporally weighted regression model, this study reveals the uneven evolution of education-led gentrification across space and time. Specifically, this study argues that the spatial variations in education-led gentrification in Shanghai and its temporal changes are largely policy driven. This finding foregrounds schools as an important driver of gentrification rather than merely a "downstream effect" of the existing gentrification process, especially in recently gentrifying suburbs. Therefore, this study adds novel conceptual and empirical insights to the scholarship of education-led gentrification in non-Western contexts in particular and the literature on the geographies of education in general.

Urban Analytics and Interventions Research Lab

1. Research Seminar on Transport and Health

   - Titled 'Staying Mobile and Healthy as We Age', the webinar was given by Charles Musselwhite, Professor of Psychology at Aberystwyth University, on 8 March 2022, to examine the importance of transport and mobility in relation to health and wellbeing in later life. The event was co-hosted with the Centre of Urban Studies and Urban Planning (CUSUP). More information: https://www.arch.hku.hk/event_/staying-mobile-and-healthy-as-we-age/

2. Mr Dongsheng He (PhD Year 1 student)

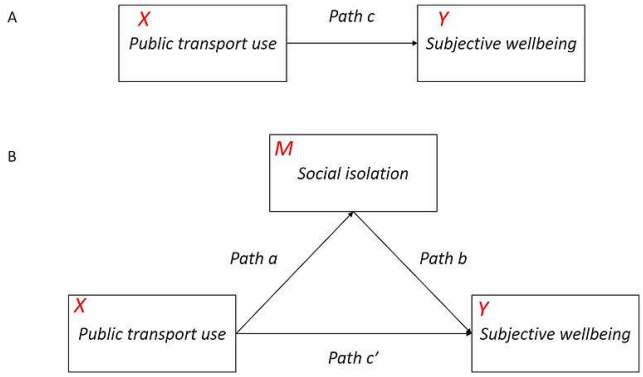
   - received an additional funding of HK$20,000 from RGC to support his research as an HKPFS awardee.

3. Miss Yao Du (PhD student), Dr Guibo Sun and Dr Eun Yeong Choe

   - have published the following paper:

     Du, Y., **Sun, G. B.***, **Choe, E. Y.**, & Kwan, M. P. (2022). Mediation effects of social isolation on pathways connecting public transport use with subjective wellbeing among older people. *Journal of Transport & Health*, *25*, 101378. https://doi.org/10.1016/j.jth.2022.101378

***Abstract**: This paper explored the question of 'To what extent can social isolation explain the association between public transport use and wellbeing?' We found the mixed-use of metro and bus is beneficial to subjective well-being (measured by life satisfaction, hedonic wellbeing and eudaimonic wellbeing) of older people. Social network explained 6–31% of the total association between public transport use and subjective wellbeing, and loneliness explained 14–41%. These findings have policy implications for public transport planning concerning the ageing population in Hong Kong.*

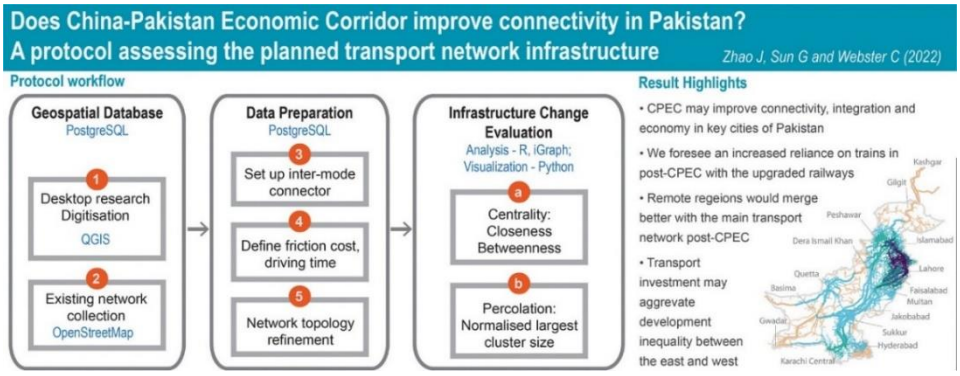


4. Miss Jianting Zhao (PhD student), Dr Guibo Sun and Dean Webster

   - have published the following paper:

   Zhao, J. T., **Sun, G. B.**, & **Webster, C.** (2022). Does China-Pakistan Economic Corridor improve connectivity in Pakistan? A protocol assessing the planned transport network infrastructure. *Journal of Transport Geography, 100*, 103327. https://doi.org/10.1016/j.jtrangeo.2022.103327

   ***Abstract**: In this paper, we developed an analytical protocol that evaluates the changes in transport network connectivity before and after the Belt and Road Initiative (BRI) transport infrastructure construction, using open-source data and tools, and tested it on the China-Pakistan Economic Corridor (CPEC), the flagship project of BRI. Results show that China's transport infrastructure investment may improve connectivity and the potential for economic agglomeration in certain key cities and some regions in Pakistan but would widen the development inequality in the country.*

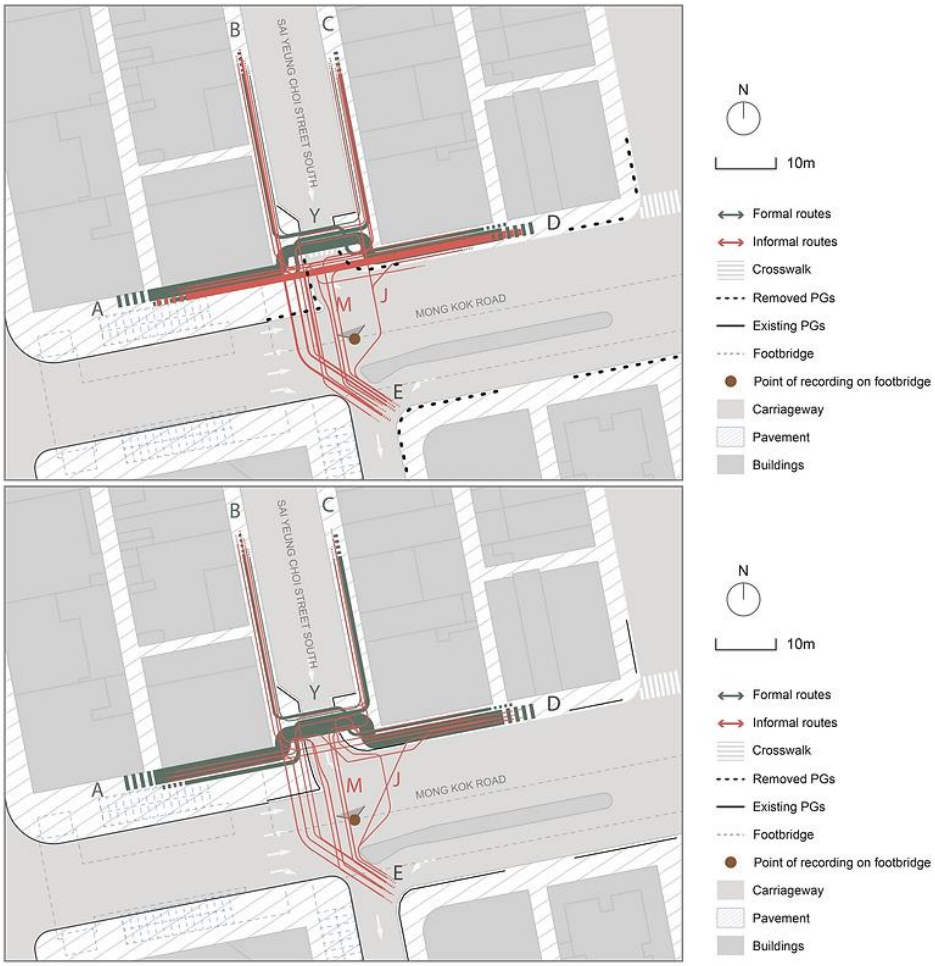


5. Dr Guibo Sun

- has published the following paper:

  Talamini, G., Shao, D., Chow, A. H. F., & **Sun, G. B.** (2022). The controversial impact of pedestrian guardrails on road crossing behaviours. Evidence from Hong Kong. *URBAN DESIGN International*, 1-17. https://doi.org/10.1057/s41289-022-00184-y

  ***Abstract**: We conducted a before-and-after observational study of the temporary removal of guardrails in Hong Kong, to explore the controversial issue: Are pedestrian guardrails for pedestrian safety or speeding up cars? We found pedestrian guardrails restoration significantly reduced low-risk crossings but increased high-risk behaviours. Specifically, people aged 65+ were more likely to cross the road aberrantly to avoid grade-separated pedestrian crossings.*



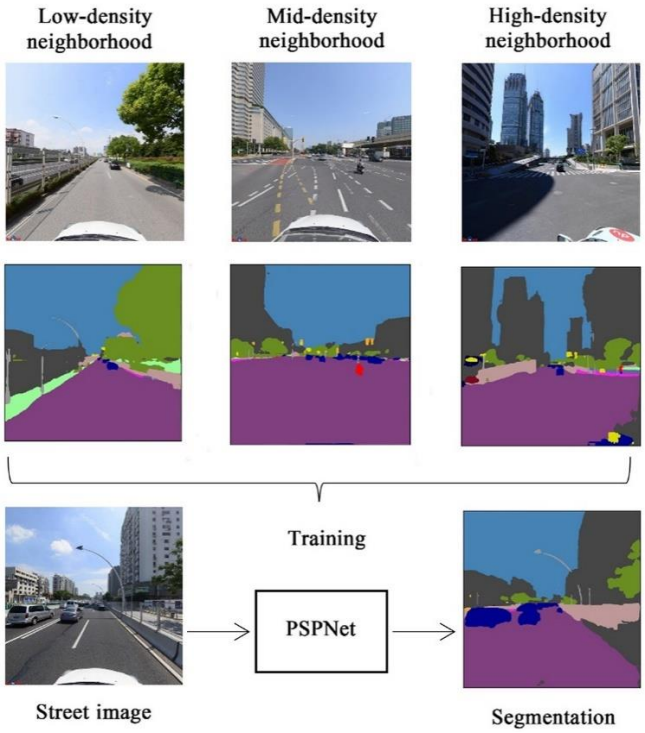
Pedestrian crossing behaviours before and after the restoration of the guardrails due to the social movement.

6. Mr Dongsheng He (PhD student)

   - has published the following paper:

     He, D. S., Miao, J., Lu, Y., Song, Y., Chen, L., & Liu, Y. (2022). Urban greenery mitigates the negative effect of urban density on older adults' life satisfaction: Evidence from Shanghai, China. *Cities*, *124*, 103607. https://doi.org/10.1016/j.cities.2022.103607

     ***Abstract**: Results from structural equation modelling showed that higher urban density was related to lower life satisfaction, and a reduced sense of community was a significant pathway between higher urban density and lower life satisfaction. Furthermore, eye-level greenery cushioned the negative effect of urban density on life satisfaction.*



Virtual Reality Lab of Urban Environments and Public Health

1. Miss Wenyan Xu (PhD Year 2 student) and Dr Bin Jiang

   - have published the following paper:

     Xu, W. Y., **Jiang, B.**, & Zhao, J. W. (2022). Effects of seasonality on visual aesthetic preference. *Landscape Research.* 1-12. http://doi.org/10.1080/01426397.2022.2039110

     ***Abstract**: Seasonality is a typical feature of landscapes in temperate regions. Seasonality's effects on visual aesthetic quality (VAQ) are widely recognised but not well understood. To address this gap, 10 sample sites were selected to represent the diversity of urban green spaces in Xuzhou, eastern China, which has a typical temperate monsoon climate. Photographs of the 10 sites were acquired in eight typical months to capture seasonality. Online surveys were used to evaluate the VAQ of the photographs. The mean value of the coefficient of variation of 16 landscape characteristics of a site during the seasons was used to represent seasonal diversity. The results indicated that: (1) the autumn landscape was the most preferred, and the winter landscape was the least preferred; (2) there was a significantly inverted U-shaped relationship between year-round VAQ and seasonal diversity. This is the first study to define seasonal diversity and its effect on VAQ.*

2. Dr Bin Jiang

   - has published the following paper:

     Huang, D. K., **Jiang, B.**, & Yuan, L. (2022). Analyzing the effects of nature exposure on perceived satisfaction with running routes: An activity path-based measure approach. *Urban Forestry & Urban Greening* (IF=4.537, SCI & SSCI, JCR Q1)*, 68*, 127480. https://doi.org/10.1016/j.ufug.2022.127480

     ***Abstract**: Studies on the linkages between nature exposure and physical activities often focus simply on the immediate vicinity of home locations, but path-based exercises, such as running and cycling, are continuous activities and cover a broad spatial extent. Thus, the traditional home buffer approach fails to acknowledge the settings where road running actually occurs. This study employed an activity path-based measure approach using public participation GIS (PPGIS) to investigate the associations between running satisfaction and nature exposure. The mapped routes (N=545) that included an assessment of satisfaction level were collected from 249 runners resided in the Helsinki Metropolitan Area, Finland. Logistic regression analyses revealed a positive association between running satisfaction and nature exposure,*

including eye-level greenness, top-down greenness and blue space density. Top-down greenness was assessed by Normalized Difference Vegetation Index (NDVI) and the eye-level greenness by Green View Index (GVI), the latter one of which uses a deep learning algorithm. Running environment was more satisfying in those routes with more public transport nodes. Other traffic-related factors breaking the momentum of runners such as traffic light density were inversely related to running satisfaction. Demographic characteristics such as education background also played a significant role in the perceived satisfaction with running routes. The positive impacts of nature exposure on running satisfaction further verify the linkages between landscape and public health.