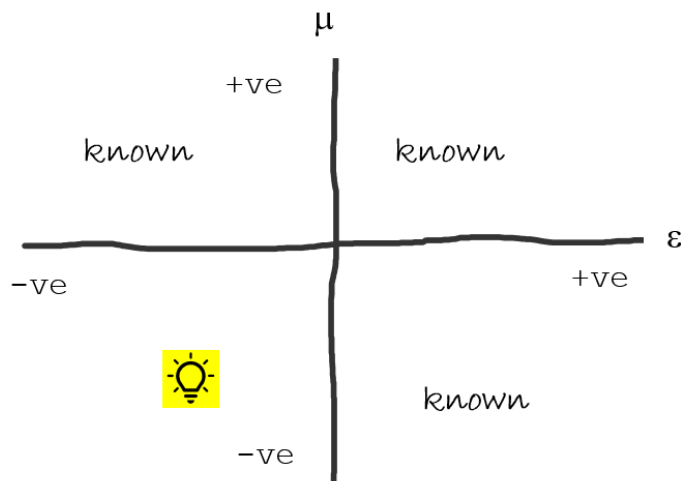


Quadrants for creative thinking

Shortly after HKU's President had taken up his post, I was in Cambridge, UK when I received a call from HKU's Director of Development and Alumni Affairs Office asking if I could come down to London the next evening to front an alumni and supporters event for the President, who had been delayed travelling from HK. Fortunately, a few weeks before, I had attended the President's inaugural scientific lecture and because of his genius at science and communication, understood fully (*sic*) how to make invisible cloaks by nano engineering novel molecules. I enthusiastically addressed Lord Wilson (of The Wilson Trail) and others for 10 minutes on the subject. Apart from making the point that good science and good scholarship is simple and clarifying rather than complicated and obscuring, and that President Zhang is a good communicator, the anecdote presents a lesson on the role of theory in driving innovative discovery. I'll explain.

Some innovative ideas and research questions come from observations requiring an explanation. Some come from potential explanations demanding a problem. The famous so-called 'garbage-can' theory of organisations (Cohen et al 1972)¹ posits, among other things, people who always have the same solution ready to throw into a decision-making discussion, regardless of the problem to be solved. It's an amusing theory but surprisingly predictive. Some innovations come from theory. Or more precisely, theoretical 'space': gaps in conceptual space that indicate the possibility of a new concept. President Zhang's, graphically represented, is as follows:

¹ Cohen, M.D.; March, J.G.; Olsen, J.P. (1972). "A garbage can model of organizational choice". *Administrative Science Quarterly*. **17** (1): 1–25. Doi: [10.2307/2392088](https://doi.org/10.2307/2392088). JSTOR [2392088](https://www.jstor.org/stable/2392088).



This shows two dimensions that can be used to describe any material: electrical properties and magnetic properties. The vertical axis μ (mu) represents magnetism and the horizontal ϵ (epsilon), electricity. Both axes have positive and negative regions, producing four quadrants. What motivated President Zhang as a young researcher was that all known naturally occurring molecules function in only three of the quadrants ($+\epsilon+\mu/+ \epsilon-\mu/-\epsilon+\mu$). From optical physics, he knew that theoretically, a molecule in the bottom left ($-\epsilon-\mu$) quadrant could bend light in such a way that would make it possible to develop sci-fi and fantasys' holy grail: an invisible cloak. But he did not leave his insight there. He reasoned that since the tools and theory are now available to design and make novel molecules, it should be possible to design what nature has not: a material occupying the bottom left quadrant. And so he did. Using naturally occurring molecules that themselves perform in the naturally occurring quarters of this conceptual space, he constructed a man-made molecule that performed in the missing quadrant. And thus he became famous and thence our President.

It's an elegant and simple story. I tell it here to ask: are there missing quadrants in the conceptual spaces of your own research domains? What are they? How would you define them?

Here's some tips. Try dimensioning your conceptual world on two primary dimensions. For example, density and health in my current research domain. Instead of using + and -, try high and low. So, a four-quadrant model: high density cities with high health performance (HK), high density with low health (Lagos), low density with high health (Atlanta) and low density and low health (??). There we have it – I can't think of one immediately. It took me 2 minutes to write and it produced a question that I cannot myself answer. That's a powerful creative thinking technique. Might my simple missing quadrant reveal something that I have missed in all my erudite reading and statistical analysis: that while high density habitats can be both healthy and unhealthy depending on socio-economics and other confounding factors, low density habitats are more uniformly healthy? That might lead to profound insights if taken further. But let's say that after some further digging, I discover that there are, in fact, quite a few notable cities in the low-low quadrant, Kinshasa in DRC, for example, which has poor health,

a large population and relatively low density at 1,400 per km², almost exactly the same population density as Atlanta, Georgia. The first insight is not necessarily lost, but it becomes a starting point for an intellectual rabbit hole. And perhaps on my 10th or 50th rabbit hole, I may find my invisible cloak. Actually, I think I shall look into this tentative theory, under the hypothesis that while we might be able to find instances of cities in all four quadrants, those in the low-low quadrant are statistically much rarer. If a quick analytical survey of WHO and UNCHS data support my hypothesis, this may have been an unusually productive DRup blog. To make this meaningful, I would probably need to add a third dimension: GDP per capita, turning the creative thinking space into a 3D quadrant diagram, i.e. a 2x2x2 cell cube. If I found that low density low-income large cities are relatively rare and that most of these are unhealthy as a result of the low GDP, like Kinshasa, but that a few outliers have relatively high health indicators for their GDP, then I may indeed be on to something.

Since most of us are concerned not only with analyses and insights about process, but like President Zhang, about making things or designing and creating interventions that change things, like bending light; exploring conceptual space more systematically is highly likely to unearth some hitherto unnoticed, perhaps completely unexplored 'invention spaces' if we draw enough quadrant-diagrams.

How about a quadrant sharing lunchtime workshop?

Happy drawing and congratulations to colleagues for their achievements mentioned below. This issue of DRup has a nice spread across our various agenda: an excitingly creative new Common Core Curriculum course on climate change responses, offered by one of FoA's designers to first year students from all HKU's disciplines; built environment research papers published in top-drawer environment and medical journals; an FoA architect appointed to oversee a well-regarded international design award; HKU teaching innovation awards for deepening our online pedagogy; FoA's professorial representation on a key government policy research awarding body; and FoA represented at a World Bank invited symposium on the circular economy. Proud to be dean of FoA, as ever.

Chris Webster
Dean, FoA

Department of Architecture

1. Dr Eric Schuldenfrei and Dr Kristof Crolla

- have received a UGC Special Grant for Strategic Development of Virtual Teaching and Learning, at the amount of HKD100,000, for an initiative titled 'Novel Mixed Reality (MR) strategies for online Architecture design teaching and learning'.

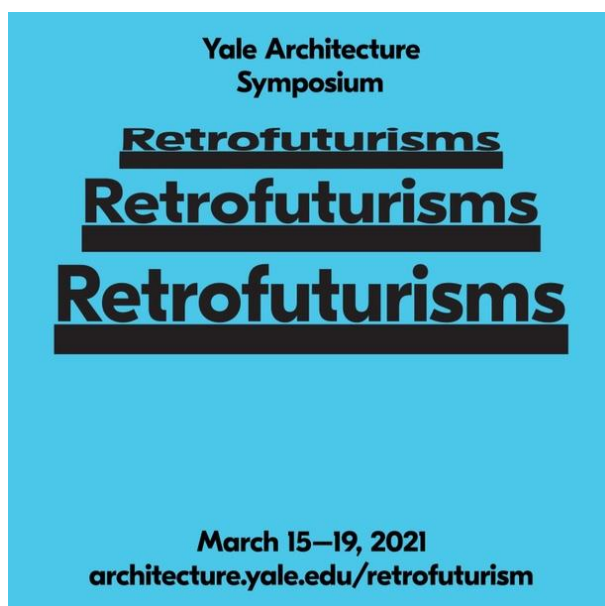
2. Cesar Jung-Harada

- has been selected by Common Core Curriculum Committee for his proposed course of 'Our Response to Climate Change: Hong Kong 2100', which will be offered for three years commence in 2021/22 academic year.

Course Description: As we cannot afford a 'failure of the imagination', and prompted by Einstein's quote, that 'we cannot solve our problems with the same thinking we used to create them', this course is about studying mainstream and controversial responses to climate change. We will criticise, debate, role play and imagine new narratives, models and metrics of success and ultimately design and advocate for a future we want. We use Hong Kong 2100 as the theatre of this speculative design work. The students will have to build an argument for why their proposition/design is better than the status quo and should be adopted, taking into account the potential impacts and associated risks.

3. John Lin

- gave a talk at Session 2 of the [Yale Architecture Symposium 'Retrofuturisms'](#) on 16 March 2021. The Symposium was conceived and organised by the Yale School of Architecture's M.Arch II '21 class as a means of exploring speculative design methodologies and alternative forms of engagement with architecture's past and future.



Division of Landscape Architecture

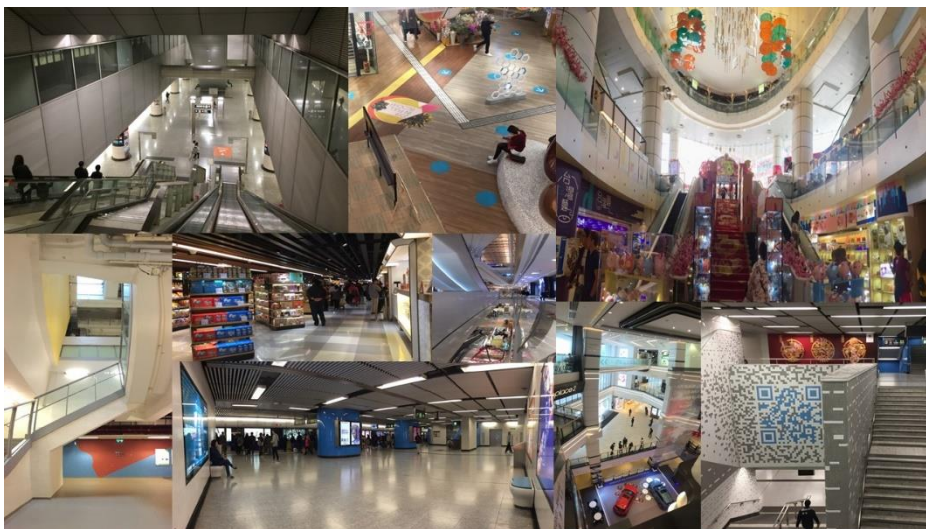
1. Mathew Pryor

- has received a UGC Special Grant for Strategic Development of Virtual Teaching and Learning, at the amount of HKD500,000, for an initiative titled 'Virtual Socialized Learning Environment (vSLE)'.

Department of Real Estate and Construction

1. Dr Isabelle Chan

- has received a UGC Special Grant for Strategic Development of Virtual Teaching and Learning, at the amount of HKD400,000, for an initiative titled 'Interactive Learning and Teaching of Construction Management in 3D Virtual Reality Environments'.
- has been awarded by the University Research Committee (URC), a PDF post under the 45th Round URC PDF/RAP Scheme, for her research on 'Enhancing Health of Underground Development Users in High Density Cities through an Automated Risk Assessment System for Facilities Management'.



Department of Urban Planning and Design

1. Professor Rebecca Chiu

- has been re-appointed by the Policy Innovation and Co-ordination Office of HKSAR Government as a Member of the Assessment Panel of the [Public Policy Research \(PPR\) Funding Scheme and the Strategic Public Policy Research \(SPPR\) Funding Scheme](#) from 1 April 2021 to 31 March 2023.

Centre of Urban Studies and Urban Planning

1. Dr Derrick Ho

- has published the following papers:

- (i) Zheng Cao, Feng Gao, Shaoying Li, Zhifeng Wu, Wenchuan Guan, **Hung Chak Ho** (2021). Ridership exceedance exposure risk: novel indicators to assess PM_{2.5} health exposure of bike-sharing riders, *Environmental Research*, 197, 111020, ISSN 0013-9351. DOI: <https://doi.org/10.1016/j.envres.2021.111020>

Abstract: Identifying the fine particulate matter (PM_{2.5}) exposure risk for bicycle riders is crucial for promoting the development of theory and technology in transportation-related air pollution assessment as well as urban health planning. Previous studies have employed daily mean PM_{2.5} concentrations and designed routes to evaluate air pollution exposure risk. However, because the daily mean PM_{2.5} concentrations cannot fully illustrate the intra-day variations in PM_{2.5}, which are typically higher than daily mean values, the adverse effects of PM_{2.5} concentrations remain underestimated. Moreover, the quantity and representativeness of monitoring samples make large spatial-scale and multi-temporal-scale analysis challenging. By defining hourly exceedance PM_{2.5} concentration and sharing bicycle rider data, two novel indicators were proposed in our study: exceedance exposure risk of PM_{2.5} for sharing bicycle riders (EPSR) and accumulative exceedance exposure risk of PM_{2.5} for sharing bicycle riders (AEPSR). Standard deviation ellipse analysis was conducted to investigate the multi-temporal variation of EPSR and AEPSR. A geographically weighted regression model was applied to quantify the relationship between city function zones and exceedance PM_{2.5} exposure risk for sharing bicycle riders. Results revealed that the mean values of EPSR and AEPSR during morning peak periods ranged between 0.109 min $\mu\text{g}/\text{m}^3$ and 1.27 min $\mu\text{g}/\text{m}^3$ and 6.83 min $\mu\text{g}/\text{m}^3$ and 43.41 min $\mu\text{g}/\text{m}^3$, respectively, whereas the mean values of EPSR and AEPSR during evening peak periods ranged between 0.19 min $\mu\text{g}/\text{m}^3$ and 4.28 min $\mu\text{g}/\text{m}^3$ and 14.67 min $\mu\text{g}/\text{m}^3$ and 357.66 min $\mu\text{g}/\text{m}^3$, respectively. This implied that sharing bicycle riders were exposed to higher PM_{2.5}-related risks during the evening than in the morning. When considering the accumulative effects, the average centers of the AEPSR moved to the north side as compared to the average centers of the EPSR. Expanding areas of EPSR shrunk by 20.25 km². This indicated that accumulative effects aggregated spatial clusters of exceedance PM_{2.5} exposure risk for sharing bicycle riders more tightly to the north of the study areas. Spatiotemporal variation of EPSR and AEPSR led us to investigate the mechanism behind this phenomenon. Spatial associations between city function zones and EPSR and AEPSR showed that sharing bicycle riders experienced more severe exceedance PM_{2.5} exposure risk around financial/corporations and leisure service areas, with R² values of 0.33 and 0.35, respectively. This spatial association tended to be more significant during the evening peak periods. By developing two novel indicators, the increasing health threats for bicycle riders caused by exceedance PM_{2.5} were investigated in this study. The mechanism results should be included for developing mitigation strategies to alleviate the adverse effects of air pollution for public rider participants and achieving the goal of eco-health cities.

- (ii) Yunquan Zhang, Jing Wei, Yuqin Shi, Chao Quan, **Hung Chak Ho**, Yimeng Song, Ling Zhang (2021). Early-life exposure to submicron particulate air pollution relates to onset of childhood asthma: a retrospective investigation. *The Journal of Allergy and Clinical Immunology*, S0091-6749(21)00359-6. Advance online publication. DOI: <https://doi.org/10.1016/j.jaci.2021.02.030>

Background: Emerging research suggested an association of early-life particulate air pollution exposure with development of asthma in childhood. However, the potentially differential effects of submicron particulate matter (PM₁) remain largely unknown.

Objective: This study primarily aimed to investigate associations of childhood asthma and wheezing with in-utero and first-year exposures to size-specific particles.

Methods: We conducted a large cross-sectional survey among 5,788 preschool children aged 3–5 years in central China. In-utero and first-year exposures to ambient PM₁, PM_{2.5} and PM₁₀ at 1×1 km-resolution were assessed using machine learning-based spatiotemporal models. A time-to-event analysis was performed to examine associations between residential PM exposures and childhood onset of asthma and wheezing.

Results: Early-life size-specific PM exposures, particularly during pregnancy, were significantly associated with increased risk of asthma, while no evident PM-wheezing associations were observed. Each 10 µg/m³ increase of in-utero and first-year PM₁ exposure was accordingly associated with an asthma's hazard ratio (HR) in childhood of 1.618 (95% confidence interval: 1.159–2.258, *p*=0.005) and 1.543 (0.822–2.896, *p*=0.177). Subgroup analyses suggest that short breastfeeding duration may aggravate PM-associated risk of childhood asthma. Each 10 µg/m³ increase of in-utero exposure to PM₁, for instance, was associated with a HR of 2.260 (1.393–3.666) among children with 0–5 months' breastfeeding and 1.156 (0.721–1.853) among those longer breastfed.

Conclusion: Our study added comparative evidence for increased risk of childhood asthma in relation to early-life PM exposures, highlighting stronger associations with ambient PM₁ than PM_{2.5} and PM₁₀.

Healthy High Density Cities Lab

1. Dr Guibo Sun, Yao Du, Dr Michael Ni, Jianting Zhao and Dean Webster

- have published the following paper:

Sun G, Du Y, Ni MY, *et al.* Metro and elderly health in Hong Kong: protocol for a natural experiment study in a high-density city. *BMJ Open* 2021; 11(3); e043983. DOI: <http://doi.org/10.1136/bmjopen-2020-043983>.

Abstract:

Introduction: Public transport accessible to older people may offer a transformative solution to achieving healthy ageing. However, the evidence to support such transport infrastructure modifications is unclear. Previous studies on public transport use and elderly health were mostly observational studies using cross-sectional data. Few studies have examined the before-and-after effects of a new metro, for example, to see if it leads to improved elderly health.

Methods and analysis: We use a new metro line in Hong Kong as a natural experiment to examine the impact of the metro-led public transport intervention on elderly health. In Hong Kong, more than 90% of daily travels are made by public transport. The public transport modifications consist of the new metro line with eight stations and changes in the walking environment and bus services around the stations. We will look at the before-and-after differences in public transport use and health outcomes between elderly participants living in treatment neighbourhoods (400 m walking buffered areas of the new metro stations) and in control groups (living in comparable areas but unaffected by the new metro). Questionnaire-based baseline data were collected in 2019 before the COVID-19 pandemic, while some qualitative interviews are ongoing. Amid the pandemic, we conducted a quick telephone-based survey of COVID-19's potential impact on public transport use behaviours of our elderly cohort in September 2020. Note there is no lockdown in Hong Kong until the writing of the paper (January 2021). After the new metro opens, we will conduct a follow-up survey, tentatively in late 2022. We aim to investigate if the new metro and the associated changes in the built environment have any effects on public transport use behaviours, physical activity and wider health outcomes among the elderly (e.g., social inclusion, quality of life, subjective well-being).

Ethics and dissemination: The Human Research Ethics Committee of the University of Hong Kong reviewed and approved the study procedures and materials (reference number: EA1710040). Results will be communicated through scientific papers and research reports.

1. Professor Wilson Lu

- spoke at the [World Bank Group's Learning Series on Circular Economy & Private Sector Development](#) on 23 March 2021, in its [Session 9: Construction](#) and on the theme of 'Enabling and Creating Demand for Circular Construction'.

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Speakers:

 Dr. Andrew Minson Global Cement & Concrete Association	 Dr. Jeremy Gregory MIT Concrete Sustainability Lab	 Eric Bourdon VICAT	 Robert Madeira The CW Group
 Salomé Galjaard City Government of Amsterdam	 Dr. Wilson Lu University of Hong Kong	 Monica Moeskaer Danish Design Center	 Felix Heisel Circular Construction Lab, Cornell University

Presentation, opening and closing remarks by:

 Carol Lemmens Global Advisory Services Leader ARUP	 Demetrios Papathanasiou Global Director World Bank Group	 Sabine Schlorke Manager IFC / World Bank Group	 Etienne Kechichian Senior Private Sector Specialist World Bank Group
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Hosts:  

Sponsors:   

Rural Urban Framework

1. John Lin

- has been invited to join the judging panel for the [AR New into Old awards 2021](#).

Details: As the need for sustainable alternatives to building anew becomes increasingly urgent, the 2021 AR New into Old awards celebrate the creative ways buildings are adapted and remodelled to welcome new contemporary uses. Launched in 2017, the awards recognise the imaginative appropriation of existing structures, from innovative insertions to ambitious adaptations, that offer buildings a new lease of life.



John Lin joins the judging panel

Rural Urban Framework director John Lin joins Eva Prats on the jury for the 2021 AR New into Old awards

John Lin is an architect based in Hong Kong and currently an Associate Professor at The University of Hong Kong. He was born in Taiwan and immigrated to the US in 1983. After studying in both the Art and Engineering programs at The Cooper Union in New York City, he received a professional degree in Architecture in 2002.

Together with Joshua Bolchover he is the director of Rural Urban Framework (RUF), a research and design platform dedicated to developing sustainable prototypes for rapidly urbanising areas. Their approach combines research into large scale processes of urbanisation and the integration of local construction practices with contemporary technology in built projects. [Read more.](#)



Rural Urban Framework were highly commended in the 2019 AR New into Old awards for their work on the [Tulou tower and plug-in in Lantian village](#), China, and the community hub and plug-in prototype they designed for the ger districts of Ulaanbaatar were published in our Land issue (AR October 2020).