



**DEPARTMENT OF GEOSCIENCES AND GEOGRAPHY C16**

**TOWARDS HUMAN SCALE CITIES -  
OPEN AND HAPPY  
15<sup>th</sup> biennial NECTAR conference**

**TUULI TOIVONEN, KARST GEURS &  
ELIAS WILLBERG (eds.)**



UNIVERSITY OF HELSINKI  
FACULTY OF SCIENCE

# **TOWARDS HUMAN SCALE CITIES - OPEN AND HAPPY**

15<sup>th</sup> biennial NECTAR conference

5-7 June 2019

**TUULI TOIVONEN, KARST GEURS & ELIAS WILLBERG (eds.)**

CONFERENCE BOOK OF ABSTRACTS

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Cover photo: Christoph Fink

Book Layout: Anna Ahlgren & Kerli Müürisepp

ISSN-L 1798-7938

ISSN 1798-7938 (print)

ISBN 978-951-51-4922-0 (paperback)

ISBN 978-951-51-4921-3 (PDF)

aDigi Oy (print)

Helsinki 2019

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## FOREWORD

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## Welcome to the 15<sup>th</sup> NECTAR conference

Urban population is growing worldwide. Our societies are facing grand challenges like climate change and growing inequalities between people. There is an increasing need to develop cities that are environmentally and socially sustainable, functional and supporting well-being of their inhabitants. When striving towards these goals, transportation and mobility play a crucial role. Easy and environmentally sustainable mobility options are called for in most cities. For these to attract users, they need to be safe and pleasant, providing positive experiences and well-being in addition to efficiency in time or cost.

NECTAR conference is organized with a title “*Towards Human Scale Cities – Open and Happy*” to reflect the new requirements of urban transportation. This 15<sup>th</sup> NECTAR conference, organized in Helsinki 5<sup>th</sup> - 7<sup>th</sup> June 2019, provides presentations by world-class keynotes *Mikael Colville-Andersen* and *Professor Tim Schwanen*, who approach human scale mobility from the viewpoints of a designer and a researcher. More than 140 scientific presentations explore advancements in the field of transport, communication and mobility, with a particular focus on good quality mobility options for people. The focus of the conference is urban transportation and the new possibilities that open data and digital technologies provide for mobility solutions and their research. Presentations provide food for thought concerning mobility choices and quality, new mobility solutions like MaaS, and policies that are implemented to support them.

Helsinki offers an interesting environment for the 2019 NECTAR conference. It is the home of the busiest passenger harbor in Europe with a twin-city development with Tallinn across the bay, and a major air transportation hub between Europe and Asia. It is one of the fastest growing capital regions in Europe, with large densification developments taking place in old logistic centers: harbor areas of Jätkäsaari and Kalasatama and a train depot in Pasila. Public transportation is valued high by citizens, as well as politicians and planners making investment decisions for the future. First robotized buses are in operation and MaaS solutions are emerging. New bike sharing system is one of the most used in the world and has expanded to cover most of the city region. As everywhere in Europe, new forms of micromobility from electronic scooters to electric longboards are appearing on the streets making planners and police puzzled. The city has profiled itself as an open city: large amounts of open data about the region have been made available and the region of Helsinki is committed to open and transparent decision

and policy making. This supports also research in the major universities: University of Helsinki and Aalto University, the local organizers of the conference.

We anticipate that the conference days will forward our thinking on how to make cities more sustainable, functional and pleasant for people, and how to study them scientifically in a meaningful and transparent manner.



**Karst Geurs**

NECTAR Chair  
Professor of Transport  
Planning  
University of Twente



**Tuuli Toivonen**

Chair of the Conference Committee  
Associate Professor of  
Geoinformatics  
University of Helsinki



**Elias Willberg**

Conference Secretariat  
PhD Candidate  
University of Helsinki



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## SCHEDULE

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## Wednesday, 5 June 2019

### ● 11:00 Registration

📍 University of Helsinki main building (new side), Fabianinkatu 33, Aula

### ● 13:00 Open plenary session

📍 University of Helsinki main building (old side), Unioninkatu 34  
Great Hall (*Suuri Juhlasali*)

**Opening words by the chair of the local organising committee**  
Associate professor of Geoinformatics  
Tuuli Toivonen, *University of Helsinki*

**Opening words by the NECTAR chair**  
Professor of Transport Planning  
Karst Geurs, *University of Twente*

**Opening words by the City of Helsinki**  
Director of Transportation Planning Division  
Reetta Putkonen, *City of Helsinki*

**Keynote talk: Mikael Colville-Andersen**

### ● 14:30 Coffee break ☕

📍 University of Helsinki main building (old side), Unioninkatu 34  
Etulämpö, 2<sup>nd</sup> floor

### ● 15:00 Parallel sessions I

📍 University of Helsinki main building (old side), Unioninkatu 34

**Widening Impact Analysis and Participation in Project Appraisal (CL1 Thematic Session)**  
📍 Auditorium II

Chair: Robin Hickman

#### 🗣️ 2

Shoshanna Saxe, *University of Toronto*  
Timelines of urban transport infrastructure delivery: From idea to operation

#### 🗣️ 3

Mengqiu Cao, *University of Westminster*  
A bottom-up process for transport infrastructure evaluation: The wider 'intangible impacts' on choice of transport mode for residents living in Underground station areas

#### 🗣️ 4

Katy Indira Huaylla Sallo, *UCL*  
The political economy of street space reallocation: Aldgate Gyratory & Bank Junction, London

#### 🗣️ 5

Egor Kotov, *National Research University Higher School of Economics*  
The effects of introduction of the Moscow Central Circle rail passenger service: transport, urban, economic and travel behaviour consequences

**Spatial interaction and regional development (CL4 Thematic Session)**  
📍 Auditorium III

Chair: Thomas de Graaff

#### 🗣️ 7

Jie Huang, *Chinese Academy of Sciences*  
Tracking job and housing dynamics with smartcard data

#### 🗣️ 8

Kees Maat, *Delft University of Technology*  
Dual car ownership as an effect of the residential and working locations

#### 🗣️ 9

Manuel Ojeda Cabral, *ITS - University of Leeds*  
Valuation and policy analysis using hedonic pricing with accessibility models: results and lessons learned for a large multi-city region

#### 🗣️ 6

Thomas de Graaff, *Vrije Universiteit Amsterdam*  
Housing market structure as barriers to moving residence: a multilevel approach

**Promoting valuable urban travel experiences based on personal mobility data (MoTIV Special Session)**  
📍 Auditorium XIII

Harri Paloheimo, *CoReorient Oy*  
Welcome

#### 🗣️ M1

Yannick Cornet, *University of Žilina*  
Exploring worthwhile travel time in the MoTIV project and with the Woorti app

#### 🗣️ M2 Keynote

Matti Hämäläinen, *Forum Virium Helsinki Oy*  
Developing new mobility services for the Helsinki metropolitan area

**Panel and Q&A: How to enable data-driven MaaS and service development**  
Matti Hämäläinen, *Forum Virium Helsinki Oy*  
Stella Aaltonen, *City of Turku*  
(TBA), *Ministry of Transport and Communications, Finland*  
Moderator: Heikki Waris, *CoReorient Oy*

**Panel and Q&A: Challenges and learnings from app-based mobility research**  
Yannick Cornet, *University of Žilina*  
Heikki Waris, *CoReorient Oy*  
Miguel Barreda, *Eurecat Technology Centre*

#### 🗣️ M3

Yannick Cornet, *University of Žilina*  
MoTIV research impact for promoting valuable urban travel experiences

#### 🗣️ M4

Harri Paloheimo, *CoReorient Oy*  
Field experiences and advice on co-innovating solutions to urban challenges

### ● 17:00 Open NECTAR cluster meetings 🧑🏫

📍 University of Helsinki main building (old side), Unioninkatu 34

#### Cluster 1

📍 Auditorium II

#### Cluster 2

📍 Auditorium III

#### Cluster 3

📍 Auditorium XI

#### Cluster 4

📍 Auditorium IV

### ● 18:00 Welcome reception by the University of Helsinki 🍷

📍 University of Helsinki main building (old side), Unioninkatu 34  
Lehtisali & Etulämpö

#### Opening words

Dean of the Faculty of Science, Professor in Computational Materials Physics  
Kai Nordlund, *University of Helsinki*

### ● 20:00 Jatkot 🍷

📍 Brewery *Bryggeri*, Sofiankatu 2  
Afterparty (at own expense)

Wednesday, 5 June 2019

<b>Accessibility impacts</b> ♣ Auditorium XI Chair: Steven Farber	<b>Human scale mobility innovations (CL8 Thematic Session)</b> ♣ Auditorium IV Chair: Emmanouil Tranos	<b>Experiences &amp; choices – mode, destination &amp; well-being 1</b> ♣ Auditorium XII Chair: Yusak Susilo	<b>Cycling and bike-sharing</b> ♣ Auditorium XVI Chair: Andrés Monzón
♣ 10 Genevieve Boisjoly, <i>Polytechnique Montreal</i> Assessing the impacts of accessibility by public transport and income on mode choice in Recife, Brazil	♣ 14 Fabio Antonialli, <i>CentraleSupélec</i> Governance of autonomous urban mobility platforms: a conceptual analysis within big data context	♣ 18 Rumana Islam Sarker, <i>University of Innsbruck</i> Applying affective event theory to explain transit users' reactions to service disruptions	♣ 79 Gustavo Romanillos, <i>Universidad Complutense de Madrid</i> Analysing and modelling the location of stations in bike-share systems: planning the optimal growth of existing programs
♣ 13 John Pritchard, <i>University of Twente/Technion Institute of Technology</i> The Impact of heterogeneous employment classes and workers on potential job accessibility estimation in the Netherlands	♣ 17 Luc Wismans, <i>University of Twente</i> The governance of Smart Mobility: connected cyclists to traffic light controllers case	♣ 19 Rebecca Shliselberg, <i>Tel Aviv University</i> The Contribution of Motility to Women's Personal Wellbeing: A Quantitative Analysis	♣ 81 Elias Willberg, <i>Digital Geography Lab, University of Helsinki</i> Equity of bike sharing – lessons learned from Helsinki
♣ 12 Borja Moya-Gómez, <i>IGIS   Universidad Complutense de Madrid</i> Identifying causes of low urban accessibility	♣ 16 Milos Mladenovic, <i>Aalto university</i> Governance through Participatory Expansion of Emerging Mobility Futures: Case of Self-Driving Vehicles	♣ 21 Jonas De Vos, <i>Ghent University, Geography Department</i> Does moving to urban neighbourhoods result in happy travellers?	♣ 80 Tom Thomas, <i>University of Twente</i> Smartphone challenges to stimulate cycling: Clues from a Living Lab with SMART in Enschede
♣ 11 Steven Farber, <i>University of Toronto</i> Planning Transportation for Social Inclusion: Quantifying the Accessibility-Activity Participation Relationship for Low-Income Households	♣ 15 Maarit Kahila, <i>Aalto university</i> Does mapping improve public participation? Exploring the pros and cons of using public participation GIS in urban and transportation planning practices	♣ 20 Yusak Susilo, <i>KTH Royal Institute of Technology</i> Investigating the nature of Public Transport service attributes	♣ 78 Lissy La paix, <i>University of Twente</i> Spatial autocorrelation of pedestrian and bicycle crashes using network attributes and GPS-based smartphone data

## Thursday, 6 June 2019

- 9:00 **Conference registration**  
 ☛ University of Helsinki main building (new side), Fabianinkatu 33  
 Aula

- 9:00 **Open plenary session**  
 ☛ Tiedekulma/Think Corner, Yliopistonkatu 4  
 Chair: Karst Geurs

**Keynote talk: Tim Schwanen****Panel discussion: "How to plan open and happy cities?"**

Discussant: Tuuli Toivonen

## Panelists:

Tim Schwanen, *Director of the Transport Studies Unit, Associate Professor in Transport Studies and Human Geography, University of Oxford*  
 Milos Mladenovic, *Assistant Professor, Transportation engineering, Aalto University*  
 Johanna Palomäki, *Planning Manager, City Of Espoo,*  
 Jarkko Jaakkola, *Area Manager, Finland & Baltics, MaaS Global*

- 11:00 **Coffee break ☕**  
 ☛ Tiedekulma/Think Corner, Yliopistonkatu 4

- 11:30 **Open NECTAR cluster meetings 🧑🏫**  
 ☛ University of Helsinki main building (old side), Unioninkatu 34

**Cluster 5**  
 ☛ Auditorium II

**Cluster 6**  
 ☛ Auditorium III

**Cluster 7**  
 ☛ Auditorium XI

**Cluster 8**  
 ☛ Auditorium IV

- 12:30 **Lunch 🍴**  
 ☛ University of Helsinki main building (new side), Fabianinkatu 33  
 1<sup>st</sup> floor

- 13:30 **Parallel sessions II**  
 ☛ University of Helsinki main building (old side), Unioninkatu 34

**Widening Impact Analysis and Participation in Project Appraisal (CL1 Thematic Session)**  
 ☛ Auditorium II  
 Chair: Imre Keserü

🗨 31  
 Jesse Pappers, *Vrije Universiteit Brussel*  
 Learning through evaluation: the application of the Multi-Actor Multi-Criteria Analysis in co-creation to solve mobility problems

🗨 32  
 Stephan Tischler, *University of Innsbruck*  
 New Railway Infrastructure Decision-Making: A Case Analysis Of Using Multi-Criteria-Analysis Based Methods For The Brenner-Corridor

🗨 30  
 Robin Hickman, *UCL*  
 Testing the application of participatory MCA: a case study of the South Fylde Line, UK

🗨 33  
 Paulo Anciaes, *University College London*  
 A new approach for the appraisal of roadspace allocation in major urban roads in Europe

**Spatial interaction and regional development (CL4 Thematic Session)**  
 ☛ Auditorium III  
 Chair: John Östh

🗨 34  
 Chia-Lin Chen, *University of Liverpool*  
 High mobility in China? The impact of high-speed rail on work-related commuting: A case study of Suzhou-based commuters

🗨 35  
 Cristóbal Mendoza, *Universidad Autónoma Metropolitana-Iztapalapa*  
 Everyday spaces of a group of skilled immigrants in Mexico: Geographies of comfort and restricted mobilities

🗨 36  
 Jean-Daniel Saphores, *University of California Irvine*  
 Why Do They Live so Far From Work? Determinants of Long-Distance Commuting in California

🗨 37  
 Umut Türk, *Abdullah Gül University*  
 How much does geography contribute? Measuring Inequality of Opportunities using a bespoke neighbourhood approach

**Happiness through Accessibility (CL6 Thematic Session)**  
 ☛ Auditorium XI  
 Chair: Ahmed El-Geneidy

🗨 39  
 Jonathan Levine, *University of Michigan*  
 A Century of Evolution of the Accessibility Concept

🗨 38  
 Claudia Berghoth, *Digital Geography Lab, University of Helsinki*  
 Incorporating dynamic population in accessibility research: a case study from Helsinki, Finland

🗨 41  
 Jean Ryan, *Lund University and K2*  
 How to assess accessibility: subjective accounts, objective measures, or both?

🗨 40  
 Roberto Patuelli, *University of Bologna*  
 The Role of Accessibility and Spatial Interaction in a Doubly Constrained Model: Evidence for Domestic Tourism Flows in Italy

Thursday, 6 June 2019

<p><b>Changing landscapes of mobility for future social and health inequalities (CL7 Thematic Session)</b>  📍 Auditorium IV  Chair: Tanu Priya Uteng</p> <p>📍 42  Maria Attard, <i>University of Malta</i>  The inequalities of a car-based transport system in Malta</p> <p>📍 43  Jessica Berg, <i>Swedish national road and transport research institute VTI</i>  How can public transport contribute to social equity? A study of mobility in socially deprived urban areas in Sweden</p> <p>📍 44  David Duran-Rodas, <i>TUM</i>  Inequality in the usage of bike sharing systems considering built and social environment factors among residential areas.</p> <p>📍 45  Ignacio Tiznado Aitken, <i>Pontificia Universidad Católica de Chile</i>  Exploring the use of qualitative data to enhance the understanding of accessibility through public transport</p>	<p><b>Experiences &amp; choices – mode, destination &amp; well-being 2</b>  📍 Auditorium XIII  Chair: Ann Verhetsel</p> <p>📍 47  Saidul Chowdhury, <i>Sweco Nederland BV</i>  Intrapersonal Variation in Destination Choice</p> <p>📍 46  Lars Böcker, <i>University of Oslo</i>  Access, egress and transfers in multimodal public transport: Implications for subjective wellbeing and en route place valuation</p> <p>📍 48  Marie-José Olde Kalter, <i>Goudappel Coffeng / University of Twente</i>  Dynamics in mode choice behaviour: the relationship between trip distance and changes in mode use variation</p> <p>📍 49  Ann Verhetsel, <i>University Of Antwerp</i>  Commuters' burden revisited: The relationship between travel time and well-being</p>	<p><b>Mobility-as-a-Service – case studies</b>  📍 Auditorium XIII  Chair: Karst Geurs</p> <p>📍 53  Bhavana Vaddadi, <i>KTH- Royal Institute of Technology</i>  Measuring system level effects of Corporate MaaS – A case study in Sweden</p> <p>📍 50  Anna-Maria Feneri, <i>Technical University of Eindhoven</i>  Mobility-as-a Service in the Netherlands: The implementation of a Dynamic Choice Experiment to Examine Travel Behavior Adaptations</p> <p>📍 52  Konstantinos Gkiotsalitis, <i>University of Twente</i>  Mobility-as-a-Service in a depopulating area: An exploration of small and big data</p> <p>📍 51  Karst Geurs, <i>University of Twente</i>  Fancy some MaaS, Paleisquare? How residents in a densely populated neighbourhood in the Netherlands welcome the introduction of a Mobility-as-a-Service pilot and how it impacts on reducing parking needs</p>	<p><b>Tourism in Open and Happy Cities (CL5 Thematic Session)</b>  📍 Auditorium XVI  Chair: Peter Nijkamp</p> <p>📍 54  Antoni Domènech, <i>Universitat Rovira i Virgili</i>  First-time cruise tourists' intention to recommend a port city: space and time matter</p> <p>📍 55  Ayelet Gal-Tzur, <i>Ruppin Academic Center</i>  Which tourists use public transport? panel data analysis</p> <p>📍 56  Janika Raun, <i>University of Tartu</i>  The Role of Major Gateways on National Tourism Flows</p> <p>📍 57  Ralph Wahnschafft, Frank Wolter, <i>Global Forum on Human Settlements</i>  Sustainability of waterborne transport in European tourist destination cities: Assessing experiences with battery-powered excursion boats</p>
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## Thursday, 6 June 2019

## ● 15:30 Coffee break ☕

📍 University of Helsinki main building (old side), Unioninkatu 34  
Etulämpö, 2<sup>nd</sup> floor

## ● 16:00 Parallel sessions III

📍 University of Helsinki main building (old side), Unioninkatu 34

→ 18:00

**Planning the future of transport for sustainable, open and happy cities (CL2 Thematic session)**

📍 Auditorium II  
Chair: Maria Attard

🗣 58

Juan Francisco Coloma,  
*Universidad Politécnica de Madrid*  
Environmental strategies for selecting eco-routing in small cities

🗣 59

Lígia Conceição Pereira,  
*University of Porto, Faculty of Engineering*  
How transport planning in urban regions shall be addressed to integrate automated vehicles reality: a mixed traffic analysis

🗣 60

Olaf Jonkeren, *KiM Netherlands Institute for Transport Policy Analysis*  
Bicycle parking at railway stations for sustainable cities

🗣 61

Richard Quodamine, *City of Philadelphia*  
Towards a practical municipal investment paradigm: How do municipal governments prioritize access to municipal services through investment using GIS in both the short and long term?

**Accessibility modelling and the evaluation of EU-wide policies (Special session JRC)**

📍 Auditorium III  
Chair: Mert Kompil

🗣 65

Hugo Poelman,  
*European Commission - DG REGIO*  
Measuring daily accessibility by road and rail in Europe's regions and territories

🗣 63

Alexander Lembcke,  
*OECD Centre for Entrepreneurship, SMEs, Regions and Cities*  
Roads, market access and regional economic development

🗣 62

Mert Kompil, Aris Christodoulou,  
*European Commission, Joint Research Centre*  
Measuring accessibility and congestion in European cities

🗣 64

Dimitrios Papaioannou, *ITF-OECD*  
Measuring accessibility in urban Europe

**Happiness through Accessibility (CL6 Thematic Session)**

📍 Auditorium XI  
Chair: Benjamin Büttner

🗣 66

Jinhyung Lee, *The Ohio State University*  
Measuring reliable transit accessibility considering travelers' multi-criteria route choice

🗣 67

Amparo Moyano,  
*University of Castilla La Mancha*  
Assessing spatiotemporal variations of traffic congestion: comparison of 2012 and 2018 accessibility scenarios in Madrid

🗣 68

Elias Pajares, *Technical University Munich*  
GOAT: a dynamic and open accessibility tool for modelling and encouraging active mobility

🗣 69

David Vale, *University of Lisbon, Lisbon School of Architecture, CIAUD*  
How much are we overestimating accessibility by ignoring the cost of travel?  
Comparing multimodal effective accessibility for different income groups

## ● 19:00 Welcome reception by the City of Helsinki 🍷

📍 Old Town Hall (*Vanha Raatihuone*), Aleksanterinkatu 20  
Empiresali

**Opening words**

Director, Urban Research and Statistics  
Timo Cantell, *City of Helsinki*

## ● 20:00 Experience the Helsinki archipelago

→ 0:30

📍 Meeting point: Kauppatori Pier  
Hosts: Elias Willberg, Henrikki Tenkanen, Tuomas Väisänen

**Boat trip to Isosaari island 🚤**

● The boat leaves at 20:30, **strictly**, from Kauppatori Pier (5 min. walk from the reception hall)

● Bring warm clothes (hat, jacket, gloves)

**Sauna and barbecue 🍷 🍴 🍻 🍷**

● Bring your sauna gear (towel, swimsuit, sandals)!

**Boat trip back to Kauppatori**

Thursday, 6 June 2019

#### Changing landscapes of mobility for future social and health inequalities (CL7 Thematic Session)

📍 Auditorium IV

Chair: Michael Widener

📍 70

Juan Carrasco, *Universidad de Concepcion*  
Accessibility to healthy food: A multi-method analysis approach from Chile

📍 71

Daniel Oviedo Hernandez, *University College London*  
Drawing the (base)line: exploring the links between liveability and health equity in Cali's Corredor Verde

📍 72

Marina Van Geenhuizen, *Delft University of Technology, Faculty of Technology, Policy and Management*  
Traffic Noise and Health Risk: What the Role of Citizen-Sensing May Be

📍 73

Michael Widener, *University of Toronto*  
Comparing time use, transportation options, and dietary behaviours in three Toronto, Canada neighbourhoods: Initial results from the FASTT Survey

#### Human mobility & social integration

📍 Auditorium XIII

Chair: Marina Toger

📍 74

Carolina Duarte Gonçalves Ramos, *Architecture School of University of Lisbon*  
Walkability as an element of integration of public policies

📍 75

Kamyar Hasanzadeh, *Aalto University*  
Monocentric, bicentric, or polycentric? The varying ways young and old adults use neighborhoods and extra-neighborhoods spaces in Helsinki Metropolitan Area

📍 76

Kerli Müürisepp, *Digital Geography Lab, University of Helsinki*  
Human mobility as an indicator for integration? Big data to reveal socio-spatial interactions

📍 77

Marina Toger, *Uppsala University*  
When people meet in cities how far do they integrate? Exploring mixing and functional use at various spatial scales

#### Mobility-as-a-Service – challenges and opportunities

📍 Auditorium XIII

Chair: Eric Miller

📍 22

Rodrigo Gandia, *CentraleSupélec*  
Mobility as a Service (MaaS) Ecosystem: The Eco-Innovative Business Model of Mobility

📍 23

Iria Lopez Carreiro, *TRANSyT - Universidad Politécnica De Madrid*  
Evaluating the implementation of a MaaS travel assistance App in metropolitan areas from travellers and urban stakeholders' point of view

📍 25

Emmanouil Tranos, *University of Birmingham*  
The effect of Uber on Yellow Taxis in New York

📍 24

Eric Miller, *University of Toronto*  
A Conceptual Framework for Modelling the Supply Side of Mobility Services within Large-Scale Agent-Based Models

#### Tourism in Open and Happy Cities (CL5 Thematic Session)

📍 Auditorium XVI

Chair: Luca Zamparini

📍 82

José M. Coronado, *Universidad de Castilla - La Mancha*  
Pedestrian behaviour associated to specific events in small cities: assessing the behaviour of the FENAVIN conference attendees through GPS tracks in Ciudad Real

📍 83

Kazuo Nishii, *University of Marketing and Distribution Sciences*  
Preconditions of introducing integrated mobility services in tourism destinations in Japan: Toward more attractiveness in urban tourism

📍 84

Anthony Perl, *Simon Fraser University*  
Exploring the evidence on mobility and quality of life among Vancouver's hospitality workers

📍 85

Luca Zamparini, *Università del Salento*  
Mobility at tourist destinations and everyday transport choices of young people: A cross-country survey

## Friday 7 June 2019

## ● 9:30 Parallel sessions IV

📍 University of Helsinki main building (old side), Unioninkatu 34

## Analysing cross-border mobility

📍 Auditorium II

Chair: Juan Carlos Martin

📺 124

Maurizio Mussoni, *University of Bologna*

**Centralized vs Decentralized Tourism Policies: a Spatial Interaction Model Framework**

📺 87

Olle Järvi,  
*Digital Geography Lab, University of Helsinki*  
**Implementation of Big Data in cross-border mobility research: a Twitter case study from the Greater Region of Luxembourg**

📺 88

Juan Carlos Martin,  
*University of Las Palmas GC*  
**A MCA-DEA method to measuring immigration openness in 23 countries. An analysis of the 2016 European Social Survey**

## New views on walkability

📍 Auditorium III

Chair: Milos Mladenovic

📺 90

Noriko Otsuka, *ILS*

**Walkability assessment for the urban area around TEN-T railway stations**

📺 91

Tuuli Toivonen,  
*Digital Geography Lab, University of Helsinki*  
**Modelling of healthy, equitable and sustainable urban accessibility**

📺 89

Benjamin Büttner, *TUM*  
**Access to Rail:  
The Influence of Comfort on Accessibility**

Mega events and transport  
(Special session IGU)

📍 Auditorium XI

Chair: Richard Knowles

📺 92

Marie Delaplace, *UPEM*

**Do the Olympics affect airline networks to the host city? The case of Rio de Janeiro**

📺 94

Maciej Tarkowski, *University of Gdańsk*  
**Can mega event help change the patterns of urban and regional mobility? A Case Study of Gdańsk – the co-host of the UEFA EURO 2012**

📺 93

Richard Knowles,  
*University of Salford, Manchester*  
**Effects of the re-imposition of border checks on trans-Øresund commuting between Sweden and Denmark**

## ● 11:00 Coffee break ☕

📍 University of Helsinki main building (old side), Unioninkatu 34  
Etulämpö, 2<sup>nd</sup> floor

## ● 11:30 Parallel sessions V

📍 University of Helsinki main building (old side), Unioninkatu 34

Green and electric cars  
(CL2 Thematic Session)

📍 Auditorium II

Chair: Maria Attard

📺 107

Hans Nijland, *PBL*  
**Electrification of the Dutch national car fleet**

📺 108

Aviv Steren,  
*Ben-Gurion University of the Negev*  
**The clash of policies:  
Do green cars affect driving behavior?**

## Revealing socio-economic equities

📍 Auditorium III

Chair: Renata Oliveira

📺 114

Mauro Pereira, *Lisbon University*  
**The socio-economic equity through built environment characteristics – The context of Metropolitan Area of Lisbon**

📺 113

Renata Oliveira, *Federal Center for Technological Education of Minas Gerais*  
**Accessibility to food systems in Belo Horizonte, Brazil**

Methods for analysing  
spatial accessibility patterns

📍 Auditorium XI

Chair: Henrikki Tenkanen

📺 111

Albert Steiner,  
*Zurich University of Applied Sciences*  
**A Three-step Floating Catchment Area Method to Quantify the Spatial Accessibility of Healthcare Facilities for Citizens**

📺 112

Henrikki Tenkanen,  
*University College London*  
**Where are the centers of a city?  
A method to analyze centrality and modal equity of transport across city regions**

## ● 12:30 Lunch 🍴

📍 University of Helsinki main building (new side), Fabianinkatu 33  
1<sup>st</sup> floor

## ● 13:20 Parallel sessions VI

➡ 14:50 📍 University of Helsinki main building (old side), Unioninkatu 34

## Property values &amp; accessibility

📍 Auditorium II

Chair: John Nellthorpe

📺 123

Adam Radzinski,  
*Adam Mickiewicz University in Poznań*  
**The effects of public transport improvements on travel behaviour, housing choices and property values – evidence from a Polish city with new tram network**

## Tourism, perceptions and well-being

📍 Auditorium III

Chair: João Romão

📺 86

Vuokko Heikinheimo,  
*Digital Geography Lab, University of Helsinki*  
**Estimating the origins and destinations of social media users for mobility studies: a critical comparison of measuring techniques**

## Wayfinding and navigation

📍 Auditorium XI

Chair: Dea Van Lierop

📺 129

Christoffer Weckström, *Aalto university*  
**Navigability - the forgotten dimension in public transport network overhaul assessment**

Friday 7 June 2019

<b>The Logistics of Living in Cities (CL3 Thematic Session)</b> ♡ Auditorium IV Chair: Cathy Macharis	<b>Impacts of new infrastructures</b> ♡ Auditorium XIII Chair: Joao De Abreu e Silva	<b>Telecommuting, e-shopping and accessibility</b> ♡ Auditorium XIII Chair: Rob Konings	<b>Human scale mobility innovations (CL8 Thematic Session)</b> ♡ Auditorium XVI Chair: Luc Wismans
♣ 95 Alessandra Boggio Marzet, <i>TRANSyT-Universidad Politécnica de Madrid</i> Energy efficiency of urban freight in Madrid: comparison between urban and suburban deliveries	♣ 98 Zhenhua Chen, <i>The Ohio State University</i> Socioeconomic Impact Assessments of High-Speed Rail: A Meta-Analysis	♣ 102 Hannah Budnitz, <i>University of Birmingham</i> Telecommuting and the accessibility of amenities	♣ 105 Imre Keseru, <i>Vrije Universiteit Brussel</i> Can we rely on data collected by motivated citizens? Advantages and limitations of citizen observatories for mobility
♣ 97 Dirk Wittowsky, <i>ILS - Research Institute for Regional and Urban Development</i> Blessing or Curse? How e-Commerce is Transforming our Cities and Mobility	♣ 100 Elena Lopez, <i>UPM</i> Territorial cohesion impacts of HSR in Spain Learning from the past and planning future developments	♣ 101 Aldo Arranz-López, <i>University of Zaragoza</i> How e-shopping impacts on walking time-willingness to retail destinations	♣ 106 Robin Palmberg, <i>KTH Royal Institute of Technology</i> Uncovering Effects of Spatial and Transportation Elements on Travellers Using Biometric Data
♣ 96 Cathy Macharis, <i>Vrije Universiteit Brussel</i> The difficult road to decarbonizing the freight transport sector: a participatory exploration for Flanders	♣ 99 Joao de Abreu e Silva, <i>Instituto Superior Técnico</i> The impact of motorway expansion on urban growth patterns: the case of Portugal between 1991 and 2011 (Orig. P.Melo)	♣ 103 Rob Konings, <i>Delft University of Technology</i> Online grocery shopping and future accessibility of supermarkets	♣ 104 Itzhak Benenson, <i>Tel Aviv University</i> Public transport travel patterns revealed from mining Israeli smart card data

<b>The Logistics of Living in Cities (CL3 Thematic Session)</b> ♡ Auditorium IV Chair: Cathy Macharis	<b>Ride hailing</b> ♡ Auditorium XIII Chair: Alejandro Tirachini	<b>Public transport planning as a means to improve accessibility</b> ♡ Auditorium XIII Chair: Milan Janić	<b>Elderly mobility challenges</b> ♡ Auditorium XVI Chair: Anabela Ribeiro
♣ 109 Nicolas Brusselaers, <i>Vrije Universiteit Brussel - MOBI Research Centre</i> Air quality and freight transport in cities: a dynamic approach to measure the real impact	♣ 116 Rebekka Oostendorp, <i>German Aerospace Center (DLR), Institute of Transport Research</i> New mobility services in new residential areas: challenges and opportunities of measures for sustainable urban mobility	♣ 117 Ahmed El-Geneidy, <i>McGill University</i> Planning a high-frequency transfer-based bus network: How do we get there?	♣ 119 Tanu Priya Uteng, <i>Institute of Transport Economics</i> Planning for elderly mobilities: How can car sharing aid the transition towards sustainable travel behaviour? Case of Oslo, Norway.
♣ 110 Victoria Muerza, <i>Zaragoza Logistics Center</i> Environmental and energy effectiveness of an urban freight distribution model, based on cohabitation between passengers and light goods in proximity rail transport, and last mile distribution integration with green vehicles	♣ 115 Alejandro Tirachini, <i>Universidad de Chile, Technische Universität München</i> Fixing the number of vehicles and/or setting a tax for ride-hailing? Insights from a social welfare maximisation approach	♣ 118 Milan Janić, <i>Delft University of Technology</i> Analysis and modelling performance of the airport landside access transport modes and their systems	♣ 120 Anabela Ribeiro, <i>University of Coimbra</i> MOBI-AGE: Promoting urban mobility in ageing populations

<b>Cycling infrastructures</b> ♡ Auditorium IV Chair: Kevin Krizek	<b>Autonomous and shared mobility</b> ♡ Auditorium XIII Chair: Dick Ettema	<b>Built environment, attitudes and travel behavior</b> ♡ Auditorium XIII Chair: Bert Van Wee	<b>Happy Cities: The Home of People (Special Session Regional Science Academy)</b> ♡ Auditorium XVI Chair: Aura Reggiani
♣ 130 Jukka Krisp, <i>University of Augsburg</i> Sensor-based analysis of bike lane quality	♣ 133 Rami Darwish, <i>The Royal Institute of Technology - KTH</i> Lessons from a Driverless Bus Service Deployment on Public Roads in Stockholm	♣ 136 Joao de Abreu e Silva, <i>Instituto Superior Técnico</i> Effects of residential urban environment, social networks and social influence on travel behaviour of university students	♣ 141 John Östh, <i>Uppsala Universitet</i> My home is my castle



## Friday 7 June 2019

## 📍 121

Christopher Leahy, *University of Leeds*  
**Modelling large-scale multi-modal accessibility impacts on residential property prices in a polycentric region**

## 📍 122

John Nellthorpe, *Institute for Transport Studies, University of Leeds*  
**Modelling and valuing local-scale accessibility and place quality using hedonic pricing methods in the housing market**

## 📍 125

Concepción Román, *University of Las Palmas GC*  
**The residents' perception in Gran Canaria: A mature mass tourist destination.**

## 📍 126

João Romão, *University of Algarve*  
**Tourism, smart specialization and well-being**

## 📍 127

Anthony Ferri, *Technical University of Munich*  
**Making the Connection: How Emotional Responses to Transit Environments Effect Navigation**

## 📍 128

Dea van Lierop, *Utrecht University*  
**Wayfinding for e-bikes: Assessing e-bike users' experiences with wayfinding along a bicycle highway in the Netherlands**

🕒 15:00 **Plenary session**

📍 16:00 **University of Helsinki main building (new side), Fabianinkatu 33**  
 Small Hall (*Pieni Juhlasali*), 4<sup>th</sup> floor

**NECTAR PhD Award 🏆**

Joram Langbroek, *KTH Royal Institute of Technology*  
**Changing travel habits of electric vehicle users**

**Conference closing sessions****Cluster wrap-ups**

**Invitation by the NECTAR 2021 conference organisers**

**Closing words**🕒 17:30 **Jätkäsaari – renewal of an urban waterfront district**

📍 Meeting point: Clarion Hotel, Tyynenmerenkatu 2, *Living Room & Bar*  
 Hosts: Olle Järvi, Joel Jalkanen, Kerli Mürisepp

**Presentation “From cargo port to quality living” 📺**

📍 Jätkäsaari Library, Tyynenmerenkatu 1

**Walking tour 🚶**

📍 Jätkäsaari

**Rooftop sightseeing 🏠**

📍 Sightseeing terrace (Verkkokauppa), Tyynenmerenkatu 11

🕒 20:00 **Unofficial dinner 🍴**

Friday 7 June 2019

🗣️ 132

Cecilia Silva, *University of Porto*  
**Boosting Starter Cycling Cities:**  
 strategies and support to foster  
 sustainable transport planning

🗣️ 131

Kevin Krizek,  
*University of Colorado Boulder*  
**Channeling the human element to design**  
 our future streets

🗣️ 135

Bat Hen Nahmias Biran, *ARIEL University*  
**Activity-Based Accessibility for**  
**Measuring Shared Mobility Impacts**

🗣️ 134

Dick Ettema, *Utrecht University*  
**Geography, culture and potential AV**  
**pathways and impacts: A comparison of**  
**Australia and the Netherlands**

🗣️ 137

Mayara Monteiro, *FEUP*  
**I know what you did last semester:**  
**Examining adaptation and travel behavior**  
**change among millennials short-term**  
**exchange students**

🗣️ 138

Bert van Wee,  
*Delft University of Technology*  
**Impacts of the built environment and**  
**travel behaviour on attitudes: theories**  
**underpinning the reverse causality**  
**assumption**

🗣️ 139

Karima Kourtit,  
*Vrije Universiteit Amsterdam*  
**Assessment of**  
**a city love production function**

🗣️ 140

Peter Nijkamp,  
*Vrije Universiteit Amsterdam*  
**Urban culture as a magnet**  
**for foreign visitors**

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## KEYNOTES

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## Mikael Colville-Andersen

Mikael Colville-Andersen is one of the leading global voices in urbanism. He advises cities and businesses in how to design - and embrace - bicycle and pedestrian friendly streets in order to improve urban life. He is known for his pioneering philosophies about simplifying urban planning and how cities and towns should be designed instead of engineered.

Mikael is the author of *Copenhagenize - the definitive guide to global bicycle urbanism* and the host of the urbanism tv series *The Life-Sized City* and he inspires with his keynotes around the world about how to make cities better. He will speak about how cities should be at the forefront of fighting climate change, the bicycle's primary role in this task and how this Age of Urbanism is inspiring citizens around the world.

*Wed 5th June at 13 at the University of Helsinki Main building, Great Hall*



## Dr Tim Schwanen

Tim is Director of the Transport Studies Unit, Associate Professor of Transport Studies in the School of Geography and Environment, and Fellow at St Anne's College. He joined the Transport Studies Unit (TSU) in March 2009 and became Director in September 2015. Since July 2016 he has been a Visiting Professor of Human Geography at the School of Business, Economics and Law at the University of Gothenburg in Sweden. Before coming to Oxford, he worked as a lecturer in urban geography at Utrecht University, the Netherlands. He also completed his PhD dissertation (2003, cum laude) and MSc dissertation (1999, cum laude) at Utrecht University.

Tim's research concentrates on the geographies of the everyday mobilities of people, goods and information. It is international in outlook, interdisciplinary in scope, informed by the thinking in various sub-disciplines within Geography.

Since 2001 he has published more than 140 book chapters and articles in international journals in Geography, transport studies, urban studies, environmental studies and interdisciplinary science on a wide range of topics related to everyday mobility.

*Thu 6th June at 09.00 at Think Corner*

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# ABSTRACTS

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🖥️ keynote

## Urban mobility, wellbeing and inequality: Understanding the relationships

<sup>1</sup>\*Schwanen, T.

\* lead presenter, tim.schwanen@ouce.ox.ac.uk

<sup>1</sup>Transport Studies Unit, University of Oxford, United Kingdom

The literature on transport and wellbeing is burgeoning, with many studies seeking to examine in particular the hedonic experience of travel behaviour. Research in this vein is a welcome and important complement to the conventional focus on cost, speed, convenience and attitudes in transport studies. Nonetheless, wellbeing as a concept is much broader than hedonic experience or indeed subjective experience, and transport studies can benefit from harnessing and advancing other conceptions. This is particularly important if transport scientists want to consider questions of inequality and justice alongside or as part of wellbeing, and understand the transport-wellbeing nexus in cities across the planet. Cities are, after all, not only the sites where most people live and sustainable mobility might be achieved most easily but also the places where inequalities run deepest. This presentation will elaborate a transport-related conception of wellbeing that is eudaimonic and rooted in Amartya Sen's capability approach yet also move beyond this to consider the relational, emergent and experiential nature of capabilities as they relate everyday mobility. To this end the presentation will also draw on and rework on the concepts of 'motility' and 'spaces of wellbeing'. It will utilise empirical research about cycling and walking in São Paulo and London to illustrate salient aspects of the interrelations between wellbeing and travel behaviour. One insight emerging from this manner of thinking is that wellbeing cannot be understood as inhering in individuals but rather is an always-emergent quality of shifting configurations of humans and all kinds of other urban elements.



## Timelines of urban transport infrastructure delivery: From idea to operation

<sup>1</sup>Raghav, S., <sup>2</sup>Dean, M., <sup>1</sup>Siemiatycki, M., <sup>2</sup>Durrant, D. & <sup>1</sup>\*Saxe, S.

\* lead presenter, s.saxe@utoronto.ca

<sup>1</sup> University of Toronto, Canada

<sup>2</sup> University College London, United Kingdom

Narratives of shortage and delay are a significant feature of the discourse on the state of urban infrastructure. This leads to pressure to expedite the delivery of infrastructure projects. The push for speed, however, runs counter to arguments that the planning of major infrastructure projects requires ‘time to breathe’ to fully appreciate the needs that might be met by major infrastructure and to avoid negative consequences of an expedited decision-making process.

This work researches the timelines of large-scale transportation infrastructure projects in Toronto, Canada and London, England. A census of transportation projects that have opened since the year 2000 are examined for the length of time spent in different development stages, namely inception, planning, environmental assessment, procurement, and construction. The studied projects took between 10 and 60 years to move from conception to operation. In Toronto, we find that node (e.g. airports, storage facilities) and road projects are completed relatively quickly, while linear rail and public transit projects often stretch over decades. These rail projects have particularly long inception phases, where the project is discussed publicly but little concrete progress is made. In London, the results are less generalizable. The length of the planning and decision-making process appears to depend on political, institutional, economic, and social conditions rather than on the specific category and morphology of the projects.

For projects with long planning phases (+10 years) the degree of change in the project is qualitatively and quantitatively investigated probing the premise of the time to breath argument. For the majority of the long inception phase projects, long periods of stability with little change is observed.

This research is the result of a collaborative research project between University College London and the University of Toronto examining and comparing the timelines of infrastructure delivery in two global cities (London and Toronto).



## **A bottom-up process for transport infrastructure evaluation: The wider ‘intangible impacts’ on choice of transport mode for residents living in Underground station areas**

<sup>1,2</sup>\*Cao, M. & <sup>2</sup>Hickman, R.

\* lead presenter, m.cao@westminster.ac.uk

<sup>1</sup> Department of Planning and Transport, University of Westminster, London, United Kingdom

<sup>2</sup> Bartlett School of Planning, University College London, United Kingdom

Cost benefit analysis (CBA), as one of the traditional transport appraisal methods, has been widely used to evaluate transport infrastructure projects, focusing in particular on financial resources and economic efficiency. Once a transport infrastructure project has passed the CBA appraisal, governments are more likely to invest in it, as they assume that it will significantly benefit local residents, particularly those who can easily access and use the local transport infrastructure. However, a bottom-up form of public participation evaluation has always been overlooked, which means that the social impacts are poorly covered in the appraisal process, as various factors may influence people’s travel mode choice, even though residents may have similar levels of accessibility to the local transport infrastructure. In this research, we conducted face-to-face surveys with local residents living in Underground station areas in Beijing, and investigated their main travel mode choice for commuting by employing a discrete choice model. Our findings show that only 35 per cent of local residents used the Underground as their main travel mode, whereas 28 per cent of people still drove private vehicles, although they all had similar levels of physical accessibility and were able to access their local Underground stations easily. Their travel mode choices can therefore be attributed to various socio-economic characteristics, travel factors, built environment features and attitudes, which have often been overlooked in the transport project evaluation process. Consequently, it is argued that more variables should be taken into account when evaluating transport infrastructure projects. Overall, our research could help transport planners/policy makers to understand the wider and potential impacts of transport infrastructure projects.





## The political economy of street space reallocation: Aldgate Gyratory & Bank Junction, London

<sup>1</sup>\*Huaylla Sallo, K. & <sup>1</sup>Hickman, R.

\* lead presenter, [katy.sallo.16@ucl.ac.uk](mailto:katy.sallo.16@ucl.ac.uk)

<sup>1</sup> University College London, United Kingdom

Street space reallocation schemes are essential to reduce motor traffic, pollution, and provide quality public spaces. Nonetheless, implementation of these policies is often controversial, widely resisted and sometimes blocked. The old Aldgate Gyratory transformation into a quality public realm now offers safety and improved public space and air quality, but took ten years to be a reality. Alongside, Bank Junction car banning trial was made permanent after long discussions and, despite the strong opposition of the taxi trade that almost pushed back the scheme.

This paper aims to examine the political economy of the implementation of these two street space reallocation projects in the City of London, Aldgate Gyratory transformation and Bank Junction car banning scheme. The primary questions we aim to answer are: (1) what are the success factors that can help accelerate the implementation of street space reallocation schemes in the UK; and (2), what can we learn from the successful implementation of non-controversial and controversial schemes?

A political economy framework for transport innovations (Feitelson and Salomon, 2004) is used to evaluate how key factors might help or block policy implementation and how actor views are mediated through the process. Qualitative data is the base for this research. Content analysis is used to examine the thirteen in-depth interviews and is supplemented with secondary data.

This study finds that success factors for street space reallocation projects include: ambition and tenacity to develop innovative projects; sufficient funding and a framework to deliver; urban temporary experiments; gradual development of schemes and extensive public participation and engagement. Controversial policies require high levels of social and political support; thus, less controversial but successful schemes can help implementation of more controversial ones. Policy implementation is a transition that involves positive and adverse impacts. Hence, project development requires leadership and a strategic approach for success.



## **The effects of introduction of the Moscow Central Circle rail passenger service: transport, urban, economic and travel behaviour consequences**

<sup>1</sup>\*Kotov, E., <sup>1</sup>Muleev, E., <sup>1</sup>Koncheva, E., <sup>1</sup>Stakhno, D., <sup>1</sup>Nifontova, K., <sup>1</sup>Gorbatyuk, S., <sup>1</sup>Glyshkova, T. & <sup>1</sup>Doletskaya, O.

\* lead presenter, ekotov@hse.ru

<sup>1</sup> National Research University Higher School of Economics, Russia

In 2016 passenger service on the Moscow Central Circle (MCC, a circular urban rail line in Moscow) was reintroduced after its closure in 1934. The launch of this line allowed us to study the effects of a transport infrastructure project using observed rather than model-forecasted data.

We collected empirical data on changes in real estate values, land use, transportation flows and travel behaviour as consequences of integration of the new rail line into existing urban transit system.

The research project consists of several parts. First, we studied residential rent rates. The rent growth effect was most substantial in the residential areas around Moscow Central Circle stations without access to existing metro stations.

Second, we used the Node-Place model to evaluate the magnitude of the potential (and officially planned) land use changes in the long-run, i.e. the increase in the place value. We revealed that the long-term MCC impact is modest, because the opportunities for land use change around the MCC stations are currently limited and therefore the increased node value is not accompanied by the proportional change of the place value.

Third, we used Moscow Metro origin-destination matrices for typical working days in March 2016 and March 2017 to evaluate the impact of the MCC on the redistribution of passenger traffic volumes. We observed an insignificant decline in load level of Metro Circle line and radial lines and interchanges in the city centre.

Finally, we studied changes in travel behaviour. The majority of respondents do not use the MCC to reach locations near new stations but use it mostly to optimise their existing routes, which also supports the findings of the relatively low place value of the territories around the new stations.

Repeating the same measurements regularly will allow us to monitor the changes in the use of the MCC and track its performance and its effects over time. This paper covers the short-term effects that occurred in the first 12 months of the MCC operation.



## Tracking job and housing dynamics with smartcard data

<sup>1</sup>\*Huang, J., <sup>2</sup>Levinson, D.M., <sup>3</sup>Wang, J., <sup>4</sup>Zhou, J. & <sup>4</sup>Wang, Z.

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<sup>2</sup> School of Civil Engineering, University of Sydney, Australia

<sup>3</sup> Department of Urban Planning and Design, Faculty of Architecture, The University of Hong Kong, China

<sup>4</sup> School of Civil Engineering, Beijing Jiaotong University, China

Residential locations, the jobs–housing relationship, and commuting patterns are key elements to understand urban spatial structure and how city dwellers live. Their successive interaction is important for various fields including urban planning, transport, intraurban migration studies, and social science. However, understanding of the long-term trajectories of workplace and home location, and the resulting commuting patterns, is still limited due to lack of year-to-year data tracking individual behavior. With a 7-y transit smartcard dataset, this paper traces individual trajectories of residences and workplaces. Based on in-metro travel times before and after job and/or home moves, we find that 45 min is an inflection point where the behavioral preference changes. Commuters whose travel time exceeds the point prefer to shorten commutes via moves, while others with shorter commutes tend to increase travel time for better jobs and/or residences. Moreover, we capture four mobility groups: home mover, job hopper, job-and-residence switcher, and stayer. This paper studies how these groups trade off travel time and housing expenditure with their job and housing patterns. Stayers with high job and housing stability tend to be home (apartment unit) owners subject to middle-to-high-income groups. Home movers work at places similar to stayers, while they may upgrade from tenancy to ownership. Switchers increase commute time as well as housing expenditure via job and home moves, as they pay for better residences and work farther from home. Job hopppers mainly reside in the suburbs, suffer from long commutes, change jobs frequently, and are likely to be low-income migrants.

Overall, this paper uses transit smartcards from travelers in Beijing retained over a 7-y period to track boarding and alighting stations, which are associated with home and work location. This allows us to track who moves and who remains at their homes and workplaces. Therefore, this paper provides a longitudinal study of job and housing dynamics with group conceptualization and characterization. This paper identifies four mobility groups and then infers their socioeconomic profiles. How these groups trade off housing expenditure and travel time budget is examined.



## Dual car ownership as an effect of the residential and working locations

<sup>1\*</sup>Maat, K. & <sup>2</sup>Kasraian, D.

\* lead presenter, c.maat@tudelft.nl

<sup>1</sup> Delft University of Technology, The Netherlands

<sup>2</sup> University of Toronto, Canada

How people perceive cities, is largely determined by mobility and the orientation towards transport modes. Many large cities have invested heavily in public transport, while for example Copenhagen and Dutch cities are easily accessible by bicycle. Yet, other cities, including the US, are car-oriented or even car-dependent. Worldwide, apart from some urban centres, the car is the dominant transport mode, despite all the attention and investments in sustainable mobility.

Although car use is a complex phenomenon, it requires above all the availability of a car. Car ownership is a significant intermediate variable. In Europe, especially dual car ownership is increasing, as a result of which car availability is becoming increasingly an individual property. This paper tests the assumption that second cars are mainly purchased to enable both partners to reach their working locations by car, and that they evaluate the accessibility of different modalities on both sides. How this mechanism works depends on preferences: is car commuting preferred unless circumstances prevent this, or just because circumstances prevent the use of bicycle or public transport?

Dual car ownership is tested on the basis of a survey of 2,770 car-owning households in urban areas and surroundings in the seven countries around the North Sea (INTERREG NSR programme). Households were asked about a large number of characteristics of car ownership and use (including company cars), as well as characteristics of the location of residence and the working locations of (both) working partners. A generalised structural equation model was developed to estimate dual car ownership on the relation between the residential and working environment and between the two partners. The likelihood of buying a second car increases if the car accessibility is sufficient in terms of the origin and destination of both partners, or the accessibility of the alternatives, controlled for SEDs.



## Valuation and policy analysis using hedonic pricing with accessibility models: Results and lessons learned for a large multi-city region

<sup>1</sup>Nellthorp, J., <sup>1\*</sup>Ojeda-Cabral, M., <sup>1</sup>Leahy, C., <sup>1</sup>Jiang, L. & <sup>1</sup>Johnson, D.

\* lead presenter, M.A.OjedaCabral@leeds.ac.uk

<sup>1</sup> Institute for Transport Studies (ITS), University of Leeds, United Kingdom

This paper summarises a recently-completed study which developed a comprehensive hedonic pricing (HP) model for a multi-city region with nearly 15 million people (the North of England), linked to a mix of newly-developed and off-the-shelf models of local and regional accessibility. The purpose of the research is to address a number of policy questions, including: what role does accessibility – on different spatial scales – play in making a location attractive?; how does accessibility fit with the other variables that determine property prices?; accessibility by which modes, and to what, matters to people?; what types of spatial economic model are most effective at modelling these relationships?; and how can they be used to estimate the impacts of transport investments?

Key features of the modelling are as follows. The HP model has an economic theoretical basis in which income is allowed to influence the market value of key attributes (e.g. access to jobs). Second, a very wide range of factors influencing property prices are included, thanks to a unique dataset pooled together at detailed spatial level. Third, the accessibility indicators embody generalized journey time, bringing the model close to traditional transport methods. Fourth, the mixed urban/rural context with multiple cities provided plenty of variation in the data. The HP models were estimated using all property transactions in the region in 2016 (over 165,000 observations).

Among other contributions, the study shows how some drivers of value are better understood at the regional level (as opposed to local level), how valuable walk accessibility is, how income interactions can deal with spatial variation and provide both global and localised parameters more suitable for policy than geographically weighted regressions and spatial error models, how housing supply constraints have an impact, and how property values may change due to transport investments or other policy changes across the region.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>



## Housing market structure as barriers to moving residence: A multilevel approach

<sup>1</sup>\*de Graaff, T.

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<sup>1</sup> Department of Spatial Economics, Vrije Universiteit Amsterdam, The Netherlands

In the 1990s, Andrew Oswald wrote two famous working papers postulating that homeownership rates would have a negative impact on labor market behavior, as the high costs of moving residence associated with homeownership would impede regional mobility. These two working papers evoked a large empirical literature looking at the impact of individual and aggregate homeownership on labor market performance, where seemingly paradoxically at the aggregate level homeownership is indeed harmful for labor market behavior where at the individual level it is correlated with positive labor market performance.

This paper revisits the impact of the housing market structure on interregional migration, but adopts an alternative modeling approach to migration flows between cities. The starting point is a gravity model, but instead of using fixed effects for cities of origin and destination, I use a mixed effects approach allowing me to simultaneously model migration flows and the cities of origin and destination. This approach has two main advantages. First, it allows for simultaneous prediction of the impact of city characteristics on migration flows, where the impact is not necessarily symmetrical for cities of origin and destination. Second, it allows for prediction of migration flows between cities out of sample. Preliminary results show that homeownership and social renting rates decrease migration flows significantly.

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## **Assessing the impacts of accessibility by public transport and income on mode choice in Recife, Brazil**

<sup>1\*</sup>Boisjoly, G. & <sup>2</sup>El-Geneidy, A.

\* lead presenter, gboisjoly@polymtl.ca

<sup>1</sup> Polytechnique Montréal, Canada

<sup>2</sup> McGill University, Canada

Accessibility, the ease of reaching destinations, plays a significant role in individuals' well-being and travel behavior. Previous research has shown a positive association between accessibility by public transport and public transport mode share in several cities in the Global North. Yet, cities in the Global South did not receive much attention with respect to the impacts of accessibility on travel behavior. Furthermore, given the important socio-spatial segregation characterizing many of these cities, understanding this relationship across income groups is essential. The aim of this research is to assess the relationship between accessibility by public transport, mode choice, and income in Recife, Brazil. The study combines regional travel survey data (2016 origin-destination survey) and socio-economic data (2010 census) with measures of accessibility to jobs by public transport. The accessibility measures are generated from: (i) morning peak travel times by public transport across the metropolitan region, obtained through the Google Distance Matrix application programming interface, and (ii) job locations, obtained from the Ministry of Labour. Descriptive statistics are first explored and the determinants of mode choice across income groups are later identified through a multinomial logistic regression model predicting the likelihood of commuting by public transport, active transport, or car. Our descriptive statistical analysis shows that, despite experiencing the highest levels of accessibility, only 10% of high-income individuals commute by public transport. In contrast, although low-income individuals exhibit the lowest levels of accessibility, almost 80% of them commute by public transport. The multinomial regression model demonstrates that income is amongst the main determinants of mode choice, as found in previous studies. Yet, contrary to the literature, accessibility to jobs by public transport is found to be non-significant both for low-income and high-income individuals. The study thereby highlights the need for more context-specific research on accessibility and travel behavior in the Global South.

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## The impact of heterogeneous employment classes and workers on potential job accessibility estimation in the Netherlands

<sup>1,2</sup>\*Pritchard, J.P. & <sup>1</sup>Geurs, K.T.

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Potential Job accessibility is often calculated relying on a single distance decay function for all types of jobs and workers. However, different worker groups and types of jobs are likely to be distributed in differing spatial patterns. Additionally, workers in different fields and of different skills are likely to show different commuting patterns and will have access to a different subset of employment opportunities, e.g. a transportation professional may have spatial access to employment opportunities in the medical field but not the skills necessary. Therefore, the aim of this paper is to include information regarding the types of jobs and the skills and qualifications necessary to actually have access to the particular type of jobs, beyond the theoretical spatio-temporal access to jobs.

Accessibility is calculated for the car and public transport using a *door-to-door* approach (relying on network data, schedule-based data (GTFS) and speed profiles and will be calculated for private vehicles and public transport. We estimate this potential accessibility to jobs for different skill levels and industry types at different times of the day relying on data from the Dutch labor force survey (EBB, Enquête Beroepsbevolking, vragenlijst 2013), which includes information regarding individuals' characteristic, their work location and the type of jobs that they perform. We believe that including job-matching attributes in job accessibility models can allow governments to implement better transport policies, and help them address the inclusion of disadvantaged groups in the job market more efficiently.



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## Identifying causes of low urban accessibility

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Accessibility constraints limit full participation in the social and economic activity of a given society, becoming the main factors responsible for social exclusion. A proper identification of the causes of an unfavourable accessibility pattern should facilitate the formulation of the most efficient policy response in order to improve the level of accessibility, diminish its inequalities and improve quality of life of inhabitants. However, most of accessibility studies investigate a spatial pattern of accessibility, leaving apart the underlying mechanisms which produce limited accessibility. The presented study attempts to fill this gap, taking the advantage of the emergence of new data sources, including big and time-sensitive transport network data.

We use Madrid as a case study area and we apply complex network data in order to confront accessibility by private car and by public transport. First, we build a benchmark model, which is based on the ‘idealistic’ assumption of spatial homogeneity of transport networks. Then, we use TomTom’s speed profiles for evaluation of network quality (based on free flow speeds) and the extent to which accessibility by private car is limited due to a temporally diverse impact of congestion. Finally, we use GTFS feeds in order to build public transport network. Tailor-made techniques of data wrangling enable to generate several scenarios, which varies in terms of waiting times and simulated frequencies. In consequence, we propose and test a multilayer model which enables to identify different factors affecting spatial patterns of accessibility, including geography, quality of transport network and congestion levels and organization of public transport, including its routing, frequencies and timing. Our results clearly show, that in Madrid we can observe a significant intermodal imbalance, as car accessibility in all areas is far above accessibility by public transport, even in case of the most congested scenario.

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## Planning transportation for social inclusion: Quantifying the accessibility-activity participation relationship for low-income households

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A basic function of urban transportation is to enable participation in daily activities. Nevertheless, transportation planning has historically focused on increasing mobility, reducing environmental impacts and improving traffic congestion, in lieu of policies that directly foster widespread and equitable participation in the broad range of daily activities. As a result, recent qualitative evidence from the Greater Toronto and Hamilton Area (GTHA) suggests that poor transit accessibility is responsible for reduced satisfaction and participation in essential daily activities such as employment, medical appointments, and leisure. This is especially concerning given that income distributions are increasingly polarized, and many socioeconomically deprived neighbourhoods are now within suburbs with low levels of transit provision, putting more than a million people at risk of transport poverty.

This research, couched in the transport and social exclusion framework and making use of travel behaviour modelling, explores the relationship between transit accessibility and out-of-home activity participation in the GTHA. The paper consists of novel spatial analyses of a large-sample travel diary dataset, and presents new transport-geography concepts such as *participation deserts* and empirical rates of substitution between transport accessibility and activity participation, differentiated by socioeconomic profile.

Focusing on low-income and carless populations, we seek to improve our ability to predict and value the activity participation gains that may occur with improvements made to public transit. We find that the participation gains among marginalized groups are far greater than among the affluent. Furthermore, we find that these participation gains are far more valuable than traditional measures of project benefits, such as the value of travel time savings. In turn, this supports a reformulation of business-case appraisals of transport projects that can explicitly value the benefits of increased accessibility through measures of social inclusion.

## Governance of autonomous urban mobility platforms: A conceptual analysis within big data context

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With the widespread adoption and fast pace of smart innovations, data is playing an important role within transportation. Recent transformations in automobile culture led to significant changes on urban transport: away from personally-owned cars towards on-demand mobility, Autonomous Vehicles (AVs) and dynamic pricing.

Therefore ownership and management of huge datasets are inherent for creating new business platform models within urban mobility, which brings up the need of proper governance mechanisms for data-based mobility solutions. Therefore, **this study sought to conceptually explain how big data impacts on governance structures in four scenarios of autonomous urban mobility platforms.**

By gathering data on grey and academic literature, 24 assets were ranked to plot governance models for each proposed scenario (Figure 1). Scenarios were plotted and validated qualitatively with 12 mobility researchers and specialists in Brazil and France.

Scenario A entails unimodal mobility by a single company that owns the AVs' fleet. Scenario B also provides unimodal mobility however AVs' are offered as a P2P platform. Scenario C consists on multimodal autonomous mobility with all fleet owned by the service provider. Scenario D provides multimodal mobility on both B2C and P2P fleet ownership.

	Scenarios	Tangible assets (transport modes)					Intangible assets (data)																		
		a. Autonomous vehicles (AV)	b. Bicycles	c. Autonomous Shuttles	d. Autonomous Taxis	e. Public Transport (PT)	a <sub>1</sub> . AV's location	a <sub>2</sub> . AV's availability	b <sub>1</sub> . Bicycle's location	b <sub>2</sub> . Bicycle's availability	c <sub>1</sub> . Shuttle's location	c <sub>2</sub> . Shuttle's availability	d <sub>1</sub> . Taxi's location	d <sub>2</sub> . Taxi's availability	e <sub>1</sub> . PT's location	e <sub>2</sub> . PT's availability	f. Passenger's location	g. Trip's demand	h. User's evaluation	i. Trip's travel time	j. Modal's occupancy	k. Weather	l. Traffic	m. Trip's revenues	n. Trip's costs
A	✓	✓					✓	✓									✓	✓	✓	✓	✓	✓	✓	✓	✓
B	✓	✓					✓	✓									✓	✓	✓	✓	✓	✓	✓	✓	✓
C	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓
D	✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Figure 1. Surveyed assets for plotting the governance charts.

As Figure 2 shows, Scenarios C and A presented predominantly hierarchical governance structures, entailing on higher operational costs. Scenarios B and D are predominantly hybrid governance structures with higher transaction costs. Furthermore, the greater the number of transport modes, the greater the disturbances' frequency. Thus, for scenarios where platform providers owns the fleet (A; C) disturbances tends to be lower than in scenarios where providers do not own such assets (B; D).

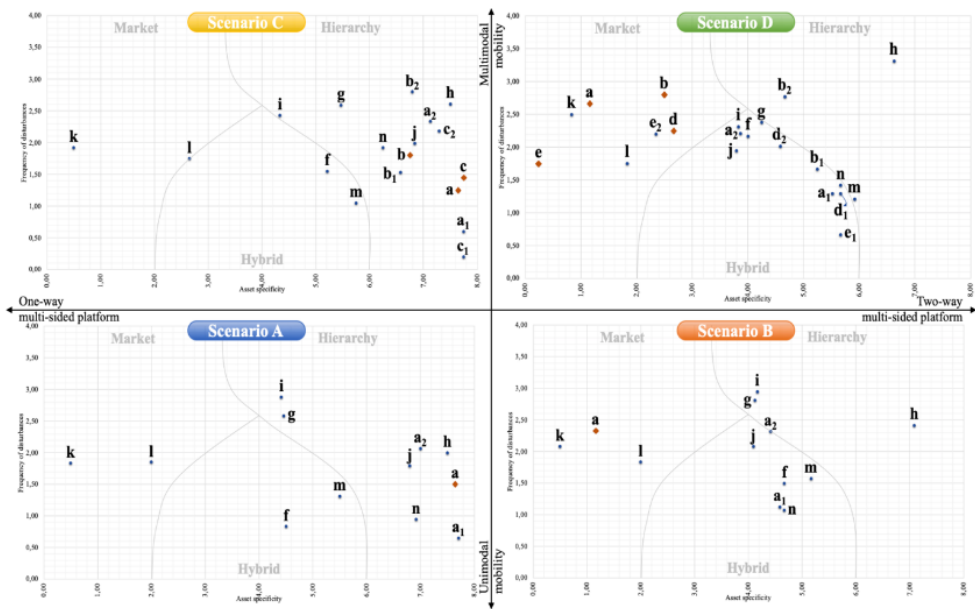


Figure 2. Scenarios' assets distribution towards specificity and disturbance frequency.

Big data ownership delineates each scenario's governance mechanisms within mobility platforms. Furthermore, blockchain and smart contracts technologies may benefit all Scenarios, however Scenarios B and D are likely to benefit more from it, due to their hybrid governance models.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>



## The governance of Smart Mobility: Connected cyclists to traffic light controllers case

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Smart Mobility is associated with emerging ICT technologies which will significantly change individual mobility and the mobility system as a whole including the increased influence of other stakeholders than road authorities like mobility service providers. As a result Smart Mobility will change the governance of mobility (i.e. way the system is organized as well as the role of the various stakeholders involved), although the governance of Smart Mobility itself is in most cases yet not clear. Investigating the governance context of first applications and pilot projects provides information on the supportive and restrictive elements which should be addressed for successful deployment of Smart Mobility measures. In this research the Smart Green pilot project of Enschede is used as a case. Within this project private parties, the municipality and the cyclist interest organization cooperate implementing and testing a system part in which cyclists are given priority at traffic light controllers when they have installed a smart phone app used for cyclist to traffic light controller communication. Using the governance assessment tool, which was developed and applied earlier in the energy and water sector (Bressers et al., 2016), the involved stakeholders were questioned on the current governance context including the supportive and restrictive elements as well as their expectations regarding these aspects for future large scale implementations. The findings were compared with literature and provide some useful insights on supportive and restrictive elements like trust, marketing, governance structure, mutual knowledge of objectives and ambitions of involved stakeholders, control and coordination, ownership of assets, business case and standardization. The outcomes show that there are many aspects with increased complexity beyond the pilot phase which should be addressed in the near future for successful large scale deployment of Smart Mobility measures like Smart Green.

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## **Governance through participatory expansion of emerging mobility futures: Case of self-driving vehicles**

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Self-driving vehicle (SDV) technology, currently in its foundational stage, brings about society-wide uncertainties. In this context, one cannot disentangle envisioning futures with SDVs from questions of (re)distribution of societal benefits and burdens. Contrastingly, the need for strategies to cope with this disruption has recently been recognized through several planning and governance efforts. Despite their fruitfulness, elaborated understanding of technology as a socio-technical phenomenon remains an underlying challenge. As the central point of contention, we recognize the threat of anticipation inequality if we solely rely on expert-based practices for envisioning mobility futures with SDVs. To support divergent envisioning efforts, we propose a phase of participatory expansion of technological horizons for (un)desirable mobility futures. To this end, we provide two examples of participation platforms for reflective engagement about aspects of mobility futures with SDVs. First case relates to in-person and online interactive experiments about potential mobility management schemes with SDVs, while the second relates to an online discussion forum about SDV zone planning. These public engagement efforts bring forth a set of opportunities and threats from SDV deployment in urban areas. In particular, contrastingly from previous efforts, results show the concern for several aspects of lifestyle change. Furthermore, findings underline several dimensions where SDV development and deployment is an irreducible question of distributive justice, with contestation of underlying societal values and individual rights. Neglecting to take into account a unique combination of social and cultural norms and values in each region means neglecting an important aspect for hindering or helping comprehensive technological utilization. These findings lead to a set of challenges for new policy levers and relationship between transport and innovation governance. In conclusion, challenges for inter-organizational learning in coping with contingencies are discussed through questions of standardization and data management practices, policy coordination, and experimentation with organizational constellations.

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## **Does mapping improve public participation? Exploring the pros and cons of using public participation GIS in urban and transportation planning practices**

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While participatory urban and transportation planning have become a widely accepted approach to enhance the democratic aims of community and urban development, challenges remain. Planners lack the knowledge of usable tools to reach broader groups of participants, which can turn participation into a small-group elitist activity. Also, the quality and utilisation of the knowledge produced is problematic, the collected data remains invisible and systematic analysis is often not realized.

In this paper, we ask whether digitally supported PPGIS (public participation Geographical Information Systems) tools, which provide digital means to support map-based dialogue and data collection, can help addressing these challenges. Through a critical analysis and reflection upon over 200 real life planning cases in Finland (62%) and other countries (38%) using PPGIS methodology we study the ability of PPGIS tools to (1) enhance effective arrangements of public participation, (2) reach a broad spectrum of people and 3) produce high quality and versatile knowledge.

Our results indicate a variety of advantages and disadvantages in using PPGIS methodology in urban and transportation planning practice. By categorizing the pros and cons of using PPGIS in practise, we enable planners to implement more inclusive and people-centred urban and regional planning in the future.

## Applying affective event theory to explain transit users' reactions to service disruptions

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Transit systems are complex open systems susceptible to service disruptions due to a variety of operational and infrastructure failures. Demand-side transit user reactions form an important part of system resilience. This study proposes Affective Events Theory (AET) to understand transit user's affective and behavioral reactions to service disruptions. The behavioral reactions are structured in accordance with Hirschman's Exit-Voice-Loyalty framework. While service disruptions can cause passenger frustration, the behavioral response varies among complaints (voice), avoiding transit use on the next trip (exit) and continue as usual (loyalty). The collected data is a representative sample of 1,629 transit users from Innsbruck (Austria). Exploratory factor analysis followed by an estimation of a structural equation model served to validate the model framework. Perceived operator efficacy and low event frequency mitigate frustration of transit users upon event occurrence. Higher perceived operator efficacy is positively associated with better perceived network coverage, personnel behavior and service quality. Higher transit user frustration is related to greater complaint behavior (voice). In contrast, greater complaint behavior is associated with lower reduced transit use on the next trip (exit), meaning that voice and exit are substitutional behaviors. Individual and trip characteristics are correlated with both the affective and behavioral reaction to service disruptions.

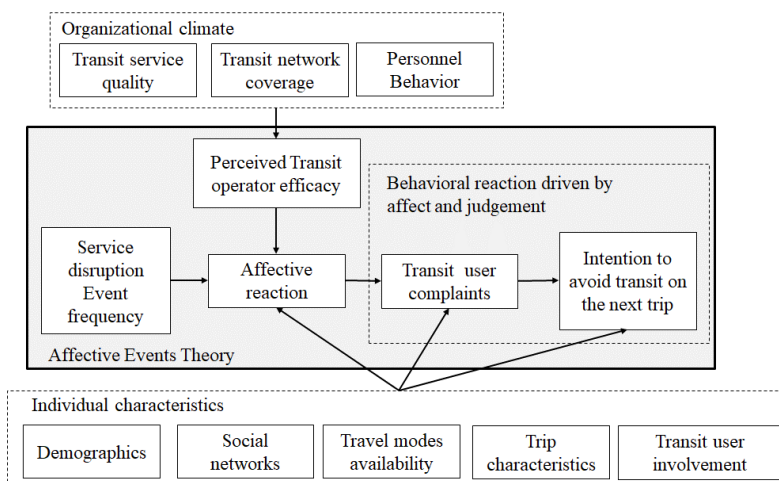


Figure. Behavioral framework for explaining transit user reactions to service disruptions.



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## **The contribution of motility to women's personal wellbeing: A quantitative analysis**

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Transport policy at the human scale aims at promoting happiness and wellbeing, incorporating both hedonic happiness derived from positive experiences, and eudemonic happiness, derived from individual flourishing and self-realization. Motility, by capturing the accrued value of mobility experiences, links transport systems to eudemonic happiness, or personal wellbeing. The study seeks to establish a quantitative relationship between motility, comprised of personal access, mobility skills and cognitive appropriation (Flamm and Kaufmann, 2006) to personal wellbeing combining relatedness, competencies and autonomy (Deci and Ryan, 2000; Ryan et al., 2008).

The sample of 1,116 Jewish women living in Israel, have varied socio-economic characteristics, with a relatively homogenous set of norms and expectations in a common social and cultural context (Miralles-Guasch et al., 2016). Exploratory factor analysis identified five factors for motility and four factors for personal wellbeing. Confirmatory factor analysis and structural equation modeling linked motility variables to measures of wellbeing, with observed indicators for mobility histories contributing to motility factors. The model fits reasonably well, with CFI of 0.839, close to the recommended value, and RMSEA of 0.055 ( $p=.000$ ) relative to the recommended maximum value of less than 0.06-0.08 (Schreiber et al., 2006).

Motility factors for skills and openness to new people and places influenced all four wellbeing factors: positive relations, personal growth, autonomy, and self-acceptance. Residential access influenced positive relations with others, while travel self-confidence contributed directly to autonomy. Observed variables related to mobility histories contribute to travel self-confidence and openness to new places and people. Daily mobility experiences were important for mobility skills.

Motility brings forward a way to assess human-scale transport policies that build skills, self-confidence and openness that can only come from travel experiences. The findings support a value chain from mobility experiences to motility to personal wellbeing. This linkage provides an additional assessment mechanism for transport policies.

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## Does moving to urban neighbourhoods result in happy travellers?

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Previous studies indicate that travel satisfaction is affected by elements such as travel mode choice and trip duration. However, how people's satisfaction levels with travel adapt after changing their travel behaviour has not yet been analysed thoroughly. In this study we analyse travel satisfaction of 1,650 respondents who recently relocated to selected neighbourhoods in the city of Ghent (Belgium), and therefore changed their daily travel patterns (i.e., commute and leisure trips). A two-step approach is used in this study. First, a factor analysis – resulting in six factors – was performed to detect patterns in respondents' self-reported changes in travel behaviour and other travel-related elements (Table 1). Second, respondents were segmented into four clusters based on a k-mean cluster analysis using the six obtained factors (Figure 1). Results indicate that especially clusters with respondents moving to more urbanised neighbourhoods, and with resulting decreased travel distance and duration, and increased use of car alternatives have high levels of travel satisfaction (for both commute trips and leisure trips) (Table 2). Respondents from these clusters also indicated the highest levels of travel satisfaction improvements (Table 3). This study provides additional motivation for policy makers and urban planners to convince more people to relocate to urban areas, or for densification and land use mixing of existing neighbourhoods, as this might not only result in more sustainable travel patterns, but also in more satisfying travel patterns and happy travellers.

Factor	Self-reported change in travel-related elements	Loading
1. Increase in commute distance/duration	Change in commute distance	0.92
	Change in commute duration	0.92
2. Increase in leisure trip distance/duration	Change in leisure trip distance	0.91
	Change in leisure trip duration	0.90
	Change in walking for leisure trips	0.77
	Change in car use for leisure trips	-0.56
	Change in cycling for leisure trips	0.40
3. Increased multimodality for leisure trips /increased urbanisation	Change in bus/tram use for leisure trips	0.36
	Change in level of urbanisation	0.35
	Change in train use for leisure trips	0.32
	Change in attitude towards walking	0.25
	Change in car possession	-0.23
	Change in cycling for commuting	0.77
	Change in cycling for leisure trips	0.55
4. Increased cycling (attitudes)	Change in attitudes towards cycling	0.44
	Change in car use for commuting	-0.42
	Change in walking for commuting	0.21
	Change in bus/tram use for commuting	0.67
	Change in train use for commuting	0.54
5. Increased public transport (attitudes)	Change in bus/tram for leisure trips	0.43
	Change in train use for leisure trips	0.31
	Change in attitude towards public transport	0.29
	Change in car use for commuting	-0.26
	Change in walking for commuting	0.25
	Change in attitudes towards travel liking	0.51
6. Improved travel attitudes	Change in attitudes towards cycling	0.50
	Change in attitudes towards walking	0.49
	Change in attitudes towards public transport use	0.49
	Change in attitudes towards car use	0.40

Table 1. Changing travel behaviour factors (principal axis factoring, promax rotation)

Commute trips					Leisure trips				
	Avg.	1.	2.	3.		Avg.	1.	2.	3.
1. Cluster 1	3.79				1. Cluster 1	4.03			
2. Cluster 2	3.87	0.30			2. Cluster 2	3.72	<b>0.00</b>		
3. Cluster 3	3.18	<b>0.00</b>	<b>0.00</b>		3. Cluster 3	3.47	<b>0.00</b>	<b>0.00</b>	
4. Cluster 4	3.40	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	4. Cluster 4	3.62	<b>0.00</b>	<b>0.04</b>	<b>0.03</b>

Table 2. Travel satisfaction scores (average score on six statements on travel satisfaction (min. 1 – max. 5)) and p-values of a one-way ANOVA with post-hoc multiple comparison analysis using the Least Significant Difference (LSD) method (bold = significant at  $p < 0.05$ )

	Satisfaction with commute trips			Satisfaction with leisure trips		
	Decreased	No change	Increased	Decreased	No change	Increased
Cluster 1	7.0%	26.6%	66.4%	2.2%	16.6%	81.2%
Cluster 2	2.9%	22.4%	74.7%	8.4%	39.7%	51.9%
Cluster 3	31.0%	45.4%	23.6%	21.2%	57.6%	21.2%
Cluster 4	17.0%	65.4%	17.6%	13.9%	68.4%	17.7%

Table 3. Self-reported changes in travel satisfaction

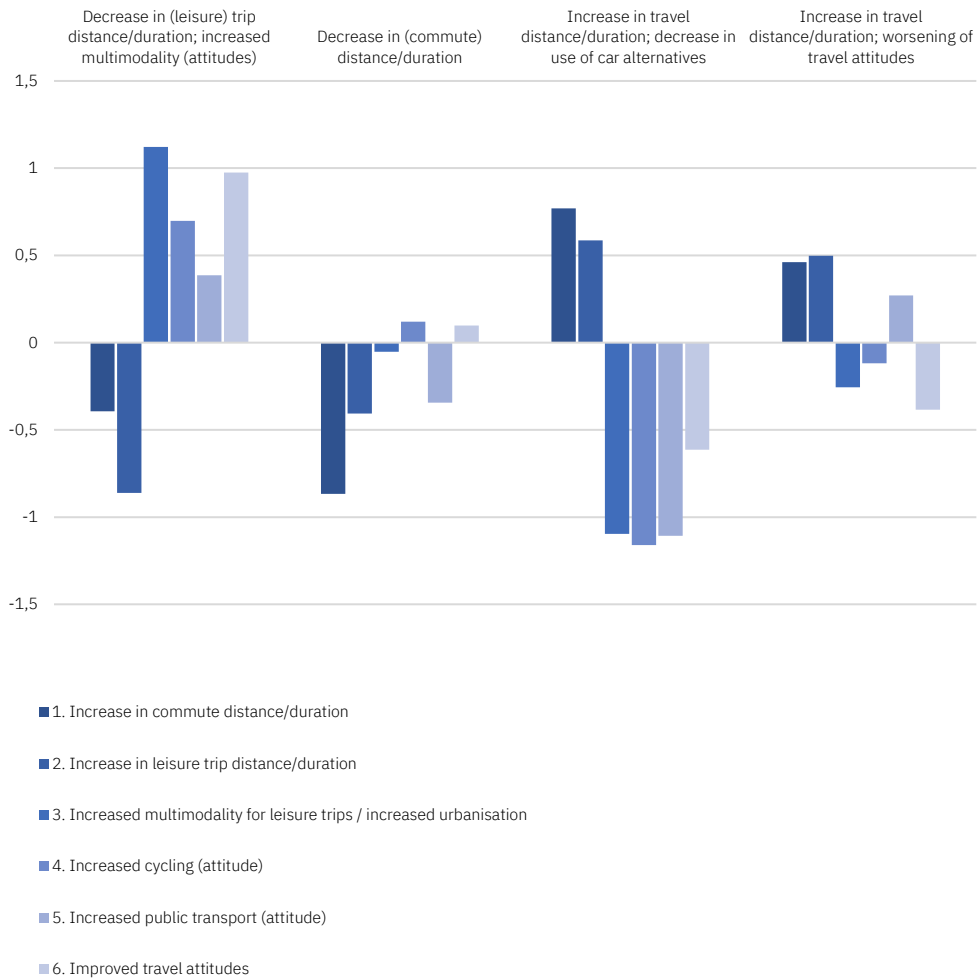


Figure 1. Segmentation of recent movers derived from factor and cluster analysis (clusters 1, 2, 3, and 4 account for respectively 21.9%, 23.2%, 11.2%, and 43.7% of the respondents)

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## Investigating the nature of public transport service attributes

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Classifying public transport service attributes based on their influence on overall traveler satisfaction can assist stakeholders and practitioners in introducing cost-efficient measures. To date most studies employed methods that were based on the assumption that the impact of service attributes on traveler satisfaction is entirely linear and symmetric. This study examines whether service attributes have a non-linear and asymmetric influence on the overall travel experience by employing the Three-factor theory (basic, performance and exciting factors). The analysis is conducted for different traveler segments depending on their level of captivity, travel frequency by public transport and travel mode used, and is based on a relatively large sample size collected for Stockholm County. Moreover, the estimated models control for important socio-demographic and travel characteristics that have been insofar overlooked. Results are presented in the form of a series of multi-level cubes that represent different essentiality of traveler needs which provide a useful methodological framework to further design quality service improvements that can be applied to various geographical contexts. Our findings highlight that a “one size fits all” approach is not adequate for identifying the needs of distinct traveler segments and of travelers using different travel modes. Furthermore, two-thirds of the attributes are consistently classified into the same factor category which entails important policy implications. This research deepens and expands the very limited knowledge of the application of the three-factor theory in the transport field.

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## **Analysing and modelling the location of stations in bike-share systems: Planning the optimal growth of existing programs**

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Bike-Share Systems (BSS) have experienced an extraordinary growth over the past years. After the implementation of such systems, many cities are now planning their expansion, in order to respond to an increasing demand. What can cities learn from their experience with existing programs? Based on the study of the current performance of BSS: How can we expand the service beyond the area already covered, improving the accessibility to the system in an optimal way? How can we densify the presence of stations in the areas already covered but insufficiently serviced?

Based on the analysis of thousands of trips collected by the Madrid Bike Share System, BiciMAD, this research analyses the cycling demand of the stations through different Regression Models, quantifying the local impact of different variables such as population, employment, land use or closeness to important transport nodes. The temporal resolution of the data collected allows to perform a dynamic exploration, so cycling demand is analysed over time. This temporal analysis of the different behaviour of the system during weekdays, weekends, holidays or over the course of a day, brings new opportunities for a better planning, offering more dynamic solutions that could eventually improve and balance the use of the system.

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## Equity of bike sharing – lessons learned from Helsinki

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The number of bike-sharing systems has increased rapidly during the last decade. These systems expand urban mobility options and provide a solution to the so-called “last-mile problem”. While new systems are opened and current ones expanded in large numbers globally, it is important to understand how these systems are used and by whom. This is needed to ensure that the benefits of systems distribute equitably among citizens.

Here, we employed a person-based approach to study mobility patterns of bike-sharing users in Helsinki. We aimed to understand the typical user profile and how different user groups differ in their usage. We used a dataset provided by the local transport authority, which contained all bike-sharing trips (~1.5 million) and user demographics from 2017.

The Helsinki system has been very popular compared to many international examples. An average bike has made approximately 6 trips/day and in summer months even more. Regardless, the results of this study show that high use of shared bikes does not mean equal use among citizen groups. Young adults and men are overrepresented both in the number of users and trips, which is in line with findings from other cities. Furthermore, a small minority of users generate the majority of trips. The users that live inside the system area make 80% of the trips. As the Helsinki system served only the inner city in 2017, the results suggest that the bikes are used more on their own, than in conjunction with public transportation.

We conclude that it is vital for system managers and urban planners to be aware of user demographics and profiles. Even if the system attracts high use, a surprisingly small and homogenous group of people might still generate most of the usage, as in Helsinki. This finding opens new possibilities for expanding the use even further.



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## Smartphone challenges to stimulate cycling: Clues from a Living Lab with SMART in Enschede

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Reduction in car use is one of the most effective ways to tackle congestion related problems. One possibility to do this is by using positive incentives to stimulate the use of other transport modes. There is evidence that this may be more effective than punishing travelers for undesirable behavior. Cycling apps that promote cycling are for example Strava, CycleMaps, BetterPoints, and SMART. The latter is used in the Dutch region of Twente. From a simulation study using mockup apps, we found that cycling challenges in which earned points can be redeemed for in-kind gifts is probably the most promising incentive to change travel behavior. However, there are many ways to provide challenges. Part of the problem is that incentive schemes often have been tested during relatively short trial periods. As a result, it is difficult to measure to what extent behavioral change can be attributed to these incentives or to external factors.

Within the European project EMPOWER, we have used the SMART app to provide multiple challenges over a period longer than a year. Each month a challenge with a challenge period of 14 days was provided. Users themselves had the option to choose one out of five levels, from very easy to very difficult. This enabled us to provide equal opportunities for everyone and at the same time personalize the challenge level. One of the drawbacks however is that users can choose challenges and win points without changing their behavior. In that case they choose a level that is too easy for them. However, the advantage is that it is less likely they will be discouraged to participate because a challenge is too difficult. Some of the challenges have also been repeated. As a result, we are better able to establish which type of challenges is most successful and what the effects are on car use.

The main results are as follows. Monthly choice challenges can be an effective way to encourage cycling, and the challenge is most effective when it is easy to comprehend and accomplish. Most users choose challenges that lead to an improvement in cycling behavior, but too difficult challenges may be counterproductive. One of the important remaining questions is whether behavioral change will be sustained when no challenges are provided. Or do people fall back towards their former behavior, even if they say they will continue cycling more? According to preliminary results, we find no sustained behavior change. This would be in line with findings from some other studies. However, more analyses are needed to provide a more definitive answer.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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## Spatial autocorrelation of pedestrian and bicycle crashes using network attributes and GPS-based smartphone data

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This research investigates the spatial correlation of pedestrian and bicycle crash frequency and severity using three different case studies of disaggregated databases from the Netherlands (SWOV *Institute for Road Safety in the Netherlands*), Dominican Republic (AMET), and the state of Florida (DoT-Department of Transport, USA) within 2007-2016. A set of 15 explanatory variables was collected (e.g. day of week, location, alcohol involvement, pavement type, speed, lighting, age of driver and opponent, vehicle type, etc.) and merged with GPS network-based (cyclist speed and intensity) data.

Three analytical procedures are adopted: 1) spatial autocorrelation, via Moran's index; 2) spatial regression model with *Ordinary Least Squares (OLS)*; 3) *logit* model with both spatial (SRI) and temporal (TRI) correlation effects. The Moran's index shows that there is no spatial autocorrelation by frequency of crashes, but there is spatial autocorrelation by crash severity, which is consistent with the SRI results over the three cases. Furthermore, the spatial OLS regression shows that pedestrians are more vulnerable, as expected. Also, crash type (flank and frontal) and day of week are significant variables to determine crash severity. The results show, in the Dutch case, the SRI shows that high repetition of crashes per link is associated with lower severity. Consistent with the link data, the speed measured from the smartphone data shows correlation with more severe crashes. The intensity of cyclists measured from GPS data shows to be significantly associated with low severity levels. In the case of Florida data, the total number of pedestrians or cyclists involved and the age of the injured, having drugs or alcohol and drugs significantly increased the probability of having a severe crash. The *logit* model shows that days of the week and speed are significant determinants for the severity of crashes, in both the Dutch and the Florida cases.

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## **Learning through evaluation: The application of the Multi-Actor Multi-Criteria Analysis in co-creation to solve mobility problems**

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Formal evaluation techniques such as Multi-Criteria Analysis (MCA), and Multi-Actor Multi-Criteria Analysis (MAMCA) are frequently used to evaluate the impacts of and the stakeholder support for possible solutions to mobility problems. At the same time, local and regional governments are crowdsourcing ideas from citizens to solve mobility problems via public participation. Nevertheless, ex-ante evaluation of ideas often remains an important step as well as a formal requirement to facilitate the selection of a solution. Rather than just a formal requirement, evaluation of ideas to solve mobility problems can also be used to inform citizens and stakeholders of the possible barriers to implementation of their ideas, such as negative impacts on sustainability or lack of stakeholder support.

Combining formal evaluation methods with less formal co-creation methods to crowdsource ideas from citizens has been trialled in Brussels to find out how all relevant stakeholders can remain engaged during evaluation of ideas and how evaluation methods can be used to inform and educate stakeholders of possible barriers to implementation of their ideas. This trial took place in the context of the Learning Loops in the Public Realm (LOOPER) project, a JPI Urban Europe project that demonstrates 'learning loops' i.e. new ways of decision-making which bring together citizens, stakeholders and policy-makers to iteratively learn how to address urban challenges.

In the Brussels LOOPER Living Lab, MCA and MAMCA were used to evaluate the impact of and stakeholder support for five solutions suggested by citizens that would improve traffic safety in a neighbourhood in Brussels, Belgium. This novel approach gives insights on how MCA can be used to see whether ideas from citizens have a positive effect on the sustainability of a neighbourhood, and whether stakeholders are expected to support the implementation of a solution by using MAMCA.

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## **New railway infrastructure decision-making: A case analysis of using multi-criteria-analysis based methods for the Brenner-corridor**

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Transportation authorities as well as investors and governments are seeking places and corridors to invest in the improvement of transport infrastructure. Due to various reasons - from ongoing urban sprawl, rising awareness among society about possible social and environmental impacts to last but not least increasing cost pressure, it is more and more difficult to find suitable routes for new transport infrastructure using traditional methods such as cost-benefit-analysis.

Split into several sections, different approaches mostly based on multi-criteria analysis (MCA) were - and still are - used to assess a new high speed railway line with several route alternatives for the Brenner-Corridor, a high priority corridor in the Trans European Network for Transportation. The focus of the presentation is set on the currently investigated northern feeder line to the Brenner-Base-Tunnel which connects the new railway line in Austria to the north into Germany.

Before starting the first engineering works, an evaluation method based on the MCA was developed in order to facilitate the new railway infrastructure decision-making process generically, reflective of federal German and Austrian guidelines as well as European legislation, local priorities and preferences. Furthermore it was required to combine the whole evaluation process with involvement of affected communities, stakeholders and NGOs. Hence, well-known standard elements of a MCA had to be modified and expanded in order to express different viewpoints by favoring particular criteria and weighting.

After a short description of this new MCA approach, the presentation analysis the use of such multicriteria methods, its contribution for the planning process as a whole and – last but not least - its limits. It concludes with a retrospective discussion of such major transport infrastructure planning processes in the era of social media, big data and modified public awareness.

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## Testing the application of participatory MCA: A case study of the South Fylde Line

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In recent decades, many authors have claimed that, compared to traditional appraisal techniques such as cost-benefit analysis (CBA), participatory multi-criteria analysis (MCA) methodologies represent a more effective approach to appraising transport projects, largely due to the range of criteria able to be used and the ability to reflect multiple viewpoints. The limits of the more conventional technocratic approaches to appraisal, including CBA and even analyst-led MCA, are very evident, especially when applied to large-scale and complex infrastructure projects with uneven spatial impacts (Hickman and Dean, 2017).

This paper applies a participatory MCA process to appraise potential rail investments on the South Fylde Line in North West England. A one-day workshop was held to discuss investment options with 26 participants from the local authorities and local stakeholders.

The results of the analysis show that, while promising, participatory MCA processes also have several limitations, and successful application is subject to a number of issues, which require careful consideration. These include selection of participants, identification of appraisal criteria, and the process of assessing impacts. Unless participatory MCA approaches are carefully framed they can also be problematic, with potential problems in completeness, transparency, arbitrariness and aggregation.



## A new approach for the appraisal of roadspace allocation in major urban roads in Europe

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Urban roads are under great pressure due to the need to accommodate increased mobility levels and new economic activities relying on 'just in time' deliveries and servicing, at the same time that policy-makers are putting increased focus on developing attractive spaces to support active modes of transport and encouraging street activities, all within fixed road widths. However, the allocation of roadspace is a highly contentious issue. Decisions to reallocate roadspace are often made on an ad hoc political basis and there are no established methods to objectively assess the desirability of different options for redesigning roads.

This presentation discusses a new approach for the appraisal of road design options for reallocating roadspace, considering the impacts on all roads users, related both to the movement and place function of the road. The options are generated in 'design days' with road user groups and practitioners. The appraisal method then has four stages:

- 1) estimate indicators of the impacts of each option, based on the results of the micro-simulation of user behaviour (including 'place' activities);
- 2) assess whether the indicators meet minimum political and technical requirements regarding user needs;
- 3) monetise the impacts, where possible, including difficult-to-measure aspects such as the value of servicing and of street activities
- 4) rank options using multi-criteria analysis, based on the results of the previous stages and weights provided by a range of stakeholders.

The tool is being developed in five European cities, in road corridors with particular challenges due to their multi-function and multi-modal character and their importance not only at the city level but also at national and international level. Two major sets of options are being tested: 1) static reallocation of roadspace prioritising specific functions or modes and 2) dynamic reallocation based on real-time information on patterns of road use and network conditions.

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## High mobility in China? The impact of high-speed rail on work-related commuting: A case study of Suzhou-based commuters

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The Chinese high-speed rail (HSR) network has revolutionised the time-space perception and potentially restructures social and economic relationship through new spatial and temporal arrangements, which was once unimaginable and unrealisable. “High mobility” refers to workrelated forms of long-distance travel (Viry and Kaufmann, 2015). There is an optimistic assumption that HSR will facilitate a new form of long-distance daily commuting patterns in China whereas this claim does not consider other factors such as the commuting time, quality of life, location of the HSR stations, the movement of commuters (implying the concept of reversibility), business relocation vs. near-home job opportunity brought by HSR etc. How will these aspects underlie the high-mobility phenomenon from a commuter’s perspective?

Most HSR research has devoted to accessibility studies and spatial-economic impacts while little has been explored from perspectives of commuters: to what extent and how the arrival of HSR has impacted on high mobility practices. This paper intends to bring new insight by bringing concepts of mobility studies into the field of territorial planning to enhance better understanding of social and territorial transformation in the age of HSR.

This paper presents and discusses the findings from a pilot study of the emerging phenomena of Suzhou-based long-distance HSR commuters within the Yangtze River Delta area. An online questionnaire survey of approximately 288 valid answers was conducted to understand their attributes (social groups, spatial-economic patterns of employment and locations) and travel experiences. A further in-depth interview with seven participants of different social-economic characters was used to gain deeper understanding of the factors underlying the socio-economic and spatial patterns. This paper is expected to shed light on HSR-related commuting patterns and social-economic characteristics that could offer valuable policy implications and lessons for HSR-related urban planning practice.

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## Everyday spaces of a group of skilled immigrants in Mexico: Geographies of comfort and restricted mobilities

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The paper analyses the everyday spaces of a group of skilled immigrants from Italy and Spain in four Mexican cities. In doing so, it observes how the interviewed immigrants live, perceive and construct three geographical scales: home, neighbourhood and the city itself. It is based on an extensive fieldwork which consist in 129 in-depth interviews with Italians and Spaniards living in Mexico City, Guadalajara, Monterrey and Puebla. Home (and workplace) is the main everyday space for those interviewed who admit that they spend indoors longer times that they used to in their home countries. This relates to the assumption of a lifestyle in which private spaces dominate, since the public ones are generally associated with insecurity and lack of comfort (e.g. few public parks, non-walking streets). As for the areas of residence, the interviewed immigrants live in middle and upper-class neighbourhoods. These areas can be grouped in two: (i) central neighbourhoods in which the interviewees value the quality of services and the fact that services are within walking distances, and (ii) gated communities located in suburbs. For the former, the interviewees believe that a certain European lifestyle is re-created. For the latter, the point stressed in interviews is security and a good place for families and children. In this context, mobility is highly reduced to those displacements that are strictly necessary, such as commuting to work. Partly because they move within the limits of very specific areas, the city as a whole is valued with mixed feelings, with many areas considered to be no-go unsecured zones. Indeed, the fact that gated communities contain themselves a varied range of services refrains immigrants from moving to other parts of the city.



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## Why do they live so far from work? Determinants of long-distance commuting in California

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The determinants of long-distance commuting (i.e., trips longer than 50 miles one-way) in the U.S. appear to be poorly understood even though long-distance commuting likely has substantial environmental, social, and economic impacts. A review of the literature shows that few papers have considered how housing costs influence long-distance commuting. To start addressing this gap, we analyze the long-distance travel component of the 2012 California Household Travel Survey (CHTS) via a generalized structural equation model. In our model, land use and housing costs are explained by household and head of household characteristics; together with these characteristics, land use and housing costs influence long-distance commuting via a logit model.

We find that there is a strong relationship between long-distance commuting and median housing costs (OR=0.488\*\*\* for a household's home census tract and OR=1.765\*\*\* for the work location of a household's census tract). This suggests that long-distance commuting is to some extent a consequence of California's high housing costs, which have long been higher than in most other states in the U.S., partly because of Proposition 13 of 1978. This proposition capped property tax rates at 1% of the full cash value at acquisition of a property, with subsequent annual tax increases of no more than 2% as long as a property is not sold.

Second, our results confirm that long-distance commuting is associated with California's job-housing imbalance, as reflected by the negative relationship between the job-housing ratio and long-distance commuting (OR=0.914\*\*\*). Although changing zoning laws to increase the job-housing ratio in every neighborhood is not practical, polycentrism could be promoted in specific centers to decrease the need to commute long-distance.

These results highlight the importance of providing more affordable housing and mixed development options to reduce long-distance commuting and its associated environmental impacts.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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## How much does geography contribute? Measuring Inequality of Opportunities using a bespoke neighbourhood approach

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To what extent an individual is successful in a variety of outcomes is the result of multiple factors such as (but not limited to) parental background, level of education, discrimination and business cycles. Factors like these also indicate that the success in life can be attributable to factors that both take individual-level merits into account but also to structural factors such as discrimination and contextual effects. Over the last decades, a growing interest in decomposing and categorising factors that affect the life chances of individuals has led to the formation of Inequality of Opportunity as a research field. This paper builds upon this growing literature, which amounts to quantify the contribution of factors that lie beyond the control of individuals to the total inequality observed in different spheres of life. Using rich Swedish longitudinal register data, we are able to follow individuals over time and their educational attainment during upbringing and later labour market outcomes. In difference from other inequality of opportunity studies, we make use of an egocentric neighbourhood approach to integrate the socio-economic composition of the parental neighbourhood in an inequality model and illustrate its contribution to the total inequality in both outcomes quantitatively. Using multilevel regression analyses, we show that the parental neighbourhood is highly influential in educational attainment and remains so for market outcomes even years after exposure.

## A century of evolution of the accessibility concept

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The accessibility concept is the product of over a century of thought in urban planning and social science. Since its introduction at the turn of the twentieth century, the idea has been shaped by conceptual turns in two notable dimensions: its proper use, and its relationship to urban form.

Accessibility can be used both as a positive descriptor of the world and as a normative guide to land-use and transport planning. Its positive dimension is expressed in predictive or descriptive models of spatial phenomena including residential-location choice, travel behavior, and real-estate values. Accessibility is used normatively when it becomes an input to decision making or after-the-fact evaluation in land-use regulation or transportation investment.

Accessibility analysts have been mixed on the appropriateness of normative application of the concept. While its early appearances were naively normative, the midcentury foundations of the modern concept hewed to the positive side. In fact, Stewart, on whose work Hansen's seminal paper built, emphatically rejected normative application. Subsequent researchers of the 1950s and 60s, while less explicitly ideological, generally ignored accessibility's normative potential.

This stance partly shifted in the 1970s with growing recognition that measured accessibility could properly serve as a guide to planning practice. Actual deployment of accessibility-based planning was rare, however, and by the time the concept had re-emerged in the 1990s, it had, in many circles, taken on a different cast. Where accessibility's earlier definitions rested on speed and proximity and were indifferent to urban form, late-20<sup>th</sup> century writers began equating accessibility with urban compactness, mixed land uses, and a pedestrian orientation.

This definition undermines the accessibility concept, subverting its capacity to transform planning practice. The paper argues for an emphasis on normative accessibility that is capable of recognizing accessibility improvement over a full range of urban forms and transportation modes.

## **Incorporating dynamic population in accessibility research: A case study from Helsinki, Finland**

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Spatial accessibility is an inherently dynamic concept. Yet, the components of accessibility have predominantly been treated as static, particularly in place-based accessibility research. Although literature that considers the temporality of the transport network and opening hours of activity locations is surfacing, home locations are still as a rule considered as a proxy for origins of people despite the widely acknowledged criticism of the approach. In the light of the shift towards 24-hour societies and the needs for promoting sustainable and equitable urban planning, reliable tools that account for these dynamic realities are also needed.

Stemming from the recent research on dynamic accessibility, we set out to uncover the 24-hour distribution of people of the Finnish Capital Region using network-driven mobile phone data. We apply this dynamic population data to introduce the first fully dynamic accessibility model in the study area. The dynamic population distribution on a typical weekday was estimated on 250 m statistical grid squares using an advanced dasymetric interpolation method. The resulting 24-hour population data was combined with openly available temporally-sensitive transport network data to analyze the multi-temporal accessibility realities to two different destinations – main transport hubs and grocery stores.

The results show that integrating dynamic population data to location-based accessibility analysis provides more realistic results but the significance of dynamic population data depends on the study context and research questions. Incorporation of dynamic population data has the potential to bridge the gap between place-based and person-based accessibility, but data availability may limit these possibilities. The emergence of novel temporally-sensitive spatial data sources have, however, potential to mitigate this limitation.

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## How to assess accessibility: subjective accounts, objective measures, or both?

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The transport literature increasingly recognises accessibility as a key purpose of transport policies. Disparities in accessibility among population groups form a central concern in discussions surrounding transport equity. However, there is no consensus as to how accessibility should be defined or measured.

Calculated levels of accessibility using data on land use and the transport system ('objective' indicators) are influenced by the observer's values and assumptions, while accessibility analyses based only on self-reported information ('subjective' indicators) are often linked to dependence paths and self-selection processes.

This study includes a focus on both objective and subjective indicators of accessibility; the former, a composite measure of individual activity-based accessibility; and the latter, comprising individuals' own perceptions of their capability to access valuable out-of-home activities. This study has three objectives: (1) to more accurately represent individual accessibility by combining both objective and subjective indicators; (2) to examine the distribution of these two indicators; and (3) to analyse whether and how these two indicators differ.

The self-reported indicator was based on a survey of people aged 65-79 living in Sweden's large metropolitan regions: Stockholm, Gothenburg and Malmö. The objective indicator was developed using door-to-door travel times to a typology of 'necessary' and 'discretionary' activities, including supermarkets, healthcare facilities, sports facilities and cultural activities. Travel times were calculated using activity-based multimodal transport modelling with OpenTripPlanner, road network data from OpenStreetMap and public transport data in General Transit Feed Specification (GTFS) format. The data were analysed using factor analysis, logistic regressions, chi-square analyses and descriptive statistics.

The results of this study allow us to gain a greater insight into the ways in which the two accounts differ and can complement one another, what is overlooked by focusing on only one account, and the distribution of both objective and subjective accessibility for transport equity analysis.

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## **The role of accessibility and spatial interaction in a doubly constrained model: Evidence for domestic tourism flows in Italy**

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Spatial interaction models (SIMs) are extensively used, in many socio-economic contexts (such as commuting, migration, tourism, international trade, communication networks, FDI, citation networks, etc.) to model all kinds of bilateral interactions between spatial units. Typically, municipalities, regions or nations are the reference level of spatial aggregation. However, in this wide literature making use of SIM, very few studies make use of a complete, more proper estimation based on origin and destination constraints (ODC). In particular, ODCs allow to carry out comparative statics (e.g. simulating shocks) while maintaining consistent totals of the origin-destination matrix containing all flows. While ODCs can be numerically approximated for a specific cross-section by sets of fixed or random effects, or by what in international trade are known as multilateral resistance terms, they depend on the explanatory variables in the model, and therefore are dynamic. Their typical nonlinear estimation represents an obstacle, for most researchers, to their utilization. The analysis of tourism flows by means of SIMs has been limited by such difficulty as well. In this paper, we propose an easy-to-use algorithm and software for the estimation and calibration of doubly constrained SIMs. We employ a 12-year panel of domestic tourism flows for the 20 Italian regions, as well as a related database of regional characteristics and tourism push/pull factors for empirical verification and comparative statics. We stress that the proposed calibration method/software may be applied in SIMs for any other type of origin-destination flow data. In addition, based on the cost-sensitivity parameters emerging from the calibration of the doubly constrained SIMs, the accessibility of the most touristic regions will be computed, in order to test whether the most attractive regions in Italy are also the most accessible.

## The inequalities of a car-based transport system in Malta

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Cities across the world struggle with high costs of congestion, accidents, pollution and noise as a result of growing dependence on the car. Similar trends are observed also in small island states where economic development is translated in more car travel and increased congestion. The islands of Malta have been experiencing rapid economic and population growth since the 1990s. There has also been an increase in urban development, an increase in car ownership and use, and heavy investment in road infrastructure. As a result, in the last decade Malta has undergone urban land use intensification and external costs of transport amounting to 4% of the GDP. Regardless of this, there is increasing pressure on local and national governments to further provide space for the car in terms of roads and parking infrastructure.

Despite Government's commitment towards more sustainable transport with the publication, in 2016, of a Masterplan for 2025 and a long term transport strategy for 2050, the issues related to equity do not feature and are dismissed in what has become a one-track, discriminatory transport system aimed at providing solely for the car. This paper aims to highlight inequalities of a car-based transport system in Malta by looking at key indicators such as accidents, household expenditure on transport, access to car and urban space distribution. This will demonstrate how policies differ from realities of infrastructure development and how inequalities burden societies at large.

The study highlights growing concerns over the current political agenda of providing more roads for cars without any evident or perceivable plans in support of other, more environmentally and socially acceptable, forms of transport. It also sets a research agenda into issues related to inequalities and transport in Malta and other island states.

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## How can public transport contribute to social equity? A study of mobility in socially deprived urban areas in Sweden

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International research has shown that insufficient access to transport is an important contributing factor to transport related social exclusion. People who live in socially deprived urban areas are seldom included in public transport research, and there is a lack of in-depth, qualitative studies of how these groups use the public transport system and how their mobility practises are intertwined with individual experiences and life situations. This paper is based on aiming at exploring mobility strategies among groups who lives in Swedish urban areas that are defined as socially deprived, with a specific focus on perceptions and use of public transport.

The method consists of focus-group interviews, cognitive mapping and travel diaries. Time-geography is used both as a theory and methodological tool. Time-geography offers conceptual tools to grasp experiences, emotions, and strategies in everyday life.

One important finding is that young unemployed persons living in socially deprived areas in metropolitan Sweden does not experience transport poverty as described in the international literature. They experience good access to public transport, have their travel expenses provided for and they can participate in normal activities and relationships. At the same time, they have few weekly activities, are excluded from the labour market, and have scarce economic resources. A working hypothesis to explain these findings is the Swedish land use planning model, where suburbs have been planned with good public transport provisions and proximity to services. This paper is an important contribution to existing literature, adding new perspectives on transport poverty and mobility justice, emphasising the importance of planning ideals and practices to prevent transport poverty.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>



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## **Inequality in the usage of bike sharing systems considering built and social environment factors among residential areas**

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Around 1,600 cities in the world have bike sharing systems in operation. This wide deployment and observed growing trend of bike sharing can be attributed, among others, to its associated social, health, economic and environmental benefits. However, ridership statistics show that the systems are not necessarily equitable. Some social groups appear excluded from the bike sharing trend. Knowledge about spatial equity of the usage of bike sharing between areas with different built and social environment characteristics is limited. Therefore, our main objective is to assess the ridership of bike sharing among residential areas with different built and social environments and evaluate them through the concept of spatial (in)justice.

Our mixed method approach combines qualitative data from interview of user of the Strasbourg long-term bike sharing system with built and social environment characteristics and ridership data of the bike sharing systems in Munich. Our two case studies focus on top central European bike friendly cities. By using factor analysis, we want to identify social (social milieus, sociodemographic, political election results, social media use) and built (transport infrastructure, points of interest, land use) environment characteristics of residential areas influencing bike sharing's arrivals and departures.

The proposed study will bring a significant contribution to knowledge and theoretical understanding about the determinants that influence bike sharing equity among different residential areas. Such knowledge can help to define strategies for further development of bike sharing systems in a more just and equitable way.

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## Exploring the use of qualitative data to enhance the understanding of accessibility through public transport

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The quantitative measurement of accessibility through public transport has become more complex and accurate over time, but lacks many of the deeper nuances of how people actually experience their travel environments. Our previous works has highlighted the importance of incorporating the lived travel experiences of passengers within accessibility indicators, considering the quality of the walking environment and the public transport services. This qualitative research seeks to further improve the characterization of accessibility according to users' travel experiences, as described by those attributes that inhibit or enhance access to opportunities within the city.

Our main contribution is to develop a theoretical framework to analyze qualitative data on how people relate and discuss their public transport accessibility experiences. Using content analysis of focus groups, data gathered in a brief survey and socio-spatial analysis, we generate a range of concepts or labels to explain their perceptions of the transport environment. We apply these theoretical and methodological innovations to the unique geographical of two municipalities of Santiago de Chile.

We identify different 'socially constructed' narratives for buses and Metro. The participants' focused more on barriers to accessibility, showing an important relationship between different constraining factors, as well as substantial differences in their overarching positive perception of Metro and negative for buses. However, when disaggregating the analysis by gender, primary transport mode, age and location, we found 'hidden' values for buses. These was linked to on-streets bus priority, construction of a more integrated and redundant public transport network and better recognition of the key role of buses given their capillarity function and underlying connectivity with the Metro system. From these 'real world' experiences it is thus possible to determine some overlooked attributes that should be considered when analyzing accessibility through public transport for different population groups.

## Intrapersonal variation in destination choice

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This study focuses on destination choices to represent travel behavior, which is still not often used in large scale, nevertheless, capable to accommodate population heterogeneity. A set of mixed logit models are developed to capture intrapersonal variation in destination choice. The models incorporate the effects associated with trip characteristics and spatial information on travel behavior. The Dutch Mobile Mobility Panel (2014-2015) data was used to develop a set of mixed logit models for 442 respondents, corresponding to 68626 valid trips collected via a GPS-smartphone, including departure-arrival times, origin-destinations and modes. Based on the activity purposes, the destinations were segmented into fixed (work, education, appointment, etc.) and flexible (shopping, leisure, sports, tour, etc.). A spatial -and temporal repetition index was developed as SRI and TRI. Additionally, destination alternatives for each segment were defined based on individuals' repeated behavior as: most-visited, multiple visited, equally visited and visited once; and SRI as: Very high, high, medium and low

Results show that intrapersonal variation is high for the less repeated locations, which represents the variation seeking behavior. This variation exists also in departure time and mode repetition for the less repeated destinations. Elasticity of temporal-and spatial repetition revealed strong connection between activity, departure time and destination choice. Travel time and departure time are found significant parameters, e.g. people trust the bicycle and walking travel time. Fixed-destination trips are likely to occur in the morning, mostly in the commercial and industrial area and unlikely to be performed during the weekend. Also, afternoon and evening are likely for travelling towards flexible destinations, and retail and recreation grounds are likely. Accessibility of public transport is found more reliable than bicycle and car. Lastly, built environment variables are found strongly correlated with mode choice.

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## **Access, egress and transfers in multimodal public transport: Implications for subjective wellbeing and en route place valuation**

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A transition towards an urban-regional mobility system dominated by public transport, walking and cycling and where cars play only a minor role, could provide for drastic CO<sub>2</sub>-emission, air pollution and road congestion reductions, the freeing up of valuable urban space, the promotion of active lifestyles, and a more socially inclusive mobility system. When looked at cost-efficiency, energy use, service frequencies and user attractiveness, public transport is highly competitive in moving large amounts of people in concentrated flows between transport nodes. Yet, public transport also requires travel from/towards and interchanges between such nodes. It is at these stages of access, egress and transfers that vehicle occupancies drop, relative travel costs rise, service frequencies and reliability reduce, travel times increase, and satisfaction with travel drops.

Based on Rotterdam (Netherlands) travel diary data this paper provides a conceptual and empirical understanding of how people *practice* and *experience* multimodal travel. The paper investigates in particular how people perform access, egress and transfers and how these stages affect overall trip satisfaction and the valuation of spatial travel environments. While controlling for the individual backgrounds of respondents and contextual factors such as time of day and weather, our findings demonstrate that public transport use is subjected to enhanced fear and irritation, lower happiness, perceptions of crowdedness and reduced evaluations of aesthetics as compared to other transport modes. More specifically, not so much the type of public transport, but rather the number of transfers has a negative effect on trip satisfaction and the valuation of travel environments en route.

The significance of these findings is discussed in relation to the increasing policy focus on seamless multimodality and mobility as a service as solutions to tackle car dependency, while highlighting also the importance of walking and cycling, both as stand-alone modes and for access and egress.

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## Dynamics in mode choice behaviour: The relationship between trip distance and changes in mode use variation

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Although cycling is very popular in the Netherlands, like in the most developed countries the car is by far the most used mode of transport in everyday life: 47 percent of all trips are made by car. Extensive car use can have negative consequences on several levels, with congestion, noise and pollution the most evident results. Therefore, transport policies mainly focus on reducing car use in favour of more sustainable transport modes, such as public transport, cycling and walking. At the same time, new mobility concepts such as Mobility as a Service have – more or less – the same objective: offering different mobility services on individual level, targeting on the use of different alternatives. In the development and implementation of policies and measures to facilitate these mode shifts, it is important to understand mode choice behaviour at both household and individual level.

In this paper we analyse changes in mode use variation, using data from the first four waves of the Mobility Panel Netherlands (MPN). The MPN comprises a yearly three-day travel diary among 2,000 households. To measure mode use variation, we used the Herfindahl-Hirschmann Index (HHI). For each household and individual, we calculated the change from one year to the next. From previous research we know that most people use more than one transport mode over time. In addition to existing research, we focus on the relationship between trip distance and mode use variation. Preliminary analysis show there is less variation for longer distances. To allow for correlation within individuals and within households over time, we estimate different random coefficients models. The results give more insight into the dynamics in mode choice behaviour and provide policy makers a basis to differentiate measures, based on trip distance, to stimulate more sustainable modes of transport.

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## **Commuters' burden revisited: The relationship between travel time and well-being**

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The daily commute requires time, money and effort, it is often accompanied by a certain levels of stress. Studies on the relationship between commuting and well-being demonstrate that travel distance, time or the mode of transport significantly influence certain indicators of well-being of the commuter.

Most studies in this field focus on a single indicator of well-being or only cover one city or country. In this contribution we integrate multiple indicators of subjective and objective well-being of a large group of commuters. We use the 2015 data of the European Surveys on Working Conditions, which covers the work situation, the well-being and the travel time between home and workplace from nearly 30.000 employees. Moreover, this set contains data from 35 European countries. In our model we build a variable for well-being based on physical and mental indicators and general health condition. This variable is regressed with weekly commuting time, while controlling for determinants with a known influence on well-being. Also differences between countries are calculated. Our contribution is new research with new data, but build on previous insights from the EWCS 2010.

The results confirm our hypothesis: a longer travel time negatively impacts well-being. However, other aspects, like harassment or bullying at work, are far more important. Our results suggest that travel time to work in general, and potential strategies to cope with longer commutes, like telework or a relocation fee, should be integrated in the HRM policies and practices of employers.

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## Measuring system level effects of Corporate MaaS - A case study in Sweden

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Mobility as a Service (MaaS) integrates different elements of transportation, which mainly are: ticket & payment integration, mobility modes integration and ICT integration. It plays an important role as it is expected to enable the shift from private car use to shared and sustainable transport modes.

Corporate Mobility as a Service (CMaaS) is a version of MaaS, which enables mobility within as well as to and from, a work site for the employees. CMaaS fulfils all the above-mentioned characteristics of MaaS. It may also consist of different service packages which could either be free and/ or paid.

CMaaS is a new concept and its implementation is limited. The expected benefits of CMaaS are both to support a shift toward sustainable transportation and to be the first step towards more general MaaS solutions. In this paper, we study the effects of CMaaS from economic, environmental and societal aspects on individual, organizational and social levels.

The case study of the implementation of CMaaS at a company with 13000 employees located in a city 30 km outside of Stockholm, Sweden, is used in this study. The estate spans over three-square kilometres, and the facilities are spread over the area with distances between the buildings of up to 5kms.

The service provides internal taxis, small shuttle buses and e-bikes to aid the employees to get around the estate during the working day. It also offers a commuter bus service to and from Stockholm City. The evaluation is based on data collected through three surveys with more than 400 respondents, complemented with operational data.

The analysis is ongoing and will be completed during the spring. Preliminary results show that CMaaS have supported the shift towards the use of e-bikes in favour of motorized modes which has positive effects on e.g. health and emissions.

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## **Mobility-as-a-Service in the Netherlands: The implementation of a stated choice experiment to examine travel behavior adaptations**

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New concepts and innovative services emerged during the last decade in the field of smart mobility. Among these, Mobility-as-a-Service (MaaS), an integrated and user-oriented application, seems a promising but challenging concept for upcoming years. Despite MaaS is gaining increasing attention, we have limited knowledge on its potential effect on the user both in terms of day-to-day dynamics (activity scheduling; mode/route choice) as well as longer-term effects (perceptions and needs; habitual behavior and de-routinization), which can be attributed to the limited number of MaaS schemes existing globally. This research project emphasizes the user perspective and the potential effect of this mobility platform on day-to-day travel behavior. For this research a Stated Adaptation survey was conducted in the Netherlands to examine individual's mode-choice process adaptation in response to MaaS subscription. Travelers compare their alternatives and choose their preferred transportation mode by trading-off travel expenses or duration and non-mode specific attributes, including the inherent uncertainty and innovativeness associated with the untested service.

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## Mobility-as-a-Service in a depopulating area: An exploration of small and big data

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An ageing population in low-density and dispersed areas, combined with strong competition from private cars, makes it difficult to operate profitable commercial public transport services which meet the accessibility needs of different user groups. To provide a viable alternative, we explore the potential of a community-driven Mobility-as-a-Service (MaaS) platform in the municipality of Oost-Gelre, which is a rural and depopulating area in the Netherlands. We use a mixed method approach using a combination of small data (primary data) from household surveys and big data (secondary data) from smartcards/mobile phones. From the statistical analysis of the survey, we observe that inhabitants are generally satisfied with their accessibility and mobility options when conducting fixed, re-current trips (i.e., trips to/from work, etc.). Furthermore, car drivers are not willing to share rides. In contrary, frequent car passengers are more willing to adopt new mobility solutions. This is in line with the literature on ride sharing platforms in rural areas that highlight the need for community involvement, incentives for joining a ride-sharing initiative and financial benefits for passengers and drivers.

Using a modified version of the Density-based Spatial Clustering Algorithm for Applications with Noise (DBSCAN), analysis of smart card and mobile phone data reveals that less than 5% of the respondents use public transport on a daily basis, and most of the public transport trips are to and from other areas outside the region. In particular, infrequent trips exhibit a significant variation on their spatial distribution across different times of the day (something that hampers the introduction of fixed schedule public transport services). The combination of small and big data analyses indicates that a MaaS platform in the study area (and, potentially, in other rural areas) should target travelers who perform infrequent trips and not trips related to fixed activities (i.e., trips to/from work).

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## **Fancy some MaaS, Paleiskwartier? How residents in a densely populated neighbourhood in the Netherlands welcome the introduction of a Mobility-as-a-Service pilot and how it impacts on reducing parking needs**

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The unrestrained use of vehicles burning fossil fuels is one of the biggest sources of pollution in cities around the globe. Vehicle traffic has a negative impact on several factors, such as air quality, noise, traffic congestion, and safety. The Dutch government has supported several initiatives related to nudging individuals away from single occupancy vehicles into shared sustainable modes, such as public transportation, bike-sharing and/or car-sharing. This study is part of the Dutch *Innovatieprogramma Mobiele Stad* (IMS) consortium, which conducts practical experiments aimed at concrete innovations for the integration of mobility, technology and space in different regions of the Netherlands. The *Paleiskwartier* district, which is a highly dense neighbourhood located next to the central station of 's Hertogenbosch in the Netherlands, is one of those regions. The *Paleiskwartier* district is in full development, but the construction of new homes, offices and hotel facilities is so successful that accessibility suffers. 's Hertogenbosch's mobility management plan focuses therefore on innovative solutions to reduce traffic congestion and parking needs. An innovative solution that is currently getting some attention is Mobility-as-a-Service (MaaS), which is a concept for the integration of various mobility providers into one platform. Within this context, this study is about a six-month MaaS pilot to be carried out in the *Paleiskwartier* district from February 2019 until July 2019. The intent of our study is to observe how residents in the *Paleiskwartier* district welcome the introduction of MaaS in their place of residence. The methodology to be employed in this study will consist of conducting ex-ante and ex-post evaluations by means of 2 surveys: one survey (i.e., the ex-ante evaluation) before the introduction of MaaS in the *Paleiskwartier* district and the other one (i.e., the ex-post evaluation) 1 month after the MaaS introduction. The ex-ante evaluation will consist of gathering some insights regarding views and attitudes among residents in the *Paleiskwartier* district towards the introduction of MaaS. We are here especially interested in finding out how likely residents would be willing to use MaaS when introduced in their place of residence. In its turn, after one month of the introduction of MaaS, we will measure how satisfied the residents are with the MaaS service offered to them as well as the impact of MaaS on the reduction in parking needs in the *Paleiskwartier* district.

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## First-time cruise tourists' intention to recommend a port city: Space and time matter

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In addition to the economic impact of the cruise activity at a given destination, a positive experience can lead to other mid and long-term benefits. Satisfied cruise tourists may return as independent land tourists. Furthermore, the willingness of satisfied cruise tourists to share their positive experience with relatives and friends is also higher. Throughout the last fifteen years an interest has been raised to evaluate the determinants of cruise passengers' satisfaction when visiting ports of call. However, to the best of the authors' knowledge, there is not yet any research that analyses the association between cruise tourists' spatiotemporal behaviour at a given destination and their subsequent intention to recommend the destination.

This research fills this gap in the literature, providing a thorough knowledge. GPS tracking technologies are used to monitor the mobility of 148 first-time cruise tourists in the city of Tarragona (Catalonia) along with traditional surveys. Kernel Density Estimation (KDE) is used to identify the general mobility patterns in the city of those cruise tourists willing to recommend the city and those who do not. Subsequently t-tests and chi<sup>2</sup> tests are applied to compare both groups. Multiple variables related to their demographic profile, activities developed and spatiotemporal behaviour at destination are considered. Finally, an econometric model is implemented to identify the determinants of the intention to recommend Tarragona.

Results of the study show that those cruise tourists with intention to recommend the city have significantly differentiated spatiotemporal patterns with respect to those who do not. In this regard, special attention has to be given to the results obtained, as they can be of great utility for destination management organizations.

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## Which tourists use public transport? Panel data analysis

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Capital cities, as well as cultural and religious cities, attract many tourists that visit them as a part of their stay in a country or in a region. In Israel, about 80 percent of all incoming tourists visit Jerusalem. The popularity of Jerusalem among incoming tourists creates challenges to the Jerusalem Transportation Master Plan (JTMT), which need to plan inter-destination transport solutions in addition to intra-destination transport planning, in order to keep high levels of service and satisfaction of both tourists and residents.

The current work presents findings from a study that JTMT conducted among 2,452 incoming tourists to Israel (From December 2015 to November 2017). By using GPS tracking and follow-up surveys, the JTMT created a database of 173,487 entries, each of them representing a single travel activity of a tourist in Israel.

The current work uses this database to identify the personal and situational factors that influence the use of public transport (PT) by tourists. Three statistical methodologies (logistic regression, a rule association model and a linear regression) were conducted, addressing inter-destination as well as urban transport. All three methodologies revealed that the purpose of the visit (leisure), first time visitors, party size (less than three), age (young) and origin (Europe) are significant factors influencing the use of PT. The relationship between visit length and the intensity of using PT is more complicated, and different results were obtained from the various models.

The findings reveal the special challenges for central cities that attract large numbers of incoming tourists. Furthermore, the incomplete use of public transport calls for improving both the service and its marketing among tourists.

*Acknowledgments:* The authors would like to thank the JTMT for their generous and invaluable cooperation.

## The role of major gateways on national tourism flows

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One of today's problems in international tourism is that relatively small number of the most popular destinations attract the biggest number of tourists. It means that majority of tourism activities are accumulated into small geographical areas. However, it causes several problems, such as overcrowding, increasing living costs, and lack of public services. Similar pattern could also be seen in a narrower, national, scale, where capital cities or cultural centres functioning as gateways attract the most visitors and rest of the country is left with remarkably smaller number of visitors. However, from the sustainable destination management side, it is important that great destination hubs have also a large number of smaller peripheral destinations. One way to grasp the problem is to analyse the actual movement data about visitor flows within a destination country.

To date, relatively few studies have analysed tourists' movements on national scale. This is due to the deficiency of spatially accurate data that could be used for recording tourists' intranational movements. In this study, we will fill the gap by analysing tourists' movements on national scale in two countries, Estonia and Israel. Respectively passive mobile positioning data and GPS data are used to analyse the importance of gateways on national tourism flows. Our results confirm the major role of gateways on national tourism flows as more than two thirds of all the visits stay in the near vicinity of the gateways. Therefore, this kind of a detailed knowledge about visitation patterns of tourists in time and space is crucially important in national tourism development and planning to enhance the spatial dispersal of tourists and magnify the spillover effect.

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## **Sustainability of waterborne passenger transport in European tourist destination cities: Assessing experiences with battery-powered excursion boats**

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With continued growth in tourism, demand for guided local excursions, sight-seeing, and entertainment has increased rapidly, particularly in European tourist destination cities. In addition to local tours on (hop-on hop-off) buses, operators also offer a variety of sight-seeing cruises on motor barges along local rivers, canals, lakefronts, or ports. Many touristic sights can often be viewed best from the water. Urban waterborne tourism is typically seasonal. In many tourist destination cities and around urban heritage sites, however, increasing boat traffic and the associated air pollution from conventional diesel powered engines has become a local environmental concern. Several cities have already suggested or announced plans for mandatory tourist boat emission reductions. With recent technological progress and product adaptations, battery-powered and hybrid boat propulsion has advanced considerably. Today, electric mobility offers alternative options for safely and conveniently powering commercial tourist boats, whether large or small, for scheduled cruises or private charters. In spite of high initial cost, several pioneer entrepreneurs have already invested in no/low emission mobility boat services for tourists. Whereas some electric boat projects experienced financial difficulties to break-even, others were readily accepted by tourist customers. Depending on local conditions battery powered and hybrid electric boats can offer win-win-win solutions benefitting tourist visitors, local operators, and residents alike. Based on a comparative review of independent and own case studies and a series of in-depth interviews with operators of (electric) tour boats and other stakeholders, the authors identify opportunities, discuss constraints, and offer policy recommendations to enhance the sustainability of waterborne transport in tourist destination cities.

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## Environmental strategies for selecting eco-routing in small cities

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Recent studies conclude that over 60 % of European citizens live in urban areas. They share the same space and the same transport means for their daily mobility. But they also share the harmful effects of their mobility patterns, accounting for 40 % of total CO<sub>2</sub> emissions of road transport and up to 70 % of atmospheric pollutants.

This research has analyzed what type of road is more ecological for urban mobility in a small city (eco-route), where distances were rather short, but car dependence is really high. A real life city wide survey was carried out in the city of Caceres with almost 100,000 inhabitants (Spain) under different traffic conditions, times of the day, and weather conditions. Four different types of routes were investigated: local, collector, perimeter and bypass. The output of the study was the assessment of fuel consumption and CO<sub>2</sub> emissions for different type of vehicles, routes and drivers. The study is based on the analysis of a number of parameters such as travel speeds, number of stops, revolutions per minute, and maximum acceleration-deceleration for each of the sample segments.

The investigation concludes that the traffic conditions has higher influence on fuel consumption of gasoline vehicles than diesel ones; also that the type of road matter for eco-routing, being the “collector” sections which produce less emissions for diesel vehicles and “bypass” for gasoline.

These results could be critical when many cities are restricting the use of diesel cars in central cities for reducing pollutants but, according with this study, could increase clearly GHG.

*This work was supported by the Spain National R&D programme (Ministerio de Economía y Competitividad) under the Eco-Traffic Project. Ref TRA2016-76485-R.*

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## **How transport planning in urban regions shall be addressed to integrate automated vehicles reality: A mixed traffic analysis**

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Automated vehicles (AVs) will soon become a reality and their deployment might be challenge urban regions. Transport planning is a necessity during this transition period. Our study is focused on mixed traffic equilibrium through a non-linear optimization programming model. The model was applied in a case-study in the city of Delft, the Netherlands, through several penetration rates. We found that, in general, AVs will reduce the overall generalized travel costs, travel times and average congestion. However, the most congested roadways and queueing will still prevail until full deployment. In order to address these issues, we suggest dedicated infrastructure as a strategy to be implemented in urban regions.

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## Bicycle parking at railway stations for sustainable cities

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Between 2005 and 2016 train use, measured in traveler kilometers, increased by 24% in the Netherlands. At the same time, the bike share for access-travel to railway stations increased from 36% in 2005 until 43% in 2016. For egress-travel this share rose from 10% to 14%. This development is welcomed by local governments because the combined use of bicycle and train generates social benefits such as improved health, and less emissions and congestion in cities.

The success of combined bicycle-train use in the Netherlands has unresolved issues though. Because of overcrowded bicycle storage facilities at railway stations in large cities many bicycles are being parked outside of these facilities. This leads to nuisance and an inefficient use of space in the surroundings of railways stations.

So, the growth of combined bicycle-train use is accompanied by serious bicycle parking problems which might slow down future growth. The challenge for cities is to facilitate this future growth taking into account that additional bicycle storage facilities cannot be built indefinitely. In order to help cities tackling this challenge, the aim of this paper is to shed more light on the bicycle parking behavior of the bicycle-train traveler.

Data was collected in collaboration with the Dutch national railways (NS) by means of online questionnaires. Descriptive statistics and binary logit models were used to analyse the answers from about 3000 respondents. An important finding is that privately owned bicycles parked at the activity-end station are responsible for at least 45% of the bicycle parking pressure seen over all train stations in the Netherlands.

Possible policy options for reducing bicycle parking problems could be sought in additional bicycle sharing systems and more efficient pricing for bicycle parking at railways stations.

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## **Towards a practical municipal investment paradigm: How do municipal governments prioritize access to municipal services through investment using GIS in both the short and long term?**

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The City of Philadelphia, Pennsylvania, USA, has a unique problem for an American city: How does a city redevelop in America with new demands for 5G, transit, and building architecture and yet preserve its history? Philadelphia is the US' only UNESCO World Heritage City. Like many Northeastern US Cities, Philadelphia experienced a long-term post-industrial decline from 1950-2003. However, over the past 15 years, based on the strength of a growing technology, university and medical research sectors, Philadelphia has been growing again. Pro-urban growth policies and relatively inexpensive real estate has produced significantly increased demand. Yet, Philadelphia takes pride in its history – laws and policies keep more square footage of historically designated land per capita than any other large American city.

Given these restrictions and demand, the urban geography of transportation and communication infrastructure building becomes complex. The purpose of this paper is to demonstrate how understanding urban assets in a geographic analytical framework can enhance public investment in transport and communication facilities that maximize use of those facilities. The city of Philadelphia has produced multiple geostatistical / GIS-based tools to solve the problems of investment in public facilities. The paper will utilize the tool's multivariate results that guide decisions and essentially work backwards: given the results of the analyses, are their patterns of investment that increase the likelihood of a high level of return on investment? What tax structures and expenditures sustain the recent growth in Philadelphia? Can these geostatistical investment analysis tools apply to other cities?

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## **Measuring daily accessibility by road and rail in Europe's regions and territories: Towards a new set of accessibility indicators for road and rail**

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An adequate measurement of the level of accessibility of regions and territories is an important element when assessing the competitiveness and attractiveness of these places. Many accessibility indicators have been designed and calculated. Often these assessed potential accessibility by measuring travel opportunities to – potentially – all places on the European territory.

Accessibility is often expressed as a volume of opportunities that are within reach, for instance an absolute number of inhabitants or a volume of GDP. While this is an important characteristic of accessibility, it ignores the differences in spatial concentration of opportunities in the surroundings of the place of departure.

Some indicators are designed to be computed and interpreted at a specific geospatial level. Such a design implies specific choices as regards the network taken into account. Hence, indicators that have been designed for a specific territorial level can not necessarily be easily applied to another spatial level.

In our analysis, we try to overcome some of these obstacles. We focus on places one can reach within a reasonable travel time, suitable for day-to-day travel. Using square grid cells of 1 km<sup>2</sup> as basic units representing origin and destination, the method is designed to produce indicators at a wide variety of territorial and regional levels, without needing methodological adaptations. We propose a method that is applied to road travel, but also to passenger rail trips, using a near-complete collection of EU-wide rail timetables. Finally, our analysis provides measures of daily accessibility in absolute terms, but also relative to the population living in a circular area around the place of departure.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

## Measuring accessibility and congestion in European cities

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Joint Research Centre of the European Commission support EU policymaking through better knowledge management on territorial (urban and regional) issues. With various tools and platforms, it aims providing place-based information on demographic, socio-economic and geographical factors that affect European cities and regions. Among other territorial and spatial analyses developed in the centre, accessibility and congestion studies are particularly important for EU regional policy and will be subject to this special session.

The first part of the presentation will be on EU level accessibility analyses. Fair and balanced accessibility in European cities and regions has been increasingly promoted as one of the most important policy goals in land-use and transport plans. Several factors affect level of accessibility in cities such as population distribution and agglomeration, transport system performance and service provision. Lately, for each of these factors, new and open data sources have become available at finer spatial resolution, which makes various decent accessibility measurements applicable at European level. In this part of the presentation, a collection of recent EU level accessibility studies will be given, covering policy analyses related to accessibility to services, cross-border accessibility and historical accessibility changes.

The second part of the presentation will be dedicated to a recent congestion study. Congestion is a major issue for cities and often a determining factor of connectivity within urban areas and intra-city interactions. It is an externality directly related to the nature of cities as it represents the negative aspect of agglomeration which is the major driving force of growth in cities. In order to better understand the reasons and impacts of congestion, and be able to identify, and propose, viable solutions against it, traffic needs to be studied at a fine level of spatial and temporal detail. In this study, the congestion has been measured at the level of Functional Urban Area considering the full road network in order to estimate travel times between a large set of origins-destinations as determined by a high-resolution population grid (size: 500mx500m) and a day-time population grid. The impact of congestion is introduced with the help of the relevant TomTom indicators that provide very detailed information on the variation of speed during the day at road link level. Road traffic is assessed by considering its impact on accessibility. Accessibility with and without congestion is estimated for all the populated grid cells in the functional urban area.

**Disclaimer:** *The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.*

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## Measuring reliable transit accessibility considering travelers' multi-criteria route choice

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Fast arrivals to destinations are primary concerns for public transit (PT) users. However, direct and fast PT journeys often associate many transfers which can lead to travel time uncertainties due to delays in PT operations. PT riders recognize those risks can affect their reliable accessibility: the ability to reach destinations such as work and medical appointment on-time. Therefore, people try to balance between minimizing travel time versus risk based on their heterogeneous perceptions towards risks.

This study aims to investigate how people's heterogeneous risk-averse behaviors change PT accessibility. Travel time uncertainties including delays are used as risks in this research. We use archived Automatic Vehicle Location (AVL) data to compute travel times as well as their uncertainties for PT paths. Based on calculated travel times and variations, we generate a set of path alternatives balancing between fast travel time and low risks using the multi-criteria profile connection scan algorithm (mcpCSA). mcpCSA analyzes connections within transit and walking network, thereby computing Pareto-optimal paths optimizing three objectives: 1) later departure, 2) earlier arrival, and 3) minimizing risks. We measure and compare accessibility for PT riders with high, moderate, and low risk-averse attitudes based on Pareto-optimal paths with the lowest, median, and highest travel time uncertainties, respectively.

A multi-modal network in Columbus, Ohio, USA comprising the regular bus, bus rapid transit, and walking networks is used for the case study. Focusing on an underserved neighborhood in Columbus, we explore how the residents' accessibility to healthcare can change subject to heterogeneous risk-averse behaviors. Results show that people's PT accessibility can vary according to their different risk-averse attitudes. These findings suggest a comprehensive accessibility assessment using Pareto-optimal paths would enable more realistic and human-oriented transportation planning considering PT user's concerns on risks.

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## Assessing spatiotemporal variations of traffic congestion: Comparison of 2012 and 2018 accessibility scenarios in Madrid

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Nowadays, the problem of traffic congestion in the city centres is becoming more and more pressing in main European cities. Environmental issues related to air pollution and the implementation of new means of transport are intensifying the debate about private vehicle mobility and, in this context, new transport policies are emerging trying to reduce the use of cars in city centres. Therefore, the social debate about the impact of these new policies is laid on the table nowadays.

This paper aims to evaluate the impacts of traffic congestion in accessibility by private vehicle, comparing two different periods: first, during the year 2012, where the effects of the economic crisis made decrease significantly the use of automobiles, and second, in 2018, where the situation has been normalised. Methodologically, the daily variations of traffic congestion are analysed for the Madrid case study, using TomTom Speed Profiles data. These are incorporated in a GIS environment for the calculation of travel times at different times of the day, thus a spatiotemporal accessibility analysis is carried out for the two periods above mentioned.

The main results are oriented first, to the evaluation and comparison of the different accessibility scenarios and second, to analyse the population affected by these changes in accessibility between these years, trying to identify both spatial and social inequalities.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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## GOAT: A dynamic and open accessibility tool for modelling and encouraging active mobility

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Active mobility witnesses increasing attention by planners, decision makers and citizens. But yet widely used instruments, like transport models, are not designed in a way to answer planning questions for active mobility. This gets even more evident when important factors such as walking comfort or safety need to be examined.

Accessibility instruments have the potential to bridge this still existing gap. The chance to model both land-use and transport and the possibility to model every mode underlines their suitability. However, the vast majority of existing accessibility instruments still lack in providing more dynamic calculations as well as suitable visualization (Brömmelstroet, Silva, and Bertolini 2015; Silva et al. 2017) Furthermore, most of them do not focus on active mobility, are expensive and not transferable to other regions (Büttner et al. 2018).

The ongoing development of the Geo Open Accessibility Tool (GOAT) (Pajares, Elias 2019) aims to address these challenges. Methodically it makes use of various GIS and web development technologies, while functional programming logics are followed. Furthermore, continuous exchange with potential users, other developers and the OpenStreetMap community enable permanent feedback cycles.

This paper focuses on the interactive calculation of contour and gravity-based accessibility measures for pedestrians and cyclists. On the fly network changes allow to assess the effects of new infrastructures, such as a new pedestrian bridge. Accordingly, changes in accessibility can be analyzed within seconds and without the need to have special technical expertise. By building on open data and an automated setup procedure the tool can be transferred to study areas worldwide with minimum effort.

First experiences with practitioners and researchers showed that the effortless and transparent access to the tool opens accessibility analyses to a much larger user group. Furthermore, the openness of the framework and the use of crowdsourced data is allowing for fast feedback cycles to improve data quality and functionality. By this, public participation can actively contribute to livable urban spaces for all.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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## **How much are we overestimating accessibility by ignoring the cost of travel? Comparing multimodal effective accessibility for different income groups**

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Accessibility is paramount to transport and land use planning. However, there are several different methods in which place accessibility can be measured, which not necessarily lead to the same conclusions about who and where there are problems of lack of accessibility. In addition, the vast majority of accessibility measures use travel time to measure the transport component of accessibility, ignoring in this way the cost that someone needs to pay in order to travel at a certain speed with a certain mode. In this paper, we are adopting the concept of effective speed - the rate at which someone travels in a certain transport mode considering the total time devoted to obtain the money to pay for that mode - as the impedance parameter of place accessibility, calculating in this way what we have designated as “effective accessibility”. By calculating it with a cumulative opportunities methodology for different travel modes and three different income groups, our results show that the “traditional” accessibility map are in reality overestimating accessibility, especially for medium and low-income groups. Likewise, the comparison of the effective accessibility by different modes show that the car is not the “effectively faster” mode throughout the entire metropolitan area, as normally is depicted with traditional accessibility maps. Effective accessibility can reveal these income and mode accessibility disparities in a simple yet operational way, making it extremely appealing as a planning tool.



## Accessibility to healthy food: A multimethod analysis approach from Chile

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Chile has the second largest has an obesity rate in America and a very high percent of population requiring important modifications on their diet in order to make it healthy, especially on vulnerable groups. Yet, it is still unclear how people's activity and travel patterns – and their consequent constraints on time use and mobility – influence these undesirable health outcomes. This paper presents the experiences and insights obtained through a study that uses multiple methods to understand, identify, and assess the role of mobility on food purchasing patterns in the Chilean context.

The study included three quantitative stages. First, a Nutrition Environment Measures Survey (NEMS) collected information regarding the location, product quality, and prices of open street markets, supermarkets and corner stores in Concepción, Chile. These data, along with the latest Travel Survey, served to assess differences on people's accessibility to food, depending on their territories, mobility, and sociodemographic characteristics. The second stage involved using an intercept survey performed to 800 shoppers in open street markets and supermarkets, to model some of the key relationships between food purchasing and consumption, which a special focus on spatial patterns and health food consumption outcomes. The third stage involved a time use survey that included indicators about food consumption, mobility patterns, and the role of attitudes and social influence attitudes towards food.

All these methods generate complementary perspectives on current dynamics relating mobility and food consumption in Chile. The paper discusses the methodological challenges and insights arising from this multimethod approach. The discussion remarks key conceptual and empirical insights, such as the differential role of car ownership on the access to stores and healthy food; the relationship among transit use, time pressure, and food consumption on streets; and the relevance of fruit and vegetable street markets in the accessibility to healthy food environments.

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## **Drawing the (base)line: Exploring the links between liveability and health equity in Cali's Corredor Verde**

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The aim of the research is twofold. First, it seeks to examine and provide evidence of urban liveability and health (in)equities in the context of land use and infrastructure policies in Cali, Colombia's third largest city. The research focuses on the area of influence of the 'Corredor Verde', an ongoing large-scale urban regeneration initiative in the city, seeking evidence of current conditions of health (in)equity and the social and spatial distribution of liveability. Using 'soft GIS' for participatory mapping, we build an evidence base for future health assessments of land-use and urban interventions and policies, as well as the monitoring of the 'Corredor Verde' in future phases of its development. Using different forms of spatial, social and health-centred analysis of both primary and secondary data, we analyse case studies in both high and low-income areas adjacent to the 'Corredor Verde' with different characteristics in relation to the social determinants of health. Second, the research seeks to spark a dialogue regarding practices and challenges for planning and assessing healthy urban environments that can resonate with growing debates about urban health in Latin America. Such a dialogue builds on the baseline evidence raised for this project, and the analysis of the potential of the 'Corredor Verde' to address health equity through workshops and engagement with local practitioners and stakeholders in Cali. Our paper draws on qualitative and quantitative evidence to draw insights regarding the complex interactions between accessibility, liveability and health in rapidly growing cities.

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## Urban traffic noise and health risk: What the role of citizen-sensing may be

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There is sufficient indication that transport like rail and aviation at particular urban places, cause noise annoyance and health risks, including hypertension and heart disease. Some cities or traffic nodes have installed measurement systems to assess the level of noise exposure. Surprisingly, not much of the knowledge gained has been actually applied into policies and regulation for noise management in urban areas or areas close to traffic nodes. Situations of information monopoly and concerns about health risks without adequate response, are the background to the growing number of citizen-sensing initiatives concerning noise exposure.

In the last few years, citizen-sensing makes increasingly use of sensor networks at higher levels of granularity than traditional measurement systems, apply real-time functionality and audio maps, thereby increasing credibility of the results. This paper reviews literature that connects noise exposure to noise annoyance and health risks. It then moves attention to citizen-sensing, by first addressing its' theoretical context of social capital and participatory policy-making and its' conceptualization, and how it is practically used and how it adds to already existing measurement systems. On top of that, the paper presents an elaboration of case study analysis on two airports and one urban site to 'track' what changes can be achieved through citizen-sensing, in particular, changes that go beyond the merely collecting and presenting of exposure data, and connect with participatory noise management and policy-making.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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## **Comparing time use, transportation options, and dietary behaviours in three Toronto, Canada neighbourhoods: Initial results from the FASTT Survey**

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This talk will present results from the “Food, Activities, Socioeconomics, Transportation, Time-use” (FASTT) Survey, first introduced at the 2018 NECTAR Social and Health Issues workshop. The FASTT Survey improves on past research that typically overemphasizes simple measures of food environments near home addresses, and does not incorporate time use, individual-level activity spaces, and transportation contexts when studying how the built environment influences dietary behaviours. In doing so, the literature to this point has neglected important temporal constraints faced by many lower-income populations. These limitations are reflected in ambiguous findings in work linking undesirable health outcomes to residing in “food deserts” or “food swamps”.

The multi-part survey collected data using a nutrition, health and transportation questionnaire, a 7-day time use diary, and a 7-day GPS/dietary recall smartphone app. Recruiting and data collection of approximately 300 participants - all parents of children under 18 living in apartment complexes across three Toronto neighbourhoods with varying levels of access to transit and food retail - is underway (began in January 2019) and will conclude in early March 2019. In this talk, initial results on differences between the three neighbourhoods (N1: low transit, low food retail access, N2: high transit, high food retail access, N3: low transit, high food retail access) will be compared.

The ultimate goal of the research is to disentangle the links between people’s food environments, spatial access, travel patterns, time pressure, and socioeconomic status. By doing so, planning decisions around food policies can be made that account for both the built environment and time pressures.

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## Walkability as an element of integration of public policies

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Walkability, as the condition of the urban space to stimulate pedestrian mobility, is related to way city inhabitants live. Thinking about the sustainability and quality of the urban lives, the walkability notion is a pluridisciplinary theme that dialogues with other sectors of the welfare state policies, as health, environment, tourism, education, housing, economy, etc. Walkability as an element of integration of public policies in different levels of governance is the main subject of this text.

In this context, the appropriated urban walking should be promoted as an instrument of public policies, with transversal relation to different sectors. For that reason, it should be showed how to come to the importance of emphasizing the walkability as a priority element in masterplans guidelines through instruments of public planning and managing. However, the guidelines to promote walkability is been used more like a discourse whose measures and actions to its implementation is not been seen in the practice. Much of the difficult to practice comes from public management and local governance failures.

This work looks forward to make a critical analyze of the contradiction between the discourse and practice into the planning system and governance that impacts the implementation of walkability projects. This works stars from a framework of plans and works on which are inserted projects, actions, and measures to increase walkability in the context of the Europeans policies that concern to Portugal planning system.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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## **Monocentric, bicentric, or polycentric? The varying ways young and old adults use neighborhoods and extra-neighborhoods spaces in Helsinki Metropolitan Area**

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Research shows that the daily physical and social environments that people relate to do not usually follow the clear boundaries of neighborhoods, cities, or even nations. Everyday life commonly has developed from place monogamy toward a spatial polygamy. This change in the spatial behavior of individuals is highly relevant to urban planning from different aspects. While urban planning can help shape the spatial behavior of individuals, studying the ways in which people distribute their everyday life spatially can also lead urban planning. Therefore, understanding people's mobilities is a key to understanding how people dwell in cities.

The concept of activity space has been widely used as a measure of individual mobility. In this study, we introduce a novel measure of activity space, namely “centricity”, which aims to measure individuals’ mobility behavior by differentiating neighborhood and extra-neighborhood travels. Accordingly, individuals are categorized under three groups of monocentric, bicentric, and polycentric bases on their activity locations.

This study is conducted on two datasets collected through public participation GIS surveys from Helsinki metropolitan area. The first dataset targets older adults aged 55-75, while the other is from younger adults aged 25-40. Using a comparative approach, we aim to answer several research questions. First, we explore how mobility patterns differ between the two age groups. Second, we will compare the role of socio-demographic variables in explaining these differences. Third, we will investigate the associations between centricity of activity spaces and individuals’ use of different travel modes in the two age groups. Fourth, we will explore the potential motivations behind the extra-neighborhood travels in the two age groups by comparing the environmental characteristics. Finally, yet importantly, we will investigate the associations between mobility patterns and perceived health and quality of life of individuals in the two age groups. Additionally, we will discuss our findings in relation to ‘multi-locality’ concept and highlight the potential implications for urban planning practices.

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## Human mobility as an indicator for integration? Big data to reveal socio-spatial interactions

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International migration has reached record highs in recent years. Movement of people from their familiar community to a foreign place and culture creates challenges for both migrants and host communities. The need to alleviate possible tensions, support migrants to realize their potentials and ensure social sustainability of new urban realms puts the operationalization of current integration policies under pressure and urges researchers to strive for a better understanding of migrants' integration processes.

Integration is widely studied from various angles such as civic and political participation, education, health, and labour market outcomes. Scientists concerned with the spatial aspects of integration have mainly focused on residential segregation and neighbourhood effects, and we still do not know much about immigrants' segregation regarding their whole activity spaces. Moreover, in spite of the understanding that two-way socio-spatial interactions – dialogues between people and places through spatial mobility and social engagement – play decisive role in integration processes, we lack suitable data and methods to provide such information.

We argue that studying individuals' everyday mobilities would open new avenues for understanding migrants' spatially embedded social interactions, and therefore, would provide new insights for segregation research and practice. Furthermore, we propose that novel big data sources have the potential to provide necessary information on both individuals' spatial mobilities and social interactions. Based on a systematic literature review, we give an overview on how activity space approach has been incorporated into spatial segregation research, to date. Furthermore, we present a systematic overview of the big data sources that have been applied for studying activity-space-based segregation, and assess critically their strengths, weaknesses and ethical aspects of implementation.





## When people meet in cities how far do they integrate? Exploring mixing and functional use at various spatial scales

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Over the course of the day, most parts of the urban landscape will be visited by individuals from different residential areas and for very different purposes including recreation, work, commuting, service and similar. People's mobility affects their exposure to different socioeconomic groups and thus their integration into the society. Depending on areal qualities such as centrality, accessibility, function and size, various parts of the city will be frequented differently at different hours and at different parts of the week.

We utilise the Swedish mobile phone database (MIND) to analyse peoples' spatio-temporal trajectories. While different parts of the society might be segregated by where they sleep, they are more exposed to each other during their diurnal activities. We measure co-presence of a large number of mobile-phones in Sweden in the greater Stockholm area to characterise a typical working/weekend day. Since MIND allows us to associate phones with mast-locations, it is possible for us to assign phones to areas that can be described as neighbourhoods (mast-catchment areas).

These areas can in turn be associated with sociodemographic classifications (based on residential statistics) as well as function in terms of economic activities, infrastructure and recreation. Focusing on Stockholm destinations, we identify the areas frequented by residents from different parts of the urban fabric, and areas that can be characterized more or less as shared space, and areas that are more integrative at a variety of spatial scales. By comparing between-hour differences and between-weekday variations in uses we can identify, characterise and map areas and areal functions that improve socio-demographic integration in the urban landscape.



## Mobility as a Service (MaaS) ecosystem: The eco-innovative business model of mobility

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By presenting a shift away from the existing ownership-based transport system and towards an access-based one, the MaaS concept is gaining ground in recent years and is becoming a concrete market option. Furthermore, the construct is still surrounded by ambiguities and uncertainties among academics and mobility experts.

By eliminating the need of car-ownership and by bringing a more dynamic, integrated transport solution, we believe MaaS should create value from a range of distinct actors and thus be compatible with concepts from Business Ecosystem as well as with Eco-innovation theories – due to its sustainable essence – even though MaaS has not been yet analyzed by this latter perspective. In this sense, this paper aims to analyze the MaaS concept as an Eco-Innovation and under the Ecosystem theory.

Starting from an integrative review of academic and grey literature, we drew distinct MaaS levels considering the main MaaS characteristics and also the Eco-innovation perspective, presented in “need to have / exclusively use vehicles in urban environments” considering that: the greater this need, the lower the levels of Eco-Innovation (Figure 1).

From an ecosystemic perspective, Eco-Innovative MaaS can use platforms as businesses tools (Figure 2), in which the central actor (MaaS operator) establishes platform rules, but does not determine tasks and contributions of each stakeholder, which are agglomerated in order to deliver value to transport users and are orderly orchestrated.

Thus, MaaS ecosystem within Eco-innovation must seek sharing and integration of transportation modes and also create value to users which have vehicles as “mobility insurance”. Thus, we propose a new MaaS definition ; “a business model that should, via single platform, integrate booking and trips’ payment among different transport/service stakeholders in an ecosystemic with a value proposition sufficiently greater for the user to adopt the platform over usage and possession of personal vehicles”.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

	Eco-Innovation Need to have / exclusively use vehicles in urban environments	Integration of infrastructure (physical and virtual)	Tarif option a-pay as you go b-package c-full package	Integration of transp. models a-public b-private	Customization to users' preferences	Multiple actors a-mobility stake. b-variety of stakeholders	Description
0	No MaaS	✗	✗	✗	✗	✗	User owns a transportation modal
1	Peer Transport Services	✓	a ✗	✗	✗	✗	Payment, without integration
2	Integration of public transport	✓	a b ✓	a ✗	✗	✗	Information and payment public modal
3	Combination of mobility services	✓	a b ✓	a b ✓	✓	a ✗	Public/private integration and payment
4	Full MaaS	✓	c ✓	a b ✓	✓	a b ✓	Fully ecosystem integration
STAFF	Multimodal Planner	✓	✗	✓	✓	✗	Integration of information

Figure 1. Levels of MaaS under Eco-Innovation approach.

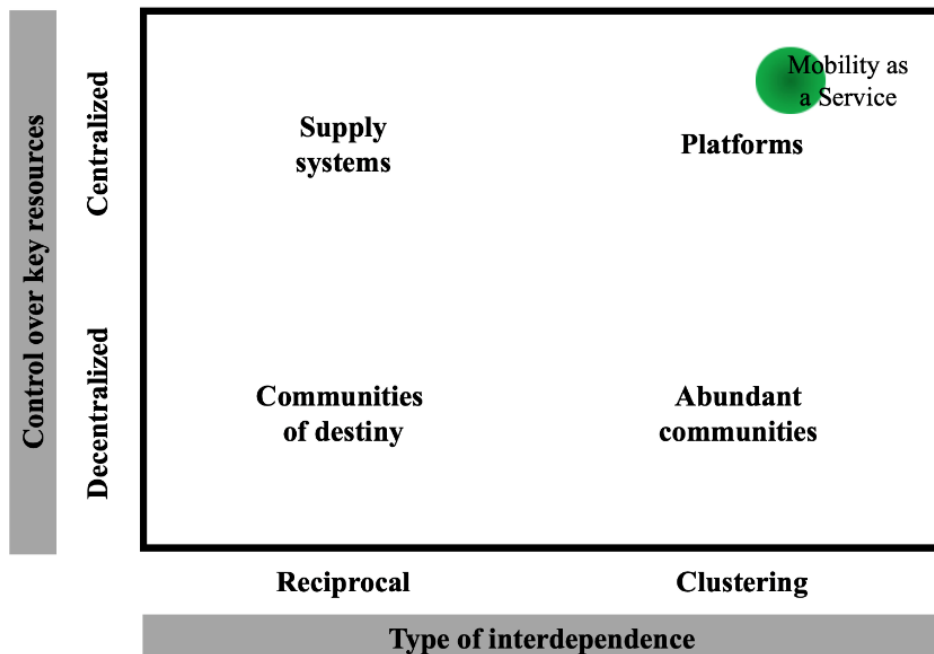


Figure 2. Platform as a business tool for a MaaS Ecosystem.



## Evaluating the implementation of a MaaS travel assistance app in metropolitan areas from travellers and urban stakeholders' point of view

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MaaS (Mobility as a Service) emerges to customize the mobility offer and meet the needs of each traveller by proposing multimodal solutions 'on demand' adapted to the urban environment. However, existing MaaS choice-supporting tools are at a very early stage of their development, just focused on central urban areas. Within this framework, MaaS needs to be further developed in order to encourage the change towards more sustainable multimodal mobility behaviours for promoting more liveable, zero-carbon and resilient cities.

This study analyses the design and implementation of a MaaS travel assistance App in the metropolitan area of Madrid. To that end, it covers two points of view: potential users of the App (travellers); and key urban stakeholders relevant for the implementation of MaaS solutions: i.e. transport operators, ICT developers and public authorities.

The research applies a qualitative approach based on two techniques. On the one hand, Focus Groups were conducted with travellers, subdivided by age profiles. Subsequent analysis allowed to identify key features of the MaaS App derived from users' expectations and preferences, such as the payment integration of transportation services, or the provision of real-time information, among others.

On the other hand, a series of semi-structured interviews were applied for evaluating the urban stakeholders' perspective. The main findings included key factors related to their expected role in the implementation process of the App, as well as their perceived opportunities and challenges. Institutional barriers and data sharing were identified as the main threats for developing MaaS solutions.

Overall, our findings indicate that both travellers and urban stakeholders are interested on the implementation of MaaS strategies within the metropolitan context, as they provide social, environmental and economic benefits. Setting the appropriate policy framework is essential for the success of these innovative solutions.

*This paper is based on the results of a European-project supported by the EIT Climate-KIC and led by the Universidad Politécnica de Madrid: KLIMATe.*

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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## The effect of Uber on Yellow Taxis in New York

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Uber has coupled their ability to dodge regulation with their ride-hailing app, to grow from a Silicon Valley start-up, to a global powerhouse challenging established taxis in over 700 Metropolitan areas. Through the lens of Schumpeter's 'Creative Destruction' and Rogers' 'Diffusion of Innovation', this paper aims to investigate how Uber challenges the established taxis, focusing on yellow taxis in New York. This paper uses 'big data' made available through the Taxi & Limousine Commission (TLC) and NYTimes API to investigate to what extent Uber has impacted yellow taxis. Using regression analysis, we aim to find the impacts that Uber has had on trips by yellow taxis. Granger-Causality was also used to find if there was a Granger-Causal (or reverse) relationship between NYTimes articles and yellow taxi trips. This paper also aimed to investigate if an increase in the popularity of Uber would cause yellow taxis to increase their quality of service. However, we found that the framework of using complaints to assess quality is not successful in establishing an answer for this research question and suggest another framework is needed to fully understand these impacts.



## **A conceptual framework for modelling the supply side of mobility services within large-scale agent-based models**

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Mobility services (MS) are rapidly revolutionizing transportation systems. The inherently dynamic and responsive nature of MS imposes fundamentally novel modelling requirements, hence, a conceptual framework for modelling the supply side of MS is proposed in this paper.

Encapsulation of processes is a design principle of the framework, which focuses on modelling the supply side of the problem in isolation from the demand side. Fundamental design guidelines must be established for the framework to achieve encapsulation and broader objectives in general, namely:

- Networks and services have conventionally been modelled as a single entity, yet a clear distinction must be made between them to model MS.
- To achieve encapsulation, clear interfaces must be defined between demand, services, and networks.
- Maintain human agency on decision-making processes, as opposed to a MaaS-oriented setting where centralized solutions are provided by a platform.
- A bottom-up approach is adopted by assessing operational features of various MS in isolation to ultimately derive a generalized MS model.
- A “transportation as a market” guideline is also incorporated into the framework because the complex supply-demand interactions of MS, pricing schemes, and competition are inherently market-oriented concepts.
- Simple yet accurate models are essential for large-scale models from a computational perspective, hence simplified modelling representations of complex dynamic processes are desirable.

Stemming from the mentioned design guidelines, four modelling pillars are proposed as the core of a generic MS model, namely: matching, rebalancing, a pricing mechanism, and a driver activity model –as opposed to existing literature predominantly framed around AVs. The framework culminates with a generic service process that logically integrates the four modelling pillars, wherein various mobility services can be instantiated. Ultimately, this configuration allows to establish clearly defined interfaces among the supply, demand, and network components of a model system.

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## **Pedestrian behaviour associated to specific events in small cities: Assessing the behaviour of the FENAVIN conference attendees through GPS tracks in Ciudad Real**

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HSR transforms cities' systems, connecting and integrating medium and small-sized cities which are taking a more active role thanks to the increase in accessibility provided. In this context, this paper focus on the new possibilities provided by HSR to intermediate small cities for promoting tourism/business activities and organising conferences or events where these small cities should take advantage of their size and compactness, in contrast to large metropolitan areas, as an important strength for promoting 'walkable' events.

The main aim of this paper is first, to analyse the characteristics of the main conferences in relation to the city where they are organised, trying to identify which factors (size, heritage, university, commerce, etc.) have an influence in the conference profile; and second, to assess the mobility generated by this type of events, especially focusing on pedestrian routes.

For these purposes, first, surveys and interviews will be carried out to the conference attendees and workers, which will be complemented with their detailed mobility patterns by tracking their displacements through a GPS data Logger receiver. To do this, the sample analysed will be chosen randomly (at the conference venue or in the associated hotels) and they will be asked for carrying a GPS receiver that will register their location and detailed information about their routes during the days of the event. These methods will be applied to the event FENAVIN (National Wine Fair) that will take place in Ciudad Real in May 2019, as it is considered an important event in a small HSR city, and, therefore, as a relevant case study for this research.

The main results will allow identifying the main pedestrian routes used in a certain city during an specific event and analysing the characteristics of the public space related to their 'walkability'.

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## Preconditions of introducing integrated mobility services in tourism destinations in Japan: Toward more attractiveness in urban tourism

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This paper is motivated by a great concern for 'integrated mobility services' like Mobility-as-a-Service (MaaS) in ICT-innovated urban cities. While the existing MaaS schemes aim to integrate different transport modes and provide seamless door-to-door mobility in passenger transport system, we have hardly had experience with the MaaS scheme in tourism destinations. This paper aims to identify prerequisite conditions when the MaaS is applied to urban tourism destinations in Japan.

Starting on review of previous tourist-related transport measures in a few typical tourism destinations, two of newly derived challenges are clarified: One is how these measures can be decided on continuously to contribute to form the attractive and sustainable tourism destinations. As they are expected to create the emerged demand, the goal of the MaaS scheme for tourists in tourism destinations would be therefore different from that for residents in urban cities. The other challenge is concerned with 'inclusive' destinations management. Such a manageable challenge is more essential for urban tourism and common to that in the MaaS scheme in urban cities.

Kamargianni (2016) has pointed out that the MaaS is based on four integration types: Ticket & Payment, ICT, and Mobility package integrations. According to her developed criteria, existing measures in urban tourism destinations (Kyoto, Koya-town, Ise, and Izumo) are evaluated from the level of mobility integration.

In addition, we discuss prerequisite conditions for introducing the MaaS scheme in urban tourism destinations and how we can establish inclusive destination management toward more attractive and sustainable tourism destinations. The following agendas for discussion are summarized: 1) Relationship the spatial spread of areas and the targeted residents & tourists, and their segmentation, 2) A variety of stakeholders (transport, tourism and local economic sectors), and 3) Relationship the goals of the MaaS scheme and the roles of inclusive tourism destinations management.

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## Exploring the quality of life and work effects of public transit subsidies for Vancouver's hospitality workers

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Our paper presents results from an experimental study about how hotel workers in downtown Vancouver have responded to enhancing employer-provided public transit subsidies. This study originated in the City of Vancouver's goal to enhance sustainable mobility behaviour by its residents and workforce, which yielded a research partnership between the Urban Studies Program at Simon Fraser University, the City of Vancouver, TransLink, UNITE HERE Local 40 and the management of seven hotels in the urban core. Workers at three smaller hotels did not receive subsidized transit passes before the study, while four larger hotels had offered employees a 15% monthly pass subsidy. This subsidy variation enabled us to examine outcomes for employees' mobility patterns, quality of life, and job performance when higher levels of transit subsidy were introduced. After completing a first round of baseline surveys, four of seven hotels were selected to receive an experimental subsidy enhancement; new subsidies were introduced at two of three hotels that previously had none, and subsidies were increased at two of four hotels which already offered the 15% subsidy. We have also conducted a six-month interim survey and will conduct a final survey one year after the baseline. The study design permits before/after, treatment/non-treatment comparisons. For example, comparing baseline and interim surveys indicates that the experimental subsidies had both expected, as well as uneven and unexpected, effects on commuting mode. Our analysis seeks to interpret the relationship between these mobility patterns, and their evolution following subsidy enhancements, with hotel employees' life and work satisfaction. Our findings can contribute to better understanding the relationship between mobility, productivity, and quality of life among hospitality employees in a global city known as a global tourism destination. We seek to know whether such a mobility management strategy could enhance urban social welfare or further growth in tourism.

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## **Mobility at tourist destinations and everyday transport choices of young people: A cross-country survey**

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Transport sector currently faces two major environmental challenges: the finite nature of fossil-based resources and the need for reductions of negative transport-related externalities. In this regard, fostering environmentally friendly transport solutions lies at the core of the strategies aimed at implementing a sustainable mobility and urban environments. One of the contexts that, at the moment, appears to have attracted a limited degree of interest is the heterogeneity of travelling habits at home and at tourists' destinations. To the best of the authors' knowledge, there is not any research that has yet considered the effects of mobility at tourist destinations on everyday transport choices of young people.

The present paper aims at analysing and discussing this issue. It is based on a questionnaire that was proposed to more than 1,200 students in Apulia and in Catalonia in the second half of 2018. After summarising the related literature, the paper proposes a comparative analysis and discussion of the results emerging from the survey. It first considers the statistics related to the socioeconomic and travel data of the respondents. Then the determinants of environmentally friendly transport options both at home and at tourist destinations are identified by means of an econometric model. Lastly, the relevance of mobility at tourist destinations on transport choices at home is assessed.

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## Centralized vs decentralized tourism policies: A spatial interaction model framework

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The choice of centralizing tourism policies at the national level or, on the contrary, of decentralizing them at the local level is widely discussed in the literature, which highlights the related pros and cons. In fact, the simultaneous role of originator and attractor of tourism of each spatial unit may imply a range of complex and competing interests at various geographical scales. In particular, in a framework of regional competition, a central (national) policy may be necessary to offset or coordinate the clashing regional interests.

This paper focuses on the choice between implementing tourism governance and policymaking at the central (national) or at the local (regional) level. The issue is raised by the following problem: (1) regional endowment (i.e., attractivity factors) may positively influence arrivals to tourism destinations, providing a justification for local policies; (2) however, regional competition may reduce the positive direct effect, so that it may be necessary the intervention of the central (national) policy maker, to “compensate” or “correct” the local (regional) policies.

The issue concerns the choice of how managing regional spillovers: regions could use their attractivity factors to gain a competitive advantage over other regions, but at the same time they risk damaging the national interest to attract tourists and increase the international market share. It is therefore critical to correctly balance and coordinate the tourism policies between the national and regional levels in order to effectively manage the regional endowment to cater to the cultural tourism demand.

We stress that more profound insights into the problems and challenges of (de)centralized tourism policies can be gained by examining the national-regional choice, and in particular by using as a modelling framework, the ‘normative’ spatial interaction model.

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## Implementation of Big Data in cross-border mobility research: A Twitter case study from the Greater Region of Luxembourg

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Cross-border research has gained particular importance in line with the emergence of globalization and unprecedentedly increasing mobilities of everything (people, objects, and information) transcending the borders of states and nations. Hence, the amount of people who are regularly crossing state borders and practising daily activities on both sides of the border for work, shopping, services and leisure purposes is rapidly growing. This is a reality especially within the borderless European Union, however, not much is known about who are crossing state borders, why and what are their mobility patterns.

To foster cross-border cooperation, development and governance in border regions, there is a crucial need for more detailed knowledge about individuals' cross-border spatial practices and social interactions. While large-scale surveys are time and resource consuming, we propose that an intriguing novel big data approach could provide additional insights for understanding cross-border mobility patterns at individual level. Furthermore, scaling up individual mobilities would allow us to monitor cross-border mobility flows over a long period, and potentially in near real-time on a global scale.

We propose a conceptual framework for implementing big data to examine cross-border mobility by: 1) detecting individual activity spaces and mobility patterns; 2) profiling people crossing borders; 3) profiling and monitoring cross-border mobility flows; 4) and assessing border porosity in border regions. We apply openly available Twitter data and examine Twitter users' longitudinal posting history in case of the Greater Region of Luxembourg. Our initial empirical findings demonstrate the feasibility of proposed conceptual framework and the potential of big data sources in cross-border mobility research. Finally, we address prospects and challenges in implementing social media data to examine cross-border mobility, and highlight avenues for further research.

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## **A MCA-DEA method to measuring immigration openness in 23 countries. An analysis of the 2016 European Social Survey.**

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The old dream of the construction of the European Union as a supranational entity is now suffering from what has been already referred as the progressive's dilemma between support for social solidarity and cultural diversity and the sustainability of the social welfare states. The current refugees' crisis is undermining the main government coalitions of many countries in the EU, and tolerant attitudes and open admission policies toward immigrants seem to be part of the recent past history. The dilemma is gaining a lot of media attention as the public and political debate on migration is now playing an important role in all the European elections, where the polarity between immigration openness and closeness is already served. Thus, the aim of this paper is to analyze the immigration openness of 23 countries, 18 EU Countries, plus Iceland, Israel, Norway, Switzerland and Russia. The analysis will be based on the data provided by the 2016 European Social Survey (ESS). The approach of Data Envelopment Analysis (DEA) will be adopted here, with the purpose of identifying which countries are more or less open to the phenomenon of the immigration. A further refinement based on a multicriteria analysis (MCA) approach will be performed in order to provide a ranking of the countries regarding the attitude towards the immigrants. The results show how the Nordic countries are those which show more openness to immigration. The findings show more light from an empirical point of view on the existing dilemma between immigration, welfare state, cultural diversity and nationhood. The findings also call for further research on other perspectives more oriented to a better understanding of spatial interactions, driving forces, dynamics of economic conditions, comparative studies of democracy, sociology of immigration, political theory and cultural anthropology.



## **Walkability assessment for the urban area around TEN-T railway stations**

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Railway stations have been increasingly playing multifunctional roles beyond their traditional transportation functions. Their missions have extended ranging from facilitating interchanges for multimodal transport networks, to the creation of public space accommodating various amenities (e.g. cafes, hotels, restaurants, and shops) within the station premise and its immediate surroundings. Walking has been considered to play a critical role in enhancing citizen's wellbeing, while a better pedestrian access between the city centre and railway station is the key to creating environmentally sustainable urban space. Over the last two decades station area regeneration has been intensively carried out in Europe that has contributed to the shift from car-dependent lifestyle and highlighting the importance of the use of public transport and walking. This paper presents a new methodology developed for the assessment of walkability in the urban area around six railway stations along the Rhine-Alpine Corridor, which is one of the nine TEN-T Core Network Corridors. The research has addressed both the objective environmental characteristics and subjective aspects, which are grouped into four key criteria: urban structure; design of the street; obstacles and traffic safety; and personal impression, together with some contextual information of the site. Using a checklist for the above criteria, researchers conducted field observation on the walkability of urban neighbourhood within a radius of 800m from the railway station. Subsequently, the concept of 'Walk Score' has been applied to provide further insight into research findings and we have developed a modified version of 'Walk Score' including traffic noise, road speed limits and air quality in addition to the proximity to various amenities which was originally introduced by the 'Walk Score' concept. Research reported in this paper presents results from three German cases studies (Düsseldorf, Frankfurt am Main and Karlsruhe) and the validity and transferability of our methodology will be discussed.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>



## Modelling of healthy, equitable and sustainable urban accessibility

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It has been estimated that by 2050, 66% of world population will live in urban areas. Many cities across the globe strive for achieving environmental and social sustainability with compact urban form and high accessibility, lower segregation and better social equity. To support this development, there has been a long-standing interest to understand how cities and societies function, and how their future growth and development can be modelled using systematic computational approaches from the perspective of equity and sustainability. Increasingly, also health impacts of urban life are being modelled.

Accessibility, as a measure of opportunity for interaction, plays a key role in assessing how equitable our urban environments are for different groups of people. Urban accessibility landscapes may appear very different depending on the perspective taken: Mode of transportation, time of day, places to be reached or people under inspection.

Most accessibility measures derive from travel time. There have been significant advances in calculating accessibility measures for major modes of transportation or taking better into account the time of day. Comparable measures across modes and times allow analysing the equity of people. However, as transportation is much more than just an activity that consumes time, it is increasingly important to compare accessibility landscapes also from other perspectives: those of health, experiences and sustainability.

In this presentation we present an ongoing project where accessibility and equity would be analysed as a function of accumulated health impacts or environmental and experience exposures, either positive or negative. We present analyses where equity of everyday mobility across urban regions are measured from the viewpoint of how much people get exposure to green, noise, good/bad quality air or aesthetics. Such exploration reveals equities at the human scale of human experience, in addition to that of time. In the presentation we also discuss about the potential of novel big data sources in providing information about these aspects of mobility, and how for example air quality, aesthetics or green exposure could be derived from them and incorporated in equity analyses of accessibility.

*Acknowledgments:* The MSc theses of Akseli Toikka, Joose Helle and Maaria Haavisto have contributed to this research.

## Access to rail: The influence of comfort on accessibility

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There is rising certainty that there is a strong connection between subjective comfort levels and walking accessibility. (Vural Arslan et al. 2018; Gkavra et al. 2019). The factors that determine walking accessibility are not only made up of objective, measurable characteristics of the built environment, but also subjective, perceived characteristics – such as the feeling of safety or comfort – that can have a very strong influence on whether or not an individual chooses to walk to a destination. Nevertheless, a holistic approach to ascertain the coherence between objective accessibility and perceived walkability is missing.

This research project aimed to identify patterns of possible issues for pedestrians as they access railway stations. Through a literature review, six overarching quality indicators were defined: comfort, simplicity, directness, built environment, traffic safety and perceived safety. These quality indicators can be described by other detailed sub-indicators. Possible deficiencies in the street networks and built environment were examined objectively through on-site inspections in six municipalities. On-site surveys and online map-based surveys allowed people to oppose the objective analysis with the subjective perception of the people.

The purpose of this paper is to identify the impact of subjective perception on accessibility to ensure access to public transportation for all no matter of gender, age or disabilities. Therefore, workshops have been taken place with decision-makers and stake holders, which are able to improve the situation around the station.

The assessment showed that specific point weaknesses – such as poor lighting or unsafe road crossings – are barriers to accessibility rather than general network connectivity. Comfort and safety also affect mode choice, for instance some persons claimed to not walk at night due to insufficient illumination.

The results are a good starting point for the aim to incorporate perceived comfort levels into existing accessibility instruments. However, there is still the need to strengthen the connection between subjective perceptions and a clear spatial location. Innovative data collection methods – such as crowd mapping, the use of crowdsourced imagery and sensory measurements of the illuminance – shall shrink this gap and improve the efficiency in data collection in coming research projects.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>



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## Do the Olympics affect airline networks to the host city? The case of Rio de Janeiro

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The impacts of mega-events on host cities have received more and more attention. Research topics notably include the specific governance of such large projects and the impacts on the local/regional economy, tourism and urban transformation. This usually includes public transport, since mega-events are often seen as an opportunity, or an excuse, to engage in investing in new facilities such as underground lines, light-rail systems and new railway stations. In contrast, issues related to long-distance travel has been largely neglected, despite the fact that mega-events attract many international visitors and induce improvement of long-distance facilities (for instance, new high-speed rail between Beijing and Zhangjiakou with a view to the 2022 Winter Olympic and Paralympic Games).

In this context, the aim of this paper is to assess the impact of mega-events on air services, considering the case of 2016 Olympics held in Rio de Janeiro, Brazil. Using OAG data (a comprehensive dataset that describes air services at the flight and route level), changes in both airline networks (that is, route operated) and capacity offered (number of flights and of seats) will be analysed. The investigation will consider the short term (impact during the event) but also the longer term (until today) to analyse the extent to which impacts have remained. Based on Brazil's statistics and literature review, similar analyses will also assess changes in the demand, having in mind potential updated visa policies. To make sure that observed changes are not simply the continuous of past trends, older figures will also be considered.

This research is of interest for transport policies, notably to assess if costly investments in new airports or in airport extensions only serve fleeting travel peaks or if they meet long-term needs.

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## **Can mega event help change the patterns of urban and regional mobility? A Case Study of Gdańsk – the co-host of the UEFA EURO 2012**

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Gdańsk – a large Polish city – was one of the co-hosts of the European Football Championships in 2012. Preparations for the event included the expansion of the airport, construction or modernization main roads leading to the stadium, modernization of public transport and reconstruction of the section of the city railway line connecting city's centre and stadium.

Importantly, almost all of these investments were part of a long-term plan to modernize urban transport infrastructure co-financed from EU funds. The location of the newly built stadium was also conducive to minimizing investments focused mainly on handling the championships.

The aim of the presentation is to present the long-term consequences of these investments – how much did they help to change the patterns of mobility? This issue is in the foreground because of the above mentioned conditions allowed to minimize problems typical for mega events of the oversupply of infrastructure and transport services after the event.

Simultaneous actions to improve the conditions of car traffic and public transport offer were typical for the ambivalent transport policy of the city. It tried to meet the objective challenges of sustainable mobility, without drastically affecting the interests of motorized residents. In the case study of Gdańsk, we managed to prepare a great event, mainly improving the transport infrastructure needed by the inhabitants. At the same time, it was not a catalyst for deeper changes in mobility patterns dominated by private cars usage.

The organization of the football championships also revealed the need to build a railway line enabling airport service. It was put into use three years later. It also created conditions for rail service to the periphery of the urban region and proved to be an attractive alternative to everyday commuting by car.

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## **Effects on the re-imposition of border checks on trans-Øresund commuting between Sweden and Denmark**

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National borders constrain interaction and movement even when countries are in a common labour market and common passport area. Suspension of open borders increases the border barrier effect. This research examines the effects of re-imposing border checks from November 2015, due to the European migration crisis, on commuting between Sweden and Denmark.

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## Energy efficiency of urban freight in Madrid: Comparison between urban and suburban deliveries

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Freight delivery within the city is increasing in volume and has great impact on traffic and GreenHouseGas (GHG) emissions, causing a deterioration of urban environmental quality. This article aims to analyze energy efficiency of urban and suburban freight delivery under real traffic conditions.

Through the data obtained from two case studies in Madrid(2018), a characterization of the driving profile is defined and a descriptive model of energy efficiency in freight deliveries is calibrated via factorial analysis.

Thirteen drivers from a Post Service Company, working on urban and suburban depots, drove electric and diesel duty vehicles for their normal deliveries during one month. 244 delivery daily-shifts were analyzed, corresponding to 7,533km recorded data. The VSP-model and a micro energy consumption model have been applied to calculate instantaneous energy consumption for diesel and electric vehicle respectively.

The initial results show that the characteristics of delivery daily-shift in urban and suburban service area are different, including average trip distance, time, speed, stop etc. In suburban the average trip distance of each daily-shift is 48.1km, corresponding to 24 package distributions within 2km each one. On the other side, in urban area, the average trip distance is 14km long, corresponding to 20 individual distributions within 0.94km each one. Moreover, the average speed is considerably lower than in the suburban, being respectively 12km/h and 23km/h.

Via factorial analysis, an energy consumption model is finally created to determine the environmental impact of urban freight deliveries, considering driving patterns, type of vehicle and route characteristics.

The findings of the paper may help to design emissions reduction strategies for urban freight companies to improve their environmental and economic cost. This article shows that city leaders should work proactively with stakeholders to develop new logistic schemes to minimize the negative impacts of urban freight transport, changing the current emissions trends they produce.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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## **Blessing or curse? How e-commerce is transforming our cities and mobility**

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The steady growth of e-commerce can be seen as one of the most important trends affecting individual consumer patterns: More and more goods are no longer purchased in local shops, but ordered online via digital devices and finally delivered by CEP services. This implies that dynamic developments in e-commerce are leading to a significant increase in urban freight traffic. This traffic is by no means limited to the city centers, but covers increasingly the residential areas of cities. There are growing concerns that this will lead to an increase in emission problems at the local level and a loss of attractiveness of the neighborhoods (e.g. through stop-and-go traffic or parking in the second row. For political planning practice, this means above all that responsibility for the last mile is shifting away from the end consumer towards the CEP services.

This contribution examines this new problem field. Based on a study - commissioned by the German Federal Institute for Research on Building, Urban Affairs and Spatial Development and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety - this paper illustrates that smart logistics concepts might contribute to a more gentle handling of CEP transports. However, this requires a certain level of knowledge about how new logistics structures and traffic flows are organized in cities and how they interact with the various effects of the growing e-commerce. In a first step, we present three future scenarios for the year 2030, in which the effects of different logistics concepts on urban infrastructure and traffic were simulated. Nonetheless, the challenges within the scenarios are highly complex and differentiated, making one-dimensional solutions politically and planning-wise useless. For this reason a comprehensive catalogue of possible options for political action was drawn up, in which potential solutions are offered for various administrative levels.



## **The difficult road to decarbonizing the freight transport sector: A participatory exploration for Flanders**

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With the Paris climate agreement in 2015 and further followed up in the other COPs, concrete commitments were taken to reduce greenhouse gases. The ambition level for Flanders is high and the route to lower emissions is not yet clear, not even for freight transport. In this paper we examine which measures are the most promising for the transport sector to reduce greenhouse gas emissions. Because of the strong link, the impact of these measures on air-polluting emissions is also taken into consideration.

The scope of the study focuses on the greenhouse gas emissions from road freight transport, inland navigation and rail traffic and the reduction ambitions by 2030 are examined, with attention for the long-term ambitions (2050).

The aim of the study is to come up with a 'roadmap': a roadmap that indicates the most cost-efficient, logical and feasible way to achieve the climate ambitions in time. This roadmap serves as a basis for the political and social debate on measures for the transport of goods.

Next to the scientific analysis of the possible impact of the measures, support for possible measures is an important part of this study. Therefore, at various moments during the study trajectory, input is requested from various stakeholders. A first form of input was collected via an online survey in which the feasibility and impact of various measures were assessed. The results of this survey were included and deepened in the further research process.

In the research process, the support and feasibility of the measures identified were also further investigated through a multi-actor multi-criteria analysis (MAMCA) workshop. This MAMCA methodology maps the impact of the various emission-reducing measures on the relevant criteria of the stakeholders involved. This allows a more nuanced picture of the potential implementation barriers and therefore also the feasibility of the measures at stakeholder level. The results of this MAMCA workshop are the subject of this paper.

## Socioeconomic impact assessments of high-speed rail: A meta-analysis

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High-speed rail (HSR) infrastructure has experienced a substantial development over the past three decades in many European and Asian countries, such as France, Germany, Italy and Spain, Japan and China. Despite the number of countries with a HSR development plan is still growing, other countries, such as the United States and the U.K., are still debating whether the gigantic cost of developing large transport infrastructure such as HSR may be offset by the benefits that the system is expected to generate. Although there have been an increasing number of empirical studies evaluating the socioeconomic impacts of HSR from various perspectives recently, it remains unclear how reliable and robust the results are since these assessments were developed based on different modeling frameworks with specific assumptions.

The objective of this research is to investigate to what extent different factors of research design (e.g. data, modeling framework, and control variables) may affect the empirical outcome of HSR project appraisal. The characteristics of the HSR studies are analyzed based on a review of 159 empirical studies published in the period of 2008-2018. In addition, a meta-analysis is conducted based on 200 observations obtained from 33 empirical studies pertaining to socioeconomic impacts assessment of HSR using various econometric approaches. This study is expected to provide a comprehensive understanding of the socioeconomic impact assessment methods for HSR project appraisal. The research findings will also provide implications for scholars and practitioners to improve the validity of the evaluation framework in future research endeavor.



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## **Territorial cohesion impacts of HSR in Spain - Learning from the past and planning future developments**

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The length of the Spanish High Speed Rail (HSR) network has been steadily growing since its opening in 1992. It is currently the second longest network in the world, with over 3,200 km. This important network development has significantly improved rail accessibility, increasing average accessibility values of the Spanish mainland in a 48.6%.

Meanwhile, a profound transformation in the spatial distribution of rail accessibility values has also taken place. These spatial distributive effects are of great importance for the assessment of HSR developments, and are related to the strategic territorial cohesion goal. In the Spanish case, since 1992, a more balanced territorial distribution of rail accessibility has been achieved, with a 15% reduction in the dispersion of accessibility values, i.e. in accessibility terms, a positive territorial cohesion effect.

We believe the next steps in the strategic planning process of the Spanish HSR network -currently under assessment- should take into account the valuable lessons learned from the past. Our research is therefore aimed at supporting this planning process, presenting a methodology based in the computation of accessibility indicators, with the support of a Geographical Information System (GIS). The methodology is applied to a set of 10 new corridor development alternatives in Spain, planned for the 2025 time horizon. Each of these corridors is assessed both in terms of their impact on rail accessibility and in terms of their effect on the territorial balance of accessibility values. The main findings are contextualized in terms of the Spanish current strategic planning framework, and future research directions are outlined.

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## The impact of motorway expansion on urban growth patterns: The case of Portugal between 1991 and 2011

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Portugal experienced a massive growth in its motorway network after joining the European Union (EU) in 1986. The chart in Figure 1 shows the evolution of the motorway network. Just before joining the EU, the country's motorway network had about 200 kms, growing to 409 km in 1991, over 1000 kms in 1998, over 2000 kms in 2003 and reached 3000 kms in 2012, after which it remained stable. The fast expansion of the motorway network during the 1990s and 2000s had several implications on the economic geography of the country. The urban spatial structure has become characterised by growing suburbanization leading simultaneously to an increase in metropolitan area size and urban core decline. Data for the country's largest metropolitan area, the Lisbon Metropolitan Area (AML), illustrates this pattern clearly: the share of the city's population in the total AML population fell from 32% in 1980 to 21% in 2000 and 19% in 2010 (it is 18% in 2017).

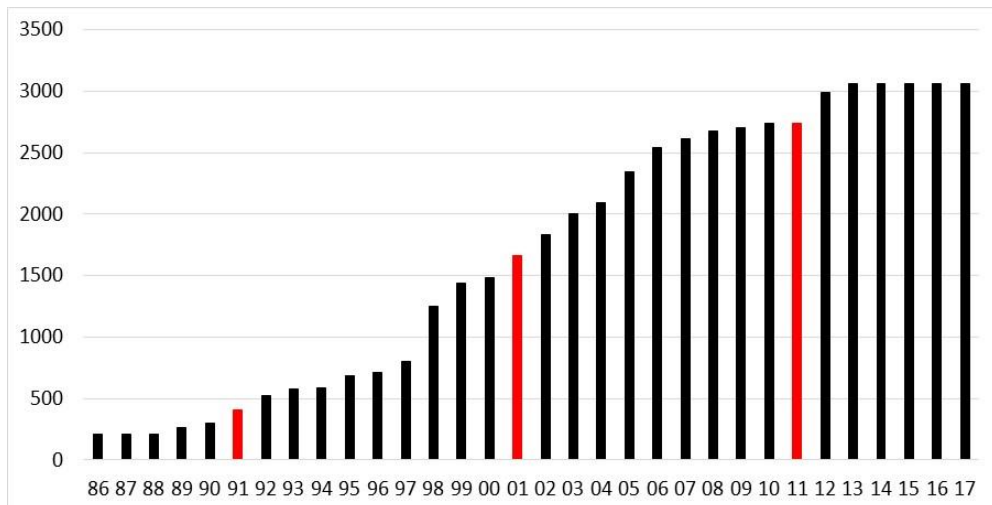


Figure 1. Kilometres of motorway in Portugal

In this paper, we investigate the extent to which the expansion of the motorway network contributed to a redistribution of population across the country favoring a pattern of suburbanization of the population and decentralization of employment. We combine SIG-based road network data with census data for population and employment in 1991, 2001, and 2011, and estimate the relationship between the growth of population, employment and motorways at three levels: central city or urban core, suburbs, and overall country's urban spatial structure. Issues of reverse causality are addressed using different model approaches, including instrumental variables and inconsequential units techniques. Similarly to existing studies for Spain, France, the Netherlands, and the US, the results indicate that motorways contributed to the suburbanization and decentralization of the spatial structure of urban areas, and overall the country, over the period.

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## Telecommuting and the accessibility of amenities

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This paper considers the potential for telecommuters to adopt lifestyles that are sustainable and active, rather than increased online access resulting in less physical activity and more car travel (de Abreu e Silva and Melo, 2018; Marsden et al., 2018). Some studies suggest telecommuters travel more for activities like shopping and personal business, but if they live in neighbourhoods with locally accessible services, such travel can be healthy and sustainable (Asgari and Jin, 2017; Loo and Wang, 2018). By using the UK National Travel Survey (NTS) 2009-2016, the daily travel patterns of those who self-identify as telecommuters are explored, particularly non-work journeys. The NTS divides self-declared telecommuters by the frequency with which they telecommute, enabling the comparison of journeys of regular, occasional, and non-telecommuters. Socio-demographics and geographic characteristics can be included to control for or subset differences in behaviour. Distance and mode can also be analysed to provide insights into the current level of sustainability of neighbourhoods where telecommuters live and their non-work travel.

This paper also proposes to explore which neighbourhoods throughout England, excluding rural areas, offer the most access to and choice of amenities frequented by regular and occasional telecommuters, and also where home broadband speeds are suitable for a variety of work tasks. The former 'amenity accessibility indicator' is developed using crowd-sourced data from OpenStreetMap. The quality of fixed broadband speeds is explored using data compiled by Speedchecker Ltd, a private company that allows internet users to check their own broadband speeds. As commuting becomes less important and telecommuting more popular (Le Vine et al., 2017), mapping the extent of geographic potential for patterns of sustainable travel and telecommuting, or, conversely, areas unlikely to support such travel patterns due to the lack of convenient amenities, could help shape policy and planning for more sustainable, healthy places.

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## How e-shopping impacts on walking time-willingness to retail destinations

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There is a growing number of studies focusing on analysing the potential of e-shopping for substituting or complementing in-store shopping, including its potential effects on motorised travel behaviour. This paper diverges from this commonly used approach by studying how e-shopping affects the individual time willingness to reach daily, weekly, and incidental retail on foot. The city of Zaragoza (Spain), which has a clear intention to improve non-motorised accessibility to major destinations, serves as a case study. First, a questionnaire was disseminated focusing on socio-economic issues, e-shopping habits, and the individual willingness to reach in-store retail on foot. A total of 205 people filled-out this questionnaire (online: 90 responses; face-to-face: 102 responses). Second, an ordinal regression model was applied, using the time-willingness to reach retail locations on foot as dependent variable. Third, a gravity-based model was used to calculate, map, and compare the present walking accessibility levels to retail with a 2030 BAU scenario, simulated according to the regression model's results. It was found that the frequency of doing e-shopping had a positive impact on walking time-willingness, while socio-economic attributes had different effects depending on the type of retail. Furthermore, in the 2030 BAU scenario a relevant decrease of walking accessibility levels to weekly and incidental in-store retail is expected. However, the individual time-willingness to reach daily retail is projected to increase in 2030, independently of variations in the population's e-shopping frequency. The obtained findings can be used to develop and improve walking-oriented policies.

## Online grocery shopping and future accessibility of supermarkets

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Groceries are not extensively bought online yet, but due to further improvements of the delivery conditions expectations for growth of online grocery shopping are predominantly high. Online purchases, however, will take place at the expense of in-store purchases and hence online grocery shopping is expected to have an impact on the range and location of physical stores. Knowing that supermarkets contribute to social contacts and vibrancy in neighbourhoods and that other stores in shopping centres also benefit from the presence of a supermarket, their disappearance endangers the local economy and social cohesion. So far little is known about which supermarket stores will be affected and whether impacts will be different in villages and cities. On the one hand, so-called mega-supermarkets may increasingly emerge, focusing on a broad product range in conjunction with shopping enjoyment in order to remain competitive to online shopping. On the other hand, small local supermarkets may fall or can only survive as a niche, i.e. focussing on craftsmanship and/or daily products.

This paper explores the possible effects of online grocery shopping on the future spatial distribution of supermarkets, using survey data from neighbourhoods in the Dutch city of Delft and neighbouring suburbs, villages and the rural area. The issue is elaborated through testing three hypotheses: the innovation diffusion hypothesis, the efficiency (shop accessibility) hypothesis and a social neighbourhood hypothesis.

Our analyses show that with the current distribution of supermarkets, primarily socio-economic and attitudinal characteristics influence the likelihood of ordering groceries online, rather than variations in accessibility. This gives support to the innovation and to the social neighbourhood hypotheses. However, when confronting respondents with various future accessibility scenarios it turns out that supermarket accessibility does have an impact. This observation suggests that changes in the landscape of supermarkets and online grocery shopping may reinforce each other.

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## Can we rely on data collected by motivated citizens? Advantages and limitations of citizen observatories for mobility

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Data collection for mobility (e.g. travel surveys or traffic counts) are usually organised in a top-down manner, when data collection is commissioned by transport authorities or research organisations. Recently, however, there has been an increasing tendency towards bottom-up initiatives when citizens and stakeholders initiate and implement data collection campaigns in citizen observatories. Citizen observatories are online, cloud-based platforms based on participatory sensing i.e. data collection by volunteers using smart mobile devices. Nevertheless, deploying a new citizen observatory remains technically difficult and labour-intensive. Today, citizen observatories have to be developed from scratch, which acts as a significant barrier to their deployment. In addition, there are many open questions concerning the quality of data that such observatories generate, how citizens can be motivated to sustain participation in data collection, how research and policy making can use such data and what guidance needs to be provided to campaign organisers to collect data that is accurate and valuable for research and planning.

This paper outlines the concept of a citizen observatory for mobility, an open, reusable and reconfigurable citizen observatory platform to enable citizens and other civil stakeholders to set up data collection campaigns to address local mobility problems. We discuss the potential functionalities of such observatories (type of data, campaign organisers, possible outputs), the possible barriers (motivation, effort, knowledge of setting up a travel survey campaign, sampling), measures that can ascertain accuracy and representativeness of data and the importance of feedback to participants (visualisations, reporting, gamification). Finally, the first results of the testing of the observatory platform through three use cases will be presented.

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## Uncovering effects of spatial and transportation elements on travellers using biometric data

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Travel surveys has been used for decades to observe the patterns, locations, and choices, which travellers chose and do during the given observed period. This information can be utilized as background for informed planning decisions. Despite the progress in the travel survey technologies, the applications mostly focus on more traditional travel parameters. With programmable smart watches now, we can also collect real time data that is not solely pertaining to position and travel mode choices, but also to users' biometric data. Such an application would open another level of possibilities in dynamically integrating land use and transport planning with public health research.

Utilising a smart watch platform, we are aiming to develop a tool that will collect biometric data, in combination with spatial context, such as position, spatial features and objects in the built environment, and by utilizing machine learning algorithms, try to detect how travellers are affected by their choice of transport mode, the built environment in general as well as how the public transport is operated.

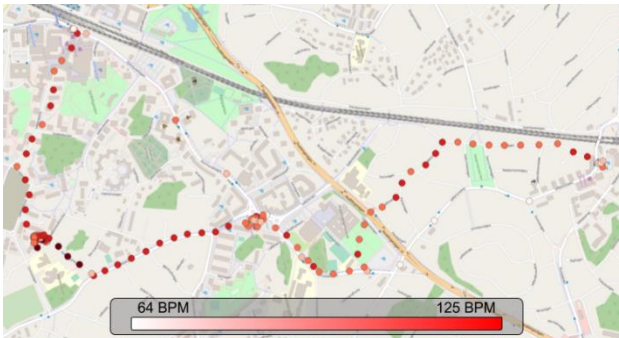


Figure 1.

This figure shows the heart rate of a young man, walking and taking the bus.

Early testing reveals the possibility to find correlations between heart rate and position, which in turn could reveal the effect of spatial and transportation elements on the traveller. By targeting widely available hardware, the scalability for this tool is virtually endless, making it possible to collect large amounts of data and utilizing machine learning algorithms to analyse it.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>



## Public transport travel patterns revealed from mining Israeli smart card data

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Public transport (PT) networks usually remain stable for years. The rail services are fundamentally inflexible and their changes require substantial funds. Bus networks are, potentially, more flexible. Nonetheless, the changes are hardly implemented and bus routes, stops and even timetables remain steady for long periods, interrupted by infrequent but intensive updates (“bus line reforms”). These phenomena can be considered as an outcome of rather cumbersome assumptions of conventional transport planning: (1) Aggregate spatial description of travel demand at the resolution of Transport Analysis Zones (TAZ) is sufficient for PT planning and management; (2) The goal of the PT system is to serve captured (by various reasons) frequent users that have fixed and habitual activities and their travel patterns remain stable for a long time. If these unwritten “*conservative traveler*” assumptions are indeed true then, the job of the transport planner is to wait until demand changes become sufficient for a network update. Since these conservative travelers are minority of the urban population, the latter will usually happen when new and large residential/office/commercial land use is established.

Our alternative PT view considers PT users as urban citizens with a wide range of spatially distributed activities. These “*flexible travelers*” repeatedly try out alternative modes and are able to switch between them including PT and private car. If so, any change in PT outline, as well as, in the reliability of the PT service, can induce disproportional increase or decrease in the PT use.

The nature of the urban travelers’ mode choice can be explored if we would be able to monitor, explicitly in space and time, trips of all urban travelers. One Big Data source of information on travel patterns is PT smart card records. Investigating this data can provide unique understanding of the citizens’ mode choice and compatibility of the PT network to users’ needs.

The data in this paper is based on the four months of smart card data (train, LRT and buses) for the entire State of Israel for October-December 2017 and November 2018. The size of the monthly dataset is 80M boarding records. Smart card fare transactions comprise about 85% of all PT trips, the reminder 15% are with paper tickets.

In the paper, we present a unique typology for understanding travel behavior patterns of Israeli PT users. The analysis results in several unexpected outcomes. First, a high percent (27%) of travelers use PT service only for one leg of their daily trip schedule. Assuming most travelers return to their origin on the same day, the data shows that around one-quarter of the PT users use multiple travel modes for their daily activities. Second, an analysis of the weekly patterns shows that 42% of travelers travel one or two times a week only. If we assuming the majority of passengers’ do work or study more than two days a week, the data

shows that about half of travelers switch modes on a daily basis, opting for public transport one day and selecting a different mode the next. Only 25% of the PT travelers are commuters who travel between their residence and work more than 3 days a week. Analysis of travelers' spatiotemporal also demonstrates great variety of travelers' activity patterns.

Based on the analysis, we claim say that PT users, at least in Israel, are mostly "flexible travelers" who actively plan their trips and will readily react to the changes of the PT system. This view of the travelers' behavior strongly supports the recent concept of Mobility as a Service (MaaS) that aims at seamless integration of all types of mobility services for a smooth multimodal journey and demands deep rethinking of the transportation planning models.

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## Electrification of the Dutch national car fleet

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In accordance with the Paris Agreement, the Dutch Government has set ambitious climate targets, consisting of a reduction of 49% in CO<sub>2</sub> emissions from traffic in the Netherlands by 2030 and of 90% by 2050. Traffic (road, railway and inland shipping) is currently emitting 32 Mt CO<sub>2</sub>. Emissions should be reduced by 7.3 Mt by 2030, regardless of a foreseen growth in passenger traffic and transportation of goods. A process of stakeholder involvement was initiated to reach an agreement on the necessary measures and policies to reach the required emission reduction. This does not include international aviation and shipping. Most reductions are expected to be achieved by blending biofuels and by the electrification of passenger vehicles. This paper focuses on the latter.

The Dutch tax system was changed in 2008, in favour of fuel-efficient cars, especially for the company car market. Until 2016, company cars were mainly very fuel-efficient diesel and petrol cars and plug-in hybrids. As of 2016, the tax system has been stimulating the use of fully electric vehicles, which has resulted in related sales increases. We are nevertheless still far from the aspired large-scale electrification of passenger vehicles. More drastic measures are called for, if we are to reach such a level of electrification, with special attention for preventing the export of electric company cars at the end of their lease period of 4 to 5 years. This paper provides an overview of the measures that have been taken to stimulate the electrification of the Dutch national car fleet, followed by an estimation of their impact.

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## The clash of policies: Do green cars affect driving behaviour?

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Energy-efficient cars have become increasingly prevalent in recent years, in many cases because of governmental policies that incentivize consumers to purchase them. Importantly, these cars are characterized by light weight and small size, both of which are likely to negatively affect the car's safety. A critical research question is, therefore, do policies that incentivize the purchase of energy-efficient cars – thereby increasing their presence on the roads – also increase car-accidents' fatality rates?

However, whereas energy-efficient cars are less safe due to their small size and light weight, their limited safety may stimulate their drivers to drive more carefully.

To measure the difference in driving behavior between drivers of small versus large cars, we first utilize Israeli Police records of all fatal and severe car accidents between 2007-2015. Specifically, we examine whether drivers of small cars are more likely to be involved in a severe or fatal accident. We then use Israeli Police records of all traffic violations between 2007-2015 to address the likelihood of selection bias (i.e., careful drivers own small cars) and test if drivers of small cars are less prone to traffic violations, suggesting that they drive more carefully.

Our preliminary results suggest that drivers of small cars are less likely to (1) be involved in fatal car accidents and (2) commit traffic violations than drivers of large cars. We postulate that considering the limited safety of their cars, drivers of small cars drive more carefully, thereby offsetting the increased hazard inherent to the cars they own.

From a policy perspective, our study examines two critical policy goals: energy-efficiency and road-safety. While prior research associated energy-efficiency policies with increased risk of fatalities, our study provides policy makers with a better understanding of the complex relationship between energy-efficiency and road-safety, so that more informed policies could be designed.

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## **The socio-economic equity through built environment characteristics – The context of Metropolitan Area of Lisbon**

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The socio-economic status (SES) is the main shaper of individual life results. The surrounding built environment (BE) and SES characteristics have an impact in social connections and life achievements. Built environment plays a crucial role in emphasizing the social inequality gap between different social groups. Unfortunately, there is a lack of research in measuring these inequalities through BE characteristics. The most frequent indicators are income and financial measures; however, several authors show that money is not fundamental for social connections and life achievements.

The goal of this paper is to apply methods of measuring inequality from different fields to BE characteristics to evaluate the dimension of the gap between poor and rich for the surrounding BE characteristics in Lisbon's Metropolitan Area (AML).

Built environment characteristics were measured through the concept of walkability for 500 meters buffer of each census block in AML including design, diversity, density and accessibility measures for different transportation modes. Moreover, a spatial exclusion evaluation was performed to identify the most excluded in accessibility to green areas, public transportation and activities. Inequality was measured using the Lorenz curves and Gin's coefficient, evaluating the gap between the previous accessibility measures for different types of SES. The SES was measured using occupation, education and house property values.

The results show a different relationship between BE and the SES across the context of the AML i.e., not always the poorest are in the worst BE characteristics and the inverse is also true. Moreover, the intensity of the correlation between SES and public transport accessibility is higher for the higher SES. This result is particularly worrisome due to the role of public transport in excluding the most deprived population. With these results, it is possible to identify the critical locations for spatial exclusion and the main spatial causes.

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## Accessibility to food systems in Belo Horizonte, Brazil

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In 2050, there will be nine billion people in the World to be fed, and two-thirds of them will live in cities (FAO (2009)). In Brazil, the urbanization rate is growing, and currently represents 86% of the population (IBGE, 2018). In this context, access to food systems is essential to sustain urban life. Recent epistemological discussions regarding the needs to structure more comprehensive analyses of urban systems have emerged. According to Garcia *et al.* (2018) and Cervero *et al.* (2017), the planning of urban accessibility with a focus on sustainability and equity has been considered the best approach to explore the impacts of the urban built environment on the quality of life. Consequently, effective food supply in cities becomes crucial to support the city life and, thus, the accessibility to food should be investigated. Despite this, little has been discussed in the literature regarding the access to food systems in Brazilian cities.

In this paper, we assess the accessibility to food systems in Belo Horizonte, Brazil. For that, we have considered spatial statistics, combining the effects of transport and land use systems. We determined a decrease in the interaction potential of districts regarding the food system through a distance-decay function and, for non-motorized modes, we analyzed the spatial coverture of the food system.

There are great spatial differentiation and economic inequality regarding the access to food retailers. The spatial concentration of food retailers in Belo Horizonte is identified both in the analysis of the spatial structure and through the accessibility levels to the stores. The areas with lower accessibility levels are mostly coincident with the clusters of low-income population. Public policy can be directed to land use regulation to stimulate more equity in the access to food and, in addition, allow more operational efficiency concerning the food supply to cities.

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## A three-step floating catchment area method to quantify the spatial accessibility of healthcare facilities for citizens

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The provision of good health care services to citizens is of increasing importance to improve their health and well-being. These services include, amongst others, general practitioners, specialists and ambulant or stationary hospital facilities. Besides the quality of the facilities itself (personnel, equipment), their supply (e.g. capacity) and proximity (temporal/spatial) are key for patients. Accessibility is a well-established concept that combines the above factors, i.e. land-use components (supply, demand) and transport components (e.g. travel times) in an integrated way.

When it comes to health care accessibility, models that take into account both supply and potential demand, i.e. competition, are of growing interest, both in academia and practice. The supply side comprehends e.g. the available capacity of a facility, whereas the demand consists of the number of people in an area which (potentially) might use this facility. The proximity to facilities is usually captured by some mode-specific deterrence function that depends on travel time and calibration parameters.

In this paper, a method to assess the accessibility of health care services with competition will be outlined. The model belongs to the family of so-called FCA models (Floating Catchment Areas), which considers the potential demand by facility-specific catchment areas. The output is, unlike in standard gravity models, well interpretable (e.g. in terms of physicians per person) and communicable. Hence it shall provide a transparent basis for decision-makers.

We demonstrate the applicability of our approach by some examples for health care services using real-world data for selected urban areas in Northern Switzerland. The main focus is here to determine areas that are under- or over-supplied. Together with other information, the knowledge of such critical areas together with the extent of differences might help to develop appropriate policies with the goal of reducing inequalities and of improving the well-being of the citizens.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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## Where are the centers of a city? A method to analyze centrality and modal equity of transport across city regions

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One of the most important and widely used conceptual and analytical tool to understand the functioning of cities and the wealth of issues related to developing our urban environments is the concept of *accessibility*. Accessibility has been widely used to understand the abilities of people to move in cities by different travel modes at different times of the day and assess how equitable urban environments are for different groups of people. In this paper, we introduce *multi-modal centrality assessment* (MMCA), which is a methodology to understand centrality of city regions in a comparative manner by different travel modes. By applying MMCA in two city regions (Helsinki in Finland, and Tallinn in Estonia), we show that there exists clear discrepancy between the distribution of the most central areas in the regions depending on the travel mode. Hence, the proposed approach is able to provide new insights about urban morphology and also detect differences in the orientation of the transportation system. Furthermore, our analyses demonstrate that by combining the multimodal centralities with different datasets (such as socio-demographic data) it is possible to retrieve valuable information about the performance of a city, or to estimate how equitable the city is from the transportation perspective in a systematic manner.



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## Air quality and freight transport in cities: A dynamic approach to measure the real impact

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Air pollution (PM, O<sub>3</sub>, NO<sub>x</sub>) is considered the largest threat to human health [1, 2]. A large share of these transport-related emissions is attributable to freight transport: only representing 14% of total traffic, it is responsible for 33% of traffic-related PM emissions in the Brussels Capital Region [3]. The associated external costs of air pollution are directly linked to the number of receptors (people in vicinity of the emission source).

Studies so far have only considered the static link between the presence of the emission source and the number of its vicinal receptors (often home location-based), thus making abstraction of individual travel patterns [4, 5]. To our knowledge, combining both dynamic receptor densities and freight transport emission sources is novel [6].

This study highlights the impact of freight transport-related PM and NO<sub>x</sub> levels in the Brussels Metropolitan Region (BMR) applying the impact-pathway approach [7], combining both the receptors' and emission sources' geotemporal dynamics. Dynamic receptor densities were obtained from mobile service provider data [8, 9]. Spatiotemporal emission levels were derived from the TRABAM freight transport model, enveloping vehicle-, road-, traffic-dependent emissions [10]. The emitted and dispersed pollutants and number of receptors were connected using dose-response functions [11, 12] based on UZ Brussels hospital data. Results were compared to the conventional static methodology.

On local-level analyses, this dynamic vs. static comparison revealed large discrepancies in freight-transport-generated external costs (PM, NO<sub>x</sub>), up to a factor 45. Especially higher external costs were observed in the inner city during peak hours. These findings therefore suggest the proposed dynamic methodology should be used in micro-scale air pollution analyses. Notwithstanding these micro-level differences, it's worth noting the overall difference is negligible when applied to the entire BMR (0,5%), supporting the conventional static approach on meso-/macro-level. To allow generalizable statements on this subject, further research is needed.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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This work has been submitted as journal paper to:

Mommens, K., Brusselaers, N., van Lier, T., Macharis, C., 2019. *The impact-pathway approach in agent-based freight transport modelling; a case study for Brussels Metropolitan Region*, *Journal of Cleaner Production*

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## **Environmental and energy effectiveness of an urban freight distribution model, based on cohabitation between passengers and light goods in proximity rail transport, and last mile distribution integration with green vehicles (RailCarPack)**

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This paper deals with the study of an intermodal transport model of light goods. The model considers that goods share existing intercity services of passenger rail transport, and the last mile distribution of urban cargo using non-polluting vehicles. The proposed model will be applied among urban areas with the following characteristics: significant commercial activity, active rail connections linking surrounding regions or populations with productive activity whose products are commercialized in the big city. The objective is to analyze from an operational, technical and economic standpoint the viability of this model that allows offering the service, and to reduce globally the costs of transport operations, while providing important environmental advantages.

In the proposed transport model, the study of logistics operations, the technology to be used and the costs at each stage of the distribution process will be addressed. The demographic, commercial and accessibility study of the regions and populations near the railway line selected for the analysis will be carried out. A logistics operation model will be proposed for the last mile freight distribution. This model will be applied in several scenarios, in order to comply with operational and commercial requirements, and thus optimizing distribution costs. In addition, a comparison between the current and proposed model will be carried out to analyze the cost savings and the reduction of environmental impact.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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## **New mobility services in new residential areas: Challenges and opportunities of measures for sustainable urban mobility**

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Neighbourhood-based mobility services (such as car sharing for residents, bicycle rental systems, mobility stations) are currently being discussed in science and practice as new and alternative forms of urban mobility. Alternative mobility services are often considered to have the potential to promote modes other than motorised private transport, relieve infrastructures, and achieve cost advantages in housing construction which can directly affect rents. When combined into an integrated mobility concept, such services can support space-efficient land use and sustainable transport and, ultimately, the well-being of the inhabitants of new residential development.

In our contribution, we want to present and discuss neighbourhood-based mobility services considering the following questions:

- Which different mobility services and measures exist to foster sustainable mobility in residential areas?
- What challenges and opportunities are related with implementing mobility services in residential areas?
- What are the potential impacts of mobility services on transport and space-efficient land-use?

We present experience and assessments of three stakeholder groups involved in the implementation of mobility services in new residential neighbourhoods: public administration, housing companies and private planning offices. The results are based on a case study in a new residential area at the outskirts of Berlin, Germany, and a Germany-wide expert survey with around 200 participants.

The findings show that a wide range of measures in different action fields, including public transport, sharing mobility, logistics, and information is necessary to enable residents to be mobile without their own car. In the view of the experts, the development of cycle paths and cargo bike sharing contributes most to traffic reductions. Furthermore, reducing car parking space is assessed to have the highest positive impact on space efficiency.

With our contribution we want to discuss how neighbourhood-based mobility services can contribute to sustainable urban mobility, space-efficiency and thus the well-being of the inhabitants.

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## **Fixing the number of vehicles and/or setting a tax for ride-hailing? Insights from a social welfare maximisation approach**

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The regulation of ride-hailing companies has been a topic of heated debate between policy makers, practitioners and researchers around the world. A perceived increase in traffic or the need to raise funds to support sustainable mobility initiatives have usually been put forward by city officials as a way to justify special taxes for ride-hailing or caps to the number of ride-hailing licences operating in a city. As examples, we can mention Washington D.C. with a special 6% tax on Uber and similar apps, in order to support public transport improvements; Sao Paulo, which since 2017 charges a fee per kilometre to ride-hailing companies, with discounts for female drivers, off-peak periods and pooled rides; and New York, which apart from setting a tax, has decided to temporarily fix the number of ride-hailing licences during 2018.

In this context, a relevant question is understanding if ride-hailing supply controls, by quantity and/or price interventions, are sensible ways to proceed by policy makers. In this paper, we present a social welfare maximisation model in which we study the problem of finding an optimal value for the number of ride-hailing vehicles and/or the optimal tax per trip. The model is sensitive to both the social benefits of ride-hailing (user benefits in terms of convenience, travel time) and the social cost of ride-hailing (related to traffic externalities like congestion and pollution). We find the conditions under which it is optimal to set a price per trip larger than the price that maximises private profit, and also the conditions that would make beneficial to fix the number of vehicles in service. Results are illustrated with numerical applications and discussed under different scenarios regarding demand sensitivity to trip characteristics, social valuation of external costs and other relevant parameters.

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## Planning a high-frequency transfer-based bus network: How do we get there?

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As cities have grown more dispersed and auto-oriented, demand for travel has become increasingly difficult to meet via public transport. Delivering high-quality bus service in this challenging environment has recently brought attention to bus network redesign. Commonly, bus networks are designed with a door-to-door approach, which often entails a circuitous route design leading to slow and infrequent service, especially in the suburbs. Alternatively, high-frequency transfer-based networks have been promoted as the optimal network design both for promoting ridership and operational efficiency. For cities wishing to adopt such a bus network design, there is presently no comprehensive methodology for transitioning to this network model. For that reason, this study presents a methodology to guide public transport professionals through the process of redesigning an existing door-to-door low-frequency network to a transfer-based high-frequency service, using Longueuil, a medium-sized Canadian city as a case study. A variety of data sources that capture regional travel behaviour and network performance are overlaid using a GIS-based grid cell model, to identify priority corridors for high-frequency bus routes. The frequency of the proposed high frequency network is then decided with a constraint that all buses will operate with a 10 minutes headway or less using the exact number of buses that are currently used in the region and will cover the same service area to ensure a fixed operating budget. To quantify and communicate the impacts of the proposed network redesign, changes in travel time and accessibility to jobs are calculated and the network redesign is revisited to cover any gaps or decline in accessibility. This methodology provides public transport agencies with a flexible and reproducible guide for designing a transfer-based network, while ensuring that such a network overhaul maximizes the number of opportunities that residents can conveniently access by public transport and does not add an additional burden to an agency's operating budget.

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## **Analysis and modelling performance of the airport landside access transport modes and their systems**

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This paper deals with an analysis and modelling performance of the airport landside access road- and rail-based transport mode and their systems. These connect the airports and their catchment areas. The systems of the road-based mode are individual vehicle(s) - car(s)/taxi(s), and bus. The systems of the rail-based mode are tram, light, conventional, and high speed rail. The infrastructural, technical/technological, operational, economic, environmental, and social performance is considered. The infrastructural performance embraces geometrical characteristics of the roads and rail links connecting airport(s) and its (their) catchment (area). The technical/technological performance embraces the characteristics of vehicles and supporting facilities and equipment of particular systems. From the supply side, the operational performance includes the transport service frequency, transport work, technical productivity, and required vehicle fleet size. From the demand side these are the volumes of user demand (air passengers, airport employees, and others), and the quality of service characterized by the schedule delay, travel time, reliability, and punctuality of services. The economic performance relates to the operational costs and prices of transport services. The environmental performance embraces the energy consumption and emissions of GHG (Green House Gases), and land use. The social performance includes noise, congestion, and safety (i.e., traffic incidents and accidents).

The analysis of these performances implies elaboration of their current state at the airports of different size - small, medium, and large. Modelling implies development of the analytical models of indicators and measures of particular performance and their application to the selected airport case(s). These are the taxi system of the road-based and the AirTrain JFK of the rail-based mode providing accessibility of the JFK (John F. Kennedy) international airport (in Queens) from/to its catchment area - the New York City (USA).

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## Planning for elderly mobilities: How can car sharing aid the transition towards sustainable travel behaviour? Case of Oslo, Norway

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Demographic projections highlight that the fastest growing group is that of the elderly (65+). Though studies exist on travel patterns of elderly, no study till date has indulged into exploring how and why can car sharing become one of the most environment friendly and inclusive mobility option for the (urban) elderlies in the coming decades. We address this research gap in this paper.

Spatial planning in the urban areas of Norway has shifted towards (re-) densification in the last decade-exhibited through increase in high rise apartments near transit nodes, urban centers and in locations which are in close proximity of basic facilities like grocery, medical store, library etc. There is a parallel development which has occurred alongside – a vast majority of the elderly population, 65+ have sold their houses and moved to apartment blocks built near the transit nodes and urban centers. The reason quoted revolves around being in close proximity to basic facilities. This development operates in tandem with the national level policy on *Active Ageing* which clearly states that elderly population should reside in their own homes and care should be provided to them at their residences. The elderlies are offered a place in the elderly homes *only* when continuous monitoring and care is needed.

In this paper, we will highlight the travel patterns, needs and preferences of the elderly to plot the potential of car sharing for addressing their daily mobility needs. This is achieved through employing a combination of quantitative and qualitative data analyses. The quantitative data is generated by a web-based questionnaire survey, distributed by the car sharing service providers to their respective members. The survey was distributed in November-December 2017. The survey collected information on travel behaviour, preferences, life circumstances, mobility biography of the household, and further probed life-events possibly leading to car sharing.

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## MOBI-AGE: Promoting urban mobility in ageing populations

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Urban centres, especially the historical ones, are places where a greater number of elderly people are concentrated, both residents and visitors. It has been observed that neither the urban public space nor the transport system are adequate to the mobility needs of these groups. The project MOBI-AGE aims to do a bibliographical review on Urban Ageing and Ageing Healthy among other subjects and also study the adequacy of the urban space at the level of urban design and infrastructures and at the level of mobility and accessibility in the transport system, through the analysis of two case studies, in Coimbra and Oporto. It will study characteristics of resident elderly population, characteristics of the public space and characteristics of the transport system, identifying needs and failures. These processes will go beyond desk work, and will also have the objective of creating social innovation, by holding participatory and dynamic collaboration sessions with this population, assessing more precisely what their needs and aspirations are. A methodology for the diagnosis and classification of historical central spaces, particularly those that are the target of urban rehabilitation operations, will be elaborated from the bibliographical review and the evaluation work of the case studies, as to their suitability in terms of mobility inside the zones considered and between those zones and other zones of the city. This methodology should inform the future development of interactive information platforms, aimed at end-users of the space and not only for visitors, but also for residents, which will allow them to find solutions to their travel needs easily. In the end, a decision support system based on indicators and multi criteria analysis will be consolidated, together with a decision supports interactive platform. Representations on new target maps with target places and paths will be part of the information provided.

*Acknowledgements:* FCT-MIT Portugal - MITEXPL/STS/0065/2017.

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## **The effects of public transport improvements on travel behaviour, housing choices and property values – evidence from a Polish city with new tram network**

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Evaluation of the impact of public transport infrastructure is an important issue for local authorities e.g. for the justification of the expenditure. While a wide variety of approaches and methods can be found in the literature, simple indicators are among the most widely used methods. However, such indicators may not accurately reflect the actual impact of a transport project. Thus, in our study we tried combining different perspectives by looking at effects in terms of travel behaviour, housing choices and property values.

Olsztyn – a city with 173,000 residents – seems to be an interesting example for such investigations. In 2016 a new tram network was constructed there. Three lines are connecting city centre with the main travel destinations (train station, university campus, shopping malls, largest housing estates). For research purposes there were selected two housing estates located outside the city centre with an access to tramline. We conducted face-to-face questionnaire survey (more than 500 conversations) and asked inhabitants about their travel behaviours, satisfaction with the neighbourhood quality and potential housing decisions. What is more, we analysed also transactions in the local property market using hedonic pricing models and several apartments characteristics.

Our results demonstrate that accessibility is strongly linked with the frequency of public transport use. Most of inhabitants declared that they are more satisfied with their place of living among others due to good tram accessibility. However evidences flowing from transaction analyses were not so strong. New infrastructure did not influence apartment prices importantly – there were observed only weak correlations in our models. We could conclude that the use of different research methods and a broad view on the potential effects are important postulates in future studies on impacts of public transport infrastructure.

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## Modelling large-scale multi-modal accessibility impacts on residential property prices in a polycentric region

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This paper demonstrates a method for modelling the impact on house prices of multi-modal accessibility to employment over a large and polycentric region of the UK. The motivation for the work is to measure the value to citizens of accessibility to economic opportunities by different modes (rail, car, walk, bus) and assess the extent to which the value of improved accessibility, arising from a large-scale rail investment, can be ‘captured’ by the property market. The study uses a hedonic pricing model built with a large and spatially-detailed cross-sectional dataset containing over 165,000 observations, in an area covering 40,000km<sup>2</sup> and containing the urban centres of Manchester, Leeds and Liverpool, among others.

To model residents’ access to employment, a gravity model is specified, capable of representing the dispersed nature of approximately 10 million jobs in the region. The deterrence function is calibrated for each major transport mode (rail, car, walk) separately by combining population travel-to-work demand data from the UK census with detailed transport network performance data (generalised journey time including delay and crowding). A two parameter deterrence function is found to have a better fit to the data than the more commonly used Power or Exponential forms. The paper goes on to show how unique travel costs are calculated for up to 0.5 billion origin-destination pairs using a combination of local access (e.g. to and from stations), and modelled transport network performance.

In the subsequent hedonic regression, the fine spatial detail in the data makes it possible to overcome multicollinearity between the transport modes – a key achievement. There are significant findings on the value of walk accessibility as well as rail and car – all are positive but different. The paper concludes by discussing the implications both for transport investment and for spatial planning (including densification and transit-oriented development).

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## Modelling and valuing local-scale accessibility and place quality using hedonic pricing methods in the housing market

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This paper examines the impact of local-scale accessibility and place quality on citizens' lives and wellbeing through the lens of housing market price data. The central questions addressed are: to what extent do people value accessibility to local facilities and amenities within their neighbourhood – as distinct from wider regional accessibility? how do they value accessibility to shops, healthcare, other services, schools, parks, playgrounds and other greenspace? how do people weigh up proximity versus quality – for example in local schools? and how do these values compare with other factors in the quality of a place to live – e.g. environmental quality (air quality and noise exposure) – and accessibility to employment, which is found to be a major factor in the paper by Leahy et al. and in previous studies.

The paper covers a very wide range of attributes. The data used is a large cross-sectional dataset with over 165,000 observations of residential sold prices and all the independent variables at the finest spatial detail available. The model covers the North of England, an area of 40,000km<sup>2</sup> containing the urban centres of Manchester, Leeds and Liverpool, among others.

Alternative formulations of accessibility to local facilities are tested, and we compare the results: we find that a deterrence function similar to that found in the gravity model of regional accessibility is often appropriate. The results show that accessibility to local facilities and place quality have substantial value – at least as seen through the property market – and are comparable in scale with the value of wider regional accessibility. Finally we consider which elements of value may not be well represented in the housing market (including value to social-renting tenants). There are some surprising distributional findings – which suggest that policy may need to actively address the quality of place and amenities in low income communities.

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## Estimating the origins and destinations of social media users for mobility studies: A critical comparison of measuring techniques

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Social media provides new possibilities for studying human mobility patterns. Geotags, timestamps and content from social media offer new perspectives about the movement, activities and preferences of people. Knowledge about the origins and destinations of people, either at a country, regional or neighbourhood level is essential in spatial analyses about people and the society. For example, it is useful to separate tourist from locals in urban studies and tourism research. Different techniques have been proposed to extract information about people's origins from social media data. However, there has been little attention given to the reliability of the applied techniques in the current literature.

This research aims to fill this gap by systematically evaluating different measuring techniques in determining home locations of social media users at different spatial and temporal scales, and by critically addressing the merits and drawbacks of each method. The compared techniques are based on social media content, geotags, timestamps and user information. We apply the measuring techniques on geotagged Instagram and Twitter data sets, which contain posts from users who have visited our study area during a one-year period, and the global posting history of these users. We compare the results retrieved from different methods to official visitor statistics of the case study area. Furthermore, we have manually assessed home locations for a sample of users to validate the applied methods.

Finally, we assess the applicability of the best technique against official national statistics of foreign tourists in the case of Finland. In addition to a methodological contribution, this work addresses the spatial and temporal biases inherent in social media data and discusses how to consider and handle these biases in research.

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## **The residents' perception in Gran Canaria: A mature mass tourist destination**

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Mature tourist destinations like Gran Canaria need to reinvent themselves as tourism is becoming an important industry throughout the world because many countries nowadays are developing this industry as a way to improve the quality-of-life of the local residents. Nevertheless, tourism is not exempt of important negative externalities that affect the quality-of-life of residents increasing the awareness in the best of the cases or even the hostility towards tourists. For this reason, local and regional governments need to measure the impacts of tourism, both positive and negative, from the local residents' perspective. This study analyzes the local residents' perception on tourism highlighting the key drivers of the residents' perceptions on tourism using a logit-ordinal model in order to better understand the how the critical perception is formed in an industry whose importance in the economy of the island is crucial. We extract and comment the main key drivers as well as other varied nuances and third variables involved. The study sheds some important insights which can be considered an interesting contribution for the understanding of the residents' perception on tourism which is a complex, diverse and multi-faceted phenomenon. As said, a logit-ordinal method was applied to a sample of 504 local residents in Gran Canaria. Contributions to the body of knowledge and policy implications are discussed. A future research agenda is given.

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## Tourism, smart specialization and well-being

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Assuming that the impacts of tourism on economic performance depend on the interconnections with other economic activities, in particular those related to the creative sectors and ICT, this work analyzes the relation between tourism and well being of the resident population, by using a panel data econometric model. While analyzing a relatively long period (2004-2017), with phases of growth, recession and recovery, the results of the model allow for the identification of different levels of regional socio-economic resilience.

The level of analysis considered in this work is the region (NUTS 2). These regions can be heterogeneous, often including several destinations, but they are adequate for the purposes of this research considering institutional aspects such as the existence of organizations with responsibility for tourism management and economic development (including the regional innovation strategies), which allows for the formulation of policy recommendations. Thus, this analysis focuses on the role of tourism within broader regional economic development strategies, rather than destination management.

The work includes a literature review (Section 2) focused on the concepts of Tourism-Led Growth (2.1), Smart Specialization (2.2) and Resilience (2.3), preceding the presentation of a panel data econometric model (Section 3). The results are presented in Section 4 and Section 5 concludes, synthetizing the main contributions and limitations of the analysis, while opening new research opportunities.

The main expected result of this analysis is the identification of the different impacts that diverse strategic options related to the priority of the tourism sector and its different relatedness with other economic activities within regional innovation strategies generate on the well being of the resident population, expressed in terms of economic growth, development and regional resilience.

## **Navigability – the forgotten dimension in public transport network overhaul assessment**

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Public transport network overhauls, with the aim of increasing public transport ridership and more efficient operation are implemented in many cities worldwide. Complete or partial network overhauls are considered when demand patterns has changed, new modes have been introduced or when incremental changes are not deemed sufficient to meet the future requirements. Overhauls are typically planned to create a clearer hierarchy in the network, with a high frequency trunk network complemented by less frequent routes offering coverage. While the main aim is to improve the service in locations with high demand potential, a further goal is to make the public transport network structure easier to understand, that is, more navigable.

However, due to lack of suitable methodology and performance measures, navigability has remained a neglected factor in public transport overhaul evaluation. In this study a methodology for user-centric navigability measurement is presented and implemented. Navigability is measured as the variations of the available route options between origin and destination. Pareto-optimal route alternatives are generated using open schedule data. The Pareto-optimality is determined based on departure and arrival time and the number of transfers. The measures are intended to describe the complexity public transport users face when planning their trips and selecting a suitable route alternative.

The methodology is applied to the public transport overhauls in three cities: Amsterdam, Helsinki, and Houston, implemented years 2014-2018. These case studies are performed as before-after comparisons. The results indicate a clear link between the changes in network topology and navigability. Furthermore, the study increases the understanding of measuring navigability in public transport networks and offers policy recommendations on navigability based on the results of the implemented overhauls.



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## Making the connection: how emotional responses to transit environments effect navigation

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As we move through the cityscape, we are making navigational decisions that help us get to our intended destination. In order to make our journeys understandable, we interact with our surroundings in a way that allow us to recognise the complex environment around us, and helps us create a personalized path to our destination. The act of navigating is ingrained in daily life, and the more that one performs that act, the more automatic the act becomes (Montello, 2005). Individuals who travel the same public transit routes every day, tend to perform these tasks “without thinking” of the navigational choices they have to make.

It is only when a change happens in one’s daily routine that one is required to make different navigational choices. It is at these key moments of unfamiliar mode-transferring that quick navigational decisions are crucial and where many individuals begin to rely on both their intuition and wayfinding devices for solutions (Downs and Stea, 1973; Scollon and Scollon, 2006). If a user perceives an environment to be too complex, or that it lacks navigational cues, this can have an impact on their route and even mode choice (Gärling et al, 1983).

Making public transit more accessible can foster a sense of sustainability through environmental and social practice. One initiative to help improve accessibility is by removing the anxiety, confusion, and stress of transit-related navigation. In order to better understand what causes these emotions, a qualitative method, such as a Destination-Task Investigation (DTI) used in this study, helps to identify a user’s experience while navigating, how environmental characteristics elicit certain emotional responses in their navigational decisions, their reliance on their mobile phones, and how their perception to certain navigational challenges impacts their route choice. The DTI involves recorded first-hand experience from a participant as they navigate through an unfamiliar transit environment, followed by an interview focussing on their decision-making choices while transferring between modes.

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## Wayfinding for e-bikes: Assessing e-bike users' experiences with wayfinding along a bicycle highway in the Netherlands

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In recent years, technological improvements and the wide-spread availability of electrically assisted pedal bicycles (e-bikes) have made it easier for cyclists to travel for longer distances compared to trips made using traditional non-motorized bicycles. In many regions, e-bike adoption is on the rise, and regional planning bodies have begun designing infrastructure and policies that support the continued adoption of this relatively higher-speed, and therefore often farther reaching, sustainable mode. Bicycle-highways are an example of infrastructure that is designed to support higher speeds with fewer stops between nodes, thereby facilitating the use of e-bikes for commuting. While recent research has focused on e-bike adoption, policy, and technology, little is known about the influence that wayfinding has on how e-bike users experience bicycle highways.

Using qualitative analysis including field observations, ride-along videos, and semi-structured interviews, the present study assesses e-bike users' opinions and experiences with wayfinding signage along a pilot bicycle highway route located between Tilburg and Waalwijk in the Netherlands. In the summer of 2018, base-line observations and interviews were administered with twelve e-bike users who were unfamiliar with the route to assess their experiences with conventional signage for cyclists before changes were made to the wayfinding system. Follow-up observations were held in the fall, after the installation of two new pilot wayfinding systems that were specifically designed to accommodate e-bike users. Initial findings suggest that the changes made to the location, size and clarity of the signage improve cyclists' overall experience. Specifically, it became easier for e-bike users' to navigate the route, their overall travel related stress decreased, and several participants' perceived shorter travel times.

Policy makers and transportation planners are likely to be interested in the results of this study as they reveal how specific improvements to wayfinding along bicycle highways not only help improve navigation, but also positively influence e-bike users' perceived distance, comfort, and stress.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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## Sensor-based analysis of bike lane quality

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Riding a bike poses a number of risks. These include the condition of the road or bike lane. Driving on “rough surfaces” or potholes might have a negative impact on travel experience and safety. Especially when goods are transported on a bike, a flat surfaced route is beneficial.

We analyze the surface conditions of selected bike lanes and streets using data collected with smartphones. All the tools to collect and process our data are open source. Utilizing the smartphones linear accelerometer sensor, we record a time series of geotagged three-dimensional acceleration data. This acceleration data is processed to deliver a representation of the comfort (or the lack thereof) of a bike ride.

To test and validate the process we track a selected bike route throughout the city of Augsburg shown in figure 1. Data points are recorded with the Vieyra Software app “physics toolbox”, which registers selected sensor inputs. The track time is about 12 minutes, in the old part of Augsburg. Here we find some uneasy bike lanes, which lead along cobblestone streets. The raw data contains time-sampled acceleration values and is therefore processed as a time discrete signal. Since “roughness” of cycling paths is perceived as the intensity of up and down movements, we use the acceleration data perpendicular to the direction of movement. Whether the acceleration is going “up” (negative domain) or “down” (positive domain) does not matter for modeling the process. Only absolute values are considered. For the initial test track session, the app delivers 57744 samples. Cleaning and processing the data, results in a test dataset with 3941 samples, about 5 samples per second, including 484 unique geotags. Each geotags includes an accumulated average value of the “up and down” movements.

Trajectories derived from these measurement gives an indication about the surfaces (e.g. cobblestone), on which the bicycle is moving. Furthermore, some events that are recorded as shock movements, like driving through a pothole or over a high curbside. Based on these measurements we can derive information about the quality of the routes taken and summarize these into a Happy-Bike-Index.



*Figure 2.* OSM basemap & test route summarized into a Happy-Bike-Index; blue points indicating potholes or high curbsides

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## **Boosting Starter Cycling Cities: Strategies and support to foster sustainable transport planning**

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The transition of cities to the human scale endorses the recognized process of mobility paradigms' change towards sustainable modes of transportation and car-free development. Despite the increasing acknowledgement of the bicycle's potential for mitigating the transportation system's externalities and satisfying the competing range of economic and social goals as well as, Starter Cycling Cities are struggling to achieve an effective approach to bring about change. The dominant political scepticism and technical resistance emerge as the hardest challenges to overcome. Indeed, regardless of the global political discourse in favour of a modal change towards bicycle, the lack of cycling tradition and technical know-how in these cities spurs cycling planning strategies with timid incursion and less effective measures, diminishing the right political and social commitment to a real modal shift.

This paper presents supportive strategies for Starter Cities in reaching the next level of bicycle use, drawn on research conducted for the project '*BooST – Boosting Starter Cycling Cities*', which explores two tools under development as part of the 'Starter City Roadmap'. First, the assessment framework of the Gross Potential for Cycling (GPC) provides the spatial visualization of the baseline conditions for bicycle use in any city with limited or no cycling strategies in place. Second, the selection framework of mobility management measures provides guidance in the decision-making process, identifying measures for promoting cycling best suited to starter cities contexts and tailored to their GPC.

The research involves local authorities in a number of selected Portuguese municipalities, contributing to the current mobility transition debate and how to reorient planning practices and urban planner's attitudes towards the bicycle, from the specific perspective of starter cycling cities instead of approaching them from the lens of champion cities.

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## Channeling the human element to design our future streets

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Urban streets are a canvas upon which transportation modes etch their tracks into the surface over time. Technology's influence on future etchings is inevitable. As electric vehicles, autonomous cars, 'for-hire' cars, electric scooters, and more arrive on our city streets, an intense design challenge emerges. The role of human-centered movement becomes uncertain next to machine-centered movement.

Transport innovations have literally rolled through cities in the last two centuries. Despite these changes, a steadfast way of moving around town—the bicycle—endures, and is growing. The human-centered movement of bicycling can serve as a North Star for urban street design. Importantly, bicycles are a liminal mode—fast yet human-centric, they bridge the competing forces of modern cities and their transportation.

Cities of all sizes are struggling with how to redesign roadways; they benefit from having a path charted through the transport revolution by drawing on new research showing what works for bicycle travel and why. Building on proof-of-concept work in Boulder, Colorado, Amsterdam, and Medellin, I first present a diagnostic tool to assess cities' transport networks and analyze characteristics of urban form to diagnose the potential for bicycle-centric places. Are destinations close enough to one other? Answers to these questions are by examining the city's morphology—focusing on its built form, grain, network structure and land forms.

Second, I identify corridors where design interventions will likely increase cycling and pedestrian safety, using theories about predominant transport flows. These corridors target (1) trips for school-age children, (2) trips to access neighborhood services, (3) recreational trips, and (4) the first and last stage of trips using long-haul mass transit. Enabled by this framework, cities can experience how small successes coalesce to create substantive gains. They can use it to forge a clear and human-centered path through the haze of a mounting transportation revolution.

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## Lessons from a driverless bus service deployment on public roads in Stockholm

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Two automated ten passenger bus were deployed on public road in Kista, Stockholm from January to June 2018, in a service connecting Kista metro station with a business area. The service was free of charge and open to public. The service was used by more than 10000 passengers and logged more than 2000 km. This project is a first step to understand the challenges of deploying a shared automated buses (AB) from technical, societal, user and system perspectives. This knowledge has since been used to deploy a new, more comprehensive service in Stockholm.

This presentation focuses on the lessons learned from:

- operation of the AB service
- users' reactions towards the AB service, in particular: a) willingness to use and willingness to pay (WTP) and b) reaction of other road users to the AB running on the mixed traffic road space.

The results are based analysis of operational data, LIDAR data, and a three-waves panel survey among more than 500 users. The survey was designed to capture the longitudinal changes of attitudes, acceptance, and expectations of commuters and residents toward this new public transport service. A series of psychological questions, which are derived from Modified Theory of Reasoned Action, were deployed.

Selection of results:

- Respondents, and in particular those familiar with automation technology, tend to perceive riding the AB without steward onboard to be unsafe.
- Respondents are willing to pay more when they perceive the AB customer service to be good. Females 25 to 64 years old and with high income has high expectations on the customer service, and did not perceive that the service on the AB to be good enough.
- Safety and customer service significantly influence WTP. Such safety perception is primarily based on personal safety in terms of possibility of being a victim of a crime.

*Acknowledgments:* This project was funded by Drive Sweden and ITRL - the Integrated Transport Research Lab at KTH. We also would like to thank Nobina AB who granted the authors access to the "Autopiloten" project.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

## Activity-based accessibility for measuring shared mobility impacts

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Autonomous vehicle (AV) technology is under constant improvement with small-scale pilot programs underway in a few urban areas. Researchers and policymakers are demonstrating that shared mobility coupled with AV technology for autonomous mobility on demand (AMoD) service is a viable pathway for the delivery of better levels of service while reducing environmental impacts. Given these fast-emerging developments, there is an urgent need for methods to adequately quantify the economic impacts of new vehicle technologies and future urban mobility policy.

In this paper, we show how these large-scale impacts can be captured by the activity-based accessibility (ABA) measure, which takes advantage of the rich data and model outcomes of the activity-based model and the mesoscale agent-based traffic simulation frameworks. Using the state-of-the-art SimMobility simulator, we evaluate shared mobility strategies applied to a Singapore micromodel city testbed. A near future strategy of exclusive availability of AMoD service in the CBD of Singapore, and a further horizon strategy of the full operation of AVs island-wide in the absence of other on-demand services, were tested and evaluated. Our results provide insights into the income and accessibility effects on the population in the implementation of shared and automated mobility policies. We also demonstrate the performance of an on-demand service controller under various supply and demand conditions.

The outcomes indicate that while the island-wide deployment of AMoD service is more robust, the restriction of AMoD to the CBD along with the operation of other on-demand services does provide a certain level of benefit to segments of the population. We further establish the efficacy of the ABA measure, as these findings motivate the need for measuring socioeconomic impacts at the individual level. The work presented here also serves as a foundation for further policy evaluation in real-world urban models for future mobility paradigms.



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## Geography, culture and potential AV pathways and impacts: A comparison of Australia and the Netherlands

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Driven by rapid developments in ICT and in the automotive industry, autonomous vehicles (AVs) are expected to enter our cities within the next decade. While the impacts of AVs on travel patterns and traffic may be far reaching, the way in which the adoption of AVs will materialize, and the implications for social inclusion and personal well-being depend to a high degree on individuals' daily as well as longer-term travel decisions. Daily travel decisions concern the extent to which AVs will substitute other travel modes and whether the availability of AVs will lead to induced demand due to modal shifts toward AVs by populations who currently identify as both drivers and non-drivers. Longer-term decisions include whether to buy an AV, whether to subscribe to a shared AV system and the selection of work and residential locations.

Our study aims to investigate how people's daily activity and travel decisions would change in a hypothetical future when AVs are available to be owned, to hire for private travel (i.e. like a taxi) or to use as a shared service (i.e. like a bus). We compare the Sydney Greater Metropolitan Area with the Dutch Randstad and investigate how differences in environmental factors (i.e. population density, topography, infrastructure, and traffic), attitudinal factors (i.e. social norms, willingness to share vehicles, and technology acceptance) and agency (perceived control and self-efficacy) affect individuals' intentions to use AVs.

In anticipation of a survey that records responses to future AV scenarios, this paper reports the results of focus group meetings held in Sydney and the Netherlands, in which people's knowledge, expectations, attitudes and travel decisions regarding AVs were investigated. Particular emphasis is placed on how AVs will change travel behavior and activity patterns in these contrasting land use and transportation environments, and how this might impact social inclusion and personal well-being.

## Effects of residential urban environment, social networks and social influence on travel behaviour of university students

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The influence of urban environment on travel behaviour has been thoroughly studied in the last decades. Different urban characteristics change the relative costs of different travel modes, with urban density increasing congestion and reducing the attractiveness of the car, while simultaneously increasing the number of travel opportunities easily accessible by more sustainable modes such as walking and bicycling. While the effects of urban environment on travel behaviour is emphasised by most research, several studies have debated whether effects stem from residential self-selection. As people locate at least partly based on their individual travel preferences, it is reasonable to consider that people living in similar urban environments will adopt more similar travel behaviour patterns. This can contribute to the creation of social norms and the emergence of peer pressure effects, favouring the use of some modes in detriment of others. In this sense, the characteristics of the urban environment can contribute to the formation of control beliefs, change perceptions and the emergence of social networks supportive of specific behaviours. This study proposes a model framework to analyse travel behaviour focused on the influence of the urban environment and social influence. More specifically, the model framework will explicitly analyse the interactions between social networks, social influence, location characteristics, travel preferences and perceptions of peers, individual attitudes, and travel mode use frequency. To analyse these complex relationships survey data from university students of Lisbon and Copenhagen are used, and structural equation models (SEM) are applied to validate the framework where residential land use patterns are modelled endogenously to account for possible effects of residential self-selection. The model results support the hypothesis that land use patterns are able to influence social norms and create peer pressure towards certain types of behaviour. These results are then discussed in light of its policy implications.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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## **I know what you did last semester: Examining adaptation and travel behavior change among millennials short-term exchange students**

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The mobility behavior of short-term residents is a subject poorly explored in the literature. The vast majority of published research overlooks the contexts associated to where people come from and arrive at, while ignoring aspects related to the processes and motivations for spatial and mobility adaptation in the hosting place. Thus, this study aims at understanding the behavioral adaptation of short-term residents in a context of a transnational relocation. As a proxy for temporary residents, international exchange university students were chosen as they share relevant aspects, such as transnational relocation, education level, age range and the need to adapt themselves.

The data used comes from an online questionnaire answered by 298 international students from the University of Porto, between May and June of 2018. The questionnaire included several questions focused on students' previous and current behavior, perceptions and attitudes. They allowed the construction of latent variables related with: previous transport mode frequency use and travel habits; initial perceived difficulty in walking and using public transport in Porto; perceived level of service of public transport in Porto; navigation confidence in Porto; and perception of technology as a tool to help mobility. These constructs were built using exploratory factor analysis and later included in a Structural Equation Model to analyse the frequency of public transport use by international students.

The results showed that: (i) students who temporary relocate tend to change their travel behavior, decreasing the use of privately owned transport modes and increasing travel by public transport and by foot; (ii) perceptions about the transportation system, and consequently the willingness to use it, are strongly impacted by the easiness/difficulty that students face in the beginning of their stay; (iii) perceiving technology as helpful to move around influences the perception of spatial orientation and leads to more intensive use of public transport.

**Note:** Extended abstract available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

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## **Impacts of the built environment and travel behaviour on attitudes: Theories underpinning the reverse causality assumption**

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The importance of attitudes in the relationship between travel behaviour and the built environment has been the subject of debate in the literature for about two decades. In line with the Theory of Planned Behaviour, attitudes are generally assumed to be constant. However, it might be possible that attitudes can change via the built environment, both directly or indirectly through the impact of the built environment on travel behaviour.

This paper provides clusters of processes and mechanisms explaining such attitude changes, as well as related theoretical underpinnings. Furthermore, it reviews the literature in this area concluding that two explanations dominate: a change in attitudes due to new experiences which can be underpinned by learning theories, and a change in attitudes due to a mismatch between attitudes and behaviour which can be explained by the cognitive dissonance theory. The literature also suggests a few additional explanations, while we also suggest explanations which we did not find in the literature.

Finally, we present a research agenda for future research.

🏆 *Winner of the NECTAR PhD Award*

## Changing travel habits of electric vehicle users

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A transition towards electric vehicle use is connected to positive environmental effects. In most studies so far, it is believed that travel behaviour will remain unchanged after changing to an electric vehicle. However, travel behaviour changes might cause side-effects reinforcing or diminishing these positive effects.

In this in-depth interview study, 16 experienced electric vehicle users were asked to reflect about their travel and charging behaviour. In multicar households, the electric vehicle appears to be the preferred vehicle rather than the “second car”. Moreover, several interviewees indicated that they had purchased a second electric vehicle afterwards.

The hypothesis of stable travel behaviour after electric vehicle adoption does not seem to hold. Two-third of the respondents increased car travelling as an effect of electric vehicle adoption. The main reasons given were the low marginal cost and the fact that internal combustion engine vehicles are most polluting for short distances with a cold engine. As one of the interviewees formulated: “it is just so environmentally friendly cheap”.

A large-scale deployment of electric vehicles is likely to contribute to rebound effects causing increased energy use and increased congestion. By increasing the marginal cost of car use, this tendency to drive more might be tempered.

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 M3

**MoTiv research impact for promoting valuable urban travel experiences**

Yannick Cornet

 M4

**Field experiences and advice on co-innovating solutions to urban challenges**

Harri Paloheimo

**Note:** Extended abstract for marked abstracts are available at <http://www.nectar-eu.eu/nectar-conference-2019-schedule/>

**\*Note:** “GC” refers to general call for papers

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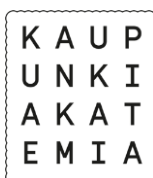
<b>Prof. Marie Delaplace</b>	Université Paris-Est Marne-la-Vallée, Observatory for Research on Mega-Events (ORME), France
<b>Dr. Frédéric Dobruszkes</b>	Brussels Free University (ULB), Belgium

*Special Session: Geopolitical changes and transport*

<b>Prof. Richard Knowles</b>	University of Salford, Manchester & University of Huddersfield, United Kingdom (Special session IGU)
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**NECTAR conference** is organized with a title “*Towards Human Scale Cities – Open and Happy*” to reflect the new requirements of urban transportation. This 15<sup>th</sup> NECTAR conference, organized in Helsinki 5<sup>th</sup>-7<sup>th</sup> June 2019, provides presentations by world-class keynotes Mikael Colville-Andersen and Professor Tim Schwanen, who approach human scale mobility from the viewpoints of a designer and a researcher. More than 140 scientific presentations explore advancements in the field of transport, communication and mobility, with a particular focus on good quality mobility options for people. The focus of the conference is urban transportation and the new possibilities that open data and digital technologies provide for mobility solutions and their research. Presentations provide food for thought concerning mobility choices and quality, new mobility solutions like MaaS, and policies that are implemented to support them.

Department of Geosciences and Geography C

ISSN-L 1798-7938

ISSN 1798-7938 (print)

ISBN 978-951-51-4922-0 (paperback)

ISBN 978-951-51-4921-3 (PDF)

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Helsinki 2019



UNIVERSITY OF HELSINKI

FACULTY OF SCIENCE