

SEMINAR  
SERIES  
ANTHROPOLIS  
CHAIR  
AND  
FUTURES  
CITIES  
LAB

ACADEMIC YEAR 2020-2021  
JUNE 2021



Seminar Series | Academic Year 2020-2021

# JOINT SEMINAR SERIES OF THE ANTHROPOLIS CHAIR AND THE FUTURES CITIES LAB

Report | June 2021

In November 2020, we started the joint seminar series of the Anthropolis Chair and the Future Cities Lab. The research seminar aims to exchange knowledge and ideas on the ongoing projects within the Chair and its affiliated and partner organisations and communicate the research progress to external stakeholders. The bi-weekly one-hour sessions consist of short input presentations on specific topics and interactive discussions in which everyone is welcome to contribute actively. In total, twelve speakers from France and China presented their work online.

## Partners of the Anthropolis Chair



GROUPE RENAULT



## Partners of the Futures Cities Lab



# ANTHROPOLIS CHAIR

## Human-Centred Mobility

The Chair is constructing a vision of future mobility integrating the major challenges of urban life, such as reducing carbon emissions and improving the quality of life in cities. Anthropolis develops fundamental methods to design mobility systems and services with a human-centred approach.

Our main research area is the Saclay plateau in the Île-de-France. However, other French and European cities are considered for our investigations. We collaborate with Centrale Casablanca (joint PhD supervision) and Centrale Pékin (Future Cities Lab) to enlarge our vision towards non-European cities. We explore the following three complementary topics: future mobility and urban life, mobility as a service (MaaS), and future infrastructures.

For **urban life and mobility futures**, the Anthropolis Chair is particularly interested in mobility and immobility in tomorrow's society to answer questions on the futures of urban and regional development and management. The creative exploration of possible futures is systematically explored based on individual and collective views compiled through multiple stakeholder workshops.

The implementation of regional **MaaS** systems demands a commitment by political decision-makers and a genuine intention to collaborate by all stakeholders of urban and suburban mobility.

The question is how new technologies will influence new forms of MaaS, and what forms of governance and organisational models will emerge? Finally, the impact on regional attractiveness and mobility behaviour is modelled and analysed for different MaaS concepts.

For **future infrastructures**, the Chair investigates the interaction between the future evolution of urban infrastructures and mobility, complemented by a socio-technical, human-centred approach. Sensors, charging stations, shared mobility stations, and urban spaces are major areas of investigation. Replicable planning methods for various mobility infrastructures are being developed, taking technological, organisational, and social factors into account.

Finally, the Chair addresses the transversal topic of **sustainability of urban mobility**. This part of the contribution is placed under the umbrella of Sustainable Development Goal 11, Cities and Sustainable Communities. Our ultimate goal is set by the Paris Agreement: Zero carbon emissions by 2050. In our work, we intend to balance and examine the sustainable value creation and negative (environmental and social) impacts generated by mobility solutions.

# FUTURE CITIES LAB

## E-Mobility & Power Systems of Tomorrow

The Future Cities Lab is a multi-national joint research initiative between **Ecole Centrale Pékin, Beihang University in China, and CentraleSupélec in France**. The Future Cities Lab is co-financed by the Région Île-de-France and the City of Beijing and is co-directed by Prof Hai-Jun Huang and Prof Jakob Puchinger.

The research conducted within the Future Cities Lab addresses the challenges related to planning, operating, and managing increasingly complex future urban systems, particularly the interdependence between critical infrastructure systems, such as the transportation, energy, and healthcare systems.

Through these collaborations, the Future Cities Lab seeks to act as a foundation to advance knowledge related to these complex challenges and a platform for exchange between researchers from China and France.

The Future Cities Lab focuses on investigating the interaction between **future electrified urban mobility and electric power systems** and providing technical management insights to ensure the reliable and economic operation of these interdependent systems. The researchers in the Future Cities Lab are currently developing quantitative state-of-the-art modelling frameworks to try to address the following questions.

What is the technical and economic potential for shared autonomous electric vehicles for providing power grid services when needed while maintaining excellent transportation satisfaction levels?

How to mitigate the risks of disruption for power grid and electric mobility services and ensure—and even improve—the resilience of the interconnected systems?

How to coordinate the SAEV (Shared Autonomous Electric Vehicles) charging schedule considering the uncertainty in transportation flow patterns and transportation demand?

To answer these questions, the researchers depart from techno-economic modelling, mathematical programming, and analysis techniques to evaluate the conditions under which electricity pricing, transportation demand, SAEV fleet size, and the interaction of the system's parameters would enable a successful and scalable implementation of these services.



23.11.2020 | 10-11 AM CET

**Smart Cities & Urban Mobility**Prof Dr Jakob Puchinger | Anthropolis Chair  
IRT SystemX & CentraleSupélec[> Download the presentation](#)

In the first session, Chair Holder Jakob Puchinger introduced the bi-weekly format and gave a short presentation of current projects and initiatives of the Chair.



07.12.2020 | 10-11 AM CET

**Urbanisation and mobility: Past, present, and futures**Mr Tjark Gall | PhD Candidate at the Anthropolis Chair  
IRT SystemX & CentraleSupélec[> Watch the recording](#)

The second seminar outlined some elements of the relationship between urbanisation and mobility. Led by urbanist and PhD candidate Tjark Gall, the session explored how urbanisation and urban mobility influence and shape each other. A short input presentation initiated the discussion on some key concepts, events, and trends of the past, the present, and the future. The following interactive discussion centred around own ideas, imaginations, dreams, and worries and fears of individual urban futures. We explored further how our urban mobility futures may look like and which tendencies, trends, and transitions are shaping them.



18.01.2021 | 10-11 AM CET

**How does intercity commuting affect urban spatial structure & housing price in a two-city system?**

Mr Tao Ren | PhD Candidate, Beihang University, Beijing

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This paper studies how intercity commuting affects the urban spatial structure and housing rents/prices in a two-city system. The social optimum and competitive equilibrium are fully investigated. The central government distributes the population over the two cities and decides the number of intercity commuters for maximising the social welfare of the system, leading to a social optimum. Instead, individuals choose where they live and where they work to maximise their utilities, leading to a competitive equilibrium. We first show that letting people residing in a megacity commute to a small city is neither a social optimum nor a competitive equilibrium.

Moreover, intercity commuting increases the housing rents/prices of the area of a small city close to a megacity but has no effects on the area away from the megacity. At a stable equilibrium, residents living in the central area of the small city

are almost unlikely to be intercity commuters. Choosing a two-city system from the Yangtze River Delta region, we conduct a case study with the proposed model. Results show that the advent of high-speed trains does greatly facilitate intercity commuting and that the current number of intercity commuters is less than the socially optimal level. In particular, the demand for intercity commuting is suppressed due to the insufficient carrying capacity. Finally, the megacity in the two-city system has the leading position, and therefore, the small city should develop the industries complemented with that in the megacity in order to avoid the loss of labour forces.



01.02.2021 | 10-11 AM CET

### **The place of MaaS ecosystems in mobility futures: Overviews and challenges**

Ms Mariana Reyes | PhD Candidate at the Anthropolis Chair  
IRT SystemX & CentraleSupélec

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The seminar session on “The place of MaaS Ecosystems in Mobility futures” gave an overview of the context that brought MaaS to emerge and of the current challenges it faces as a complex ecosystemic solution from a Northern European perspective. Mobility as a Service (MaaS) represents a new way to access and to provide a variety of mobility services through the scheme of a “one-stop-shop”. MaaS solutions aim to simplify and improve the access and the experience of mobility for users. These services are made available through a single-access / single-payment digital platform. The concept has strongly developed over the last decade. Academics, industry partners and other actors in and out of the mobility sphere continue to work to get a more precise, stable, and unified definition.

Many questions still wait for an answer, especially regarding MaaS business models and the economic equilibrium of stakeholders. Other issues must also be addressed/covered, like the liability and responsibility of the actors in the ecosystem and the “ownership” of the end-user.



03.03.2021 | 10-11 AM CET

### **Stranded to be? Diesel ban in cities and used car markets**

Dr Quentin Hoarau | Post-doc, CentraleSupélec

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After promoting their development for two decades, European governments are pulling back their support for diesel cars. While those engines were assumed to be ‘cleaner’ than gasoline ones, thanks to lower fuel consumption and reduced CO2 emissions, they turned out to emit much more air pollutants. In response to growing concerns about the effects of air quality on public health, Low Emissions

Zones (LEZs) are gradually implemented by several cities, announcing a progressive ban on diesel cars which could turn those vehicles into stranded assets for households. This is a thorny issue in France, where half of the passenger vehicles are diesel-fueled. Investigating about one million used cars ads across France, we find that diesel vehicle sellers located within ongoing and planned LEZs anticipate this change of regulation and lower their asking price for those cars. This effect is robust to the introduction of an air pollution indicator for cities, evidencing a specific effect of this LEZ policy.



17.03.2021 | 10-11 AM CEST

### **Mode choice and public transport operation strategy with heterogeneous users**

Ms Weihong Li | PhD Candidate, Beihang University

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Considering the heterogeneity of individual residents, this paper studies the public transport subsidy strategy in a monocentric city. The model describes the interaction between different participants in the urban system: the government formulates appropriate bus subsidy strategies under the goal of feasibility or fairness; high-income groups choose travel mode to minimise travel costs; heterogeneous residents maximise their utility by choosing where to live. The results show that the implementation of different public transport subsidy strategies will affect residents' travel mode and residential location choices, thereby changing the urban spatial structure. Under different urban structures, the implementation effects of public transit subsidy strategies are also different.



14.04.2021 | 10-11 AM CEST

### **Electric Autonomous Dial-a-Ride Problem (E-ADARP)**

Ms Yue Su | PhD Candidate, CentraleSupélec

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This paper investigates the Electric Autonomous Dial-a-Ride Problem (E-ADARP) which consists of scheduling electric autonomous vehicles (EAVs) to transport users from specific origins to specific destinations within predefined time windows. The authors propose a Deterministic Annealing (DA) meta-heuristic where efficient local search operators are integrated to enhance the solution's quality. The potential visits to the recharging stations are explicitly handled by a bi-directional insertion algorithm. Computational experiments prove the effectiveness of the proposed algorithm in solving E-ADARP. The experiments are conducted under three scenarios: low, medium, and high energy level restriction, representing the

constraint on the minimum level of the battery capacity at the end of the route. For each scenario, adapted instances from the literature are tested and an average gap of 0.58% is achieved compared to the best-known solutions for E-ADARP. Several new best solutions are found on previously solved and unsolved instances. Then, we investigate the effect of allowing multiple visits to the recharging stations. The experiments show that this operation can efficiently decrease the total cost and improve the solution feasibility. Furthermore, they establish new benchmark instances based on literature with up to 8 vehicles and 96 requests, with our algorithm providing feasible solutions that the exact method from the literature cannot solve in a given amount of time. These results are an indicator of the high performance of the proposed algorithm.



05.05.2021 | 10-11 AM CEST

### **Coupled taxi and ridesourcing markets with charging information service fee**

Ms Siyang Wang | PhD Candidate, Beihang University

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This paper studies the impacts of the policy of charging taxi driver's information service fee on the coupled taxi and ride-sourcing markets. The ratio of taxi drivers who would like to pay for information service provided by the ride-sourcing platform over the total taxi drivers is considered. We first model the single taxi market and prove the existence of market equilibrium mathematically. The necessary conditions of increasing platform revenue and enhancing social welfare are presented, respectively. Then we model the coupled taxi and ride-sourcing markets, prove the existence of equilibrium, and analyse the properties of the model through some numerical examples. It is found that there exists an optimal ratio that maximises the revenue of all the taxi drivers or the social welfare. The platform should subsidise the taxi drivers more and increase the commission to make more profits when a small number of taxi drivers would like to pay the information service fee. It reveals that flexible workforce supply of ride-sourcing ensures that the average revenue of ride-sourcing drivers is always higher than that of taxi drivers and benefits the customer average travel utility.



12.05.2021 | 10-11 AM CEST

**Future urban cities: Resilience of the integrated electric autonomous mobility systems and power grids**

Dr Adam Abdin | Post-doc

Future Cities Lab, CentraleSupélec

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The number of EVs and charging facilities is expected to increase significantly in the near future, further coupling the existing transportation system with the power grid. This may bring new challenges and risks to the management and operation of these interdependent systems. In this talk, I will present our recently developed mathematical framework to analyse the resilience of an electrified road network (ERN) subject to potential failures of its supporting fast-charging stations (FCSs). I will then discuss its application to a numerical example to illustrate the usefulness of the proposed approach for analysing the ERN resilience and discuss some guidelines that can be extracted from the results for effective management of the resilient-critical ERN operation.



26.05.2021 | 10-11 AM CEST

**Influence of high-speed railway station location on intercity commuting**

Mr Xingqi Yang | PhD Candidate, Beihang University

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The objective of this paper is to provide new insights into the commuting patterns in two linear monocentric cities with endogenous household distribution, where a high-speed railway (HSR) provides intercity commuting services for households in a linear intercity corridor. The conventional commuting pattern, i.e., where households live and work in the same city, has been found to be only one of several possible commuting patterns. We first propose a two-city spatial equilibrium model that the HSR station in a small city can be located anywhere to investigate the subtle effects of the station location on households' residential location choices, households' commuting behaviours, and housing market. The location of HSR stations is an essential factor affecting the intercity commuting cost that is positively related to the home-to-station distance. We reveal eight possible commuting patterns. The transition conditions among these commuting patterns are derived in both open system and closed system. Further, we summarise the sufficient and necessary condition for the existence of each commuting pattern. We provide numerical evidence to show that the absentee landlords are sometimes the only beneficiary of the train speed-increasing. A counter-intuitive result is that the workforce in a small city is likely to decline with the increase of the length of the intercity corridor. We also discuss the changes in commuting patterns, the number of different kinds of households, and the housing rents with the different total number of households, the station locations, and the train travel speeds. The ver-

ification of the effectiveness of the proposed model is by conducting case studies based on the data of 76 city pairs in China. It is shown that an HSR station built in a small city may contribute to the development of a new HSR town (satellite town) or blend into the large city when the station is close to the large city.



09.06.2021 | 10-11 AM CEST

### **Open data travel demand synthesis**

Dr Sebastian Hörl | Researcher, IRT SystemX

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With the increasing individualisation of passenger and freight transport, new tools for modelling and analysis have become necessary, which shift the focus from macroscopic simulation models to detailed microscopic analyses. The basis for many such detailed, agent-based simulations, in which the entities of the transport system are simulated in detail, are synthetic populations. While they can be used to represent and understand the individual travel demand of the people, they can also be used to obtain information on the logistics demand of a city. The talk will cover several challenges in terms of making the use of synthetic travel demand replicable and showcase several past and current use cases at IRT SystemX, which are based on open and publicly available data.



23.06.2021 | 10-11 AM CEST

### **Designing an urban mobility serious game to teach radical innovation**

Dr Flore Vallet | Senior Researcher at the Anthropolis Chair  
IRT SystemX & CentraleSupélec

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Serious games are not primarily designed for entertainment but to balance fun and learning aspects. This type of games gains momentum in several domains such as engineering design education, scenario planning or policymaking in the urban context. This presentation leans upon the results of a recent PhD thesis: "Design of serious games for teaching industrial engineering methodologies" by Yiming Ma. Urban mobility indeed provides a challenging societal context for the serious game. The initial goal for developing the game was to give players/designers preliminary notions of a need-seeker innovation method called Radical Innovation Design®. The game more specifically enables designers to dive into the deep exploration of poorly addressed travel problems in specific travel situations and the search for promising areas to innovate. Throughout the presentation, you will live the player's experience from the choice of your mobility company to the proposition of the most promising value buckets for specific traveller profiles.

The Anthropolis Chair, operated by IRT SystemX and CentraleSupélec, brings together the partners EDF, Engie, Groupe Renault, Communauté d'Agglomération Paris-Saclay, and Nokia Bell-Labs to work towards human-centred mobility. The Future Cities Lab is a joint initiative of Centrale Pékin, Beihang University Beijing, and Laboratoire Génie Industriel (LGI), CentraleSupélec, Université Paris-Saclay. To get to know more about ongoing activities, visit the Chair's website and join the mailing list.

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