

NECTAR'26

Book of Abstracts



NECTAR (Network on European Communications and Transport Activity Research) is an international research network that brings together scholars and practitioners working on transport, communications, and mobility in their wider social, economic, and spatial contexts. The 18th International NECTAR Conference, held in Munich from 13–15 July 2026 and hosted by the Technical University of Munich, focuses on the theme “Planning for Urban Mobility Transitions in Times of Uncertainty.” Against the backdrop of climate emergency, energy scarcity, geopolitical instability, digital disruption, and growing public discontent, NECTAR 2026 invites interdisciplinary, practice-oriented, and theoretical contributions that critically engage with how mobility systems can be transformed under conditions of uncertainty. This Book of Abstracts is structured around the eight NECTAR clusters, which organize specific thematic sessions and reflect the breadth of NECTAR’s research agenda.

The table of contents is organized by NECTAR cluster, and within each cluster the abstracts are listed in alphabetical order using the presenter’s last name.

NECTAR’s eight clusters are:

Cluster 1: Transport Infrastructure Impacts and Evaluation

Cluster 2: Policy and Environment

Cluster 3: Logistics & Freight

Cluster 4: Urban Mobility Transitions

Cluster 5: Leisure, Recreation and Tourism

Cluster 6: Accessibility

Cluster 7: Social and Health Issues in Transportation

Cluster 8: ICT

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CLUSTER 01

Transport Infrastructure Impacts and Evaluation:
examining the appraisal and evaluation of transport
policies and projects in a multi-actor environment



Forecasting the modal share of future Aerial Cable Car projects. A case study in Manizales, Colombia.

Cluster 1

Cardona-Urrea, Santiago

Authors: Cardona-Urrea, S., Soza-Parra, J., Raveau, S & Ettema, D.

Aerial Cable Cars (ACC) are an innovative transit mode that has gained popularity for overcoming urban and topographic challenges. Latin America and the Caribbean (LAC) have been vital in the adoption of ACC as a transit mode, beginning with Medellín's Metrocable in 2004 and now including more than 33 operational ACC lines, rapidly evolving after 2010 across countries such as Colombia, Bolivia, Ecuador, Venezuela, Mexico, and Brazil, among others. Usually, ACCs in the LAC connect disadvantaged, low-income communities to broader transit modes such as Metro or Bus Rapid Transit (BRT), working as first- and last-mile connectors. These communities are usually established in hilly terrain with significant topographical challenges and are prone to natural hazards such as landslides. Besides, they are in peripheral areas of the city, which are more affordable but pose challenges to accessing essential opportunities such as employment and healthcare. On the other hand, some cities, such as Manizales (Colombia) and La Paz (Bolivia), have designed the ACC system to cover the entire city rather than serving as a feeder to the urban public transport system. These two ACC roles in urban mobility have led to different transport and social outcomes, with the feeder role having the most empirical evidence to date. This research aims to evaluate the impact of a new ACC line on modal share in Manizales (Colombia), a medium-sized Colombian city with an ACC system called Cable Aéreo, comprising three lines that reach a large part of the city and serve disadvantaged and non-disadvantaged neighbourhoods. We used revealed preference (RP) data collected in 2024, when two lines were operating, and the third was under construction, inaugurated in September 2025 and was a huge success, doubling ridership from 8500 to 19000 passengers per day. We estimated a nested logit (NL) model for commuting modal choice, considering walk, car, motorcycle, bus and ACC as alternatives. In addition, we included transport-related social exclusion (TRSE) variables as regressors, influencing the choice, calculated from a factor analysis. Finally, we examine the impact of new ACC projects using modal choice models, focusing on the third line as a case study. To do this, we forecast the city's modal share, including a new ACC alternative, to distinguish differences between the baseline and future scenarios. This enables us to identify the primary modal shifts and assess the transport policy in relation to various public policy objectives. For instance, we explored fare integration of buses and ACCs, allowing free transfers between the modes, and estimated the future modal share if this transport policy is implemented.

For instance, we explored fare integration of buses and ACCs, allowing free transfers between the modes, and estimated the future modal share if this transport policy is implemented.

United States High-Speed Rail: A Politics of Mobility Perspective

Cluster 1

Goetz, Andrew

Authors: Henderson, J.M.

We consider why, despite almost six decades of proposals, building high-speed rail (HSR) in the United States (US) has so far been a failure. Amtrak's Northeast Corridor (NEC) from Boston to Washington DC continues its slow incremental steps toward true HSR (operating speed over 250 kilometers per hour) but capital costs to achieve true HSR along the entire NEC are prohibitive. Optimism for HSR in California between San Francisco and Los Angeles has melted away in the face of rapidly rising costs and uncertainty over its completion. The private Brightline West project to connect Southern California and Las Vegas has potential for delivering the first true HSR in the US if it is completed. A "politics of mobility" framework is used to analyze historical and contemporary support for and opposition to HSR in the US. This framework puts political power at the center of understanding transport policy and considers the underlying ideologies, or worldviews, about what the scope of government should be in shaping transport policy. We find that economic and political support for HSR has been fragmented between and within the left progressive and global neoliberal groups while opposition has largely coalesced for both classical conservatives and right-wing populists. An in-depth analysis of California's HSR program reveals political and planning mistakes which have led to the project's uncertain future.

Power/knowledge: discourses on urban development and transport at Battersea Power

Cluster 1

Hickman, Robin

Authors: Hickman, R.

This paper examines the redevelopment of Battersea Power Station in discursive terms, seeking to understand the multiple socially-constructed realities associated with the project. In-depth interviews are carried out, with urban planners, transport planners, academics and residents, to examine the project in discursive terms, including the discursive formation, discursive practice, discursive meaning; and related concepts of truth, knowledge, power, ethics and subject. The analysis finds that the project is developed through a contested process, eventually to serve some interests over others, including using urban planning and infrastructure provision for capital accumulation, overlooking wider public policy goals. This includes relations of power to knowledge, concerning how the working procedures of urban planning and transport are revised to facilitate the implementation of developer-led planning. Broader implications for urban planning and transport planning practice are discussed, including how the disciplines may align more effectively with public policy

Counterfactual Urban Mobility Scenarios as a Learning Tool: Re-imagining Brussels' 1970s Traffic-Centred Rebuilding

Cluster 1

Keseru, Imre

Authors: Keseru, I.

Transport research often uses scenarios to explore possible futures, while transport historians look back at the past in order to learn from mistakes and successes. Sometimes, however, it is worth looking back at the history that did not happen i.e. developing and analysing scenarios in a historical perspective: what would have happened if ...? Such an analysis can shed light on the impact of historical trends and decisions and why such decisions should be avoided or repeated in the present and the future.

Counterfactual analysis compares real historical events with a world constructed with a historical distortion, a decision or an event that did not happen but could have realistically happened. Setting the real world alongside an alternative one lets the analyst reveal the consequences of that imagined shift (Gordon & Todorova, 2019).

This paper proposes counterfactual urban mobility scenarios as a learning tool that links retrospective analysis to forward-looking decision-making: by reconstructing plausible alternative presents, we can surface path dependencies, reveal hidden assumptions in past planning, and identify how to avoid repeating trajectories such as traffic-based planning.

The study focuses on large-scale proposals for rebuilding Brussels' city centre developed in the 1970s, during a period characterised by traffic-based planning that prioritised road capacity, grade separation, urban motorways and high-rise buildings proposing to build the "Brussels Manhattan". Only fragments of the plans were eventually built, but original plans, policy texts, drawings, archival photographs reveal a plan that could have tuned the centre of Brussels into a motorway-laced, high-rise business district, profoundly reshaping walkability, public space, and everyday accessibility.

From the analysis of this past evidence we define explicit "points of divergence" (e.g. plans for constructing two major European motorways through the city centre) and translate each into a set of parameters relevant for transport and urban planning reflected by street hierarchy, junction typologies, parking supply, pedestrian permeability, building density and heights.

We then operationalise these counterfactuals through AI-assisted visual scenario construction. Targeted prompts, constrained by a documented evidence base, are used to generate street-level images and short walkthrough videos (via ChatGPT-supported prompting and video generation tools such as Sora) of how current, well-known streetscapes could look like if certain decisions were taken in the past. To strengthen validity, we link historical sources to each visual

element. The visuals will then be evaluated by professionals in a focus group to identify possible inconsistencies, anachronisms, or distortions.

By creating such scenarios we aim to demonstrate a replicable method for producing, evidence-based counterfactual mobility scenarios; and demonstrate how immersive counterfactual visuals can support learning in transport planning—by making trade-offs legible (walkability, , safety, accessibility, and public space) and by enabling reflective discussion about contemporary and future policy choices. The results can contribute to enhancing participatory planning by demonstrating the potential consequences of policy and planning decisions on streetscapes that are easily recognisable for participants. Such an analysis could help cities avoid undesirable futures by confronting the futures they once almost built.

Reference: Gordon, T. J., & Todorova, M. (2019). Introduction. In *Future studies and counterfactual analysis* (pp. 1–9). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-18437-7_1

Integration between Transit Investment and Strategic Land Use Planning: Tram-Train's potential for helping to deliver TOD

Cluster 1

Knowles, Richard

Authors: Knowles, R.D., & Ferbrache, F.

Transport shapes space at local, national and global levels (Knowles 2006). At the local level, Transit-Oriented Development (TOD) is a widely adopted urban planning policy framework of mixed-use development clustered around mass-transit heavy rail, light rail or bus rapid transit stations and stops (Cervero 1998; Thomas et al. 2018). Mixed-use housing, employment, facilities and services in a TOD can reduce car dependency, enhance use of transit and active transport, and prioritise environmental and social well-being and improve urban sustainability (Knowles et al. 2020; Knowles & Nikitas 2025). However, although there are examples of successful Planned TOD, epitomised by Copenhagen's 1947 Finger Plan, there is often a serious mismatch between strategic land use planning policies and expensive rapid transit investment that often undermines TOD's objectives (Knowles 2021). An innovative and cheaper solution is to invest in hybrid Tram-Trains that are light rail vehicles that can operate safely on both heavy and light rail lines. This reduces the amount of investment required in new rail track by integrating existing heavy and light rail networks. Benefits can include, for example, extending train services onto tram tracks on-street into Central Business Districts.

The objective of this research is to examine the extent of synergy between investment in Tram-Trains and strategic land use planning and regeneration.

The research method is to identify all current Tram-Train systems, proposals and plans globally and examine their integration with strategic land use planning and regeneration schemes, focussing on five UK conurbations (South Yorkshire, South Wales/Cardiff, Greater Manchester, Tyne & Wear, and West Yorkshire) and three cities in Germany and Denmark (Karlsruhe, Kassel & Aarhus).

The results show that integration between investment in Tram-Trains and Strategic Land Use Planning can be a cost-effective way of facilitating TOD. However, there is often a mismatch between transit investment and strategic planning policies as they are frequently developed separately in 'silos' rather than as an integrated package. Better integration between them is needed to deliver more TOD and improve urban sustainability.

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Spotlighting collective and individual gains - Analysis and extension of wider economic benefits for bicycle infrastructure (WEBBI)

Cluster 1

Merz, Keke P.

Authors: Merz, K.P., & Loder, A.

Transport project appraisals and evaluations influence the scenario space where decisions on city-shaping policies are made. However, due to their decade-long development, they incorporate normative assumptions by practitioners as well as political and civil stakeholders. This leads to two challenges: Firstly, included benefits are selected based on their interaction with general car traffic, thus they may not cover all actual benefits and/or potentially underestimate them. Secondly, benefits have been vastly researched and quantified for historically dominant infrastructure (specifically car and high-speed rail), while similar considerations are lacking for (re-)emerging modes and innovative urban transformation concepts, such as cycling infrastructure, micromobility, or the x-minute city. Consequently, project appraisal methods for policy decisions may lack important benefit components which delays or even prevents cycling infrastructure projects, limiting their potential role in achieving decarbonization targets.

In this research project, we aim to clarify which cycling-focused wider economic benefits exist and are not usually considered, then build a coherent framework and apply it to a case study of Munich through simulation.

Firstly, we analyse present wider economic transport benefits in connection to selected Sustainable Development Goals (SDGs) and the benefits' inclusion or omission in political decision-making. The benefits are prioritised according to their mechanisms, relevance, and potential impact.

Secondly, the solution framework WEBBI (Wider Economic Benefits for Bicycle Infrastructure) defines and evaluates which and how benefit indicators can be measured and estimated. Additionally, it gives an overview which procedural requirements and methods are necessary for a case study application.

Thirdly, the WEBBI framework will be applied to a transformed city of Munich, evaluating its impact and policy implications. Munich will be transformed from its current state into a coherent cycling, walking and public transport city with the existing Street Network Manipulator (SNMan); the travel impact in the new network is simulated via MATSim. Then, WEBBI evaluates and discusses which benefits the simulated transformation may bring in context with the selected SDGs, cost considerations, stakeholder involvements and possible policy implementations.

As preliminary results, seven benefit clusters have been identified: Traffic parameters, emissions and pollution, health, physical environment, productivity, society, and infrastructural

cost. Literature review shows an immense potential for the detailed extension of health benefits that accompany more liveable streets, while negative benefits include a potential collision increase depending on infrastructure setup, cyclists' age and cycling experience, as well as a rent increase.

In conclusion, this study proposes the WEBBI framework to specify and extend wider economic benefits for cycling infrastructure. The Munich case study shows the potential benefits offering a more comprehensive picture and opening a scenario space for sustainable urban planning in practice.

Beyond Narratives and Maps: Using Virtual Reality to Communicate Transport Futures

Cluster 1

Tagliari, Valentina

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Participatory transport scenario planning is increasingly used to support strategic policymaking under conditions of uncertainty by incorporating public perspectives and expanding the range of future visions considered in decision-making. However, important challenges remain in how long-term scenarios are communicated to non-experts—typically through narratives, maps, and creative visualisations—which can hinder interpretation and engagement. This is particularly relevant in participatory planning contexts, where differences in perceptions and judgements may shape the appraisal of transport futures. Virtual reality (VR) offers additional potential by enabling immersive communication of long-term scenarios, although its effectiveness remains underexplored.

This research integrates VR as a communication tool for transport scenario planning, focusing on how immersive representations influence non-experts' perceptions of future transport conditions. The study examines which factors—and through which mechanisms—shape the interpretation of VR-communicated transport scenarios. A dystopian 2050 scenario for the Henares Corridor (Madrid, Spain) was translated into an immersive urban streetscape and experienced by sixty participants using head-mounted displays. Participants' perceptions of security, social equality, mobility conditions, public space quality, and retail and service provision were collected through questionnaires and analysed using generalised ordinal logistic regression models, complemented by qualitative insights derived from video-based observation.

The findings show that scenario perception is systematically shaped by individual factors (such as gender, age, mobility resources, public transport use, and present-oriented lifestyles), VR-related design elements (including traffic and noise levels, façades, sidewalks, ground-floor uses, and human presence), and interaction processes related to immersion, assessments of realism, and post-exposure recognition of problems. Rather than producing uniform interpretations, VR reveals heterogeneous ways in which non-expert actors perceive and translate abstract futures into lived experiences. Overall, VR is recognised as a promising tool to enhance participatory transport scenario planning by enabling more accessible, experience-based engagement with long-term transport futures. By supporting richer interpretations of scenario implications among non-expert actors, VR can contribute to more inclusive and reflective appraisal processes, complement existing evaluation approaches in transport planning, and support deliberation in multi-actor decision-making contexts.

Proportional Needs-Analysis (PRONA): an alternative to CBA and MCDA based on diminishing marginal returns

Cluster 1

te Boveldt, Geert

Authors: te Boveldt, G.; Boussauw, K.

Any substantial transport project requires balancing conflicting interests. Ex-ante evaluation, i.e., synthesising estimated effects into usable decision advice is therefore an essential component of transport planning. The challenge is how to aggregate diverse impacts into a single measure of societal desirability. The standard method in infrastructure planning, cost-benefit analysis, translates all impacts into monetary terms but disregards socio-spatial distribution and assumes that any ecological or social harm can be compensated by economic growth. 'Broad welfare' approaches, by contrast, either do not aggregate or use opaque weighting procedures. The question is how to aggregate transparently while considering the fair distribution of benefits and burdens.

With the aim to address these challenges we introduce a new method: Proportional Needs Analysis (PRONA). It expresses an intervention's desirability in how it addresses needs. The arithmetic principle is that the marginal value of a basic good (e.g. opportunities for employment, housing, leisure) decreases when abundant and increases when scarce, up to a boundary where the loss of one good can no longer be compensated by any gain in another. Accordingly, PRONA captures the value of an intervention based on the relative change it imparts to people's situation, expressed a logarithmic, diminishing-returns function. Impacts on individuals in precarious situations thus automatically receive greater weight. Based on prioritarianist ethics, PRONA thus allows integrating individual and planetary boundaries as well as pre-existing inequalities into a single measure of societal desirability. In our presentation we will demonstrate how PRONA deals with socio-economical-ecological trade-offs through various examples in transport planning.

CLUSTER 02

Policy and Environment: Transport and
Health Integration in a Sustainable Future



Governing Public Acceptability of Low Emission Zones Reinforcement in Madrid, Spain

Cluster 2

A. Soria-Lara, Julio

Authors: Lopez-Carreiro, I., Elizondo-Candanedo, R.F., López-Lambas, M.E., López-Arranz, A., & Soria-Lara, J.A.

Low Emission Zones (LEZs) have become a central instrument of environmental policy across European cities. While previous research has examined their public acceptability at the initial implementation stage, little is known about how citizens respond as LEZ regulations are progressively reinforced, or how heterogeneous population groups mediate these responses. This paper addresses this gap by analysing public acceptability of LEZ reinforcement through the identification of distinct citizen profiles, combined with participatory policy design.

The study focuses on the Madrid Metropolitan Area (Spain), where the LEZ introduced in 2018 has been successively expanded following a multi-ring model. Drawing on face-to-face survey data collected in 2024 (n = 1,697), the analysis first applies a dissimilarity-based clustering approach (Gower distance and PAM algorithm) to detect citizen profiles based on individuals' perceived mobility-related impacts associated with LEZ reinforcement, including travel time, costs, accessibility, autonomy, freedom, and overall mobility experience. The second stage employs a participatory policy design process, integrating expert workshops and semi-structured interviews to co-produce tailored policy packages for each group and to assess their suitability, feasibility, and implementation pathways.

The results reveal three distinct profiles with markedly different levels of support and vulnerability. Building on these insights, the paper formulates differentiated yet integrated policy pathways that combine regulatory, economic, technological, and behavioural instruments. The analysis highlights the importance of aligning financial support, communication strategies, and mobility alternatives with the specific characteristics of each profile in order to enhance perceived fairness, legitimacy, and policy effectiveness.

Overall, the study demonstrates the value of linking data-driven citizen segmentation with participatory policy design to support socially responsive LEZ reinforcement. The proposed framework provides actionable guidance for policymakers seeking to strengthen public acceptance while advancing environmental objectives and social equity in urban mobility transitions.

Integrating Health into Innovative Public Transport Frameworks: A Governance Analysis of Cross-Sectoral Mobility Planning

Cluster 2

Caicedo-Mafla, Angélica

Authors: Matamoros López, N., & Caicedo Mafla, M. A.

The integration of transport and health policies is increasingly recognised as essential for achieving sustainable and inclusive urban mobility. However, in practice, health considerations are often only implicitly addressed within mobility planning, frequently limited to the promotion of active modes, while broader physical, mental, and distributional health impacts remain insufficiently integrated into decision-making frameworks. This paper examines how innovative public transport planning frameworks can better incorporate health objectives through governance and policy design.

The paper builds on a conceptual framework for innovative public transport solutions, partially developed within the context of the SPINE project, which focuses on integrated public transport, multimodal hubs, digital tools, and coordinated governance. Using this framework as an analytical lens, the study assesses how health is currently embedded—or overlooked—across key stages of mobility planning, including goal setting, policy coordination, implementation instruments, and evaluation criteria.

The analysis identifies structural barriers to effective transport–health integration, including sectoral silos between transport and health authorities, misaligned policy objectives, and the absence of health-sensitive indicators within mobility planning frameworks. It further highlights enabling factors, such as integrated governance arrangements, data-driven planning tools, and proximity-based service planning, which can strengthen the alignment between mobility interventions and public health outcomes.

The paper argues that innovative public transport frameworks offer significant potential to deliver health co-benefits, but only if health objectives are explicitly embedded rather than assumed. It concludes by proposing governance-oriented strategies to systematically integrate health into public transport planning, supporting more equitable and health-positive outcomes in the transition toward sustainable urban mobility.

Understanding Pedestrian Safety through Fatalistic Traffic Beliefs: Evidence from Ghana

Cluster 2

Elias, Wafa

Authors: Elias, W., Sam, E.F., Odame, P. K.

Global and local traffic safety reports consistently indicate that pedestrians account for a substantial proportion of road traffic fatalities and injuries, particularly in urban areas where interactions between vehicles and pedestrians are frequent. While infrastructure improvements and policy interventions are essential for enhancing pedestrian safety, increasing attention has been given to human factors, including psychological characteristics and culturally embedded beliefs. Among these, fatalistic traffic beliefs and related superstitions may significantly influence how pedestrians perceive risk and respond to traffic hazards. Understanding such factors is therefore critical for developing effective safety campaigns and behaviourally informed interventions.

This study employed a quantitative research design to examine the moderating effect of fatalistic traffic beliefs on the relationship between pedestrians' risk perception and safe walking behaviour. The research was conducted in Accra and Kumasi, Ghana's two most urbanized cities, which experience high traffic volumes due to their commercial importance and intense daily activities. Data were collected from 1,060 respondents (Accra: $n = 516$; Kumasi: $n = 544$), representing adults aged 16–65 years who walk for at least 15 minutes per day.

Using structural equation modelling, the study investigated whether the association between risk perception and safe walking behaviour varies across different levels of fatalistic traffic beliefs. The results indicate that risk perception has a positive and significant effect on safe walking behaviour. Fatalistic traffic beliefs were found to have a positive direct effect on safe walking behaviour. However, the interaction between risk perception and fatalistic traffic beliefs was negative and statistically significant, indicating that fatalistic beliefs weaken the effect of risk perception on safe walking behaviour. Specifically, lower levels of fatalistic beliefs strengthened the relationship between risk perception and safe walking behaviour, whereas higher levels weakened this relationship, even when pedestrians perceived traffic risks to be high.

These findings suggest that fatalistic beliefs shape individuals' responses to perceived traffic risks, determining whether risk awareness leads to precautionary behaviour or behavioural resignation. Accordingly, pedestrian safety initiatives may be more effective if they segment target audiences based on levels of fatalism or related belief systems, allowing for more tailored and culturally sensitive interventions.

Exploiting the paradigm shift in healthcare provision to increase transport sustainability

Cluster 2

Jones, Peter

Authors: Jones, P.

There has been a long history of interaction between parts of the transport and health sectors. Initially this was a negative association with public health, particularly through poor air and noise quality and high collision rates from the growing use of motorised vehicles. This developed into a positive association between the transport and health sectors, with the former encouraging a switch from car to active travel (especially walking and cycling), with consequential positive benefits for public health in terms of improved physical fitness, reduced heart disease, etc. But these interactions had relatively little to do with promoting sustainability. While beneficial on many fronts, the uptake of active travel has only a modest impact on transport sustainability, since walk and cycle trips are short and a switch from car makes a limited contribution to reducing carbon emissions: in the 2024 English National Travel Survey, walking and cycling accounted for around 31% of all trips, but less than 5% of distance travelled.

Three complementary strategies are adopted for reducing transport carbon emissions:

- Avoid: reduce trip numbers and trip lengths
- Shift: from car to sustainable modes
- Improve: switch from fossil fuels to electric vehicles

Recently, most countries have encouraged the uptake of new electric vehicles, to varying degrees, including in their health sectors – but this does not address the problem of collisions and particulate emissions. There has been a long tradition of encouraging mode Shift at key attraction sites through developing Travel Plans or Mobility Management Plans, including at major health sites such as hospitals – but the suburban or out-of-town locations of many sites makes non-car travel unattractive. And Avoid has hardly been considered – few politicians are prepared to tell voters to travel less.

The EU SUMP-PLUS project has explored a recent major breakthrough in the English health (and social services) sector, with major implications for transport decarbonisation; this has involved a fundamental reappraisal of how services are delivered, with consequential opportunities to further encourage modal shift and to avoid some health and social care-related travel.

The paper provides several examples of cases where health care has been localised, or the routings of home care workers has been optimised – thereby reducing trip lengths and increasing opportunities to switch trips from car to sustainable modes. During and since COVID-19, many doctor appointments have switched online, thereby removing a trip entirely.

The recent publication of a new NHS strategy for the next decade has the potential to further strengthen the effectiveness of Avoid and Shift strategies, in particular:

- Localisation of health care, from large hospitals to local health care centres – reducing trip lengths and enabling shifts from car trips
- From analogue to digital – avoiding physical travel, or enabling specialist diagnosis and treatment to be delivered locally via the web
- From treatment to prevention – encouraging active travel as part of a national fitness programme

Now that many organisations are committed to decarbonising their Scope 3 transport emissions, the findings reported here have wider implications for a paradigm shift in other major trip generating/attracting sectors.

Integrated healthcare accessibility: Co-created connections between Dutch healthcare and mobility sectors

Cluster 2

Lenferink, Sander

Authors: Jakubickova V., Lenferink S., Bekius F.A., & Marchau, V.A.W.J.

Mobility and healthcare services are interdependent in shaping healthcare accessibility. However, planning these services in an integrated manner is challenging in practice. It requires mobility policies to give an attention to how transport services affect access to healthcare facilities, while healthcare policies must more explicitly consider the mobility implications of healthcare service provision. In the Netherlands, collaboration between healthcare and mobility sector to improve healthcare accessibility remains limited. To address this disconnect, this study aims to support the development of integrated healthcare accessibility policies in the Netherlands by fostering cross-sectoral collaboration. As a first step, we focus on the co-creation of a shared understanding of healthcare accessibility problems and the development of a joint future vision for healthcare accessibility in two Dutch regions, involving local healthcare and mobility actors. To achieve this, we employed a facilitated modeling approach that combines participatory system dynamics through Group Model Building (GMB) with participatory visioning informed by the Appreciative Inquiry (AI) cycle. GMB engages actors in jointly exploring and structuring problems, while AI provides a strength-based framework that emphasizes learning from existing successful practices and imagining desirable futures. Initial findings suggest that the facilitated co-creation process can support participants in recognizing interdependencies between mobility and healthcare that were previously overlooked. At the same time, the process reveals that both sectors still largely work in isolation, relying on different conceptualizations of healthcare accessibility, including its problems and potential solutions. For example, within the mobility sector, healthcare accessibility has been framed in spatial and physical terms, such as travel time, infrastructure provision, and network connectivity, while healthcare actors frame accessibility through service-related dimensions, including the availability of service, appropriateness, and affordability of care. These findings indicate that facilitated modeling is a promising approach for identifying logical connections between choices in the provision of mobility and of healthcare for a region. By making these connections explicit, the approach can support improved identification, prevention, and mitigation of healthcare accessibility deficits.

Can Digital Triage Avoid Travel and Improve Healthcare Accessibility? Evidence from a Chronic Kidney Disease Outpatient Pathway

Cluster 2

Mortezapoor, Sogol

Authors: Mortezapoor, S., Schutrups, F., Nijboer, F., Grigolon, A., & Geurs, K.

Healthcare systems in the Netherlands are under pressure due to an ageing population, staff shortages, and increased demand for chronic care. In addition, the Dutch healthcare sector accounts for approximately 7% of total greenhouse gas emissions, highlighting the importance of more sustainable care delivery models. These challenges require more accessible, resilient, and sustainable models of care. Within this context, digital care has emerged as a key strategy, offering opportunities to reorganize care delivery and avoid unnecessary patient travel. Digital triage pathways, which combine remote monitoring, digital questionnaires, and selective consultations, represent one such emerging approach.

This paper examines how hybrid outpatient care pathways based on digital triage influence patients' healthcare accessibility. First, we focus on differences between patients who use and do not use digital care. Second, we investigate how digital triage affects both actual and perceived accessibility to healthcare. The study is situated within a chronic kidney disease (CKD) outpatient pathway implemented at Isala Hospital in the Netherlands, where digital triage is integrated into routine follow-up care.

To address these questions, the study adopts a mixed-methods approach. The quantitative component uses anonymized administrative appointment data to compare users and non-users of digital care in terms of accessibility-related characteristics, including travel-related burden, spatial distance to the hospital, appointment frequency, and basic demographic variables. Descriptive spatial analyses are used to contextualize geographic patterns of patient distribution and access conditions. Linear regression models are used to examine differences in access conditions between users and non-users, while descriptive analyses are employed to estimate changes in actual accessibility through avoided physical visits and associated travel time.

The qualitative component consists of 33 semi-structured patient interviews aimed at understanding how access-related factors shape experiences with the digital triage pathway. Drawing on the concept of perceived accessibility, the interviews explore patients' subjective evaluations of ease, effort, comfort, control, and overall experience of accessing care, as well as the role of digital capabilities and support needs. The interviews are thematically analysed to identify access-related facilitators and barriers that cannot be observed through administrative data alone.

Preliminary descriptive results indicate that the digital triage pathway leads to substantial avoidance of physical hospital visits, resulting in considerable reductions in travel time for patients within the CKD outpatient pathway. Early findings also suggest that these accessibility gains are not evenly distributed across the patient population, pointing to the importance of spatial and organizational factors in shaping who benefits most from digital care.

The impact of accessibility to green and blue spaces on human mental health and wellbeing in advancing Green Care

Cluster 2

Otsuka, Noriko

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In many European cities, the positive impacts of Green Care on human health and wellbeing have increasingly been recognised. In the GreenME project – a Horizon Europe funded research, Green Care is defined as a way of conceptualizing different ways of engaging with nature that improve human health and wellbeing. In the conceptual framework of GreenME, exposure to nature is understood within a three stage continuum, which is strongly linked with people's accessibility to green and blue spaces (GBS): 1) nature in everyday life through walking and viewing GBS as part of people's everyday life; 2) nature-based health promotion by being engaged in organised nature-based activities such as walking or cycling in recommended routes; and 3) nature-based therapy as a therapeutic intervention administered by specialists which requires patients to physically travel to GBS where the treatment takes place.

The access to Green Care depends on the availability of GBS in the neighborhood, which is not evenly distributed among different societal groups. Furthermore, the accessibility to nature is significantly constrained by individual ability to travel to designated nature locations. Individual mobility constraints in terms of time, space and resources relate not only to the availability of cars and bicycles and access to public transport as well as their cost implications, but also the built environment physical barriers which impose further difficulties (e.g. distance from home to GBS, busy roads lacking pavements or cycling lanes, forced detour for pedestrians due to road traffic).

To identify the current state of Green Care and barriers to its promotion, this multi-country research project carried out interviews with Green Care actors who were categorized into three different roles: policy and decision makers, implementers and supporters in seven case study countries (Germany, Italy, Poland, Spain, Sweden, the UK, and the USA). Subsequently, an online survey across the ten case study districts in the seven countries generated over 6,000 responses regarding the quality of GBS in relation to their benefits for mental health and wellbeing. The survey targeted marginalized groups as defined by GreenME. These have fewer opportunities as other groups in society with a higher risk of poverty, social exclusion, discrimination and/or violence than the general population. The results from the interviews and the survey revealed that better accessibility to GBS is an essential factor when people seek opportunities to experience nature. For example, walking or cycling paths directly connecting neighbourhoods with GBS will attract more visitors, while a lack of accessibility hinders the usage of GBS.

The ultimate aim of the GreenME project is to empower Green Care actors and ensure the scaling-up of Green Care, in order to integrate it in health care systems to promote mental health and wellbeing equity. As the findings demonstrate the importance of improving the accessibility to GBS especially by marginalized groups, there is a need to develop inter- and transdisciplinary strategies positioning mobility as the cornerstone of progress in healthcare systems.

Towards Sustainable and Active Mobility: Stated Preference Evidence from Diverse Urban Contexts

Cluster 2

Shiftan, Yoram

Authors: Tenenboim, E., Glickman, I., Fyhri, A., Egner, L.E., & Shiftan, Y.

Promoting sustainable and active mobility (SAM) is central to mitigating contemporary urban challenges such as greenhouse gas emissions, congestion, and public well-being. Cities aiming to reduce these externalities and enhance physical activity among residents seek policy interventions that can influence individual travel choices. This study investigates how environmental personal norms (PN), health-related information, urban design measures, and additional factors jointly shape users' willingness to adopt SAM. Using an exceptionally large and diverse stated preference (SP) dataset collected across ten cities, a hybrid choice model (HCM) is estimated capturing the combined effects of travel attributes, perceptions, policy measures, and a latent psychological construct, on mode choice.

The SP dataset consists of 39,900 choice observations collected from 6,716 individuals across cities varying in cultural, climatic, and infrastructural characteristics: Ankara and Istanbul (Turkey), Bologna (Italy), Gabrovo (Bulgaria), Hamburg (Germany), Jurmala (Latvia), Lappeenranta (Finland), Las Rozas de Madrid (Spain), Nazareth (Israel), and Reykjavik (Iceland). An efficient experimental design was generated for the SP scenarios, systematically varying attributes such as infrastructure for cycling/walking, improved public-space lighting, and informational cues on calories burned and CO₂ emissions. Four indicators measuring environmental PN (reflecting internalized moral obligation toward sustainable behavior) were also incorporated.

HCM estimation results show that information on calories burned increases the likelihood of cycling and walking, highlighting the potential of health-based nudges to promote physical activity. Information on CO₂ emissions was found to decrease car use, illustrating how environmental framing can contribute to emission reduction efforts. Urban design interventions, including separated cycling lanes and pedestrian zones, increase SAM adoption, underscoring the importance of secure, safe, and comfortable environments.

Environmental PN emerge as one of the strongest influencing factors of SAM choice. Individuals with stronger PN show higher probabilities of choosing PT, cycling, and walking, suggesting that policies combining environmental messaging/campaign with infrastructure improvements may yield synergistic effects. The structural equation shows that environmental PN are more prevalent among women, middle-aged, higher-income, and higher-education individuals, and EV and bicycle owners. These findings underscore the need for targeted interventions to strengthen sustainability-oriented values, particularly where PN are weaker.

City-specific scale parameters highlight substantial cross-city heterogeneity. Cities such as Reykjavik and Lappeenranta exhibit more consistent and predictable choice patterns, while

Istanbul and Ankara show greater unobserved heterogeneity. Preliminary modeling of the individual cities was conducted to identify which city characteristics offer the most promising basis for segmenting the data; climate (cold vs. warm), cultural-geographic context (European vs. Eastern), topography (hilly vs. flat), and city size (large vs. small) were evaluated. Based on this assessment, two HCMs are estimated, for large and small cities, revealing differences in key attributes such as travel time, infrastructure, and PN. These findings emphasize the need to tailor solutions to local behavioral contexts.

Overall, this study provides one of the most comprehensive multi-city assessments to date of how environmental values, health information, and policy measures interact to shape SAM adoption. The findings offer actionable guidance for designing interventions across different types of cities to foster healthier, lower-emission, and more sustainable urban mobility systems.

For the kids: Mainstreaming Children's Mobility and Health in Norway's Transport Policies

Cluster 2

Tan, Wendy

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Transport policy is increasingly expected to contribute to public health. In practice, however, health is often reduced to generic active mobility promotion and to noise and air-pollution mitigation within residential areas. This framing pays limited attention to how transport systems affect diverse populations, including vulnerable groups.

Examining how children are considered in transport policy offers a litmus test of whether policies are inclusive and just, because children have limited formal political voice and depend on institutions to provide safe and healthy mobility environments. Children also face distinct risks from road traffic and environmental exposures. However, policy responses often emphasise safety training or fare subsidies as siloed, time-limited programmes rather than institutionally embedded approaches that shape infrastructure investment, planning regulations, standards, and everyday practice. Most responses do not account for the mismatch between the scale of health impacts associated with car-dominated planning on children and the extent to which they are represented in decision-making. Negative impacts on children extend beyond physical outcomes, such as traffic injury and fatalities, asthma, and sleep disruption, to psychosocial outcomes, including fear, stress, loss of independent mobility, and social isolation.

This paper examines how child-centred mobility and health considerations are institutionalised in Norway, a critical case given its unique national transport policy for children. Here, mainstreaming is understood as the systematic integration of a specific, cross-cutting issue, such as gender equality, climate change, or environmental protection, into all stages of policy-making, planning, implementation, and evaluation. In transport, mainstreaming becomes visible when children's needs are embedded in design and planning guidelines, funding mechanisms, and laws and regulations, rather than addressed only through stand-alone projects. By analysing national policies such as the National Transport Plan 2023–2033 (NTP) and local transport and traffic plans, alongside complementary multi-level programmes and behavioural change instruments such as Hjertesone, Beintøft, and Barnetråkk, the paper traces governance barriers and incentives shaping the mainstreaming of children's mobility and health. The analysis examines how children's mobility is prioritised and translated from the national to the municipal level, how coordination occurs across the transport and public health sectors and institutions, and which justice principles are reflected in these policy manifestations.

Conceptually, the paper combines institutional mainstreaming with epistemic justice and recognition justice to analyse policies, instruments, and programmes that centre children's health and mobility. Empirically, the analysis identifies planning and coordination arrangements,

stakeholder alliances, and participatory and knowledge-building tools that render children's everyday mobility legible to policymakers and planning practitioners. Critically, this paper also examines boundary conditions and "blind spots" in the alignment of transport and health policies for children, and draws comparisons with similar policies and programmes internationally. The findings contribute to understanding how transport-health sectoral integration can be produced through institutional design and policy pipelines for child-centred transport policy as part of sustainable mobility transitions, and they offer transferable lessons for policymakers seeking to be more inclusive and just.

The Health Impact of Local Traffic Interventions: Modeling Paediatric Asthma Reductions in European cities

Cluster 2

Vandeninden, Bram

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Urban transport is a primary source of nitrogen dioxide (NO₂), a pollutant associated with, amongst others, the development and exacerbation of paediatric asthma. While sustainable transport transitions often focus on decarbonization, their direct public health co-benefits require further empirical quantification to support policy integration. This study evaluates the impact of annual car-free Sundays, a real-world (local traffic) intervention, on air quality and the associated disease burden in Brussels and Paris.

Using a multidisciplinary approach, we analysed hourly NO₂ data and meteorological parameters from twelve reference measurement stations across both cities. We employed four distinct methodologies, including Random Forest and Boosted Regression Tree machine learning models, to decouple the effects of traffic reduction from meteorological variations. The results demonstrate that NO₂ concentrations during car-free hours (13:00–18:00) were substantially lower than on regular Sundays, with reductions ranging from 63% to 83% in Brussels and 27% to 56% in Paris.

Furthermore, we conducted health impact modeling using Exposure Response Functions (ERFs) to estimate the mitigation potential of expanding these local interventions to a permanent, daily scenario. Our findings indicate that such measures could prevent between 15% and 34% of paediatric asthma cases in heavily trafficked areas. This research bridges the gap between theoretical transport planning and actionable public health outcomes. It provides robust evidence for policymakers that large-scale local traffic restrictions in (sub)urban contexts can effectively bring air pollution levels below WHO thresholds, offering health and economic benefits by reducing healthcare utilization and school absenteeism.

Exploring the Health Benefits of Cycling in Academic Settings: A Pilot Empirical Study in Coimbra, Portugal

Cluster 2

Zargarzadeh, Mehrnaz

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Physical inactivity is a major global health issue, contributing to noncommunicable diseases (NCDs) such as cardiovascular diseases, type 2 diabetes, obesity, and certain cancers. The World Health Organization (WHO) recommends 75 to 150 minutes of vigorous or 150 to 300 minutes of moderate-intensity aerobic activity weekly to address these risks (WHO, 2022). Active travel, particularly cycling, offers an effective way to meet these guidelines without requiring additional time for structured exercise. Cycling not only improves physical health but also enhances mental well-being, reducing the risks of depression and other psychological conditions (Mosser et al., 2025).

The adoption of cycling for commuting is influenced by a variety of factors, including urban design, infrastructure, secure parking, and safe traffic conditions. Demographic factors, such as age, education, income, and family structure, also significantly shape active travel behaviors. According to the European Commission's Eurobarometer, 36% of Europeans now incorporate cycling or other physical activities into their routines at least once a week, reflecting growing awareness of cycling's health benefits (European Commission, 2022). Moreover, cycling helps reduce traffic congestion and emissions, contributing to environmental sustainability.

While factors like infrastructure and demographics are key drivers of cycling adoption, the interplay between these elements remains complex (Srivastava et al., 2025). Kroesen & van Wee (2022) present an empirical model that examines how infrastructure, personal awareness, and demographic factors collectively influence active travel behaviors and their associated health outcomes. Despite this, much of the existing research focuses on short-term interventions, leaving the long-term impacts of cycling, particularly in academic contexts, underexplored.

To address this gap, Health Promoting University (HPU) initiatives across Europe have successfully integrated physical activity, mental health support, and health education into campus life. Programs such as BeWell at Stanford University, Active Workplaces at the University of Queensland, and (kind)mind at the National University of Singapore have demonstrated positive effects on the well-being of students and staff (Tafireyi & Grace, 2024; Tobia et al., 2025). These initiatives emphasize the potential of incorporating active travel into broader campus health strategies.

This study, therefore, examines the long-term effects of the UCicletas program at the University of Coimbra, which provided low-cost bicycles to students and staff to encourage daily cycling over one year. Health outcomes, including body composition and cardiovascular fitness, were assessed every eight weeks, following ACSM and WHO guidelines. Cycling activity was tracked using onboard cycle computers, with self-reports verified by the research team. By focusing on

gradual behavior changes, this research aims to identify the key factors influencing cycling adoption in academic environments and evaluate its impact on health outcomes. The findings will offer valuable insights to promote healthier, more sustainable mobility options.

These findings highlight cycling as a practical, accessible, and sustainable way to improve public health. The study helps validate the hypothesis that cycling positively impacts health. Future phases will explore participants' perceptions, barriers, and environmental attitudes, providing deeper insights into long-term adoption. Disseminating these results is crucial in countries like Portugal, where active commuting remains low, particularly for daily trips.

Designing Equitable and Low-Carbon Urban Future: A Study of Cities in the Tel Aviv Metropolis

Cluster 2

Zukin, Alina

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The rapid growth and development of cities worldwide have increased the environmental burden of greenhouse gas emissions from urban mobility, creating an urgent challenge that requires strategic policy actions and integrated urban planning. However, detailed spatial-temporal analysis is limited. Most rely on city or regional emissions data, lacking neighborhood or street-level insights at different times. This makes it difficult to identify emission hotspots and targeted interventions. Furthermore, equity dimensions are nearly absent, as research often focuses on aggregate emission reductions without examining how policies affect different socioeconomic groups or whether policies disproportionately burden certain populations.

To address this gap, this research explores equity considerations in the design and implementation of future emission reduction scenarios for the Tel Aviv metropolitan area in 2040. Thus, we examine three socioeconomically and spatially distinct cities that differ in demographic composition, socioeconomic status, and functional roles within regional mobility patterns, thereby providing a representative cross-section of the metropolitan landscape. The study evaluates three policy interventions against a baseline scenario: (1) the implementation of Low Emission Zones (LEZs) to restrict private vehicle access, (2) an increase in urban parking fees, and (3) the expansion of cycling infrastructure.

To evaluate these scenarios, the study employs a high-resolution simulation framework that integrates SimMobility's activity-based travel demand model with Aimsun Next, a mesoscopic traffic assignment and network simulation platform, alongside an emissions estimation module. The integrated framework captures dynamic interactions between individual travel patterns, transportation infrastructure, traffic conditions, and resulting system-level outcomes at spatial and temporal resolutions. By analyzing demand at the individual level, the framework enables differentiated behavioral responses and supports an equity-oriented assessment of both mobility patterns and exposure to traffic-related pollution.

The simulation results indicate that LEZs are the most effective tool for rapid decarbonization, leading to substantial reductions in emissions within restricted zones and surrounding areas. However, the magnitude of these benefits varies according to urban form and metropolitan function. In cities with stronger local employment bases and higher public transport accessibility, LEZs induce broader reductions in private car use. In contrast, in dense corridor cities serving regional travel toward the core, emission reductions within restricted areas are partially offset by traffic rerouting. This highlights the importance of metropolitan context, network structure, and through-traffic dependency in shaping outcomes. Increasing parking fees leads to moderate but meaningful emission reductions, particularly where public transport

and walkable alternatives are readily available. The effectiveness of this measure depends more on the availability of viable substitutes than income levels. In contrast, investments in cycling infrastructure alone generate limited environmental benefits, as localized improvements are insufficient to induce substantial mode shifts without broader network continuity and integration with public transport.

By linking behavioral, systemic, and environmental dynamics within an integrated simulation framework, this study provides evidence-based insights into the design of effective and equitable urban transport decarbonization policies. The findings underscore that policy effectiveness is highly context-dependent and that successful decarbonization requires strategies tailored to local socio-demographic conditions, urban structure, and regional connectivity.

CLUSTER 03

Logistics & Freight: Transitioning to Sustainable,
Resilient, and Just Freight Transport



Redistributing urban space - youth and logistics integration in the 15-minute City

Cluster 3

Bjørgen, Astrid

Authors: Bjørgen, A., Kin, B., Gehlmann, F., Karlsson, H. & Ryghaug, M.

Urban planning is increasingly shaped by proximity-based approaches, emphasizing equitable access to daily services while reducing transport demand. Redesign of space is mostly shaped around the 15-minute-city concept: less infrastructure for traffic and a higher focus on multifunctionality with more space for active mobility and green, leading, amongst others, to car-free neighbourhoods. Eventually this leads to a fundamental change to how we allocate and use public urban space.

In this redistribution exercise, not all stakeholder groups and user needs are involved equally. Two groups that are largely neglected are logistics (operators) that provide goods and services to keep areas running, and the youth that need to be able to move independently in a livable environment. In four case study areas (Arnhem, NL; Bærum, NO; Bristol, UK; Lyon, FR), we develop and apply a structured methodology for mapping stakeholders and identifying user needs within diverse socio-spatial contexts, with a specific focus on youth mobility and everyday urban logistics.

In a three-part analytical and participatory framework, we first apply contextual site analyses examining existing – and if relevant planned – urban form, service distribution, socio-economic characteristics, and mobility and logistics infrastructure. We do this through a combination of spatial analysis, fieldwork, policy document analysis and interviews with local authorities and other stakeholders. This stage identifies barriers and representation gaps. Second, stakeholder mapping is conducted by using situational mapping, which enables us to uncover the full ecosystem of actors involved. This approach reveals interdependencies between public, private, and civil stakeholders, highlighting how logistics operations, youth mobility patterns, and local governance practices intersect within each case-area. The resulting analytical maps provide a foundation for targeted co-creation processes. This is followed by the identification of user needs, which is done via a co-creative methods to capture the experiences and requirements of residents—particularly young people—and to translate these into feasible pathways for integrated mobility and logistics solutions.

This work culminates in a practical toolbox and locally tailored roadmaps supporting urban planners and logistics professionals. Furthermore, expected results of the application of this methodology in diverse socio-spatial contexts across countries include a comparison between the participation trajectories in the different cases, shedding light on the differences and similarities in planning practices, the development of a logistics footprint calculation tool and more general policy recommendations on planning practices that include all user needs in the (re)development process of urban areas towards liveable neighbourhoods.

Identifying Trends in Logistics Facilities in Chicago and Their Impact on the Surrounding Communities

Cluster 3

Boldbaatar, Otgondulam

Authors: Otgondulam, B., Carla, T.

The rapid expansion of e-commerce has fundamentally restructured global supply chains and urban freight systems. To meet consumer expectations for rapid delivery, logistics companies have adopted "proximity logistics," a strategy involving the positioning of warehouse and distribution (W&D) facilities closer to urban centers to minimize last-mile delivery times and costs. While these developments support economic growth and job creation, they present significant challenges, including heightened exposure to noise, traffic congestion, and air pollution for nearby residents. This study investigates the relationship between the growth of W&D facilities and patterns of social and environmental vulnerability within the Chicago Metropolitan Statistical Area (MSA) from 2019 to 2023.

The Chicago MSA, the third-largest metropolitan region in the U.S., serves as a national multimodal freight gateway. To measure the impact of logistics infrastructure on this region, the study utilizes the Social Vulnerability Index (SVI) which aggregates three categories of socioeconomic variables – socioeconomic status, minority status, and household characteristics – and develops an Environmental Vulnerability Index (EVI) based on air quality indicators from the EPA, specifically fine particulate matter (PM_{2.5}), diesel particulate matter (DSL_{PM}), and ground-level ozone (O₃). The analysis specifically maps the impact of market leaders Amazon, Target, and Walmart, and their ecommerce facilities which collectively hold nearly 50% of the U.S. e-commerce market share using dataset from MWPVL International.

Results indicate a significant shift in the logistics landscape, 68% of new W&D facilities established during the study period were located within the city of Chicago, particularly clustering in historically underserved neighborhoods on the south and west sides. Furthermore, the city of Joliet has emerged as a major freight hub, showing a localized but intense overlap between logistics infrastructure and vulnerable areas. Temporal analysis shows that while SVI levels across the MSA generally improved initially, they have since stagnated, suggesting a lack of positive socio-economic impact from the co-location of these facilities in vulnerable tracts. Environmental findings are more shocking; after a period of slight improvement, the EVI surged significantly across the MSA in 2023. The most pronounced increases occurred in rural areas with W&D facilities, where environmental vulnerability rose by 20%. These patterns suggest that current siting practices may reinforce structural inequalities and environmental injustice, as marginalized communities are disproportionately exposed to freight-related externalities regardless of their own participation in online shopping. The study concludes that urban planning and zoning must move beyond traditional tax incentives to integrate equity-centered policies, such as Conditional Use Permitting, multi-story mixed-use designs, or micro-hubs to ensure that

the benefits of the logistics industry do not come at the expense of community health and well-being.

Where urban development, transport modeling, and policy planning meet? A location-based demand analysis for construction logistic setups

Cluster 3

Brusselaers, Nicolas

Authors: Brusselaers, N. & Mommens, K.

Urban construction and renovation generate substantial freight movements, yet construction transport flows remain weakly integrated into urban mobility planning, particularly under conditions of uncertainty regarding timing and project typologies. Using GIS-based location-allocation modeling, this study investigates how construction-related freight demand can be spatially integrated into urban transport planning to support resilient siting decisions for construction logistics infrastructure.

The analysis draws on more than 200,000 geocoded construction and renovation site records in the Brussels-Capital Region (2015–2020), based on building construction and renovation inferred via changes in cadastral income aggregated to statistical sectors to form demand points, and public-domain infrastructure construction sites. Construction demand is approximated using a coarse yet transparent conversion of built surface area into material flows (100–350 kg/m²), reflecting both data scarcity and the heterogeneous nature of construction activities. Demand points are spatially aggregated and assigned to candidate Construction Consolidation Centres (CCCs) through network-based location-allocation modeling that accounts for travel times and congestion. Multiple scenarios are evaluated, including unconstrained locations, peripheral highway-oriented sites, and waterway-based locations, as well as constellations ranging from one to four centers. The aim was to connect location-based construction demand with transport modeling to inform policy choices on where to site logistics hubs.

From a local perspective, the analysis indicates that, under realistic assumptions, up to four CCCs could operate in Brussels before service areas begin to overlap significantly. Centrally located centers capture the highest volumes within relatively short service radii, while peripheral or water-bound locations involve trade-offs between accessibility, captured demand, and broader urban mobility objectives such as limiting heavy vehicle traffic in dense neighborhoods. Across scenarios, potential annual throughput per center is on the order of 100,000 tons with an operational service radius of 3km, suggesting that multi-center strategies are feasible but highly sensitive to spatial constraints and policy choices.

Overarching, the study highlights how integrating location-based construction demand into urban transport models can inform targeted mandates or incentives for large projects, as well as proactive infrastructure planning under uncertainty. However, the findings are constrained using annual aggregates that mask temporal demand peaks and the absence of explicit cost and economic or environmental feasibility modeling. An important alley for future prospective

research therefore lies in linking predicted construction demand to neighborhood-scale logistics hubs and flexible delivery strategies. By anticipating when and where construction and renovation waves occur, cities could pre-position hubs to serve clustered surges in activity and assess impacts at street or neighborhood level, strengthening urban mobility planning in times of uncertainty.

Optimising Micro-Hub Networks under Capacity and Topography Constraints: Evidence from Bogotá and Medellín, Colombia

Cluster 3

Granada, Carlos

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Freight decarbonization in cities requires more than switching vehicle technologies; it also demands spatially reconfiguring last-mile logistics so that low-emission modes remain efficient and resilient under constrained urban space. Cargo bikes are a promising approach toward zero-emission deliveries in dense urban areas, yet their limited payload and sensitivity to slope make network design highly context dependent, especially in emerging economies cities where land-use conflicts and uneven infrastructure constrain feasible locations for micro-hubs.

We develop a framework to design a cargo bike delivery network for Bogotá and Medellín, Colombia, using 15,790 observed deliveries (8,981 and 6,930, respectively) serving 2,783 clients through 1,200 retail nodes. Bogotá (approximately 11.66 million inhabitants in the metropolitan area) and Medellín (approximately 4.14 million) represent large urban regions, which makes distributional implications important for sustainable freight transitions. Demand is heterogeneous; most clients place a single order, while a smaller subset generates repeated demand, so we combine exploratory spatial data analysis with optimization to identify hub locations that remain robust to demand variability. We first compute Local Indicators of Spatial Association (LISA) to detect statistically significant demand hotspots and spatial outliers at a spatial scale. Candidate hub areas are then filtered using urban feasibility criteria reflecting operational and policy constraints (e.g., land-use compatibility and topographic suitability). Finally, we solve a mixed integer facility location model that selects transshipment hubs and assigns customers to hubs while minimizing operating costs and delivery emissions under explicit cargo bike capacity constraints.

Results indicate that integrating LISA diagnostics with optimization improves hub siting by prioritizing localized high-demand clusters where cargo-bike service is most viable. Average shipment weight is 30.5 kg, and 22.8% of orders are multi-package, making capacity constraints decisive for micro-hubs configurations. LISA values range from 0.0088 to 0.0728, revealing localized agglomerations suitable for micro-hubs, while peripheral zones exhibit weaker clustering and limited cargo-bike viability. By extending evidence beyond the Global North, the study contributes to the transition toward sustainable, resilient, and just urban freight through a transferable spatial-planning and optimization approach that supports public policies and logistics providers in identifying low-emission last-mile strategies under real-world constraints. The framework also enables equity screening, avoiding hub siting that concentrates freight activity near sensitive land uses.

Simulation-based evaluation of the impact of Logistics as a Service on last-mile parcel deliveries

Cluster 3

Kodera, Ryota

Authors: Kodera, R., Beckers, J., & Sakai, T.

Rapid growth in e-commerce has increased parcel volumes and intensified delivery vehicle traffic in urban areas, exacerbating congestion and emissions. Although receivers generally prefer fast delivery, some may accept slower delivery when appropriate incentives are offered. This willingness to wait, however, is rarely incorporated into conventional logistics interactions, because the primary customers of delivery service providers (DSPs) are shippers rather than receivers. In this context, the concept of Logistics as a Service (LaaS) has been proposed by Beckers et al. (2023). According to this concept, an online platform aimed at improving the delivery efficiency allows shippers, DSPs, and receivers to share delivery information, while enabling receivers to express their preferences for delivery options.

This study integrates multiple data sources and develops a logistics simulation model, based on SimMobility Freight (Sakai et al., 2020), to generate household-level parcel delivery demand and simulate the LaaS framework for Antwerp, Belgium. In the model, an online platform allows receivers to reschedule deliveries. Households using the platform may postpone parcel receipt to consolidate deliveries at the household level. Furthermore, the platform would also consolidate deliveries to neighboring households to further improve delivery efficiency.

We conducted a scenario analysis, comparing the base scenario as status quo with two different adoption levels in which 20% and 40% of households use LaaS. In the study area, while the total number of parcels delivered per day remains almost the same, the number of shipments decreases as LaaS adoption increases. Accordingly, total vehicle kilometers traveled (VKT) decreases under both adoption scenarios. We also examine spatial heterogeneity in the impacts of LaaS. In the high-density city center, delivery efficiency increases even at low adoption levels. However, in low-density areas, the low adoption levels lead to marginal improvements, likely due to insufficient opportunities for delivery coordination. Higher adoption increases the likelihood of nearby participating households and enables stronger coordination. This allows DSPs to make tours with more parcels, leading to more efficient deliveries and larger VKT reductions. The results underline the potential of receiver-centric rescheduling enabled by the LaaS platform to improve urban freight transport systems through consolidation. Future work will extend the LaaS framework to enable households to choose the other delivery modes (e.g., cargo bikes) and evaluate how household choices among delivery modes affect urban freight transport, as well as how public-sector measures through LaaS can nudge household choices toward more sustainable options.

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Urban logistics and the target of net zero communities

Cluster 3

Melo, Sandra

Authors: Melo, S.

Energy communities are one possible contributor towards the decarbonization of cities, through a more effective integration of resources and an improved resilience of the electric powered system. This study proposes the application of an integrated building and mobility study in Guimarães, Portugal, the European Green Capital 2026, with the purpose to assess the potential for the residual electricity generated from solar energy to be used on local electric shared urban delivery services within the scope of an Energy Community. The estimation of the potential of solar photovoltaic production on roofs, access self-sufficiency and self-consumption rates, and determine residual electricity and its availability for a shared mobility fleet utilisation was based on the characterisation of building stock and its archetypes, later modelled in the City Energy Analyst software. Results indicate that the local building stock has a substantial capacity for solar photovoltaic (PV) deployment, and archetypal modelling approach also proved effective in establishing demand profiles, revealing seasonal and daily mismatches between demand and PV production. Scenario analysis demonstrated that, despite these imbalances, a fraction of local mobility energy needs - particularly for shared e-bike fleets - can be met with excess PV production. In the most optimistic configuration, electric van-sharing services could also be modestly supplied with locally generated clean energy, reducing dependence on grid imports. These findings highlight the dual challenge of integrating mobility with local EC, namely the promotion of carbon-neutral transport options while ensuring the self-sufficient performance of the community. The work contributes to the academic and policy debate on decentralised energy systems by offering an integrated evaluation of production, consumption, and mobility synergies. It shows that while technical potential is significant, the real impact depends on spatial constraints, temporal dynamics, legislation, and the adoption of complementary energy storage or flexibility measures.

Advancing Sustainable Reverse Logistics in South Africa: Challenges and Solutions

Cluster 3

Mkansi, Marcia

Authors: Mkansi, M., & Matenda, F.R.

The rapid growth of electronic consumption in South Africa has led to a significant increase in electronic waste (e-waste), posing serious environmental, health, and socio-economic challenges. Effective and sustainable reverse logistics has therefore become a critical policy and development concern. This study explores the challenges that hinder the advancement of sustainable reverse logistics in South Africa and proposes viable solutions to address them. The study employed semi-structured, face-to-face interviews with founders of several reverse logistics companies. The findings reveal that challenges include inadequate regulatory enforcement, limited public awareness, insufficient recycling infrastructure, and the dominance of informal recovery practices that often involve hazardous methods. Additionally, technological constraints and financial barriers further impede the adoption of sustainable reverse logistics systems. Despite these challenges, the study identifies promising solutions to these challenges, including extended producer responsibility frameworks, technological innovations in recovery and recycling processes, public-private partnerships, and community-based awareness programmes. Strengthening institutional capacity and integrating the informal sector into formal reverse logistics systems are also highlighted as critical strategies. The paper concludes that a coordinated, multi-stakeholder approach is essential to advance sustainable reverse logistics in South Africa. The study contributes to the growing body of literature on sustainable reverse logistics in developing economies and provides policy-relevant recommendations for improving resource recovery governance.

CLUSTER 04

Urban Mobility Transitions: Explores the evolving landscape of urban mobility transitions within the broader context of transition economies



The Efficiency and Equity Paradox of France's Carpooling Scheme

Cluster 4

Abouelela, Mohamed

Authors: Abouelela, M., Araldo, A., & Antoniou, C.

The French government launched a subsidy scheme that incentivizes short-distance commercial carpooling by directly compensating users to decarbonize daily mobility and reduce reliance on solo driving. Yet, the scheme's underlying efficiency has not been examined. In this study, we use a four-part large-scale online survey ($N = 1161$) to evaluate the scheme, performing a multidimensional evaluation for carpooling users in the Île-de-France region. By overlapping geospatial analysis, socio-economic profiling, and behavioral insights, we uncover several critical divergences between the policy's stated goals of congestion relief and social inclusion versus its actual outcomes.

The first three reasons users cite for carpooling are saving money, helping the environment, and avoiding parking-related issues, respectively. Contrary to the objective of connecting transit-poor suburbs to employment centers, our spatial analysis reveals that the scheme usage is mainly concentrated in areas already served by public transit, with three-quarters of the trips occurring entirely within high-density urban zones rather than the critical suburban-to-urban radial flows that typically generate rush-hour congestion.

Furthermore, the analysis of vehicle occupancy reveals a structural flaw in the incentive design where the subsidy pays a flat rate per trip, incentivizing the act of picking up a passenger but not the efficiency of the vehicle; specifically, the "Unused Capacity" analysis shows that 56% of subsidized trips have at least two empty seats. This suggests the policy effectively subsidizes a "ride-hailing" model rather than high-efficiency pooled trips, since most trips involve a driver and one or two passengers, around 70% of the trips.

Demographic segmentation further reveals a striking class divide: drivers are predominantly from higher-income brackets, with "Driver(Exclusive)" roles showing significantly higher average incomes than passengers. This structural inequality implies the policy functions as a regressive redistribution mechanism, transferring public tax revenue primarily to wealthier car owners while lower-income individuals participate merely as service consumers. Additionally, regression analysis of compensation versus frequency indicates a "behavioral ceiling" with a moderate correlation ($R = 0.43$), suggesting that for high-frequency users, habit and workplace constraints are stronger determinants than marginal financial gain.

The modal shift from original trips to carpool trips shows increased convenience for users, as 60% reported reducing at least one leg of their original trip. On the other hand, there is a significant shift from public transport to pooled trips, potentially increasing overall VKT and emissions per passenger.

Consequently, we argue that to evolve from a recruitment phase to an efficiency phase, the policy must pivot to a "Precision Subsidy" model that introduces zonal differentiation to target

transit deserts and high-occupancy bonuses to incentivize filling empty seats, ensuring the fund remains a mobility tool rather than a passive income stream for the wealthy.

Shifting Service Trips from Vans to Lighter Modes

Cluster 4

Amaral, Julia

Authors: Amaral, J., Balm, S., Ebbink, F., Hof, E., & Beckers, J.

Service trips are an essential yet often overlooked component of commercial urban traffic. Service trips are performed by workers who install, repair, and maintain essential systems in homes, businesses, and public spaces. These trips are predominantly made by combustion-engine vans, which raise environmental concerns and exert substantial pressure on curbside parking. As cities pursue sustainability goals and face increasing competition for parking, service logistics have emerged as a critical challenge, particularly in areas with limited accessibility (e.g., historic city centers). This calls for innovative solutions.

This paper presents insights from two pilot initiatives that aim to shift service trips from conventional vans to light electric vehicles (LEVs). The pilots were conducted in Amsterdam, the Netherlands, and Mechelen, Belgium, as part of the Interreg North Sea MoLo Hubs project, which explores how logistics functions can be integrated into urban mobility hubs. Both pilots test innovative governance and operational arrangements to support behavioral and organizational change in service logistics.

In Amsterdam, the city launched a “Park + Switch” hub located at the edge of the zero-emission zone. Service providers access the hub through a subscription scheme that allows them to park their vans in the garage and switch to shared LEVs, such as cargo bikes, scooters, and small electric cars, for in-city operations. This model enables companies to use low-emission modes without purchasing new vehicles, targeting small and medium-sized service firms that often lack the resources to electrify their fleets. Early experiences indicate that interest is driven by high parking costs, a lack of parking spaces and a crowded and congested inner city that causes stress and frustration among technicians driving a van. However, the pilot also highlights limitations when technicians require access to heavy, large and/or unexpected equipment and materials, underlining the need to rethink service workflows rather than simply substituting vehicles.

In Mechelen, a medium-sized Belgian city, the pilot adopted an exploratory, human-centered approach. Field observations revealed that vans function not only as transport modes but also as mobile workshops. In response, the city tested cargo bikes with a regional water utility company. Technicians reported major travel time savings, with trips taking a third or less of the time required by van, as well as easier access to parking, improving predictability and convenience. Nevertheless, adaptations were needed to account for infrastructure constraints, such as cobblestones.

Together, the pilots demonstrate that service logistics is a diverse target group and therefore challenging when it comes to mobility transitions. Mobility hubs could facilitate modal shift, but that success depends on context, user needs, and organizational practices. There is no single solution suitable for all service providers: while some trips can shift to LEVs, others will continue

to require vans. Cities should therefore combine mode-shift initiatives with complementary measures such as off-hour servicing, decentralized micro-storage, and targeted curbside and parking policies. Ultimately, transitioning service logistics toward lighter and lower-emission modes requires systemic thinking about how essential services are organized, supported, and prioritized in urban environments.

Temporary and Permanent Street Redesigns: Shaping Public Acceptance and Mobility Behaviours through Reversibility and Participation

Cluster 4

Atanova, Angelina

Authors: Atanova, A., Welsch, J., & Klinger, T.

Many cities strive to shift away from car-oriented regimes by reallocating street space from motorised vehicles to urban greenery, active mobility, public transport and social uses. This research takes a closer look at two methods of street space reallocation: temporary street experiments and permanent street redesigns. Although both types of interventions aim to create sustainable, equitable and liveable streets, their distinct characteristics regarding temporality, reversibility and participatory processes may significantly differ in shaping their influence on public acceptance, triggering changes in mobility behaviour, and ultimately contributing to wider transitions and systemic change.

Street experiments are defined by their intentional temporality and reversibility, which aim to reduce financial and structural risks and psychological resistance, thereby enabling the trial of new mobility behaviours without a permanent commitment. Permanent redesigns, on the other hand, seek to establish lasting behavioural changes through infrastructural transformations but may encounter greater initial resistance due to their typically irreversible nature, higher costs, longer implementation timelines, and less active participation. Empirical evidence suggests that stakeholder opposition often arises from reluctance to change individual mobility behaviour routines, particularly among car users. Therefore, it is crucial to understand the processes behind mobility behaviour and acceptance to make it easier to shift away from car use over time through car-reduction interventions. This literature review develops an integrated conceptual framework that combines and synthesises insights from transitional management theory, behavioural research and public acceptance studies to analyse how temporality and participatory planning influence public support for street space reallocation initiatives.

Central to this framework is the understanding that public acceptance and behavioural changes are not static states but dynamic trajectories influenced, among other factors, by experiences, perception of procedural fairness and the quality of participatory planning processes. Procedural fairness is a key policy-specific predictor of acceptance and willingness to change mobility behaviour. It incorporates transparency and openness and provides genuine opportunities for citizens to voice their opinions and influence decisions. The research synthesises evidence that shows that meaningful community engagement and co-creation processes are more likely to enhance perceived fairness and, consequently, public support for car-reduction measures. On the other hand, superficial participation, such as mere information

about ongoing changes to the public space and a lack of transparency, can generate mistrust, frustration, and resistance to change daily mobility practices.

This research makes three key contributions. First, it develops a conceptual framework that integrates reversibility and participatory fairness with mechanisms of behavioural change. This addresses a critical gap in understanding how intervention characteristics shape mobility behaviour transition. Second, it examines the human dimension of urban transformations by going beyond engineering and design considerations, recognising street space reallocation as a mechanism for supporting the development of more just and sustainable urban environments. Third, it provides a conceptual foundation for empirical investigation of acceptance and behavioural change trajectories over time, offering insights into when and how different intervention types achieve sustained shifts in mobility behaviour necessary for long-term systemic change in urban mobility.

The potential of green mobility hubs in the Mediterranean Region: a broad stakeholder perspective across six cities

Cluster 4

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Mediterranean urbanism has been subject of many studies looking at the region's position between the developed North and the developing South. The growth of settlements and cities did not follow the path observed elsewhere, especially for cities in Central and Northern Europe. Differences between the northern and southern shores of the Mediterranean have been affected by strong cultures, even though some common influences are noticeable in cities across the entire region. This mix of cultures and heritage has indeed been identified as a factor of unity, but not uniformity, amongst Mediterranean countries. The Mediterranean was and continues to be characterised by dispersed populations, rural peripheries, and significant variations in population density between urban centres, rural towns and coastal areas. In addition, the Mediterranean is home to a sizeable number of inhabited islands, many of which dependencies of larger countries. The islands of Malta and Cyprus are however independent nation states. All this has challenged land transport and resulted in low connectivity, especially for rural and coastal populations underserved by green and efficient transport modes such as rail, but not only. Mobility Hubs emerged in Central and Northern Europe primarily as a response to issues of connectivity and multi-modality. The Hub was defined as a facility that, not only provided diverse and sustainable modes of transport (e.g. shared modes, rail and buses), but also included facilities that supported travel planning and other services (e.g. parcel lockers for small urban deliveries). Mobility hubs were mainly developed in dense urban environments linking rail with urban services. This research aims to understand the function, characteristics and potential of green mobility hubs in six Mediterranean cities, by taking into account the perspectives of stakeholders and user needs. Data was collected through interviews with policy and decision makers (top-down), and a questionnaire survey among the population of each city and a number of citizen workshops (bottom-up). This presentation focuses on the top-down analysis of stakeholder interviews comparing six case study cities in Malta, Greece, Cyprus, Spain, Bosnia-Herzegovina and Italy. Results show agreement on the infrastructural gaps, especially in Mediterranean rural areas, and the critical infrastructure for multimodal connectivity in areas with limited public transport coverage. Variations were noted in the prioritisation of services and commercial functions being integrated within mobility hubs, especially in tourist areas. Finally the challenges of implementation were highlighted by all stakeholders, especially the issues surrounding land ownership and limited land availability, funding schemes to support development, and a general lack of stakeholder engagement in the design and planning process. The analysis revealed gaps between policy-level aspirations for sustainable mobility and

practical implementation constraints for the development of green mobility hubs in the Mediterranean Region.

“It should be animal-friendly and people-friendly”: Children’s perspectives in urban space transformations

Cluster 4

Aumann, Simone

Authors: Aumann, S., Baier, L., Breyer, E., & Schmidt, M.

Safe, livable and healthy public (street) spaces in proximity to everyday life are central to children’s wellbeing and independent mobility. Here, the impact of motorized traffic on urban areas poses a particular challenge for them. Yet children’s perspectives are still underrepresented in many planning and participation processes in urban space transformations. Accordingly, there are increasing calls not only to account for children’s specific needs in planning, but also to acknowledge their right to participate.

Photovoice has proven particularly suitable in participatory research with children, both to identify needs before interventions and to evaluate measures after implementation. Participants take photographs on defined topics that reflect central aspects of their lives, which then serve as a basis for joint discussion. In doing so, children’s experiences and knowledge become key resources for understanding their perspectives.

This study uses photovoice to capture how children experience public (street) space in daily life and what needs and wishes they express. A specific challenge – and a key objective of this research – is translating children’s situated insights into actionable recommendations for planning practice. We therefore also examine how results can be fed back into an ongoing participation process and how children perceive their participation.

The study is embedded in the transdisciplinary project MOSAIQ (“Mobility and urban climate in future neighborhoods”) which is part of the “Munich Cluster for the Future of Mobility in Metropolitan Regions” (MCube) funded by the German Federal Ministry of Research, Technology and Space (BMFTR). The project tests urban space interventions to improve mobility, public space quality, and climate adaptation in two neighborhoods with residents involved through multiple formats throughout the project. As part of the participation process prior to the implementation of measures, we conducted photovoice workshops with 18 students (grade 5) in the Moosach neighborhood in July 2025 and 21 students (grade 3) in the Schwabing-West neighborhood in October 2025. In total, children collected 70 images in Moosach and 66 in Schwabing-West. We then discussed and interpreted selected images with the children, clustered initial themes, and co-produced posters. Discussions were recorded and analyzed using thematic analysis.

Across both neighborhoods, similar overarching themes were identified. Children consistently foreground mobility as shaping their everyday experience of public space, particularly through motorized traffic-related safety risks and obstacles. In both neighborhoods, children showed strong attention to nature and greening and noted aesthetic street elements such as murals, while repeatedly highlighting concerns about visual clutter and litter. Green spaces were often

framed as places of environmental protection, while litter was described as an environmental problem that can harm animals and vulnerable groups (e.g. babies). The children articulated a nuanced view on fairness and inclusion for different groups and recognized competing uses of space. Additional themes concerned social discomfort in specific places and the importance of play spaces.

Children reported positive participation experiences, describing the process as engaging and meaningful. At the same time, challenges emerged around aligning timelines and ensuring that outputs translate into influence within the broader participation process in MOSAIQ.

Microtransit in Transition: Demand Drivers, User Profiles, and Quality of Life Changes across Multiple Systems

Cluster 4

Bardaka, Eleni

Authors: Rahman, A., Haque, S., Ghimire, S. and Bardaka, E.

Microtransit is an app-based, shared, public transit service typically operated with vans or small buses, where routing and scheduling are dynamically adjusted to match passenger requests. In the United States, transit agencies have increasingly adopted microtransit to address first/last-mile gaps, expand coverage in low-density areas, and complement or reorganize traditional demand-response and fixed-route services. Despite rapid diffusion, the empirical evidence base remains limited. Prior studies are often single-case evaluations or policy discussions, and offer limited empirical evidence beyond the perceptions of potential users.

This research presents a multi-system assessment of microtransit demand, travel behavior, and user experience across several North Carolina implementations. We integrate two complementary data streams: (1) operational trip records capturing request timing, realized pickups/dropoffs, travel times, and spatial-temporal patterns of use; and (2) rider surveys measuring perceived quality of life changes, service attributes, satisfaction, travel alternatives, and user characteristics. The combined design supports three aims: (i) quantify the temporal, spatial, and operational drivers of microtransit demand; (ii) identify the mechanisms that shape satisfaction and quality of life improvements; and (iii) characterize user heterogeneity and explain variation in frequency of use.

First, using trip records, we estimate determinants of microtransit demand and quantify the role of service design and operational conditions. We construct time- and space-aggregated demand measures and apply count-data econometric models to relate demand to temporal patterns (day-of-week, time-of-day, and seasonality), spatial context (service-area structure and land-use/accessibility proxies), and operational attributes such as hours of service, coverage, exposure measures (vehicle supply and service availability), and reliability indicators reflected in observed wait time and in-vehicle time.

Second, we model satisfaction using structural equation modeling (SEM). We estimate latent constructs for perceived service quality (reliability, convenience, safety/comfort) and quantify their direct and indirect pathways to overall satisfaction and stated intentions to continue using microtransit. A similar analysis is conducted for understanding which service benefits (e.g., increased access to food) contribute to the overall change in quality of life perceived by the users.

Third, we explain behavioral heterogeneity. We estimate negative binomial models of self-reported use frequency to identify how sociodemographics and mobility resources (e.g., car access, disability status, household composition), trip purposes, and perceptions relate to repeated use. We also apply latent class clustering to derive rider profiles that jointly capture

mobility constraints, trip-making routines, and service expectations, revealing distinct segments such as first/last-mile connectors, access-constrained essential travelers, and discretionary users with high sensitivity to reliability.

Through this operational and survey evidence across multiple systems, the study contributes a coherent behavioral picture of microtransit adoption and sustained use in a U.S. setting. The findings inform mobility transitions in times of uncertainty by clarifying which design choices most strongly shape demand, how satisfaction pathways differ across contexts, and how agencies can tailor microtransit features to distinct user classes to support equitable access and efficient scaling.

Potential social and spatial equity implications of sustainable car ownership policy

Cluster 4

Blomjous, Dieuwert

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The IPCC pathways to net zero imply rapid or even (in some sectors) immediate actions to reduce emissions. This requires transformational changes in travel behaviour and vehicle technologies for daily passenger transport. Currently, the distribution of the negative and positive effects of transport or accessibility is already unequal. Policy measures that are intended to shift to net zero emissions in transportation could either exacerbate existing disparities or present an opportunity to reassess them, depending on policy choices (Sovacool et al., 2022). However, there is a lack of knowledge of the equity effects of these policies.

A main driver of differences in travel behaviour and access to opportunities is the fact that individuals have different mobility opportunities contingent upon their personal attributes and the neighbourhoods where they live. Decarbonisation policies may impact these opportunities in different ways for different groups in society, and consequently, may have an impact on social and spatial equity effects. Our study applies the Capability Approach (CA) to identify the potential social and spatial equity effects of decarbonisation strategies for sustainable car ownership (reduce car ownership or increase battery electric vehicle ownership).

Using the CA we shift the focus from - what is more traditionally studied - changes in mobility outcomes (e.g. kilometres driven by car) to changes in the capabilities of individuals (e.g. being able to have good health by travelling to healthcare facilities in a sustainable way). This enables a more complete and nuanced analysis of relevant factors and equity effects at play. Although a wide range of capabilities could be analysed with the CA, this study examines the opportunities of individuals to travel sustainably to daily activities such as work, grocery shopping, or healthcare. A person's capabilities are dependent on the resources available (e.g. private charging infrastructure) and on individual conversion factors (e.g. physical disability, income to buy a car, social network). This approach is relatively new in transport research and although on the rise, quantitative operationalisation remains challenging because of the difficulties measuring (unobservable) capabilities (Schwanen, 2022) and conversion factors, and because of its multidimensionality.

The paper describes work in progress attempting a quantitative analysis using the capability approach, studying sustainable car ownership. We aim to utilize administrative microdata of The Netherlands, containing register data of all residents (e.g. income, household composition, house ownership, driving license and car (type) ownership), enriched with geodata (e.g. accessibility of jobs or amenities, public charging points). With this data set we set out to explore which resources, and which personal, environmental and social conversion factors are available

to individual households and how these affect their capabilities and changes in car ownership. Using cluster analysis, we will analyse equity effects between different types of households. We expect that this research will provide more insight for policy makers into equity effects related to a shift to more sustainable car ownership. Furthermore, as we expect that not all relevant factors that explain the differences in opportunities can be quantified, this research will identify relevant data and knowledge gaps.

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Planning with Competing Truths: Disinformation and Conflict in Urban Mobility Transitions

Cluster 4

Busse, Jana

Authors: Busse, J., Bruns, A., Wenner, F.

Urban mobility transitions increasingly unfold in contested political and communicative environments. Measures such as street space reallocation, cycling infrastructure, 'low-traffic neighbourhoods', or parking space reduction are frequently accompanied by intense public controversy, in which conflicting claims about impacts, usage, and social consequences circulate across formal planning arenas, media, and everyday discourse. In some cases, arguments are characterised as "disinformation" or "fake news" by those who disagree. At the same time, planning theory has long emphasised the existence of multiple, situated forms of knowledge and the inherently political character of evidence in decision-making. This creates a central analytical and practical challenge: how can we distinguish between legitimate epistemic plurality and strategically misleading communication in urban mobility transitions, and how vulnerable are different planning approaches to such dynamics?

This contribution addresses this question by combining insights from planning theory with conflict analysis as a qualitative methodological approach. It builds on the observation that planning paradigms differ fundamentally in how they treat knowledge, conflict, and legitimacy: expert-oriented approaches rely on authoritative evidence, communicative approaches emphasise deliberation and epistemic plurality, while agonistic perspectives foreground conflict and power. These differences shape how disinformation and competing truth claims are recognised, amplified, or contained within planning processes.

Empirically, the contribution draws on qualitative case studies of contested transport planning processes in German cities at different planning scales. These include both local transport interventions (such as cycling infrastructure and street space reallocation) and strategic mobility planning processes, particularly the development and implementation of Sustainable Urban Mobility Plans. The analysis is based on policy documents, media reporting, social media content, public meeting records, and expert interviews. Using conflict analysis, the study maps (1) the relevant arenas of communication (formal planning procedures, political debate, media, and informal public discourse), (2) key actor constellations, and (3) recurring knowledge claims and counter-claims. Particular attention is paid to how empirically weak or misleading claims become influential through repetition, framing, and strategic positioning, and how these dynamics interact with paradigm-specific assumptions about expertise, participation, and conflict.

Preliminary findings indicate that disinformation in transport planning rarely operates as isolated falsehoods. Instead, it is embedded in broader conflict structures that exploit specific vulnerabilities of planning approaches, for example, reliance on expert authority, assumptions

of good-faith deliberation, or the normalisation of persistent conflict. At the same time, the analysis shows that not all conflicts over evidence can be resolved through additional data or modelling. Some disputes reflect fundamentally different interpretations of what counts as relevant evidence, whose knowledge is considered legitimate, and which societal goals urban mobility transitions should prioritise. The contribution concludes by discussing implications for research and practice, arguing that addressing disinformation in mobility transitions requires reflexive awareness of how planning approaches themselves shape the conditions under which misleading claims become politically effective.

Nature-Based Solutions for Everyday Walking in Peripheral Historical Centers: A Methodological Framework from Fuenlabrada (Madrid)

Cluster 4

Canahua Sosa, Hugo Enrique

Authors: Canahua Sosa, H. E.

Historical centers in peripheral European metropolitan areas often combine environmental stressors, socio-economic vulnerabilities, and dense urban forms that limit access to healthy and pedestrian-accessible public spaces. In these contexts, walking is not an optional mode but the dominant form of everyday mobility. However, these conditions frequently reduce environmental comfort, constrain daily walking, and disproportionately affect vulnerable populations, which highlights the importance of street-level interventions.

In this context, Nature-Based Solutions (NbS), when applied at the streetscape scale, offer the potential to simultaneously improve pedestrian mobility conditions and public health. However, their application in historical urban fabrics remains insufficiently explored.

This study analyses how NbS can improve walkability, social interaction, and health in historical centers located in peripheral metropolitan areas. We develop a conceptual and methodological framework that links the urban morphology of historical centers with specific NbS typologies aimed at climate adaptation, pedestrian comfort, and public health. The framework is applied to the historical center of Fuenlabrada, a municipality in the southern metropolitan area of Madrid. The proposed methodology includes an urban morphological analysis that decomposes the historical fabric into smaller, operable morphological units. These units are then assessed according to their suitability for hosting NbS, resulting in a matrix of opportunity spaces. Finally, NbS typologies are introduced and classified according to their potential impacts on walkability, health, and social interaction.

We conclude that, in the complex and widespread context of peripheral historical centers, NbS can significantly improve everyday walking, support social use of public space, and promote health through accessible and higher-quality public environments.

Leapfrogging towards sustainable mobility in Sub-Saharan Africa: Evidence from Maputo and Freetown

Cluster 4

Cavoli, Clemence

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Rapidly growing cities in Sub-Saharan Africa face intersecting mobility challenges, including low-but-rising levels of motorisation, climate vulnerability, and deep socio-spatial inequalities. International evidence demonstrates a positive correlation between increases in gross domestic product (GDP), urban population growth, and private car use in cities. In rapidly growing low-income cities, these patterns risk locking urban areas into unsustainable, inequitable, and carbon-intensive mobility systems. This paper explores the potential for cities across Sub-Saharan Africa to leapfrog towards sustainable urban mobility, focusing on Maputo (Mozambique) and Freetown (Sierra Leone) as case studies. Leapfrogging in this context is conceptualised not solely as technological shifts but primarily as an institutional, governance, and planning transformation that prioritises accessibility, inclusion, and transport and land-use integration over private car dependency. Drawing on participatory workshops, semi-structured interviews and focus groups with a range of stakeholders including policymakers, planners, and community stakeholders, and alongside the collation of secondary data, the paper examines both structural barriers and enabling conditions shaping urban mobility transitions in low-income and rapidly urbanising contexts.

The findings reveal persistent challenges, including fragmented governance arrangements, limited institutional and financial capacity, weak integration between transport and land-use planning, as well as sociocultural and behavioural issues. These factors reinforce resistance to prioritising investments in collective and active mobility modes and contribute to policy and spatial path dependencies that favour road expansion and car-centric infrastructure, often at the expense of pedestrians, collective transport, and accessible public space. At the same time, the paper identifies significant opportunities to accelerate sustainable mobility transitions. High levels of walking (as a proportion of total mode share) and reliance on collective transport provide favourable baseline conditions, even if current mode share is primarily driven by poverty rather than choice. Emerging political momentum at the local level, growing recognition of climate risks, as well as an international funding environment aligned with broader sustainability goals, and the widespread use of digital technologies offer pathways to reconfigure governance and planning practices, strengthen regulatory frameworks, and improve service quality and accessibility. Importantly, the findings highlight the importance of equity in mobility transitions, where transport inequalities are deeply entangled with poverty, informality, gender, and socio-spatial exclusion, particularly in informal settlements in the urban periphery.

By situating urban mobility transitions within the everyday urban realities of cities in Sub-Saharan Africa, this paper contributes to debates beyond technology-led solutions. It advances an equity-centred understanding of mobility transitions that foregrounds the coproduction of local urban knowledge, policy reform, and cross-sectoral collaboration. The comparative insights from Maputo and Freetown investigates the extent to which rapidly growing cities in Sub-Saharan Africa can resist 'lock-in' to car-dependent urban trajectories and leapfrog towards a more sustainable, inclusive, and resilient mobility futures.

The relationship between urban road design, perceived walkability, and walking behavior

Cluster 4

Chebe, Polycap Chesifu

Authors: Chebe, P. C., & Martens, K.

The measurement of perceived walkability and its relationship with walking has received substantial attention over the past years, especially in the Global North. However, research has largely focused on perceived walkability at the neighborhood level, often overlooking the perceived walkability of individual streets. Additionally, while many studies have analyzed the impact of perceived walkability on walking, little is known about the reverse relationship: the impact of walking on perceived walkability. This paper presents and applies a new measure—the Street-level Perceived Walkability Rating Scale (SPaRS) to assess perceived walkability at the street level, across five streets with distinct designs in Addis Ababa: three upgraded and two non-upgraded streets. Walking behavior is measured using self-reported walking frequency, and the bidirectional relationship between perceived walkability and walking frequency is examined using two structural equation models (SEMs). The findings show that upgraded streets recorded substantially higher mean perceived walkability scores than non-upgraded streets. However, higher perceived walkability did not consistently correspond to higher walking. The SEM results confirm a bidirectional relationship between perceived walkability and walking frequency: higher perceived walkability is associated with more frequent walking, and frequent walking, in turn, is associated with more positive walkability perception. Nevertheless, the strength of the association from perceived walkability to walking frequency is substantially stronger ($\beta = 0.289$, $p < 0.001$) than the reverse association from walking frequency to perceived walkability ($\beta = 0.066$, $p = 0.019$). Beyond providing robust insights into the relationship between perceived walkability and walking, the study highlights the need for upgrades that support not only transport inclusivity but also social-economic inclusivity, especially for the urban poor in African cities who often rely on small street-based activities for their livelihoods. Given the novelty of these findings, further research across diverse urban contexts is recommended.

Transport equity in the 15-Minute city: socio-spatial inequalities in the Lisbon Metropolitan Area.

Cluster 4

de Abreu e Silva, João

Authors: Amorim, J. M., Colaço, R. & de Abreu e Silva, J.

The 15-minute city (15MC) concept has emerged as a transformative framework for sustainable and human-centred urban planning, emphasising proximity to essential services and opportunities. This urban model prioritises mixed-use development, soft mobility modes, and accessible public transit over car-dependent infrastructure, aiming to reduce commuting burdens, lower carbon emissions, and enhance urban liveability. The COVID-19 pandemic further underscored the importance of local accessibility, catalysing global interest in proximity-based planning. However, growing evidence suggests that the spatial materialisation of the 15MC may reflect and reinforce pre-existing socio-spatial inequalities, with central and higher-status areas exhibiting greater alignment with 15MC principles than peripheral zones.

Most accessibility studies focus on evaluating work-related accessibility. The emphasis on commuting is supported by the fact that this "opportunity" is crucial to the mobility and quality of life of urban dwellers. Nevertheless, non-work trips account for most daily trips: for example, in the Lisbon Metropolitan Area (LMA), leisure and shopping trips alone account for 31% of all trips, comparable to commuting itself (INE, 2018). Also, the work and non-work time and distance are relatively close, suggesting that non-work travel also plays a significant role in shaping urban accessibility. Therefore, this study examines whether residents of 15-minute city areas in the Lisbon Metropolitan Area (LMA) are systematically more affluent than those in peripheral areas, addressing a critical gap in accessibility research. By evaluating non-work accessibility through proximity to 15MC amenities, this research explores how accessibility varies spatially and across socioeconomic groups, testing the hypothesis that adherence to the 15MC concept correlates with greater affluence.

Using multiple analytical approaches, including the Palma Index, Moran's spatial autocorrelation, and Pearson correlation matrices, the study assesses the relationship between accessibility and socioeconomic status across various spatial aggregation levels, from metropolitan to civil parish scales. The results reveal strong positive associations between accessibility, literacy, and high-wage employment, alongside negative correlations with commuting burden and CBD distance. The Palma Index exposes marked disparities, with over 30% of residents in some peripheral municipalities lacking adequate access to 15MC amenities. Spatial autocorrelation analysis confirms that these inequalities form non-random clusters of advantage and disadvantage throughout the metropolitan fabric, following a distinct centre-periphery gradient.

The findings demonstrate that the 15MC's spatial pattern in the LMA reflects long-standing metropolitan inequalities. Central areas, particularly Lisbon's urban core, consistently outperform peripheral and lower-income neighbourhoods in accessibility scores, supporting the

hypothesis that proximity-based benefits are spatially selective and concentrated in more affluent areas.

The study also reveals that the scale of analysis critically influences interpretations of inequality. While municipal-level analysis identifies broad structural patterns, parish-level examination exposes finer spatial dynamics essential for designing targeted equity policies. From a policy perspective, these results underscore that successful implementation of the 15MC requires deliberate redistributive planning strategies. Achieving equitable proximity requires targeted investments in peripheral areas, such as expanding essential services beyond central zones, and enhancing connected multimodal public transit networks. Without such interventions, the 15MC risks may become a privilege of affluent central neighbourhoods rather than a universal right, thereby perpetuating urban inequality rather than alleviating it.

„Just do it“ - can mobility experiments promote the mobility transition?

Cluster 4

Deffner, Jutta

Authors: Deffner, J., Nitschke, L. & Stein, M.

The reconfiguration of mobility practices away from the private combustion engine is a complex matter. So far, climate-friendly, multi-optional transport behaviour is not yet widespread among the population in Germany – even where infrastructure and services appear to be relatively well developed. Automobile mobility practices as socially widespread practices are performed as fixed structures. If this understanding is taken as a basis, it becomes clear that the elements of mobility practices – meanings, materiality and capabilities – must be considered together if transformative measures are to have an impact.

In the paper we will present results from four realworld experiments with citizens from different settlement structures (Rhine-Main area, Dortmund city, Osnabrück district). The participants were able to test alternatives to conventional private cars in their everyday mobility (overall, commuting, local recreation trips) over a period of several months: E-bikes, E-cargo bikes, E-cars or public transport. In addition, the participants were actively supported in developing skills for their new mobility practices. The aim was to enable participants to familiarise themselves with multioptional mobility and thus break up their established mobility routines. They were able to learn how they can embed the tested offers into the network of other practices in their everyday lives.

The social-empirical monitoring of the realworld experiments made it clear which new attributions of meaning go hand in hand with the new practices and what the potentials and obstacles are. The changes observed in the course of the experiments show that learning processes and a high share of changed mobility routines can be effectively triggered by such a setting. In an ongoing research project, this type of mobility experiments are to be scaled up and disseminated as an effective transformative measure for municipalities and companies at a regional level. So a second part of the experiment is currently what is needed that institutions integrate such tools as part of their mobility management in their administrative action and services.

In this presentation we explore the challenges and opportunities of this transfer. These include not only questions of the scalability of participatory offers, but also questions of how regional actors can take up the topic of skills transfer and symbolic meanings or how future multipliers and change agents can be involved in the development and implementation of transformative experiments.

Engaging Citizens in Mobility Innovation: A User-Centered Co-Creation Methodology to Design Mobility Bundles in Munich

Cluster 4

Eberhardt, Anna

Authors: Eberhardt, A. K., Zaggl, L., Gartmeier, H., Brakewood, C., & Loder, A.

Mobility bundles are an emerging trend that combine multiple transportation services into integrated packages – often accompanied by pricing incentives – such as the integration of public transport with shared mobility services. Bundles can be tailored to individual mobility needs and may contribute to the transport transition by promoting modal shift away from private car use; however, their successful adoption depends on the availability of targeted, attractive and context-sensitive offerings. Against this backdrop, the research project *MobiPionier*, embedded within the Munich Cluster for Future Mobility in the Metropolitan Region (MCube) – an interdisciplinary consortium bringing together industry, public administration, NGOs, and research institutions – aims to engage citizens of Munich in the development and testing of user-centered mobility bundles to better understand and foster their successful adoption.

This paper advances user-centered methods with active citizen involvement to design and elicit mobility bundle preferences, focusing on three dimensions: (i) willingness to pay, (ii) drivers of acceptance, and (iii) mobility bundle configurations. A comprehensive transdisciplinary co-creation workshop concept was developed and implemented through two consecutive workshops with the same focus group of 20+ participants. To gain a deeper understanding of mobility needs, both workshops combined qualitative and quantitative approaches for data collection. At the core of the process was an innovative participatory scenario-mapping exercise in which participants actively designed mobility bundles on “mobility calculation boards” by selecting transport modes, usage frequencies, and acceptable costs. This exercise was informed by travel diary maps capturing everyday mobility routines and intermodal connections and complemented by group work, focus group discussions, and surveys. Together, these methods formed a coherent co-creation process to systematically capture users’ motivations, constraints, and everyday mobility practices for bundle development.

The workshop results were analyzed using a mixed-methods approach, comprising a qualitative content analysis, a descriptive statistical analysis and a cluster analysis, with the aim of developing comprehensive and context-sensitive mobility bundles. The following results can be derived from the corresponding data and summarized along the three key dimensions: (i) willingness to pay, (ii) drivers of acceptance, and (iii) mobility bundle configurations. Participants’ willingness to pay ranged from 75 to 150 euros per month, with most preferring around 75 euros, which depended primarily on a clearly perceived financial advantage. Flexibility was identified as the most important driver of acceptance and included three different aspects: the possibility to cancel the bundle monthly, the ability to plan trips reliably and in advance, and the option to use the bundle in other cities. In terms of bundle configurations, a notable finding was that the

Deutschlandticket – a nationwide public transport subscription valid on local and regional services – was consistently selected as the core element on which bundles were built, while bike sharing emerged as the second most important component, underlining its relevance for flexible mobility.

In closing, this paper contributes both a transferable method for user-centered co-creation and its empirical application in a case-study in Munich, providing a practical approach for researchers and practitioners to systematically capture user preferences and design context-sensitive mobility bundles. Moreover, this research project has generated valuable insights for transport agencies, mobility operators, and city planners to inform user-centered design, implementation, and scaling of integrated mobility services for sustainable transport.

Which personal and societal outcomes affect the acceptability of sustainable mobility policies?

Cluster 4

Ettema, Dick

Authors: Ettema, D., Koops, M., Ünal, B., Soza-Parra, J.

The acceptability of sustainable mobility policies is key to their implementation and achieving environmental goals). Considerable research has investigated the factors driving the acceptability of these policies, including (environmental) problem awareness, perceived effectiveness and fairness (equity) of policies and the outcomes to the traveler (Schade & Schlag, 2003, Yakeen et al., 2019). Personal outcomes are mostly addressed in a generic way, without distinguishing the types of outcomes that may affect acceptability. This is a limitation in the context of the sustainable mobility transition in cities, in which outcomes of policies become increasingly multidimensional and encompass effects for accessibility, safety, quality of public space and environmental outcomes. This study investigates to what extent different types of personal outcomes affect acceptability of various policies, and how this differs across types of travellers.

We use cross-sectional survey data, collected in November 2025 in the 40 largest municipalities of the Netherlands (n=5,475). Apart from general socio-demographic and mobility characteristics, the survey asks about respondents' opinion about externalities of urban car traffic and. The survey further asks about the perceived effects on sustainability, difficulty/ease of daily travel, personal traffic safety and a healthy personal living context and about the acceptability of the following policies:

- 50% increase in parking costs
- 25% reduction in parking spots
- Reducing road space for cars
- Reducing the speed limit to 30 KMs/h
- Increasing public EV-chargers
- Implementing a zero-emission zone including the respondent's location
- Offering shared bicycles close to one's home
- Offering shared cars close to one's home

The results suggest that the parking policies face a much lower acceptance rate (<20%) as compared to the zero-emission zone (33%), reducing road space for cars (51%) and the other policies (all >70%). Based on ordered logit models of acceptability of policies, we find that a stronger awareness of externalities of car traffic (climate change, pollution, unsafety) is related to a higher acceptance for all policies. With respect to the effects of policies, a stronger belief that the policy makes mobility more sustainable is associated with a higher acceptance. In addition, we find that the perception that the policy contributes to a healthy personal living environment has a significant positive effect on acceptability. For the car restriction policies

(parking, less road space for cars, lower speed, zero-emission zone), the perceived increase in difficulty of travel has a relatively strong negative effect on acceptance. With respect to the perceived safety effects, we find that these play a particularly relevant role for the acceptability of policies that reduce the amount of road space for cars of lower driving speed. Finally, current travel habits appear to play a key role. Frequent cyclists are more likely to find all policies more acceptable. Frequent drivers, however, are less likely to accept parking restrictions and reduced road space being allocated to cars, as well as shared mobility policies. However, they do not reject speed limitations more strongly than others.

Altogether, our findings illustrate that various personal outcomes (ease, safety, health) are relevant to the acceptability of urban mobility policies, that their importance differs between types of policies, and that a significant divide exists between users of different travel modes.

Effects and influences of app-based transport sharing companies on road systems and the urban form of the cities of Madrid, São Paulo, and Mexico City

Cluster 4

Ferreira da Silva, Anderson

Authors: Silva, A. F.

The effects of technologies on urban mobility over the last fifteen years have impacted cities worldwide; commuting for work, leisure, or other needs has come to rely on an additional range of service providers. These innovations initially emerged, for users, as options for those moving within cities, between them, and for accessing them. Thus, cities such as Madrid, São Paulo, and Mexico City began to observe their urban spaces being modified, from areas surrounding airports, train stations, metro systems, and bus terminals to central zones with public and tourist-oriented interests.

Part of these changes is driven by companies such as Uber, Cabify, BlaBlaCar, and 99, all of which began operating between 2009 and 2012 and have already produced significant impacts, both on the structural road configuration of access and internal and adjacent traffic of these large facilities, as well as in the areas of major tourist attractions and central zones of the three cities (Canguçu, 2021). These impacts reveal new layouts of access bays, side roads, preferential stopping areas, and other elements of urban furniture designed to accommodate these vehicles with a certain degree of exclusivity, always under the justification of avoiding long queues and disorder during pick-up and drop-off operations.

Subsequently, sharing platforms have also promised facilities and transitions in mobility through applications for motorcycle transport and shared bicycles, which stand out in the three cities mainly through Uber Moto, Bici, Itaú Bike, and Ecobici, always promoted under narratives of change, reduction of individualized vehicles, financial savings, and agility in travel times (Aguilar, 2018).

In the three cities studied, satellite images of road systems and exclusive access bays for app-based transport vehicles in major facilities, such as airports and train and bus stations, were collected using comparative analyses between the years 2010 and 2025. This made it possible to observe road expansions, the removal of vegetated strips, and the insertion of architectural elements aimed at these solutions. Likewise, aerial images of spaces in the main tourist areas of each of the three cities were used to verify how modifications occurred in road layouts and traffic behavior to accommodate arrivals and departures using platform-based vehicles. Finally, the same comparisons were established in the central areas of the cities in order to verify the expansion of cycling infrastructure and exclusive spaces for motorcycle travel.

In conclusion, it was possible to observe how urban mobility planning has been impacted over the last fifteen years due to the diversification of modes of travel, generally managed through

applications. It was also verified how cities had to make very urgent decisions to address issues arising from systems that promised to reduce the number of private cars. On the other hand, it was possible to observe that such changes were selective and localized, and that little was done, in terms of urban design and infrastructure works, to improve and promote collective transport systems, especially those subsidized by public authorities and with lower costs for citizens (Brentini, 2020).

Designing Acceptable City Tolls: The Role of Revenue Recycling Mechanisms

Cluster 4

Fessler, Sonja

Authors: Peer, S., & Fessler, S.

Urban transport systems create substantial external costs due to congestion, air pollution, noise, and traffic accidents. Addressing such inefficiencies has long been a central concern of transport economics. Tolls are considered an efficient market-based instrument to internalize these externalities and improve overall social welfare. However, the widespread implementation of urban road pricing has proven difficult in practice, with only a handful of cities having successfully introduced such schemes. These cases demonstrate that urban tolls can be both efficient and economically feasible, yet they remain rare exceptions.

One of the main reasons why few cities have implemented tolls is the lack of public support. Growing evidence suggests that revenue recycling mechanisms play a critical role in shaping public acceptance. This study therefore examines how toll revenue recycling mechanism can be designed in ways that achieve (close to) majority support. To examine this, the paper uses data from the project City Tolls That Work. The survey was conducted in summer 2024 and includes 1,035 respondents from Vienna and surrounding areas. The dataset consists of a policy stated-preference (SP) choice experiment on a possible city toll, a behavioral SP experiment on mode choice, a hypothetical voting experiment with different revenue recycling mechanisms, and cross-sectional socio-economic, spatial, mobility-related, attitudinal, and belief variables.

The referendum data comprise four distinct questions (measured on a five-point scale) for different revenue recycling mechanisms: (1) reinvestment in sustainable transport, (2) discretionary political allocation, (3) uniform redistribution, and (4) individual cashback for public transport use. These referendum questions are used as dependent variables in an ordered logit model with dummy coding indicating the revenue recycling mechanism. Additional cross-sectional survey data and the estimates from the behavioral SP choice experiment on mode choice (analyzed with a mixed logit model) are used as covariates.

The preliminary results of the referendum data indicate that more than 50% of the respondents change their position depending on the revenue recycling mechanism, suggesting that policy design can substantially increase public support. The results of the model analysis provide insights into both average and individual preferences for the different revenue recycling mechanisms.

One contribution of the paper is to provide new empirical evidence on the impact of different revenue recycling mechanisms in shaping public acceptance of tolls. Furthermore, it combines stated-preference choice experiment data with cross-sectional data and referendum voting data in an ordered logit model. Lastly, it offers a novel case study for Vienna, for which research on toll acceptability remains scarce. This makes the analysis particularly relevant for both local decision-making and broader European policy debates.

We've done an innovation project, now what? Evidence from a survey of local authorities to create a pathway for science-backed mobility transitions

Cluster 4

Fuchs, Dominik

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Innovative mobility projects in cities often fail to scale beyond pilot stages. Knowledge remains confined to final reports rather than enabling replication and systemic transition towards sustainable mobility in other geographic or institutional contexts.

Cities often drive such pilots but rarely share their learnings systematically. This represents a missed opportunity to maximize societal returns on substantial public investment, especially in smaller and more rural areas with fewer resources. This research aims to create a process to support innovation projects in transforming their findings into formats that help create impact for municipalities.

As a first step in creating a new process that builds on impact- and process evaluation results to create 'replication guides' that actually help stakeholders to use and build on existing knowledge from previous projects, this study investigates which types and formats of information local authorities need to initiate and govern mobility transitions. Therefore, we conducted a survey with more than 120 responses from employees of local authorities in the German federal states of Bavaria and Baden-Württemberg. The survey was divided into three different topics: (1) What are suitable information channels and formats for municipalities, (2) what content should be included in the 'replication guides' and, (3) which thematic fields of mobility innovations are currently relevant for the cities. Using the results of the survey, this research aims to develop a framework that makes learning from other cities more accessible, so cities can get the needed information about the projects they are interested in.

Our results show that the most relevant contents are in this order the costs of the project (operating costs, investment costs, funding possibilities), legal necessities to implement the project, and a description of the effect of the project. Further statistical analysis (e.g. Mann-Whitney U test) to examine different preferences between municipalities of different sizes reveals only few statistically significant correlations. The contents "funding programs" and "supporting networks" are significantly more important for bigger cities. This could indicate that the higher personal resources of bigger cities enable them to pursue funding and take part in networks, which is harder for smaller cities. The authorities want to use the replication guides mainly to learn from others and as supporting arguments when addressing decision-making bodies (e.g. city council) or the public.

The results also show that the current thematic interests of the authorities are rather similar, with urban development and shared mobility ranking high. While the size of the jurisdiction is not

a major influencing factor, there are variations between cities and counties. For example, counties assess autonomous driving as one of the major topics, while cities express less relevance for it. The reason could be that counties are often responsible for public transport, where the shift towards autonomous vehicles is a major transition.

Legal and financial topics emerge as the most relevant information for local authorities when investigating existing projects. While financial and personnel resources vary between cities, the topics and necessary information are similar. We recommend that evaluations and reports on existing projects collect information on these topics and make it accessible for other cities - in an attractive and understandable format, with high visibility in the target group.

The next step of the research is to develop replication guides for selected projects and discuss them with practitioners and incorporate their feedback into the process.

From Intentions to Long-Term Practice: A Four-Wave Panel Longitudinal Analysis of Work-From-Home Effects on Commuting Patterns in Israel and Czechia

Cluster 4

Gal-Tzur, Ayelet

Authors: Brůha, J., Kogus, A., Brůhova Foltýnová, H. & Shiftan, Y.

A longitudinal panel survey was conducted in Israel and Czechia to investigate the effects of the COVID-19 pandemic on work patterns, with particular emphasis on the allocation between work from home (WFH) and work away from home. The first two survey waves were conducted shortly after the outbreak of the pandemic and elicited detailed information on work habits pre- to post-pandemic and expectations regarding post-pandemic work patterns.

The third wave, conducted in June 2022, after the removal of all COVID-19 restrictions captured post-pandemic real behaviour. The fourth wave in September 2025 followed up this cohort and comprised 321 Israeli and 328 Czech respondents who participated in all four waves.

WFH patterns were captured as five-feature vectors of respondents' preferences and intentions: revealed preferences (RP) pre-pandemic, stated intentions in April and June 2020, and revealed preferences in June 2022 and September 2025.

The 2022 survey results indicated a marked rise in teleworking in both countries from the pre-pandemic, particularly in Israel. Three years later, teleworking patterns in Israel remained stable compared to 2022, while Czechia experienced a modest additional increase in teleworking intensity.

K-means clustering was applied for each country separately, using Euclidean distance as the clustering metric. To determine the optimal number of clusters and ensure robustness of the clustering process, the algorithm was run 100 times for each value of $K=2, \dots, 10$ using different random seeds.

Across both samples, the analysis consistently revealed four highly stable clusters (adjusted Rand Index > 0.8). In both countries, one of the clusters represents a conservative group with respect to WFH, comprising 45% of the Israeli sample and 65% of the Czech sample. These respondents rarely worked from home before the pandemic and, when surveyed during the pandemic, anticipated to maintain similar work patterns in the "new normal" after it. Their RP in 2022 and 2025 confirm these expectations.

Another cluster, accounting for 27% of the population in Israel and 19% in Czechia, consists of respondents who also engaged in little WFH before COVID-19 and initially intended to increase teleworking only moderately, but ultimately increased it more than anticipated. In both countries, this cluster is characterized by a younger population compared to the overall sample and a higher share of individuals with an academic degree.

Two additional, smaller clusters were identified. One cluster, identified in both countries, includes respondents who practiced moderate hybrid work patterns before the pandemic and maintained these patterns over time. The fourth and smallest cluster differs between the two countries: in Israel, respondents maintained relatively intensive hybrid work patterns, whereas in Czechia, respondents who had practiced intensive hybrid work patterns before the pandemic, reduced their WFH intensity after the pandemic.

Although the cohort size of slightly more than 300 respondents is relatively modest, the four-wave panel survey is uncommon and provides robust longitudinal insights. Moreover, several prominent patterns observed consistently in both countries may offer valuable insights for policymakers seeking to design policies that support societal and economic adaptation to increased levels of teleworking, in areas such as urban planning, transportation policy, and labor regulation.

Urban Truck Stops at Scale: Linking Population-Level Truck Movement Data with Land Use and Economic Activity in Belgium

Cluster 4

González-Calderón, Carlos A.

Authors: González-Calderón, C. A., Alarcón-Bohada, D. I., Cardenas-Barbosa, I. & Perez-Guzman, S.

Freight transport is essential to national economies, yet it produces substantial local externalities in cities, including congestion and disruptions linked to freight loading/unloading and truck stops that obstruct sidewalks and road space. Designing effective urban freight policies requires accurate, comprehensive, and scalable evidence. However, much of the existing empirical literature is limited by small samples, short observation windows, or partial coverage of vehicle activity. Although GPS-based data can reveal vehicle trajectories, speeds, and dwell times at relatively low cost, GPS traces alone rarely provide the contextual information needed to explain where and why stops occur. In particular, many studies do not systematically combine movement data with socio-demographic, economic, and built-environment indicators that shape freight demand and curbside competition.

This paper adopts an exploratory, data-driven approach using a unique national-scale dataset from Belgium's distance-based road pricing system, capturing the full universe of medium- and heavy-duty truck movements. We integrate these records with spatially referenced information on urban form and activity, including administrative district boundaries, population density, land area, the number of establishments, and land-use characteristics. The resulting linked dataset enables detailed measurement of truck stop events—location, timing, and duration—and supports comparative analysis of freight stop patterns across urban zones in two Belgian cities. Methodologically, we employ an exploratory statistical framework. We construct zone-level indicators summarizing truck activity and logistics stopping behavior, and estimate Ordinary Least Squares (OLS) models to examine how socio-economic and land-use attributes are associated with observed stop characteristics. This modeling strategy is intended to identify the most salient correlates of freight stopping intensity and dwell time, and to highlight spatial heterogeneity within and across cities.

The paper contributes to urban freight research in three ways. First, it moves beyond small-sample GPS studies by leveraging population-level truck movement data. Second, it strengthens inference by explicitly coupling vehicle activity with spatial indicators of demand and urban structure. Third, it produces metrics that are directly interpretable for planning practice, supporting the identification of zones where curbside management, delivery regulations, or infrastructure interventions may be most impactful. Overall, the study demonstrates that integrating large-scale, real-world freight movement data with contextual spatial information

can strengthen the empirical basis for more efficient, safer, and more sustainable urban freight systems.

Public transport as ‘political infrastructure’: The case of transit disruption in Hong Kong during an urban social movement

Cluster 4

He, Sylvia

Authors: He, S.Y., Chen, X., Shiao, E., Es, M. & Tao, S.

Moving beyond a focus on the technical and instrumental role of public transport, this study expands understanding of public transport infrastructure as ‘political infrastructures’ (McFarlane & Rutherford, 2008) in the context of an urban social movement. Contested urban spaces play an important role in the mobilisation and operations of mass protest movements. In recent years, a growing number of social movements have emerged around the world, such as Occupy Wall Street (United States), Gezi Uprising (Turkey), and the Umbrella Movement (Hong Kong). These movements have seen urban spaces adopt strong symbolic meaning with regard to political power and the wider public sphere (Hutabarat, 2010; Lefebvre, 1991). Empirical studies have observed various social movements occupy and use public urban spaces, such as streets, squares and other open spaces, for public gatherings and political protest (Loukaitou-Sideris & Ehrenfeucht, 2009). Public transport systems can be sites of protest and subject to vandalism due to their symbolic nature as extensions of the government and their crucial functional role in everyday economic and social life, which social movements can strategically aim to disrupt. Service disruption of PT systems during social movements is not uncommon, which can markedly impact people’s daily lives (Salmenkari, 2009) and attitudes towards public transport (He et al., 2024).

With a particular focus on how political attitudes influence perceptions of public transport, this study examines the impact of a social movement (the 2019 Anti-Extradition Law Amendment Bill Movement in Hong Kong) on transit services, where radical protest actions disrupted urban services and everyday activity. Bringing in literature from urban studies, social movements, and transportation planning and service delivery, we study the interplay between different political stances of Hong Kong residents, attitudes towards radical protest activities, and the perceived impact on public transport disruption and travel satisfaction using a mixed-methods approach, including a questionnaire survey and interviews conducted in 2020. Our results indicate that attitudes towards radical protests affect perceived impacts of transit disruption and travel satisfaction, and such relationships vary by our respondents’ political views and socioeconomic status. Our study highlights the role of political ideology in support for social movements and the subjective nature of evaluations of service delivery performance, with citizen satisfaction not driven solely by objective performance but also by other social and political factors.

Based on the findings, we propose several policy recommendations to enhance the resilience of public transport and urban service systems during periods of social unrest. First, due to their

visibility and openness, transit systems are highly vulnerable to disruptive activities. Rail operators should prepare contingency plans for potential service disruptions. Second, measures can be taken to improve communication in similar situations as efficient communication of travel disruptions and the availability of alternative services is vital. Finally, we recommend ensuring the availability of alternative mobility options in the case of future disruptions to transit systems. More generally, it is critical to encourage a multi-modal transport system that includes emerging micro-mobility modes.

Towards mobility transitions through citizen involvement in co-designing the 15-minute city using digital technologies.

Cluster 4

Jones, Tim

Authors: Jones, T., Almukhtar, A., Carpenter, C., Grove, H., Krisch, A., Shirazi, R., & Yardi Mericiler, N.

The 15-Minute City concept reimagines urban life around neighbourhoods where everyday services and essential needs are accessible within a short walk or cycle. This 'chrono-urbanism' approach suggests that quality of urban life is inversely proportional to the amount of time invested in travel, particularly by car, and that a higher quality of life is able to be sustained by residents where they are able to perform everyday tasks within 15-minutes of their home on foot or by cycle (Moreno et al. 2021).

Digital technologies are increasingly being integrated into all aspects of our daily lives, including in urban planning (Othengrafen et al, 2023). These could serve to accelerate the shift towards the 'smart' 15mC and sustainable mobility by enhancing participatory design that allows residents to visualise, test, and interact with alternative urban futures (Popescu & Nicolescu, 2025). A dynamic field of digital research is in the use of Augmented and Virtual Reality (AR/VR) in the co-design urban environments that helps to move beyond the power-centric model of research subjects having no role in the design and outcome of projects (Jones & Osborne, 2022). However, the actual contributions, limitations, and challenges of using such technologies in social science research and particularly in co-creating inclusive urban environments remain insufficiently explored or appraised (Meckin and Elliot, 2024).

This paper presents findings from the ENACT15mC project (Envisioning Neighbourhoods and Co-creating Thriving Communities in the 15-Minute City), funded under the EU's Driving Urban Transitions programme. Using AR and VR tools to assist in urban placemaking, the project aimed to explore whether digital technologies can enable residents to envision their area as a liveable and connected neighbourhood less dominated by car traffic. It focuses on one of the project's four Urban Living Labs (ULLs), based in Oxford, UK, that involved a diverse panel of community members in a series of workshops and interactions over 12 months, to define the challenges of the neighbourhood, engage with AR and VR technologies, and explore their potential for helping envision liveable places and sustainable mobility. A process evaluation was conducted comprising workshop event evaluation and final exit interviews with participants.

The findings highlight the potential of digital tools to supplement traditional 'analogue' approaches and enrich participatory city-making by supporting dialogue around contested concepts (including the 15mC), collective imagination and co-development of ideas, and visualisation and testing of different urban interventions. At the same time, they reveal key challenges related to usability, accessibility, digital literacy, inclusivity, and the risk of misinterpreting scale and spatial impact. Drawing on these insights, the paper considers how

digital technologies can be more effectively and inclusively integrated into neighbourhood regeneration efforts to enhance liveability and sense of community and belonging, and accelerate the shift toward sustainable mobility in diverse urban environments.

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Available upon request (as this exceeds the 4000 word character limit).

Sustained travel behaviour change: Motives and barriers to maintaining commute cycling

Cluster 4

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Cycling offers a wide range of environmental, economic, and public health benefits. It is increasingly recognized as a sustainable and efficient mode of urban transportation. While considerable research has examined the factors influencing the initiation of commute cycling, there are few attempts to find the reasons behind maintaining commute cycling over the long term. Since the decision to initiate cycling is fundamentally different from the decision to maintain cycling over time, understanding the factors that contribute to maintaining commute cycling is crucial for effective policy and intervention design.

This study explores the key factors that contribute to maintaining commute cycling as the main mode of commute to and from work in Stavanger, a mid-size car-dominant city in Norway. The study draws on data from the "Health Project 2022," a mobility intervention conducted by the public transport authority in Stavanger. The project is a three-month intervention among employees from 5 different local organizations. The main aim of this intervention is to encourage the participants to shift from car to cycling as a daily mode of commute. A total of 138 participants provided data on their daily commuting behavior, their attitudes, motivations, perceived barriers towards cycling one-year after the intervention period, as well as their physical health status before and after the intervention period. Using a binary logistic regression, this study identifies factors associated with maintaining cycling as a mode of commute one-year after the intervention period.

The results indicate that e-bike ownership plays a major role in maintaining cycling even a year after the intervention period. Also, attitude change driven by increased awareness has been found to influence the decision to maintain cycling. In addition to changes in attitudes, experiencing the implications of mobility choices, such as perceived work-related benefits on participants' everyday life, can also contribute to the maintenance of cycling. Meanwhile, the greatest barrier to maintaining cycling appears to be a combination of travel distance and time. Finally, the results indicate that none of the initial motives for joining the project and initiating commute cycling can predict the likelihood that a participant maintains cycling for the long term. By distinguishing between the initiation and maintenance of commute cycling, this study contributes to the cycling and behavior change literature by demonstrating that long-term adoption depends less on initial intentions and more on enabling conditions that provide tangible benefits and cognitive shifts over time. The findings underscore the importance of cycling interventions that combine technological support, such as e-bikes, individual personalized feedback, and supportive infrastructure to foster maintaining commute cycling in a mid-sized car-dominant Norwegian urban context.

Tracing spatial patterns of shared micromobility services: Evidence from Venice

Cluster 4

Keshwani, Vanshika

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Shared micromobility services have emerged as a significant alternative to private vehicles, transforming urban transportation by offering sustainable, flexible options. To adopt a more sustainable and efficient system, the Municipality of Venice has allocated a budget to plan and design mobility in the city. To achieve those goals, one step is to implement a station-based model in place of the existing free-floating bike model. Using high-resolution trip data from the Municipality of Venice, this study analyzes routes and usage patterns of electric and non-electric bikes, as well as e-scooters, in Venice. We aim to optimize micro-mobility usage in the city by understanding usage dynamics, zone infrastructure, and socio-demographic characteristics using spatial data and open street networks. An exploratory data analysis was performed to visualize temporal trends across seasons and weekly commuting behavior in 2024. An index is constructed to measure the region's infrastructure, reflecting the relative scores of the zones in the studied area. The negative binomial model analyzes the association between travel behavior, socio-demographic factors, and the infrastructure index, and how these factors influence e-scooter and bike-sharing usage across temporal, spatial, and urban contexts. Given the unique geographic setup, a network-based method and tensor factorization are used to detect travel mobility patterns from origin and destination using actual trip data, with network measurement tools identifying the most frequently used routes in the city. It addresses the data sparsity and population-level patterns in micro-mobility usage. Results show distinct behavioral patterns across different vehicle types. E-scooters are primarily used for short-duration trips lasting less than 3 minutes, with a broader spread of drop-off and pick-up locations for flexible use. Unlike bike-sharing, which exhibits a more structured commuting pattern with moderate distance traveled (3-6 km). Users between the 18-24 age group and males show higher trip frequencies. The zones with a high index show more bike use relative to the length of bike lanes than those with a low index. Across all service types, a clear preference for short and moderate trips is observed, indicating that most micro-mobility services are primarily used for last-mile connectivity. These results provide findings for mobility companies to optimize usage, improve service accessibility, and strengthen urban transport sustainability through digital data and statistical modelling. The findings provide mobility companies with information on usage trends, enabling them to focus on the demands and regions unique to each user and identify the pockets with high demand and low availability. The obtained results support the authorities' decision-making in designing the station for bike installation based on varying demand in each zone. User-dynamic studies are essential for the efficient use of shared-mobility systems and can reduce carbon emissions and traffic congestion. The ongoing work also

focuses on user-level behaviour patterns by clustering unique users based on their travel patterns using hierarchical clustering. For future development, the study is also designed to examine whether shared mobility serves as an integration or a substitution for other public transportation, and how it affects the micro-mobility market.

How do public priorities differ across modes? Comparing support for safety, equity, infrastructure, space, and investment in urban transport

Cluster 4

Manaugh, Kevin

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Urban mobility transitions depend on public acceptance of policy measures that redistribute streetspace, reallocate resources, and change modal priorities. Existing research tends to examine either general support for a single mode or support for specific interventions. In contrast, multiple, broader domains of policy support across modes are rarely assessed. This study addresses this gap by examining how residents evaluate support for bicycle, pedestrian, bus, rail, and car modes across five policy dimensions: safety, equity, infrastructure development, space allocation, and financial investment.

Data were drawn from a survey conducted in May 2023 across the Montréal Metropolitan Area. After data cleaning and validation, the sample included 1,606 respondents, with quotas ensuring representativeness by age and gender across subregions. Respondents rated their support for policy actions related to each mode. One-way analyses of variance, followed by post-hoc comparisons, were used to assess whether support differed systematically across the five dimensions and to identify which policy areas receive relatively stronger or weaker endorsement.

Results indicate that support varies substantially across both modes and policy dimensions. For bicycle policies, safety receives the strongest support, with significantly higher ratings than infrastructure development, space allocation, or financial investment. Pedestrian results show a similar pattern: safety receives higher support than most other dimensions, although equity receives moderately favourable evaluations. Bus results differ sharply, with equity-oriented measures receiving the highest support and infrastructure and financial investment receiving considerably lower support. Rail exhibits the opposite pattern, with respondents expressing strongest support for infrastructure expansion and financial investment and lower support for safety or equity. Car results also prioritise infrastructure and financial support, with both dimensions receiving significantly higher ratings than safety or equity.

These results show that support for mobility transitions vary by the specific policy dimension through which support is assessed rather than on general attitudes toward the mode itself. Clear tensions emerge within several modes. For both bicycle and pedestrian policies, safety receives strong support, yet support declines sharply for infrastructure, space, and financial measures, even though these resources are necessary to improve safety outcomes. A similar contradiction is evident for the bus: respondents strongly endorse increased support for low-income individuals, yet express relatively low support for the infrastructure and investment required to

enhance service quality and network coverage. Rail and car results also reveal a distinct structure, with support concentrated in financial and infrastructure domains rather than in safety or equity.

Recognising these patterns is important for actors advancing urban mobility transitions, as it clarifies which policy areas enjoy broad public acceptance and where deeper engagement or improved public understanding is required. These patterns also reveal gaps between the outcomes residents value and the interventions needed to achieve them, such as strong support for active transportation safety but weaker support for the infrastructure that produces it. Addressing these gaps can inform public awareness efforts and the framing of projects, helping to guide shifts toward more sustainable, equitable, and active mobility regimes.

How Moral Framings Shape the Acceptability of Urban Spatial Transformations

Cluster 4

Marquet, Oriol

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Urban policies aimed at transforming public space—such as pedestrianisation schemes and the implementation of bike lanes—have become increasingly prominent in recent years, as cities seek to promote sustainable mobility and enhance urban well-being. These transformations are known to influence everyday travel behaviour, helping to reduce car use and promote walking and other sustainable modes.

Despite their growing relevance, these interventions frequently provoke resistance and polarisation between public authorities and certain segments of the population. Such opposition can jeopardise not only their implementation and long-term continuity, but also the broader transformative ambitions underpinning these policies. Against this backdrop, understanding the determinants of public acceptability is essential for fostering durable and socially supported urban transformations.

This research places particular emphasis on the communicative dimension, exploring how the ways in which urban interventions are justified and framed influence their levels of acceptance. Building on Moral Foundations Theory, the study examines whether moral framings can shape public support for different types of urban interventions. Previous research has shown that strategically activating specific moral foundations (care, fairness, loyalty, authority, purity and, more recently, liberty) can increase support for policies by resonating with the moral concerns of groups that may initially be more sceptical, triggering more intuitive and automatic responses. However, the role of moral framing in the acceptability of urban spatial transformations remains largely unexplored. This research seeks to fill this gap and to contribute empirical evidence to ongoing debates.

To this end, the study employs a vignette experiment with a sample of 800 residents of the Barcelona Metropolitan Area. Participants are asked to evaluate a series of randomly assigned vignettes describing different urban interventions, each framed around a specific moral foundation. The experimental design also allows us to assess the influence of additional factors, including the type of intervention (the introduction or removal of pedestrianisation schemes or bike lanes), the governance approach (top-down versus bottom-up leadership), and the spatial proximity of the intervention (on the respondent's own street or on another street).

Although data collection is still ongoing, the study aims to contribute to an underexplored strand of the literature by systematically analysing the role of moral framing in shaping public attitudes towards urban transformation policies. In doing so, it seeks to identify communicative strategies that enhance acceptability and help public authorities build broader coalitions of support, particularly among groups that are currently more critical or resistant. By reducing

social friction and opposition, these strategies may expand the political and institutional capacity to implement changes in the built environment that have proven to be among the most effective tools for fostering lasting shifts in everyday travel behaviour.

Facilitating the mobile undercommons: A path to radical transition or a niche distraction?

Cluster 4

Marsden, Greg

Authors: Buscher, M., Lopez-Galviz, C. and Cass, M.

John Urry's work on Automobility (Urry, 2002) and Ian Walker's work on Motonormativity (Walker, 2025) underline the capitalist driven grip which cars have on our lives, whether we drive or not. Supported by huge fossil fuel, industrial conglomerates and financial markets our Societies are seemingly locked in to car-based thinking (Buscher and Marsden, 2026). Arguing within paradigm about tackling negative externalities rarely cuts through. The fierce competition for space which results from car dependence seemingly makes even small scale roadscape reallocation a deeply political problem in ways which were unthinkable even 20 years ago.

One line of response is to support radical street experimentation to challenge the norms and practices of the day (Sierhuis et al., 2023). However, such experimentation is criticised for lacking any coherent theory of change (Grandel and Berger, 2025). As such they lack scalability. This paper starts from these critiques and asks whether the focus on changing outcomes has missed a critical dimension of changing process. If public buy-in is key, then any form of radical transition must be designed by and with the publics who are going to be that transition. This might mean starting with understanding those people and places who are already or want to be doing things differently (what can be seen as the mobile undercommons).

The paper describes the first two years of work on the INFUZE project (<https://in-fuze.org.uk/>) which has sought to build a citizen manifesto for change and to design a set of tools to democratise the development of scenarios of change. It describes how the different elements of the project contribute to an overall theory of change where the experimentation stage is a test of the design process as well as the behavioural outcomes. It seeks to disrupt through enabling paradigm challenging propositions to be brought forward, tried and talked about. The process is the object of transformation, whilst the experimentation is just a manifestation of what that could make possible.

Henry Ford said "if you always do what you've always done, you'll always get what you always got". Perhaps the only really radical pathway to transformation is to challenge how we plan and to provide an alternative and better template to do it? We share reflections on what has and has not worked to date and what challenges this poses for researchers and practitioners.

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Street experiments for the future generation: Assessing how children's needs are considered in urban mobility transition projects

Cluster 4

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In recent years European cities have realized various urban mobility transition projects, many of those experimenting redistributions of road space towards sustainable and active mobility or quality of stay. While recent research has evaluated these projects regarding environmental impacts, residents' mobility behavior or social justice (e.g. Gentrification), comparably little research exists on how mobility transition projects, such as street experiments, support particularly children's mobility or their use of urban space. Hence, findings on how those projects support distributional justice regarding urban space for children are lacking. Moreover, research has been undertaken on planning and participation processes in mobility transition projects. These studies often refer to procedural conflicts, i.e. tension due to perceived lack of participation and communication, usually by residents, road users or shopkeepers. Again, the question on how children are involved in those planning and participation processes often remains unanswered.

This contribution aims at addressing these research gaps by focusing on children in particular and exploring in how far children's needs are addressed in current urban mobility transition projects and to what extent children are involved in those projects. Firstly, a study was conducted during the reallocation of a street in Berlin, Germany, exploring children's (5th/6th grade) needs regarding the street reallocation. We applied participatory methods to gather insights into their mobility needs and requirements considering the built environment. Based on this study we found that for children, reallocated street should ensure (i) independent mobility, (ii) safe routes and (iii) enhance enjoyment, curiosity and aesthetics, while also offering places to (iv) do sports and play, (v) shop and eat, (vi) interact and communicate and (vii) rest. Additionally, the findings show children's desire for greenery, cleanliness, maintenance, lightning, water bodies, habitats for animals and low-polluted areas (quietness, clean air). Secondly, we plan to conduct a systematic review on the involvement of children's needs in urban mobility transition projects in major German and European cities and take the features found in our study in Berlin as a basis for analysis. We will explore (a) the aim of the projects, (b) if they address children and (c) which of those features found in the Berlin study were addressed by the transition project and how. To do so, we will conduct a systematic document analysis. Thirdly, we will conduct expert interviews with selected experts on mobility transition projects exploring if and how children are involved in those projects and to what extent the selected features are addressed. The contribution will present the findings from the document analysis and expert

interviews and provide a systematic overview of children's involvement in current urban mobility transition projects in Germany and Europe.

Urban Mobility Policy in Vienna: Qualitative Insights on Younger Generations' Priorities and Concerns

Cluster 4

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Urban Mobility Policy in Vienna: Qualitative Insights on Younger Generations' Priorities and Concerns

Cities across Europe are reallocating street space, revising regulations, and shifting financial priorities to advance sustainability, equity, and liveability in urban mobility. Yet, such policies often face limited public support and at times strong opposition by citizens. Understanding why these measures are resisted is essential for inclusive, feasible urban and transport planning. While prior work links values to acceptability of environmental policies, the generational configuration of values shaping support for transformative urban mobility measures remains underexplored. Addressing this social dimension is critical for effective communication and for reducing opposition that delays implementation.

This overall study examines how basic human values and the goals of urban mobility planning shape the acceptability of push-pull policies, with a specific focus on generational differences and shifts. The motivation is to explain how attitudes rooted in generational socialisation influence policy acceptability, and how basic values underpin these attitudes, to inform communication, co-creation, and the design of socially robust mobility transitions.

Adopting a sequential mixed-methods design, the research first elicits urban mobility goals through semi-structured interviews with Viennese residents across age cohorts to derive goal items linked to specific policy instruments. These items feed into a quantitative, cross-sectional online survey of the Vienna metropolitan area ($n \approx 800$), stratified and weighted to reflect city demographics. Values are measured using the Environmental Personal Value Questionnaire (E-PVQ), policy acceptability is assessed with items adapted from Vienna's City Development Plan for 2035, and urban mobility goals serve as mediators. The analytical framework integrates value theory and transport behaviour research (Schwartz's values, Value-Attitude-Behaviour hierarchy, Theory of Reasoned Goal Pursuit, and policy acceptability). The study addresses age-period-cohort challenges through mixed-method triangulation and careful model specification. By clarifying how values and goals shape acceptability, the study supports policymakers in designing socially acceptable, equitable, and durable urban mobility transitions in Vienna and beyond.

This presentation will report the qualitative findings from the pre-study comparing members of Generation Z (born 1997–2010) with the general population. It examines the importance this generation assigns to urban transportation goals and explains how the measurement constructs and associated items were developed for the subsequent quantitative survey.

Capturing public opinion for mobility policy change through a Participatory Value Evaluation: the case of Amsterdam

Cluster 4

Mouter, Niek

Authors: Mouter, N.

Cities face increasing pressure on the public space. Hence, there is an urgent need to reconsider how scarce public space is distributed amongst different goals related to physical-, mental- and social health, climate, economy, and accessibility. Public support is a crucial factor for the implementation of policies that aim to transform the use of public space. However, research shows that establishing public support for transformative policies is challenging due to status quo bias, amongst other things.

A potential solution is measuring public opinion through a Participatory Value Evaluation (PVE). The essence of a PVE is that participants see the policy options that a policymaker considers, the impacts of the policy options and the existing constraints. Subsequently, participants indicate what they would advise in this policy dilemma. This choice format has the potential to mitigate status quo bias as citizens realize through participating in the PVE that not all functionalities can be maximally facilitated and that tough transformative choices are required. Also citizens realize that allocating less public space to one functionality creates more space for other functionalities.

This study investigates the potential of PVE to understand public support for changes to the public space of Amsterdam. Citizens were asked to advise on the distribution of public space by considering 16 different policy goals within the constraints of limited public space as well as limited capacity of the civil service.

After providing an advice they were asked to provide a qualitative motivation of their choices. 4,796 citizens participated in the PVE (a controlled representative sample of 975 respondents and an open consultation of 3,821 citizens). We found that citizens desire more attention to safety related goals referring to the right to safe play spaces for children and safe streets for vulnerable road users. Other priorities related to allocating more public space to green and securing basic levels of accessibility for all. Policy goals that should use less public space according to citizens related to car accessibility. The priority pattern of safety related goals over these car accessibility goals is widely shared across subsegments of the population. Even citizens who travel by car more than 4 days per week deprioritize the goals that relate to car accessibility.

Based on the outcomes of the PVE the responsible Alderman decided to reframe her policy from "reducing public space for car parking" to "ensuring that kids can play outside safely". Due to the outcomes of the PVE support among the municipal council grew substantially.

Defining Public Authorities role in Mobility as a Service (MaaS)

Cluster 4

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Mobility as a Service (MaaS) has emerged as a promising approach to integrating diverse transport modes within a unified digital platform. However, if poorly governed, MaaS risks exacerbating social inequalities and contributing to transport gentrification. The MaaS business model remains one of the main barriers to widespread adoption, raising unresolved questions regarding governance arrangements (private-led, public-led, or public-private models), tariff setting and revenue allocation, and data-sharing practices. While these debates are largely framed around ensuring financial viability, equity considerations are often marginal, particularly when public authorities play a limited role in MaaS development and operation.

Although the literature widely recognizes the importance of public sector involvement in ensuring equitable MaaS outcomes, there is limited guidance on how public authorities should determine their appropriate level of engagement. This study argues that public transport authorities (PTAs) must adopt an active or enabling role in MaaS implementation to ensure that potential social benefits justify the level of public investment required. To address this gap, the paper develops a decision-support tool designed to assess and define the role of PTAs in MaaS governance. The tool is grounded in an empirical classification of 74 existing MaaS and “MaaS-like” systems worldwide, from which key institutional, infrastructural, and regulatory factors shaping public sector involvement are identified. These factors are interpreted through the lens of the multi-level perspective on socio-technical transitions and metagovernance theory and are subsequently operationalized into a practical, context-sensitive decision flowchart.

The results demonstrate that defining an appropriate PTA role in MaaS governance is inherently context-dependent. While some PTAs may express strong interest in adopting a hands-on, operational role, the tool reveals that such an approach is not always strategically or institutionally appropriate. PTAs with well-developed infrastructure, mature institutional arrangements, and high levels of IMPReSS—used here as a proxy for overall transport system maturity—are best positioned to assume a Provider role within MaaS ecosystems. In contrast, PTAs operating in less mature contexts or with constrained resources may achieve greater strategic value by assuming roles such as Analyzer, Architect, or Experimenter. Importantly, the analysis shows that not all contextual variables influence these roles equally. For instance, experience with managing complex transitions becomes a critical factor only when PTAs seek deeper operational involvement in MaaS provision.

Beyond its academic contribution, the proposed decision-support tool offers practical value for transport decision-makers navigating MaaS implementation. PTAs, consultants, and MaaS operators can use the flowchart to assess governance readiness, prioritize capacity-building investments, and define realistic implementation pathways. This is particularly relevant in procurement processes, partnership negotiations, and digital platform design, where

misalignment between institutional capacity and strategic ambition frequently undermines MaaS initiatives.

Planning for sufficient mobility across the life course: Insights from mobility biographies

Cluster 4

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Urban (transport) planning that promotes proximity and high levels of accessibility while reducing the need for mobility signals a paradigmatic shift away from increasing mobility for all and towards sufficiency-oriented ways of thinking about mobility. Radical reductions in private car ownership and use are central to these considerations (Hess 2022, Mock 2023, Rau & Matern 2024). Moreover, recent research has demonstrated both chances and challenges that emerge during the development and rollout of policies aimed at advancing urban mobility transitions through sufficient mobility, accessibility by proximity and immobility (Silva et al. 2023, Rau & Mögele 2025, Lanza 2025).

This article combines theoretical reflections on the relationship between (im)mobility and sufficiency with insights from multi-method empirical research on sufficiency-oriented mobility practices conducted in CircEular, a four-year EU-funded research and innovation action (2022–2026). Focusing on car ownership and use and its potential reduction through proximity-oriented urban (re)development, it fuses 80 qualitative interviews from four European countries (UK, NL, D, IT) with representative survey data from five European countries (UK, NL, D, IT, LT; n=5,651). To capture engagement in sufficiency-oriented mobility practices across the life course, interviewees were asked about their mobility biography and key life events. The subsequent survey captured past engagement in sufficient mobility (e.g. car sharing) and potential future uptake (e.g. shedding one's car if suitable alternatives become available).

This combination of retrospective and anticipatory questions revealed distinctive pathways across the life course regarding the adoption of sufficiency-oriented mobility, with incisive life events such as residential relocation and related shifts in the availability of alternatives to the car (e.g. relocation to a city with excellent public transport, cycling and walking infrastructure, car sharing and high levels of proximity). Obstacles to lowering car ownership and use included car-centred mobility socialisation, the availability of one or more cars in the household and negative views of alternatives, including car and bicycle sharing.

Analysing people's mobility biographies clearly helped to identify ways to shorten or prevent periods of engagement in resource-intensive mobility practices (e.g. private car ownership and use) while extending those related to sufficiency-oriented mobility practices (e.g. active mobility). Alerting practitioners and policymakers to the significance of life events for the adoption of sufficiency-oriented mobility practices seems particularly promising.

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Processing the Process – Translating transformative knowledge of street experiments into innovative municipal planning practices

Cluster 4

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Street experiments aim for systemic change from car-oriented to human-oriented cities. They are used to temporarily test street space reallocation and alternative uses of street space in pursuit of sustainable urban development goals. The planning and implementation of street experiments require agile project management, which conflicts with bureaucracy and standard processes that prevail in most municipal administrations. Thereby, during the planning and implementation process, planners gain transformative knowledge. The positive impact of street experiments on social life, the diversity of spatial uses, and sustainable mobility behavior is widely acknowledged; however, it often remains limited to the specific context and time of their implementation. At the same time, the impact on the necessary background activities at the municipal level is often overlooked, and little is known about how transformative knowledge is transferred into everyday planning practices at the municipal level. While capacity building occurs at the operational level, translating and scaling transformative knowledge remains a challenge.

In this context, transdisciplinary real-world laboratories (RwLs) pose a specific setting for implementing street experiments. The collaboration involves diverse stakeholders from science, administration, industry, and society. The diversity of expertise fosters technical, social, and spatial innovation for sustainable transition. However, the plethora of stakeholders makes coordination challenging. This contribution presents drivers and barriers that the transdisciplinary implementation of street experiments poses for municipal planning practices. In addition, a city-wide task force is introduced as an approach for exchanging lessons learned and capacity building between stakeholders to address those challenges.

Data was collected through focus groups and workshops. The findings are based on the processes of two RwLs, namely “Car-reduced neighborhoods for a livable city” (MCube AQT, 2021–2024) and “Mobility and urban climate in future neighborhoods” (MCube MOSAIQ, 2024–2027) in Munich, which were part of the “Munich Cluster for the Future of Mobility in Metropolitan Regions” (MCube) funded by the German Federal Ministry of Research, Technology and Space (BMFTR). Both projects aimed at sustainable mobility transitions, but with a slightly different approach and focus. During AQT, street space was redistributed and alternative mobility services were offered to learn about how the use of space and mobility behaviour changed through the experiments. MOSAIQ examines the effects on climate-adapted neighborhoods, opportunities for just redistribution of road space, and the resulting benefits for the community.

The findings from MCube aqt underscore that transferring transformative knowledge from the operational to the strategic level poses a challenge. In MCube MOSAIQ, a city-wide taskforce was introduced. Here, our preliminary findings show that it enables the transdisciplinary exchange and reflection among the involved stakeholders and the administration and helps translating learnings into other contexts. However, formats for reflection and learning that are suitable for everyday planning routines and can be undertaken without scientific guidance need to be developed and tested.

Designing Inclusive Demand-Responsive Transport: Comparative Insights from Wales and Israel

Cluster 4

Shiftan, Yoram

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Designing Inclusive Demand-Responsive Transport: Comparative Insights from Wales and Israel
Abstract

Demand-Responsive Transport (DRT) is increasingly promoted as a flexible planning instrument to address accessibility gaps in rural and peripheral areas where conventional fixed-route bus services are financially and operationally constrained. Within broader Mobility-as-a-Service (MaaS) narratives, DRT is often framed as an adaptive solution capable of supporting inclusive mobility transitions. However, empirical evidence reveals persistent tensions between flexibility, reliability, equity, and long-term viability.

This paper examines how inclusiveness in DRT is shaped not only by technological design, but also by governance arrangements, regulation, funding structures, and institutional coordination. It adopts a comparative case-study approach, analysing two contrasting DRT pilots: Fflecsi in Wales (UK) and Quicker in Israel's Emek Hefer region. Both operate in semi-rural contexts and were introduced as responses to declining fixed-route bus services, yet they differ markedly in governance logic, regulatory embedding, and approaches to inclusion.

The analysis draws on more than 25 semi-structured interviews with policymakers, local authorities, operators, technology providers, and community organisations, complemented by user surveys capturing travel behaviour, perceived accessibility, and service barriers. This mixed-methods design enables a systematic comparison between institutional intentions and lived user experiences, highlighting how planning and governance choices translate into everyday mobility outcomes.

Findings show that both pilots remain highly dependent on public subsidy, but follow distinct governance pathways. In Wales, Fflecsi is embedded within a nationally coordinated and socially oriented framework that emphasises accessibility and territorial equity. Yet fragmented local delivery, ageing fleets, and weak integration with rail services undermine reliability and user trust. In Israel, Quicker operates as a technology-led pilot with limited regulatory anchoring, enabling rapid experimentation and strong uptake among younger users, while systematically excluding many older and digitally marginalised populations through app-based booking and payment requirements. In both cases, efforts to improve operational efficiency frequently conflict with equity objectives, particularly for time-sensitive trips, users without digital access, and those with mobility constraints.

Across the two cases, hybrid service designs emerge as key strategies for balancing efficiency and inclusion. Semi-fixed routes combined with flexible feeder services, multi-channel booking systems, and stable funding arrangements improve accessibility and trust for some groups,

while revealing new distributional trade-offs for others. Inclusiveness therefore appears not as a fixed attribute of DRT technology, but as a negotiated outcome of planning, governance, and funding decisions.

The paper contributes to debates on urban mobility transitions by reframing DRT as a governance and planning challenge rather than a purely technical innovation. The comparative evidence points to several implications for planning practice: DRT should be designed as a complement to fixed-route networks rather than a substitute; multi-channel access should be treated as a core planning requirement rather than an optional add-on; stable, multi-year public funding is essential to avoid pilot fragility; and planners should have transparent access to operational data to monitor distributional effects over time. Together, these insights highlight that inclusive mobility transitions depend on institutional design choices and sustained public commitment, rather than on technological flexibility alone.

Car-dependency lock-ins and how to break them

Cluster 4

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The UNLOCK15 project aims to empower citizens and local authorities to activate transition pathways toward the 15 Minute City. It begins by examining the lock ins that sustain car dependency and hinder sustainable urban mobility, and by identifying empowerment tools that can help overcome these constraints.

In this presentation, we investigate car dependency through institutional, infrastructural, and behavioural lock ins, focusing on a case study in Portugal and comparing infrastructural lock ins across several European contexts. Using Carvalhido, a traditional urban centre in the city of Porto, as the main case study, we conduct a comprehensive analysis of the mechanisms reinforcing car dependency. We then compare these findings with other cases from the UNLOCK15 research project to better understand the role of infrastructural lock ins in shaping mobility patterns. The study also explores local narratives surrounding car dependency and how institutional, infrastructural, and behavioural lock ins influence these narratives.

Our results reveal a markedly stronger car dependent narrative in Porto compared to other project case study cities, despite similar levels of 15 minute accessibility. Institutional and behavioural lock ins emerge as particularly influential, illuminating the car dependent and moto-normative perspectives articulated by local stakeholders.

Bottom-up transformation of urban mobility: A comparative analysis of grassroots initiatives, mobility cultures and behavioural change

Cluster 4

Soontjens, Elliot

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Urban mobility constitutes a key sector for socio-ecological transformation, as shifts in everyday mobility practices can generate significant positive changes for planetary health and urban liveability. However, the capacity of formal state and market arrangements to deliver sustainable and inclusive mobility transitions is increasingly questioned. Within this uncertain context, this paper investigates the potential for grassroots initiatives to transform urban mobility. Here, they are perceived as alternative actors that target specific leverage points for long-term attitude and behaviour change through co-production of both knowledge and sustainable mobility interventions. In doing so, grassroots initiatives hold a significant influence on mobility cultures at ground-level, particularly on shifting mindsets and everyday mobility practices. Focusing primarily on these subjective aspects of mobility cultures, the paper argues that grassroots-led behaviour transformation can act as a catalyst for city-specific institutional and spatial mobility transformations, from the bottom up. Therefore, the research question is: How do grassroots mobility initiatives interact with mobility cultures to influence sustainable attitudinal and behavioural transformations?

The study draws on theory of sustainability transformations. Grassroots initiatives experiment with social interventions capable of confronting and changing dominant practices and worldviews through the co-production of desirable futures. Empirically, the paper develops a comparative cross-city framework of six Western European cities: Brussels, Copenhagen, Frankfurt, Madrid, Luxembourg and Vienna – representing diverse mobility cultures. The methodology is guided by the Factor 8 Model (Macharis, 2026), who's steps are followed from the perspective of one campaign per city that has or is actively transforming a mobility practice. Factor 8 traces the campaigns' developments from problem awareness to change-embodiment with the purpose to identify the conditions that most strongly shape the campaigns' influences on citizens' mobilities. A mixed qualitative methodology combines semi-structured interviews with the grassroots initiatives' leaders and desk-based research to understand the various mobility cultures as deeply as possible. This data creates a cross-case database organised around common analytical criteria, illustrating campaigns' objectives, trajectories, strategies, coalition-building processes, governance relations and observed outcomes.

The paper aims to make three contributions. First, it presents a working definition and typology of "grassroots mobility initiatives", distinguishing between forms of experimentation, co-

production and institutional engagement. By doing so, we bridge an important research gap between urban mobility and grassroots initiatives in sustainability transformations. While research in the energy and agriculture sectors have substantially demonstrated the transformative potential of grassroots initiatives, their role in urban mobility remains underexplored. Second, it demonstrates the mutual influences between mobility cultures and grassroots movements. The comparative application of the Factor 8 Model across diverse European mobility cultures effectively showcases grassroots initiatives as meso-level actors constantly interacting with both individuals and cultures. Third, it advances conceptual understanding of mobility governance from the bottom-up. Grassroots mobility initiatives are theorised as alternative actors that, by enabling participation, co-production, and embedding values of equity and justice, offer a radical approach to “governing” mobility transformations.

From Sharing to Cycling: Assessing the Potential of Bike Sharing Systems to Increase Cycling Levels

Cluster 4

Teixeira, João

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As a consequence of the negative externalities associated with private car use, cities face increasing pressure to promote more sustainable mobility patterns. Concurrently, the COVID-19 pandemic exposed the vulnerability of existing transport systems, particularly public transport, reinforcing car dependence in many urban contexts. In this context, cycling has emerged as a promising solution due to its sustainability, efficiency, and resilience.

One of the most widely adopted policies promoting cycling is the implementation of bike sharing systems (BSS), which have rapidly expanded worldwide. By lowering key barriers to cycling, such as bicycle ownership, maintenance, and flexibility, BSS are often assumed to contribute to broader increases in cycling participation. However, despite their rapid diffusion across cities in Asia, Europe, and North America, robust empirical evidence on their ability to increase cycling at the population level remains limited. Most existing studies focus on system usage, substitution effects, or single case studies, offering little insight into whether and under what conditions BSS effectively contribute to citywide cycling uptake.

Building on a critical review of the empirical literature on population-level impacts of bike sharing, this presentation introduces an ongoing research project designed to systematically address these gaps across diverse urban contexts. The project is framed within the broader literature on urban mobility transitions and shared mobility, responding to growing policy interest in scaling up cycling as a core component of sustainable, resilient, and low-carbon transport systems.

Methodologically, the project adopts an explanatory sequential mixed-methods design. The quantitative phase combines large-scale BSS trip data with disaggregated travel behaviour indicators (e.g. cycling modal share at neighbourhood and city levels) across multiple international case studies. Using quasi-experimental approaches, including difference-in-differences designs, the analysis seeks to isolate the impact of BSS implementation on cycling levels over time while accounting for confounding factors such as concurrent cycling policies, built environment characteristics, and sociodemographic conditions. Both aggregate (citywide) and disaggregate (neighbourhood-level) analyses are planned to capture spatial heterogeneity in impacts. Building on the quantitative findings, a qualitative phase will engage transport practitioners and BSS operators through interviews and focus groups in selected high-performing cases. This phase aims to contextualise the statistical results and explore governance arrangements, design choices, and local conditions that may explain why some systems are more successful than others in increasing cycling levels.

The expected contribution of this research is threefold. First, it advances the empirical evidence base on shared mobility and modal shift by explicitly focusing on population-level cycling outcomes. Second, it supports the development of a typology of BSS based on their effectiveness in increasing cycling, offering a more nuanced understanding of “what works, where, and why.” Third, it provides policy-relevant insights to support cities in designing and scaling BSS as part of broader mobility transition strategies aligned with climate, health, and equity goals.

Although empirical results are still forthcoming, this presentation will review the existing critical literature as well as outline the conceptual framing, research design, and anticipated contributions of the project, contributing to ongoing debates on sustainable shared mobility and urban mobility transitions.

Reclaiming Spaces of Mobility as Pathways to Combat Social Atrophy and Embrace Proximity

Cluster 4

von Schönfeld, Kim Carlotta

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Public spaces of mobility – e.g. train and bus stations, streets and squares, trams and busses – have historically been key spaces of social interaction, facilitating exchanges not only among friends and relatives but also among strangers, social classes and generations. However, these spaces have gradually lost their social relevance due to the conversion of streets into private-car-oriented transport networks aimed at optimising through-put. This trend has been aggravated by the conspicuous use of technological devices (namely smartphones) in public spaces for further optimization while actively disabling face-to-face interaction and engagement with place. Consequently, information about what is a desirable space of mobility, is based on efficiency metrics, quantitative travel surveys, sensors, geolocated behavioral data providers, and clicks on social media platforms. The monetary value of the emerging data has increased exponentially as it revealed the capacity to steer the behavioural choices of individuals. In turn, this has created myriad socio-economic incentives for governments, tech companies and individuals that further reinforce the optimization trend. Such self-reinforcing cycles of technological intensification and optimization intensify social atrophy, i.e. the gradual deterioration of social, cognitive, and emotional capacities of individuals caused by prolonged lack of meaningful human interaction. Simultaneously, key spaces for learning from others have become spaces where one chiefly learns that everything that matters occurs on a screen – and that if one wants to matter, one must appear on that screen. Concurrently, these processes lead to further focus on optimization and digitalisation.

To exit this self-reinforcing cycle, we propose that meaningful mobility transitions must include a rethinking of the way spaces of mobility are planned. Normatively, we suggest that efficiency, optimization and technologization could constructively take a firm back seat to other priorities, namely social engagement, learning, and local connection. The essence of how movement is facilitated and experienced should then become less about optimizing, reducing, and streamlining the time spent on mobility. If less car use and more proximity-based mobility is to be encouraged for social and environmental reasons, the focus should be on the place-based attractiveness of public spaces of mobility, and the social interactions these can foster.

Methodologically, we propose that any attempt to reach such objectives must include deliberate and synergistic shifts in planning research and practice. For research, we propose a methodological turn where regular interactive small-scale workshops, in-depth interviews, and embodied observations become the preferred data gathering options, questioning the primacy of quantitative methods. For planning practice, we propose the pedestrianization of

professionals, that is, the deliberate reduction of desk-based, data-driven and computer-based work so that embodied work at the street level can be embraced.

This presentation will relay the above in more depth, and will draw on literature and findings from various workshops and events held as part of the MobileWorlds research project to inspire what could be likely set-ups, results and theoretical and practical consequences, barriers, opportunities and threats of such a mobility transition towards meaningful social and environmental care – away from social atrophy and towards socio-spatial proximity.

From Landmarks to Cognitive Maps: Multimodal Evidence on Attention, Memory, and GPS Use in Urban Wayfinding

Cluster 4

Yuan, Liting

Authors: Yuan, L., & Susilo, Y.

Wayfinding, referring to the ability to orient oneself and navigate through space toward a destination that is not directly visible, is a complex cognitive process that relies on the interaction between attention, working memory, and spatial knowledge. While cognitive map formation has been widely studied, there remains a critical gap in understanding the specific mechanisms through which attentional allocation and memory processes shape spatial learning, especially in real-world conditions using GPS-based navigation aids. Recent studies have shown that there is a concern that heavy reliance on navigation tools may cause a weakening of mental map formation and spatial orientation, disrupt the embodied links between spatial and social cognition and potentially undermine the sense of place and social interaction that is necessary for urban models such as the 15-minute city.

The study aims to investigate the cognitive mechanisms underlying cognitive map formation, with a specific focus on the roles of attention and working memory during wayfinding and examine how navigation aids influence spatial knowledge acquisition and retention. The study uses a between-subjects experimental design in a real-world environment across three conditions: traditional wayfinding tasks (asking passers-by), GPS-aided tasks, and attentionally demanding tasks. Thirty participants are invited to complete guided and independent reversal walking tasks in the Gersthof area near BOKU University. Three routes are chosen at random for each condition. All routes include two turning points, which are anchor points such as a church, a school, or a crossroads with two supermarkets. The routes include the same types of landmarks, such as bus stops, road signs, traffic lights, green belts, slopes, car parks, graffiti, and buildings with distinctive signage, such as barbershops, restaurants, cafés and clinics, to ensure that the routes themselves are of the same difficulty.

Multimodal data, including electroencephalography (EEG), eye tracking, heart rate variability (HRV), behavioural performance, sketch maps, think-aloud reports and questionnaires, is collected from participants during and after wayfinding tasks. Eye-tracking data is combined with AI-based visual classification to quantify gaze directed towards environmental attributes. EEG and HRV data are analyzed using the MNE model and NeuroKit. These data are integrated to form a protocol relating to different events, including the initial fixation on landmarks, approaching intersections during guided walks, recognising landmarks, and making decisions at intersections during reversal walks. The coincidence of the guided and reversal walks and wrong-turn detection are also parameters used to evaluate wayfinding performance in different

conditions. The results would provide insight into how cognitive maps are formed and support policymakers, urban planners, and transport engineers in designing more human-centred cities.

CLUSTER 05

Leisure, Recreation, and Tourism: Planning
for Urban Tourism Mobility towards
Sustainability and Efficiency



Mapping the Spatial Footprint of Tartu 2024: Assessing Potential Spillover Effects of Cultural Events

Cluster 5

Altin, Laura

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Cities compete for the European Capital of Culture (ECOC) title to enhance international visibility, attract visitors and support post-crisis tourism recovery (Falk & Hagsten, 2017). Following the COVID-19 pandemic, cultural mega-events have regained importance as instruments for revitalising tourism and restoring international travel. Estonia's tourism demand is strongly seasonal, while Tartu, as a university city, maintains a comparatively stable year-round visitor base.

Tartu 2024 was designed as a decentralised regional initiative linking the host city with municipalities across Southern Estonia and prioritising international outreach in five key markets: Latvia, Lithuania, Germany, Finland and the United Kingdom. This study assesses whether the programme redistributed international visitor activity beyond the host city and examines the profile of international visitors attending flagship events.

The study links geocoded event location data with pseudonymised mobile positioning data to map international visitor mobility during the Tartu 2024 programme. Mobile positioning enables high-resolution analysis of visitor catchment areas, cross-regional movement patterns and post-pandemic recovery dynamics (Ahas et al., 2010; Saluveer et al., 2020). Spatial analytical methods include clustering and distance-decay analysis to delineate engagement zones and estimate the spatial reach of key events. By comparing event locations with observed visitor flows, the analysis examines how decentralised programming interacts with accessibility and regional infrastructure, and evaluates the share of international visitors originating from the programme's target markets. The study also considers the potential contribution of cultural programming to tourism recovery and seasonal balance, while recognising that the magnitude and direction of these effects require further empirical validation.

This study advances visitor profiling through mobile positioning data and demonstrates how such data can be used to assess spillover beyond conventional tourism statistics. It provides policy-relevant evidence for destination management and tourism mobility planning, including how decentralised cultural programming may be aligned with transport accessibility and regional connectivity.

Integrating Tourists into an Agent-Based Transport Model: A Longitudinal Analysis of Tourist Survey in Kyoto

Cluster 5

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Authors: Choi, N.H., Oi, S.Z., & Schmoecker, J.D.

Recent developments in agent-based transport simulation such as MATSim enable city-scale analyses by representing individual travelers as agents who make decisions under explicit rules, preferences, and constraints while interacting with one another and with the environment. This agent-based approach supports the evaluation of transport policies by capturing heterogeneous behavior and endogenous network feedback.

Tourism pressures in Japan have increased substantially, with inbound visitors reaching 37 million in 2024 (Japan National Tourism Organization, 2024). In Kyoto, where attractions are spatially dispersed and frequently accessed by public transport, official statistics report 56 million tourist visits in 2024 for a resident population of about 1.4 million (Kyoto City Planning Bureau, 2024). These magnitudes imply that tourists cannot be treated as a negligible demand segment, and interactions between residents and tourists may induce behavioral adaptation such as avoiding crowded areas (Koens et al., 2018). We are developing the MATSim Open Kyoto scenario to test policies addressing overtourism in Kyoto City. Typically, urban agent-based simulations construct a synthetic population by combining national census data with household-level daily trip data.

In this study, we aim to build a more realistic simulation by generating a synthetic tourist population. To understand tourist travel patterns and characteristics in Kyoto, we collected two tourist trip survey datasets conducted by the city in 2006 and 2023. Both the 2006 and 2023 surveys include daily tour trips and tourist attributes such as visit frequency, length of stay, gender, age, and companion type. However, the 2006 survey allows respondents to report up to seven trips, whereas the 2023 survey allows up to five. In addition, the 2006 survey records minute-level departure and arrival times and uses 37 destination codes, while the 2023 survey records times in 3-hour bands and uses 107 destination codes, indicating substantial differences in temporal resolution and destination coding. Both surveys also share common limitations. First, accommodation is not included in these tourist trip records, making it difficult to identify the first origin or last destination for tourists staying one or more nights. Second, because destinations must be reported only via predefined location codes, it is difficult to assign destinations to geographic coordinates. Furthermore, trip purposes are not provided for each trip.

Accordingly, this study describes how we address the limitations of the tourist surveys to generate a synthetic tourist population. First, we harmonize the survey units and describe how travel behavior changed between 2006 and 2023. Second, we explain the assumptions used to assign accommodation locations and coordinate-level destinations for each synthetic tourist.

Finally, we discuss the remaining limitations involved in implementing tourists in agent-based transport simulation. Our study represents an initial attempt to generate tourist agents for agent-based simulation aimed at addressing overtourism in cities, and we expect that resolving the identified limitations will further improve simulation realism and credibility.

Cycling tourism and bike lane investment in tourism destinations: the role of tourism taxes and quality coordination in a spatial competition model

Cluster 5

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The cycling tourism industry has experienced rapid growth, reaching \$83 billion in 2023, reflecting convergent trends in sustainable travelling, health consciousness, and experiential tourism demand. Yet, from an attribute-oriented perspective, the accessibility to tourism destinations and within-destination movements by bike tourists might be undermined by the lacking or scarce quality of bike lanes, with consequent feeling of unsafety for cycling tourism. Nevertheless, a key challenge faced by destinations planning to invest into bike lanes is that they typically represent non-excludable public goods serving both tourists and residents without direct user charges, thus the provision of quality of cycling infrastructure is strongly interconnected with fiscal aspects, including regional perspectives and the role of tourism taxes. What is the interplay between tourism taxes and quality investment in cycling tourism destinations? What is the role of tourists and residents' utility? By using an Hotelling duopoly model with hinterlands, we model a tourism spatial competition between two asymmetric destinations differing in their resident population size, namely resident-heavy (larger size) vs. tourist-oriented (smaller size) location, to study how partial cooperation arrangements, i.e., tax or quality coordination among destinations, affect equilibrium infrastructure investment. Following the destination management literature, in our framework the tourism destinations maximize a weighted objective function combining tourism-based profits with residents' welfare, assuming that a governance parameter captures whether decision-making prioritizes tourism returns or local citizens councils. As such, using the concept of subgame perfect Nash equilibria, we analyze three cooperation regimes through backward induction: full non-cooperation in both tourism taxes and quality; tax cooperation with competitive quality investment; and quality cooperation with competitive taxation, considering the EuroVelo network as real-life benchmark.

Our analysis yields key findings. First, asymmetry fundamentally alters cooperation outcomes, because when destinations have identical resident populations, tax cooperation tends to reproduce non-cooperative equilibria, as externalities cancel out. By contrast, with asymmetric populations, tax cooperation redistributes the fiscal burden from resident-heavy destinations toward tourist-oriented destinations. Second, quality cooperation tends to reduce infrastructure investment relative to competition by internalizing the demand-stealing externality in quality differentiation, transforming qualities from strategic substitutes into strategic complements. Third, governance structures notably moderate welfare implications:

when destinations prioritize tourism profits, quality cooperation dominates competition. Yet, when resident welfare is largely looked after, competition among destinations to attract tourists induces better outcomes through a sort of “quality arms race” that benefits local populations. Interestingly, these theoretical results shed light on observed patterns in European cycling tourism policy, particularly the EuroVelo network structure featuring coordinated route planning across 42 countries alongside complete fiscal autonomy. Our model theoretically mirrors this partial cooperation arrangement as quality coordination without compensating transfers, explaining the persistent heterogeneity in cycling infrastructure quality between Northern European countries (with larger resident populations and stronger focus on residents’ weights) and Southern/Eastern destinations (with economies more dependent on tourism and often lower weight on resident welfare). We derive policy implications for EU Cohesion funding design, showing how transfers, partnership principles mandating resident participation, and minimum quality standards can correct the distributional conflicts inherent in asymmetric cooperation.

Harmonizing Tourism Mobility and Sustainability: An Analysis of the Nikko MaaS Project

Cluster 5

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Japan currently faces critical social challenges, including a declining birthrate, an aging population, and a severe driver shortage. To address these issues, the national government has actively promoted "Mobility as a Service (MaaS)" since 2018, funding numerous pilot programs to foster innovation in public and private transportation. Despite these efforts, many initiatives have struggled to transition from the experimental phase to full-scale implementation. Barriers such as the slow digitalization of mobility data, operators' reluctance to share data, and insufficient cross-sector collaboration have made fully integrated booking and payment systems (Level 2–3) elusive for most regions.

Amidst this stagnation, "Nikko MaaS" in Nikko City has emerged as a distinctive success case. This study examines the initiative to clarify the mechanisms and success factors enabling its sustainable operation. Nikko, a premier destination hosting World Heritage Sites and attracting approximately 10 million annual visitors, faces structural transportation challenges. First, heavy reliance on private vehicles is a critical issue; approximately 70% of tourists arrive by car, causing severe congestion and environmental degradation. Second, the fragmentation of secondary transportation hinders convenience. Third, a local aging rate of 35% exacerbates public transportation deficits.

To address these interconnected issues, Nikko MaaS was selected as a project by the Ministry of the Environment and launched in 2021. Between 2021 and 2025, the system achieved cumulative sales of approximately 130,000 digital passes. Methodologically, this study employs a qualitative analysis based on in-depth interviews with key stakeholders, specifically Tobu Railway and Nikko City. It also draws comparative insights from traffic demand management strategies at Mont Saint-Michel, France.

The findings reveal that Nikko MaaS has effectively incentivized a modal shift, particularly among inbound tourists and younger generations. However, as overall private car usage has not yet seen a drastic reduction, traffic congestion remains a challenge during peak seasons. Therefore, referencing the Mont Saint-Michel case—where dynamic pricing for parking and digital signage effectively dispersed peak congestion—this study proposes future enhancements for Nikko, including time-based incentives and deeper cooperation with the accommodation sector. This paper contributes to the field by offering a viable framework for destination management organizations aiming to harmonize tourism promotion with sustainable mobility.

Keywords: MaaS, digitalization, environmental sustainability, destination management

Challenges and Perspectives for Sustainable Urban Tourism Mobility: Insights from European Case Studies

Cluster 5

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ABSTRACT

Tourism is a key driver of economic development in Europe, yet its rapid expansion—particularly in the post pandemic recovery period—has intensified environmental pressures, social tensions, and mobility challenges in urban destinations. As cities confront overtourism, rising emissions, and growing resident dissatisfaction, the interdependence between tourism and transport becomes central to designing sustainable and efficient urban mobility systems. This paper examines this relationship by analysing current trends, policy frameworks, and innovative practices that aim to reconcile tourism growth with environmental responsibility and urban liveability.

Transport is both an enabler of tourism and one of its most significant sources of negative externalities. Tourism accounts for an estimated 8% of global carbon emissions (Lenzen et al., 2018), with transport representing the largest share of GHG emissions in the sector (Sustainable Travel International 2024). Air travel dominates international tourism, while domestic tourism relies more heavily on surface modes such as rail and bus (World Tourism Organization 2024; UN-WTO and ITF 2019). Cruise tourism, despite its popularity, remains one of the most energy intensive forms of travel and generates substantial impacts in host cities within short timeframes. These patterns highlight the urgent need for integrated mobility strategies that reduce emissions, manage visitor flows, and protect local communities.

The paper reviews multi level strategies adopted at international, EU, and municipal levels and analyses several city examples. At the EU scale, initiatives such as the European Green Deal, the Sustainable and Smart Mobility Strategy, and the Single Digital Booking and Ticketing Regulation aim to decarbonize transport, enhance multimodality, and improve data harmonization. Cities, meanwhile, are experimenting with diverse approaches to manage tourism mobility. Examples include Constance and Geneva, where visitor cards provide free access to public transport; Bamberg's use of real time data and participatory planning to regulate visitor flows; and Barcelona's regulatory measures to curb illegal accommodations, redistribute mobility demand, and protect residents' access to essential transport services.

Beyond technical and regulatory measures, the paper highlights the growing social discontent associated with overtourism and the emergence of alternative paradigms and models; such as tourism degrowth and the Quintuple Helix model. These approaches emphasize community well-being, ecological responsibility, and co-creation between stakeholders. They also underscore the importance of shaping tourist behaviour through education, social marketing, and incentives for low impact mobility choices such as walking, cycling, and public transport.

The analysis concludes that sustainable tourism mobility requires coordinated governance, investment in green and multimodal infrastructure, and robust monitoring systems supported by standardized data. It also calls for policies that balance the needs of visitors and residents, promote equitable distribution of tourism benefits, and foster innovation through collaborative planning. By integrating environmental, social, and technological dimensions, cities can move from reactive responses to planned resilience, ensuring that tourism contributes to urban sustainability rather than undermining it.

Tourism Mobility Planning Instruments in Catalonia: A critical assessment

Cluster 5

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Tourism-related mobility represents a growing challenge for territories experiencing high levels of floating population, particularly in contexts where planning systems are fragmented across territorial, urban, mobility, and sectoral tourism planning instruments. Although Catalonia is often portrayed as an advanced region in terms of territorial and mobility planning, there is a lack of academic and applied studies critically assessing the extent to which existing planning instruments address tourism mobility as a structural planning issue. This paper addresses this gap through a review and analysis of how tourism mobility is regulated, integrated, or, conversely, overlooked within the Catalan planning framework.

Tourism mobility interacts intensively with residents' daily mobility, generating pressures on transport systems, public space, and infrastructure provision. Despite these impacts, it remains unclear to what extent current planning instruments are prepared to manage these dynamics in a coordinated and anticipatory manner. In this context, the study poses the following research question: to what extent is tourism mobility considered within planning instruments in Catalonia?

Methodologically, the study is based on an exhaustive review of territorial planning instruments at different geographic and administrative scales. At the regional scale, spatial planning instruments are analyzed to assess how tourism mobility is framed within strategic objectives and regulatory frameworks. At the local scale, 25 tourist municipalities were identified based on floating population indicators (2023), and their urban planning, mobility, and tourism instruments were analyzed to assess how tourism mobility is managed in practice. Likewise, sectoral tourism strategies are reviewed to identify their degree of coordination with territorial and mobility planning.

Based on the analysis of the 25 case studies, preliminary results reveal a significant governance gap regarding tourism mobility. An instrumental disconnection is identified: while structural urban planning (POUM) largely overlooks this specific phenomenon, it is increasingly addressed by more agile but reactive instruments such as SUMP and Tourism Sustainability Plans. These act as tactical mechanisms to manage flow saturation in the absence of strategic long-term planning. Within these recent documents, a clear paradigm shift is observed: a transition from a 'supply-oriented approach' (guaranteeing road capacity and parking) towards a 'defensive containment strategy' for residents (exclusive zones and access restrictions). However, a functional segregation of flows still prevails over true integration, prioritizing parking logistics over the sustainable mobility experience.

The paper contributes to debates on mobility and tourism planning from an institutional and territorial perspective, focusing on planning instruments rather than policy outcomes. It

highlights the need to move beyond sectoral and reactive approaches, advocating for a coordinated strategy that prevents tourism mobility from being relegated solely to SUMP. Instead, it calls for its anticipatory integration within broader territorial planning frameworks, particularly in territories experiencing high levels of floating population and tourism pressure.

Tourist Exposures and their Impact on Residents' Overtourism Perceptions in Kyoto

Cluster 5

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In 2024, Kyoto City, a city with a population of 1.4 million, received approximately 56 million visitors. This caused local concerns associated with impacts on quality of life (UNWTO, 2018), especially in areas where tourist and resident activity coexist. In mixed land-use urban setting, tourists sprawl into the connecting local streets where they attempt to cover multiple attractions in compact itinerary, causing residents living nearby become unable to circumvent but to compel to share the street with visitors when the street capacity is limited. Such tourist sprawls create unavoidable and unexpected resident-tourist encounters that cause tension when the psychological tolerance level in resident's daily routine is exceeded. As such, the overwhelming presence of tourism crowds becomes a critical factor to shaping resident's attitude towards tourism and a broader impact for community well-being (Schmöcker, 2021). In view of this backdrop, this study aims to investigate how spatial variations and intensity of tourist-resident encounters affect residents perceived tourism impacts. Specifically, it examines in detail how the context of different activities influences the way tourist-related impact is experienced and perceived.

The Arashiyama and Saga area in Kyoto City is selected as an empirical site for its considerably mixed land-use of residential neighbourhoods and tourist destinations. The area's dense network of attractions, transport nodes, shopping streets and local amenities provides a suitable testbed for observing resident-tourist conflicts. To address the research objective, the study adopts a quantitative deductive approach to integrate objective measures of tourist sprawls with subjective assessment of perceived tourism impact.

Tourist sprawl is modelled by travel demand indicators, including pedestrian flow, road traffic volume, public transport terminal crowdedness and occupancy rates, aiming to distinguish the contribution by tourists from other travellers. These objective indicators address the spatial distribution and intensity of tourist movement across the area. The perceived tourism impacts are measured through a structured questionnaire that covers multiple tourism-related issues such as perceived crowdedness at points of interests and transport facilities, parking availability, road and street congestion, noise, litter, travel time, living cost, safety, frequency of encountering tourists and unexpectedness of such encounters. By repeating these impact exposure items across different activity contexts, the study captures how perceived exposure varies within resident's mobility patterns within the area.

As an extension to previous studies of urban tourism conflicts (Li et al., 2024), this study extends an existing framework for larger urban areas by Nakamura (2016) to a framework based on street-

level observations and perceived local impacts that reflects physical capacity constraints of mobility. Structural element modelling is employed to examine the relationship between tourism impacts exposures, encounter characteristics, adaptive behavioural responses, social factors and overall perceived tourism condition.

The expected outcome of this study is a set of spatial gradients to quantify perception ratings of perceived impact condition in relation to varied proximity to tourist destination, transportation and street network. By correlating objective travel demand and subjective perception ratings, the study seeks to identify hotspots where physical and psychological capacities are exceeded. Based on the comprehensive overview of tourism impact within the study area, the research outcome can assist cities suffering from overtourism in developing visitor management or zoning strategies to manage tourism pressures and enhance quality of life in high-density tourist areas.

Challenge to define the personal "outside usual environment" by using human mobility data

Cluster 5

Shinjo, Sayaka

Authors: Kurihara, T. & Shinjo, S.

When defining "tourism," it is important that people's behavior belongs to "outside usual environment". However, whether people's travel qualifies as out of the ordinary is subjective, making it difficult to estimate tourism demand. Japan Tourism Agency's National Tourism Survey defines tourism as travel of 80 km or more one way, or travel involving overnight stays or a duration of 8 hours or more. However, perceptions of distance and time are not universal across time. In Japan, short-distance tourist trips were encouraged during the COVID-19 pandemic, and many people took tourist trips of less than 80 km. Given this, defining tourism based on fixed distances or other indicators may not be appropriate. Meanwhile, the recent advancement of big data recording people's movements suggests the possibility of distinguishing between usual and outside usual environmental activities based on individuals' travel histories. This study aims to define individuals' outside usual environmental activities based on the recorded travel history data.

Recent related research has used travel diary data from the German Mobility Panel (MOP) to define individuals' usual environments and identify travel events that leave this usual environment as outside usual environmental travel (Magdolen & Vortisch, 2025). However, the MOP survey requires responses from approximately 3,000 people about their weekly travels, limiting the sample size and duration of travel. This study uses disaggregated OD data provided by Blog Watcher in Japan. This data records travel for each individual trip, and the analysis focused on 2023 annual data for a total of approximately two million users.

The first finding from the analysis was that despite using big data from approximately 2 million users, the sample size was extremely limited, with sufficient travel history recorded to understand people's daily behavior. For example, only approximately 70,000 users (3.5% of the total) had monthly data of more than 8 months and made more than 100 trips per month. Another finding from the analysis was that travel of more than 80 kilometers, which is the standard for tourist behavior in the Tourism Statistics Survey, rarely occurred in the data defined as outside usual environmental behavior in the analysis of this study. In this study, we focused on the travel distance per trip, sorting each individual's travel distance in order of shortest to longest, and determined that cumulative travel distances up to 90% were usual environmental behavior, while travel distances above 90% were outside usual environmental behavior. The results revealed that only 4.5% of users recorded travel distances of 80km or more for outside usual environmental activities. This suggests that a definition of tourism based on a travel distance of 80km may underestimate the tourism demand. At present, this research focuses only on the

distance people travel, but future work will involve introducing the frequency of visits to destinations as a variable and refining the definition of outside usual environmental activities.

Assessing options for managing and steering local tourism demand: Initial findings from cluster-analysis and tracking tools to analyze tourist mobility in Berlin, Germany

Cluster 5

Wolter, Frank

Authors: Wolter, F., Wahnschafft, R.

The city of Berlin attracts around 13 million visitors per year. Main tourism activities include local sight-seeing, attending professional, trade, cultural, educational, or sporting events, entertainment and shopping, as well as other leisure activities. Berlin's tourism-related economy remains geographically concentrated in a few inner city districts, which also include most of the internationally well-known points of touristic interest. In Berlin, zones of touristic (over)development and zones of low touristic utilization are often in close proximity. Building on an existing segmentation with five visitor clusters, this project combines standardized surveys, smartphone based tracking via MotionTag, and expert interviews to generate high resolution mobility profiles and to identify potential cluster specific options for steering local visitor flows. The project aims to understand typical route and mode patterns per cluster, explore permission based tracking and real time information for tourists, and identifies potential measures that could be used to mitigate crowding, promote under used areas and to support more resident friendly tourism in Berlin.

Sustainable urban transport for tourism and the role of stakeholders: A comparative review

Cluster 5

Zamparini, Luca

Authors: Zamparini, L.

A seminal paper by Hinch (1996) has stated that four possible strategies may emerge in order to provide sustainable transport networks and services for tourists alongside the consideration of local residents.. : a) open market; b) industry leadership; c) public regulation; and d) regulatory partnership. The weakness of the first approach is due to the typical laissez faire that may prove inefficient given the emphasis on short term strategies by firms which are not consistent with the necessity to adopt a long-term view for sustainability. Under the industry leadership approach, the whole tourism business may appreciate the importance of the community in which they operate and adopt a long-term perspective to sustainability in the form of market alliances, consortia, or joint partnerships. Public regulation imposes boundaries to tourism business activity to safeguard the urban community and environments. Lastly, regulatory partnerships involve the urban and the business communities collectively. The two communities can then influence each other and propose a general urban strategy towards sustainability, considering all elements and all economic and social sectors.

The present paper is aimed at proposing a comparative analysis of actual case studies presented in the literature that may be linked to the considered approaches. Each section will examine cases related to a single setting. The last section is comparative and carries out a discussion of the similarities and heterogeneities emerging from the previous sections.

CLUSTER 06

Accessibility in Transition: Harnessing
Data to Navigate Change



Accessibility and Self-Assessed Transportation Sufficiency

Cluster 6

Anderson-Gregson, Brenn

Authors: Anderson-Gregson, B., & Farber, S.

This paper addresses transportation poverty using a sufficientarian framework, while combining egalitarian and capability approaches to transportation justice. Egalitarianism recognizes the inherent inequality of the transportation system, so long as the accessibility resulting from it is equal for all, while capability approaches centres the capacity of different people to convert those resources into a “good life” as defined by their preferences, promoting guaranteeing a minimum level of basic capabilities that are essential for survival and development (Pereira et al., 2017). Measuring and defining these minimum standards is the primary concern of accessibility sufficiency. Key unresolved questions include: 1) how to set “sufficient” thresholds (Karner et al., 2024; Martens, 2017), and 2) what benefits accrue when those thresholds are met (Ryan & Martens, 2023).

Existing approaches typically define transit accessibility thresholds relative to automobile accessibility (Singer et al., 2024; Van Der Veen et al., 2020; Werner et al., 2025) which, while pragmatic in research, is too arbitrary for policy use. Martens (2017) argues that the setting of specific policy thresholds should be undertaken as a democratic process by a group of agents that is informed by research on the impacts of accessibility on activity participation. However, top-down approaches for setting thresholds often overlook differences in preferences and needs (Pereira et al., 2017). Instead, we model sufficiency thresholds directly using self-assessed sufficiency measures from a national survey. This approach maintains individual heterogeneity without relying on political proxies. This paper develops a method for identifying calculated accessibility levels associated with sufficient outcomes. Specifically, we model the relationship between calculated accessibility and self-assessed sufficiency levels, accounting for individual capabilities.

We use data from the Mobilizing Justice National Survey on Transport Poverty (Morency et al., 2024), a large-sample, nationally representative survey capturing self-assessed transportation sufficiency, travel behaviour, and sociodemographic characteristics. We first apply factor analysis to identify three latent dimensions of transportation sufficiency: 1) Missed and Declined Opportunities, loading highly on missing commitments, declining employment and education opportunities, and feeling forced to use public and active transport; 2) Land-Use Insufficiency, loading highly on having too few jobs, grocery stores, health care facilities, and other locations within a reasonable commute; and 3) Transportation System Insufficiency, loading highly on long commutes, high congestion, and detours and wait times for transit. Combined, these factors account for 62% percent of the total variation in the self-assessment variables. We then implement a structural equation model using the latent sufficiency scores as the outcome variables. We calculate accessibility scores for four modes (walking, cycling, public transit, and driving) with effects mediated through travel behaviour and perceived accessibility. Results

show significant direct and indirect effects of calculated accessibility on sufficiency outcomes across modes, while accounting for individual capabilities and perceptions. Ongoing work will examine which levels of accessibility, by mode, are likely to result in sufficient transportation outcomes for population groups differentiated by capabilities, constraints, and residential location.

Mapping rural access: A data-driven framework for uncovering accessibility gaps in low-density areas

Cluster 6

Boisjoly, Genevieve

Authors: Sanchez Gomez, J.E., Cournoyer, F., Letarte, L., Trépanier, M., & Boisjoly, G.

Local and regional authorities are placing growing emphasis on enhancing regional public transport (PT) to foster social inclusion, economic growth, and sustainable mobility. In low-density areas, PT services are crucial for connecting individuals without car access to essential destinations. Limited funding and pressure to optimize services are driving demand for effective approaches to assess accessibility to key destinations via PT. Despite their widespread use, existing accessibility indicators hardly accommodate the complexities of low-density areas, where data scarcity and service diversity pose significant challenges. This study proposes a methodology to: (i) generate accessibility indicators for fixed route and demand-responsive transit (DRT) in three regions in Quebec, Canada, and (ii) assess the social and spatial distribution of PT services in the three regions using the accessibility indicators developed.

To achieve the first objective, the study first deploys a typology of fixed-route and DRT services and a framework to produce General Transit Feed Specification (GTFS) data for each service type. Then, cumulative accessibility to grocery stores, healthcare, and educational facilities is calculated at the residential lot level. Results are subsequently aggregated at the dissemination area level (small-size census units), with derived indicators introduced to support interpretation. Namely, the proportion of dwellings that have access to at least one destination of each type (one grocery store, one healthcare institution and one educational facility) is considered. Findings reveal important empirical and methodological challenges specific to low-density contexts. In the regions under investigation, PT services are limited in ensuring access to key destinations: 31% of the dwellings do not have access to at least one destination of each type within the specified thresholds. Further, low service frequency creates notable gaps between the maximum accessibility (all destinations accessible regardless of departure time) and average accessibility (which accounts for frequency) during the morning peak. Interestingly, findings reveal that the maximum indicator of accessibility is more reflective of rural conditions. Building on the data-driven methodological framework developed above, an equity analysis is then conducted to examine spatial access to key destinations. Using a clustering analysis, dissemination areas are classified based on the following four indicators: accessibility to key destinations via PT, walking accessibility to key destinations, intensity of service, and types of PT services available. The resulting typology produces distinct types of accessibility profiles that account for the interaction between PT services and local accessibility. The relationship between the accessibility profiles and socio-economic variables is then examined through correlation and regression analyses, thereby shedding light on the socio-spatial distribution of accessibility.

Overall, the study highlights key methodological opportunities and challenges in measuring regional PT and spatial equity, and offers a foundation for applications in other low-density contexts. The proposed methodology provides an indicator-based framework to support and prioritize interventions for equitable access to key destinations in low-density areas.

The Flowers of Proximity: A Participatory Method for Proximity-Centred Accessibility Planning in the 15-Minute City

Cluster 6

Büttner, Benjamin

Authors: Büttner, B.; McCormick, B. & Zuniga, M.J.

Proximity-centred planning has gained increasing attention as cities seek to address the environmental and social challenges associated with car-oriented urban development. While accessibility analysis plays a central role in this shift, many conventional approaches rely on standardised metrics and often fail to capture how accessibility is experienced across different local contexts and social groups.

This chapter introduces the Flowers of Proximity as a participatory method to support the co-design of context-sensitive x-minute city visions. Building on the visual approach proposed by Gil-Solá and Vilhelmson (2019), the method has been adapted to reflect the six social functions of the 15-minute city framework described by Moreno et al. (2021). It invites participants to articulate how they would like to access everyday destinations such as healthcare, education, retail, and public space by specifying acceptable travel times and preferred modes of travel.

The method has been implemented in a range of formats, including facilitated workshops, surveys, and digital applications. Across these settings, it has proven useful in eliciting both individual preferences and shared priorities, while also enabling comparisons between different spatial contexts, including urban, suburban, and rural areas. Findings from applications with citizens, students, older adults, children, and planning practitioners indicate a consistent emphasis on proximity to essential services, while also revealing variations in expectations and constraints related to location, life course, and mobility capabilities.

As the workshops are qualitative, the findings are not statistically representative. However, the approach provides insights into how accessibility is perceived and negotiated in everyday life. It helps to identify locally specific barriers to walking, cycling, and the use of public transport, and enables perspectives that are often underrepresented in planning processes to be incorporated more effectively. Recent digital applications extend the reach of the method and can support efforts to better align accessibility modelling with residents' stated preferences.

The Flowers of Proximity complement established quantitative approaches by offering a structured and accessible format for discussion and reflection. More importantly, they support more inclusive planning processes by improving communication between stakeholders and grounding accessibility analysis in the everyday practices and expectations of urban residents.

What amenities do people wish to have nearby? Insights from an accessibility survey inspired by the 15-minute city concept.

Cluster 6

Charalampidou, Georgia

Authors: Charalampidou, G., Dörrzapf, L., & Susilo, Y.O.

Enhanced local accessibility to essential amenities constitutes a fundamental pillar of the 15-minute city concept. Despite the plethora of methods for measuring and evaluating accessibility, individuals can still perceive it differently based on their personal needs and unique experiences in their neighborhoods. Thus, to ensure the successful implementation of new measures and interventions related to the 15-minute city concept and targeted at improving accessibility, it is essential to understand the preferences and needs of the diverse social groups residing within the area of interest. The present study utilizes data from a survey conducted in the course of the DREAMS (Driving Equitable and Accessible 15 Minute Neighborhood Transformations) project in Vienna. Each participant was asked to rate their neighborhood accessibility level and then to provide information regarding the categories of amenities they find more relevant for them and wish to have within a 10 to 15-minute radius from their place of residence. The survey also collected information regarding the respondents' current mobility patterns and sociodemographic information. By applying cluster analysis and other statistical methods we aim to identify accessibility profile groups and advance current knowledge by providing a nuanced understanding of who experiences which barriers in meeting their needs locally, which amenities they wish to have nearby, what their preferences are, and in what combinations. By linking the aforementioned factors, the study will provide a valuable framework for policymakers and planners to tailor new interventions and measures for enhanced accessibility to the unique needs of different social groups while avoiding one-size-fits-all solutions, which potentially may yield unintended consequences.

The Effect of Job Accessibility on Employment Outcomes: Evidence from the Canadian National Survey on Transport Poverty

Cluster 6

Dos Santos, Bruno

Authors: Dos Santos, D. B., & Páez, A.

The primary purpose of the transportation system is to improve its main benefit: people's accessibility. Poor accessibility is related to social exclusion, where some people or population groups are prevented from participating in location-based activities that they wish to engage in for reasons that are beyond their control. When insufficient accessibility is compounded by socioeconomic disadvantages, this can result in transportation poverty - the failure of transportation and land use systems to provide access to essential services or work intersecting with population socioeconomic disadvantages.

Recently, the Mobilizing Justice Partnership released the first national survey designed to understand transport poverty in Canada. The survey counted responses from more than 27,000 people across the country, providing an unprecedented look at the transportation challenges Canadians face, especially among equity-deserving groups whose experiences are often overlooked.

With this work, we therefore seek to answer: How can a level of job accessibility be related to employment outcomes? How could this relationship vary between different population groups? Based on the microdata of the Canadian National Survey on Transport Poverty, and adopting the Toronto Metropolitan Area and Hamilton Metropolitan Area as the study sites (together totalling around 7.8 million people in the Province of Ontario), we aim to evaluate the effect of job accessibility on employment outcomes.

Our methodology builds on the following steps. First, we conduct feature extraction and dataset creation to obtain the relevant features of the microdataset. We then calculate job accessibility indicators using a Multimodal Spatial Availability Model (singly constrained and competitive). Next, we proceed to estimate statistical models (weighted linear and ordinal regressions) to explore the effect of accessibility measures on different employment outcomes, controlling with socioeconomic variables at the individual level. Through this process, we aim to understand how varying job accessibility changes people's perceptions when answering questions related to their distance to work, how easily they can reach employment opportunities, whether they declined employment due to transportation constraints, and whether they feel that there are few job opportunities around them. To account for the likely presence of endogeneity, we create synthetic instrumental variables using a spatial filtering technique.

The results of the research help to understand the connections between accessibility and employment outcomes, and can, in the future, facilitate the development of transportation

supply thresholds needed to alleviate transport poverty for equity-deserving population groups, thereby facilitating the implementation of normative criteria that can guarantee minimum accessibility standards for disadvantaged populations, and preventing them from being excluded from the labour market.

Integrating Discomfort into Pedestrian Accessibility Modelling: Development and Evaluation of the Comfort-Based Accessibility Tool (CAT)

Cluster 6

Duran Rodas, David

Authors: Duran-Rodas, D., Zuckriegel, L., Zhan, H., Zuniga, M., & Büttner, B.

Traditional accessibility assessments in transport and spatial planning prioritise distance, travel time, and generalised cost. While these indicators estimate the structural potential to reach opportunities, they rely on idealised assumptions and largely ignore how urban environments are experienced in practice. For walking and wheeling, accessibility depends on network connectivity and also on environmental qualities and atmospheres that can generate discomfort. Inadequate lighting, excessive noise, steep gradients, narrow pavements, poor surface quality, can slow movement, alter route choice, delay trips, or deter walking altogether. As a result, conventional metrics frequently overlook inequalities faced by people with disabilities, older adults, women experiencing fear, individuals with sensory sensitivities, migrants unfamiliar with the environment, and others whose mobility is shaped by psychosocial and environmental stressors. This gap limits planners' ability to detect inequities and to design interventions that respond to lived experience rather than "average" assumptions.

This paper develops and operationalises the Comfort-Based Accessibility Tool (CAT), a multilingual web-based GIS instrument that integrates discomfort into pedestrian accessibility modelling. CAT redefines accessibility by adjusting walking speeds according to the presence and magnitude of discomfort factors. The study pursues four objectives: (1) identify, quantify, and spatialise discomfort indicators influencing walking and wheeling; (2) represent diverse needs through personas that embody distinct mobility capabilities and sensitivities; (3) demonstrate applicability across different data environments by implementing CAT in a data-rich case (Hamburg, Germany) and a limited-data context (Penteli, Greece); and (4) enhance transparency by clearly visualising how discomfort reduces effective reachability.

CAT was developed in four steps. First, discomfort indicators were identified through a mixed-methods approach combining a comprehensive literature review with empirical evidence from 81 qualitative interviews. Indicators were organised into environmental, physical, and psychological categories, and only those with spatially explicit and sufficiently stable data sources were operationalised; dynamic factors such as temporary construction, weather, and fluctuating social presence were excluded due to limited temporal resolution. Second, spatial data were acquired and harmonised by integrating municipal datasets (where available) with OpenStreetMap and OvertureMaps and translating layers into link-level attributes on a pedestrian network. Third, discomfort-adjusted walking speeds were modelled using a geometric-mean penalisation, assigning discomfort factors one of three severity weights

(slightly annoying, moderately disturbing, totally unbearable). Fourth, CAT computes default and discomfort-adjusted service areas using network-based catchment algorithms and provides an interactive interface for persona selection, scenario exploration, and transparent communication of assumptions and data provenance (link: <https://inclusive-space.vercel.app/>).

Results show that discomfort substantially alters accessibility outcomes: discomfort-adjusted catchments are consistently smaller than default catchments, especially in areas with poor lighting, high noise exposure, steep slopes, narrow sidewalks, and isolated environments. Differences between Hamburg and Penteli highlight how dataset completeness affects analytical granularity while confirming CAT's robustness under limited data conditions. Practitioner testing and an online survey indicate perceived usefulness, conceptual clarity, and transparency, supporting CAT's potential to inform inclusive, needs-based planning and to bridge qualitative lived experience with quantitative accessibility analysis.

Isolation to Inclusion: Introducing the Multidimensional Transport Poverty Index tool

Cluster 6

Félix, Rosa

Authors: Orozco-Fontalvo M., Matos G., Alvelos M., Moura F., Felix R.

Transport poverty is a multidimensional phenomenon that arises when individuals or households face limited, unaffordable, or inadequate transport options, constraining access to essential services and opportunities. It disproportionately affects low-income and peripheral populations and contributes to social and spatial exclusion. While several methodologies exist to measure transport poverty, they are often complex, data-intensive, and poorly suited for systematic and continuous monitoring over time.

This work presents the Multidimensional Transport Poverty Index (MTPI), using the Lisbon Metropolitan Area as a case study. The MTPI is a composite, policy-oriented index designed to measure, compare, and monitor transport poverty using exclusively publicly available and periodically collected secondary data. It enables longitudinal monitoring and territorial comparison at the national level, supporting evidence-based prioritization of policy interventions.

The index is built on an integrated analytical framework that combines transport infrastructure and service networks with spatialized socioeconomic data. Four core dimensions structure the MTPI: accessibility, affordability, mobility, and safety. These dimensions are operationalized through a set of standardized indicators selected based on data availability, policy relevance, and conceptual robustness. The index construction follows transparent aggregation and weighting procedures, ensuring interpretability for policy makers while maintaining analytical rigor.

The tool allows the identification and comparison of spatial patterns of transport poverty and enables the exploration of how different dimensions may overlap or reinforce one another across territories. Because the index relies exclusively on existing datasets, it can be periodically updated, enabling the assessment of changes over time as transport and social policies are implemented, as well as its replication in other cities.

To facilitate practical application, a web-based tool has been developed to implement the MTPI. The tool is supported by open-source code and allows users to apply the index using the proposed weighting methodology or to define alternative weighting schemes, including equal weights or customized combinations tailored to specific policy objectives. The tool is also adaptable to be expanded, and it is already sufficiently robust to support transport and social policy decision-making. Together, the index and its digital implementation provide a transparent and flexible framework for assessing transport poverty and informing targeted interventions across different territorial contexts.

When Satisfaction Becomes a Prerequisite: Necessary Conditions for Perceived Accessibility in Demand-Responsive Transport

Cluster 6

Friman, Margareta

Authors: Sukhov, A., Olsson, L. E., & Friman, M.

This study examines the relationship between perceived accessibility (PAC) and travel satisfaction (STS) in demand-responsive transport (DRT), using survey data from 1,206 users. As flexible transport services are increasingly positioned as solutions within mobility systems marked by uncertainty and social vulnerability, understanding how everyday travel experiences affect well-being becomes critical. While previous research has documented positive associations between perceived accessibility and travel satisfaction in conventional public transport, it remains unclear whether these constructs are linked through necessity relationships in flexible transport contexts.

Applying Necessary Condition Analysis (NCA), we demonstrate that the relationship between PAC and STS is asymmetric. Higher perceived accessibility is positively associated with higher travel satisfaction, but travel satisfaction emerges as a necessary condition for high perceived accessibility. In other words, users who perceive DRT as enabling their desired lifestyle tend to report higher satisfaction, yet without a baseline level of satisfactory travel experiences, high perceived accessibility cannot occur.

PAC reflects users' perceptions of whether the transport system enables them to carry out their desired daily activities and live life as they want, integrating functional aspects of mobility with experiential and emotional evaluations. Our findings show that such perceptions are experientially constrained: when travel experiences are unsatisfactory or emotionally negative, perceived accessibility remains limited, even when services objectively offer broad mobility opportunities. STS, capturing both cognitive evaluations of service quality and affective responses during travel, thus constitutes a critical experiential prerequisite for perceived accessibility and, by extension, everyday well-being.

These results advance theoretical understanding of the emotional foundations of perceived accessibility and provide practitioners with a necessity-based framework for identifying experiential thresholds that must be met to support user well-being and system legitimacy in demand-responsive transport. The study further contributes by proposing a visual convention for communicating asymmetric necessity relationships, using block arrows and explicit thresholds, enhancing the interpretability and practical utility of NCA results for research, planning, and health-oriented transport policy.

The (in)equity of access to cycle-friendly environments across UK cities

Cluster 6

Furlong, Jamie

Authors: Fevyer, D., Aldred, R., Furlong J.

UK cities remain predominantly low-cycling environments, characterised by limited high-quality cycling infrastructure and high levels of car dependency outside of London. In 2024, only around 2% of trips in the UK were made by bicycle, accounting for approximately 1% of total distance travelled – well below levels observed in many other Western European countries. In recent years, however, many cities – led initially by London – have begun investing in new cycling infrastructure, supported by improved national design guidance. In London, this transition has coincided with a substantial increase in cycling, with journeys rising by 43% between 2019 and 2024.

While the expansion of cycling infrastructure has the potential to improve safety and widen access to cycling, it also raises critical questions about the equitable distribution of cycling accessibility within cities. Specifically, which populations benefit from improvements in cycling environments, and which remain excluded as cities transition towards more cycle-friendly transport systems?

This paper presents a novel, spatially granular assessment of cycling accessibility across multiple UK cities. We develop a postcode-level cyclability score that captures cycling-related accessibility as a multidimensional capability, combining five indicators: provision of cycle lane infrastructure, access to everyday services, access to cycle-accessible greenspace, road traffic hostility (speed and volume), and the presence of supporting cycling facilities. This produces a consistent and comparable measure of cycling conditions for every postcode within each city. We first map cyclability scores and test for statistically significant spatial clustering, identifying concentrations of high- and low-quality cycling environments. We then link these scores to census and deprivation data to examine, using statistical modelling, how access to cycling-supportive environments varies by area-level deprivation and ethnicity. This enables an assessment of whether recent investments in cycling infrastructure have been distributed equitably or remain concentrated in more advantaged neighbourhoods.

Early findings indicate that cycling accessibility is highly uneven across UK city regions. Inner-city areas tend to exhibit higher cyclability, though substantial variation exists across suburban towns and peripheral areas. By comparing patterns across cities, the study sheds light on how access to cycling-friendly environments varies within UK cities and offers a reproducible approach that other researchers can use to assess whether cycling infrastructure investments are being delivered equitably.

15 minute city dreams and realities in European urban outskirts

Cluster 6

Geurs, Karst

Authors: Arias Molinares, D., McCormick, B.P., Duran, D. , Ulak, M.B., Geurs, K.T.

The 15-minute city (15mC) concept advocates for more sustainable and inclusive cities, making basic amenities accessible within walking and cycling distance. However, achieving 15-minute neighbourhoods creates multifaceted challenges in the urban outskirts.

The DREAMS project aims to examine how co-created and user-centric mobility services, mobility and flexible activity hubs can contribute to accessible, sustainable and inclusive 15mC neighbourhoods in urban outskirts in European cities and regions.

As part of the project, a large-scale survey (2500+ respondents) was conducted in 6 European cities across Europe: Budapest, Brussels, Munich, Paris, Utrecht and Vienna. In the survey, user needs and preferences and barriers towards reaching various amenities are examined, as well as the preferred number of neighbourhood amenities accessible at walking and cycling distance. Based on the survey, this paper examines the degree to which accessibility needs are met, for different population segments i (by age, income, gender, ethnicity) in the urban outskirts of 6 European cities.

Moreover, the paper confronts user needs and perceived accessibility values for different population groups in the different cities with calculated accessibility. In the DREAMS an integrated multi-layered Decision Support Tool is developed, which incorporates an X-mC accessibility compliance measure. The measures shows the extent to which various amenities can be accessed by different transport modes within different time thresholds.

The results of the analysis show that typically the accessibility needs of residents in the urban outskirts are not met, and perceived accessibility levels do not align with estimates of calculated accessibility measures. Residents in urban outskirts face several barriers to meet their accessibility needs and are typically unable to live a 15 minute city dream, in contrast with central urban residents.

Person-based Aggregate Space-time Accessibility (PASTA): Bridging the Gap between Place- and Person-based Accessibility

Cluster 6

Higgins, Christopher

Authors: Higgins, C. D., Li, C. J., & Paez, H. A.

Accessibility is the potential to interact with opportunities. Place-based measures of accessibility, such as gravity-type measures, have been widely applied to compute accessible opportunities traveling from a given origin and reflect aggregate geographic patterns of access across a city or region. Despite this, place-based measures are criticized for lacking consideration of individual-level space-time constraints, resulting in inaccurate estimates of potential interactions at the destination, particularly due to insufficient consideration of available time. In contrast, people-based measures rooted in time geography, such as space-time prisms (STPs), can compute both accessible opportunities and potential time to spend at each opportunity for individuals, given their travel modes and travel budgets. However, such measures are difficult to represent accessibility at spatially aggregate levels, limiting their application in planning practice. This study bridges place- and people-based accessibility by proposing person-based aggregate space-time accessibility (PASTA), a novel measure that starts by calculating voxel-based STPs. The discretized spatial and temporal dimensions enable further aggregations of the multidimensional arrays to return place-based measures of access whose units are measured in minutes of potential dwell time. From this, the PASTA-based approach can map potential dwell time across a city or region for many individuals or, with the incorporation of person weights, the entire population. Moreover, the aggregation can be conducted along different dimensions, making it easy to compare PASTA across space and time as well as travelers of different mode choice and socioeconomic characteristics. Comparisons with traditional place-based measures of market potential accessibility find positive and non-linear relationships between PASTA and gravity-type accessibility for transit and car, but more significant disparities between potential dwell time and walking and cycling access. Overall, PASTA bridges the concepts of population time and interaction potential. When paired with the underlying computational advances, this approach facilitates bringing people back into place-based accessibility analysis.

Space-time accessibility and leisure activity participation

Cluster 6

Liao, Yuan

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Understanding how transport accessibility shapes participation in everyday social and leisure life is central to building inclusive and vibrant cities. Conventional accessibility metrics typically estimate potential opportunities from fixed home locations and treat accessibility as static, overlooking the temporal constraints, trip chaining, and daily routines that structure real behavior. As a result, they provide only a partial view of individuals' actual capabilities to engage in discretionary and third-place activities. To address this limitation, we adopt a person-based space-time accessibility (STA) framework grounded in the human capability approach, conceptualizing accessibility as the set of leisure opportunities that individuals can feasibly reach between home and work given their time budgets, transport modes, and urban infrastructure.

We integrate high-resolution GPS-based travel diaries, multimodal transport networks, and detailed sociodemographic information for 2,415 residents of the Greater Paris region. For each individual, we compute STA as the number of leisure points of interest reachable within a daily time-space prism under realistic trip-chaining constraints. We then examine three linked outcomes: (i) whether observed leisure destinations align with modeled capability sets, (ii) how STA relates to total travel time, and (iii) how STA influences leisure participation, measured as the diversity of visited leisure locations. To disentangle these pathways, we estimate a structural equation model that jointly captures individual attributes, transport mode choice, accessibility, mobility behavior, and activity participation.

Results show strong behavioral validity of the STA measure: most individuals disproportionately choose destinations within their feasible opportunity sets, particularly active transport users, indicating that STA closely approximates realized choices. Higher STA is associated with shorter daily travel time, suggesting that better local opportunity structures enable more efficient activity fulfillment. At the same time, STA directly promotes broader leisure participation by expanding feasible options. However, an indirect pathway emerges: reduced travel time is linked to lower diversity of visited locations, partially offsetting the direct positive effect of accessibility. These countervailing mechanisms reveal that accessibility influences participation through both efficiency and exploration trade-offs rather than a simple monotonic relationship.

Substantial heterogeneity persists across population groups. Households with caregiving responsibilities exhibit lower STA and reduced leisure participation, while active mode users show higher accessibility and greater diversity of leisure locations. These findings highlight how transport resources, time constraints, and lifestyle factors jointly shape unequal capability sets. By reframing accessibility as an individual capability embedded in daily space-time constraints, this study advances beyond static measures and provides actionable insights for equitable

transport planning. Person-centered STA metrics offer a practical tool for identifying hidden barriers, evaluating policy impacts, and designing interventions that expand real freedoms to participate in social and urban life.

E-bikes and bikesharing integration with public transit: Evaluating impacts on job accessibility and spatial equity

Cluster 6

Louro, Thiago

Authors: Louro, T. V., Tomasiello, D. B., Grigolon, A. B., Cunha, A. L., & Geurs, K. T.

Despite their potential to address the limitations of conventional cycling, the role of e-bikes and bikesharing systems in improving job accessibility and transport equity remains underexplored, particularly when these modes are integrated with public transport. This study addresses this gap by evaluating the impacts of e-bikes and bikesharing on job accessibility and spatial equity in São Paulo, Brazil, one of the world's largest metropolitan regions.

We estimate cumulative job accessibility across travel time thresholds of 30, 45, and 60 minutes within integrated bike-and-ride systems. The analysis explicitly accounts for conventional bicycles and e-bikes at access, and (e) bikesharing at the egress stage. Cycling travel times are modeled using GPS data from a large-scale bikesharing system, while public transport travel times are estimated using General Transit Feed Specification data. Five travel time scenarios are constructed, ranging from a walk-and-ride baseline to e-bike-and-ride with bikesharing at egress.

The results show that integrating cycling with public transport substantially increases job accessibility. E-bikes consistently outperform conventional bicycles across all travel time thresholds, although their relative advantage declines as travel times increase, from a 25.5 percent improvement at 30 minutes to 10.6 percent at 60 minutes. The inclusion of bikesharing at egress further amplifies accessibility gains, particularly at longer thresholds, with increases of 31.7 percent for conventional bicycles and 38.9 percent for e-bikes at 60 minutes. Despite these improvements, substantial accessibility deficits persist in peripheral areas, reflecting São Paulo's highly centralized employment structure.

Equity analyses based on the Concentration Index and bivariate Local Moran's I indicate that cycling-based integration with public transport reduces, but does not eliminate, income-based and spatial inequalities. The Concentration Index declines progressively as access and egress options improve, with bikesharing producing the largest equity gains by reducing the index by between 19.4 percent and 23.5 percent at the 60 minute threshold. Income-decile analyses show that accessibility gains from e-bikes and bikesharing are relatively larger for lower- and middle-income groups at longer travel times, even though absolute accessibility advantages remain concentrated in higher-income and more central areas. Spatial clustering results further confirm persistent polarization, with high-income and high-accessibility clusters concentrated in central locations and low-income and low-accessibility clusters dominating the periphery, although low-income and high-accessibility clusters expand in some areas.

Overall, these findings highlight both the potential and the limitations of e-bikes and bikesharing as strategies for improving accessibility and transport equity in large, highly

centralized metropolitan regions. While cycling-based integration meaningfully extends the reach of public transport and reduces measured inequalities, these measures alone are insufficient to overcome structural factors such as employment concentration and residential segregation that fundamentally shape accessibility outcomes.

How Proximity Shapes Welfare Take-Up: Causal Evidence from Brazil

Cluster 6

Luz, Gregorio

Authors: Luz, G., Pereira, Rafael H. M., & Da Mata, Daniel.

Spatial accessibility is a central determinant of whether public policies effectively reach their intended beneficiaries. While this insight is well established in transportation research, much less is known about how geographic access shapes the performance of social assistance systems, particularly in low- and middle-income countries. This paper examines the causal effect of expanding physical accessibility to social assistance on welfare coverage among vulnerable populations in Brazil.

We study the rollout of Social Assistance Reference Centers (CRAS), the main front-line facilities of Brazil's social assistance system. CRAS are publicly funded, neighborhood-based centers that provide information, enrollment support, and basic social services to disadvantaged families. Access to these centers is a key gateway to Brazil's national social registry, the Cadastro Único (Unified Registry), which determines eligibility for major social programs, including cash transfers, housing subsidies, and utility discounts. Because interacting with the system requires in-person visits and periodic updates, distance to a CRAS can constitute a meaningful barrier to access.

Here, we examine the causal effect of expanding physical accessibility to social assistance, via the opening of new CRAS, on welfare coverage and engagement, and how do these effects vary with distance from the service center. We conceptualize CRAS openings as localized shocks to accessibility that reduce travel and information costs for nearby households.

We combine administrative data from two nationwide sources: (i) the Social Assistance Census, which provides the universe of CRAS locations and opening dates, and (ii) the Unified Registry, which contains information on low-income families, including residential address, registration, and update dates. We construct a spatial panel for the period 2011–2019 by georeferencing both CRAS and households and aggregating outcomes within concentric buffers of 1–5 km around each center. Outcomes capture both stock measures (total registered families and individuals) and flow measures (new registrations and recent registry updates over the last 12 and 24 months).

To identify causal effects, we exploit the staggered rollout of CRAS openings across space and time using a multi-period difference-in-differences design with cohort-specific treatment timing. We implement two estimators, Callaway & Sant'Anna (2020) and Borusyak, Jaravel, & Spiess (2024), comparing areas that have just received a CRAS to those not yet treated, while controlling for municipal economic conditions and common time shocks. Event-study analyses are used to assess dynamic effects and test for pre-treatment trends, and placebo tests further support the design's validity.

Our results show that improved spatial accessibility to social assistance has substantial and spatially concentrated effects. The opening of a CRAS leads to significant increases in recent

registry updates and new enrollments among families living nearby, with the strongest and most persistent impacts observed at closer distances to reference centers. Effects attenuate monotonically with distance, consistent with accessibility operating through reduced spatial barriers. Impacts emerge in the first year of operation and accumulate over subsequent years, indicating sustained engagement.

These findings provide causal evidence that proximity matters for the effectiveness of the welfare state. Beyond expanding service supply, where facilities are located critically shapes who benefits from social policies.

The Digital Flowers of Proximity: Worldwide Insights into Multimodal Accessibility Preferences for Planning the X-Minute City

Cluster 6

McCormick, Bartosz

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Gaining significant international prominence in recent years, the 15-Minute City has popularized proximity-centered accessibility planning by offering a vision for cities where residents can access their essential needs within a short walk or bike ride. The 15-Minute City serves more as an example than a blueprint, with adaptation to the local context being key. Accordingly, numerous “X-Minute” variants exist. Notably, broader ones such as “30-Minute Territories” shift away from an exclusive focus on proximity by incorporating the role of public transport in lower-density contexts. The importance of context-sensitivity raises questions including: What destinations matter most in everyday life? How should they be reached? How close is “close enough”?

This study introduces the “Digital Flowers of Proximity,” an online, gamified survey platform developed to answer these questions from the perspective of residents of cities around the world. Building on the participatory workshop approach of the same name, respondents reflect on the destinations that are important to them and how they would like to reach them, with the main distinction being a multimodal perspective. The approach complements conventional travel behavior surveys by focusing on how people would like to travel rather than how they currently travel, a perspective that is conducive to reimagining cities.

The aim of the research is to uncover how accessibility preferences differ based on sociodemographic characteristics, cultural factors, and urban topology, with a special focus on the desired balance of proximity and mobility in people’s lives. With over 600 respondents, an emerging trend is a large disparity between respondents’ current primary mode and their preferred mode. Across all destinations, the share of respondents who would prefer to drive or use public transport is substantially lower than the share that currently does. The clear desire for proximity, even in less-dense, car-centric contexts, offers evidence in favor of proximity-centered accessibility planning.

Furthermore, preliminary results suggest an emergent typology of amenities based on their (i) overall relevance to residents (universal vs. specialized) and (ii) importance of access using active modes (proximity vs. mobility). This yields four categories: (a) universal-proximity (e.g., supermarkets), (b) universal-mobility (e.g., workplaces), (c) specialized-proximity (e.g., playgrounds), and (d) specialized-mobility (e.g., cultural venues). The results also capture the influence of amenity and mode on acceptable travel times. Nearly all respondents consider a 5-minute walk as acceptable to reach every amenity, with most of them finding a 10–15-minute walk

or bike ride acceptable. Respondents who would consider using public transport or car have a lower sensitivity to travel time, which can be attributed to the lack of physical effort required to use the mode.

The findings from this research enable the calibration of accessibility models that more accurately reflect residents' perceptions and can also help inform context-sensitive X-Minute City planning.

Urban Accessibility Under Flood-Induced Disruptions: Implications for Mobility Planning in Times of Uncertainty

Cluster 6

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Climate change has intensified the hydrological cycle, increasing the frequency of short-duration, high-intensity rainfall events that overload urban drainage and transport infrastructure. Flooding is a recurrent consequence of these dynamics and represents a critical source of disruption to urban mobility systems. In Brazil, between 2013 and 2024 20,926 flood events were officially registered with declaration of emergency. A particularly emblematic case occurred in Porto Alegre in 2024, where extensive areas remained flooded for over 30 days following a rainfall event with an estimated 1,000-year return period.

Considering this context of growing climatic uncertainty, this study examines how flood-induced disruptions compromise urban accessibility to essential services, framing accessibility as a core component of urban mobility resilience. Specifically, the analysis focuses on two dimensions: (i) the loss of population access to healthcare services, which are critical for emergency care and disease prevention; and (ii) the impairment of emergency response capacity due to the loss of accessibility between rescue service units and affected populations. The analysis covers four major Brazilian cities with distinct urban and hydrological contexts: Fortaleza-CE, Salvador-BA, Recife-PE, and Porto Alegre-RS.

The study combines flood and mass movement susceptibility maps produced by the Brazilian Geological Survey with georeferenced data on hospitals and rescue service units, population and income data, and an H3 hexagonal grid of resolution 9. Accessibility is measured using cumulative opportunity indicators within a 60-minute car travel threshold, comparing baseline conditions with flood-degraded scenarios. This scenario-based approach enables the stress-testing of urban accessibility under extreme events, providing a planning-relevant assessment of mobility system vulnerability.

Regarding access to healthcare facilities, the percentage reduction in the number of health units reached within 60 minutes by car due to flooding reached 55.5% in Fortaleza, 45.9% in Porto Alegre, 87.3% in Recife, and 23.9% in Salvador. Spatially, the four cases exhibit different patterns of accessibility loss: in Fortaleza, losses are more continuous and concentrated in extensive peripheral areas; in Porto Alegre, impacts are fragmented and aligned with riverbanks and flood-prone zones; in Recife, accessibility losses are severe and nearly generalized across the urban territory; whereas in Salvador, impacts are more localized and discontinuous, primarily affecting coastal and low-lying areas.

Regarding the impairment of the emergency response by rescue services, the percentage increase in travel time due to the degradation was 459.1% for Fortaleza, 342.2% for Porto Alegre, 323.3% for Recife, and 490.1% for Salvador. The results demonstrate that flood events can

trigger widespread and uneven losses of accessibility, revealing structural weaknesses in car-dependent emergency and healthcare mobility systems. These findings underscore the need for urban mobility transitions that prioritize redundancy, decentralization of critical services, and adaptive planning approaches capable of operating under deep uncertainty.

This paper contributes to the literature on urban mobility transitions by demonstrating how extreme flood events undermine accessibility to critical services, exposing systemic vulnerabilities in car-based mobility and emergency response systems. Methodologically, it introduces a scenario-based accessibility framework to test urban mobility performance under climatic uncertainty. Empirically, the comparative analysis across four major Brazilian cities reveals how urban form, infrastructure centralization, and exposure to flood risk shape uneven accessibility losses, offering actionable insights for resilience-oriented and equity-driven mobility planning in the Global South.

Evaluating the Accessibility and Equity Impacts of Demand-Responsive Transport under Travel Time Uncertainty

Cluster 6

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Demand-Responsive Transport (DRT) is increasingly introduced as a solution to improve mobility in areas where Public Transport (PT) struggles to offer frequent, reliable services, or even to cover them. DRT's high operational costs require a clear understanding of the benefits it provides, not only in terms of traditional operational indicators such as waiting or travel times, but also in terms of accessibility and subsequent equity-related outcomes. However, DRT operations are inherently uncertain, as they depend on fluctuating demand, dynamic routing, and the resulting shared-ride detours, making reliability a critical challenge for planning and evaluation. Previous analyses of integrated DRT-PT have not examined the social aspects of service use; in other words, they have not quantified who benefits from the service, where, or whether it truly improves travel experiences across different population segments.

In this research, we address this gap by evaluating the equity impacts of DRT across different population groups. We use isochrone-based accessibility as an indicator of equitable use, and different real-world datasets from three French territories. The data include historical DRT trips spanning 2018 to 2025, sociodemographic characteristics of the population, and employment opportunities. To explicitly account for travel time uncertainty, we model DRT travel times using a probabilistic machine learning approach based on a Bayesian Neural Network, which predicts full travel time distributions rather than single deterministic values. From these distributions, we extract 95% travel time percentiles, providing a conservative estimate of travel times, which are subsequently used to compute accessibility indicators.

Accessibility to employment serves as the proxy indicator in the equity evaluation and is assessed across four population groups defined by two key sociodemographic characteristics: car ownership and unemployment. Population groups are constructed using the French national average rates of unemployment and car ownership as thresholds, allowing the identification of relatively advantaged and disadvantaged groups.

Results show that DRT-PT significantly improves accessibility for all population groups compared to PT alone, with greater gains for vulnerable populations characterized by high unemployment and low car ownership. For half of this group, DRT-PT increases individual accessibility by up to a factor of 21 compared to PT alone. We further compare DRT-PT with other modes, including walking, biking, and car. Results show that DRT-PT provides larger accessibility improvements than other non-car modes, while car remains the mode offering the highest accessibility and equity levels, although it is not available to everyone and is not a sustainable

option. Changes in accessibility inequalities are measured using the Theil index, showing a substantial reduction when DRT is integrated.

The outcomes and methods of this research provide planners and decision-makers with robust evidence and practical techniques to assess and communicate the equity and accessibility contributions of integrating DRT into public transport systems under conditions of operational uncertainty.

Transit Under Air Raids: Real-Time Transit Accessibility During Wartime in Kyiv

Cluster 6

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Armed conflict imposes recurring and unpredictable shocks on urban transport systems, yet there is limited empirical evidence on how public transport accessibility evolves during active warfare. This paper presents ongoing research examining the resilience of Kyiv's transit network during the war, with particular attention to how air-raid alerts and power outages reshape when and where residents can realistically travel. The study combines twelve months of GTFS and GTFS-RT data with air-raid alert logs, infrastructure damage reports, and shelter locations to construct a time-resolved measure of transit accessibility across the city. Rather than focusing on ridership or scheduled service alone, accessibility is defined using observed vehicle operations, allowing analysis of how service areas contract, fragment, and recover before, during, and after security alerts. Accessibility is evaluated with respect to critical urban destinations, including hospitals, schools, food retail, and civil protection infrastructure, reflecting essential activities under wartime conditions.

The analysis is designed to identify spatial and temporal patterns of accessibility loss and recovery associated with wartime disruptions, and to assess how these patterns vary across neighborhoods with different levels of network redundancy and access to civil protection infrastructure. Results will illustrate how real-time operational disruptions interact with security protocols, such as mandatory shutdowns of subways during air raid alarms, to shape everyday mobility under conditions of prolonged threat. By demonstrating how GTFS-RT can be used to measure accessibility under extreme stress, the paper contributes a methodological framework for analyzing transport resilience in conflict-affected cities and other crisis contexts.

Combining Canadian youth's neighbourhood perception with travel time: exposure-adjusted school accessibility

Cluster 6

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Background.

Efforts to promote walking and cycling for the school journey often assume that shorter trips inherently improve youth mobility. Yet young people's experiences of neighbourhood safety, comfort, and social climate shape both their willingness to travel actively and the emotional impact of those trips. These factors are not explicitly included in conventional time based accessibility measures.

Grounded in a time geography (person-based accessibility) and ecological systems perspectives, we respond to this gap by conceptualising travel time as the duration of exposure to the neighbourhood's socio-emotional benefits and limitations. We assume that perceived social safety and welcome modulate the subjective cost of moving through place, shaping autonomy, stress, and everyday social connection.

Purpose.

We propose an exposure adjusted accessibility measure that incorporates youths' perceived neighbourhood conditions into a multi-dimensional travel cost, and test whether it better reflects mental health related outcomes than the baseline travel-time-only accessibility measure.

Data.

A multi year, Canada wide youth survey (n=3,457, across multiple waves through 2021 to 2024) provides residential location, reported school and school travel mode, indicators of psychological distress, mental wellbeing, and social connectedness, plus sociodemographics and urban form characteristics from open data and census sources. This Canada wide youth survey also provides a validated measure of neighbourhood perception, based on perceptions of local safety and social climate, which is summarized as a neighbourhood exposure index. As well, the network-based travel time for residential trips to schools by walking, cycling, transit and car modes are estimated.

Methods.

We construct (i) a time only school accessibility metric using network-based travel times by mode and (ii) an exposure adjusted variant in which perceived neighbourhood conditions modify the impedance term. We compare the two via cartographic methods, equity (distributional) differences, and associations with other youth-reported outcomes such as mental distress, mental wellbeing, and social connectedness, controlling for key covariates.

Anticipated Results.

We expect the exposure adjusted metric to reveal clearer spatial variation and stronger links to youth wellbeing than the time-only accessibility. Shorter active trips through positively perceived environments are anticipated to be associated with lower reported distress and higher connectedness, whereas longer trips through negatively perceived settings may correspond to elevated distress. Associations are expected to be mode sensitive, with weaker links between neighbourhood-perception and outcomes (mental wellbeing, social connectedness and mental distress) for car travel.

Practical Implications.

Blending both quantitative and qualitative (survey-based) data, this exposure adjusted accessibility measure offers a transparent, mappable way to integrate and foreground experiential data into accessibility-oriented planning. In a time of mobility transitions and proliferation of data sources, this work demonstrate a way survey-based results may be used to create metrics that assist in system-wide planning.

Keywords: youth mobility; accessibility; exposure adjusted impedance; wellbeing; neighbourhood perceptions

How does travel app engagement among older adults shape perceived accessibility outcomes?

Cluster 6

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Digital travel applications have become increasingly embedded in everyday travel, shaping how trips are planned, navigated, and booked. Travel apps also influence the ways in which individuals perceive the places they do and do not have access to. While adoption rates of travel apps continue to grow at the population level, not all individuals are willing or able to keep pace with the latest digital developments for everyday travel. Older adults are frequently identified as a group likely to encounter challenges due to lower average digital literacy, age-related physical or cognitive changes, and preferences for familiar, non-digital travel practices. Prior studies on travel app usage suggested smartphone ownership and the alignment between app design and users' digital skills as the main factors influencing who can and cannot use travel apps effectively. While this perspective has been instrumental in identifying important barriers related to skills and design, it often implicitly treats adoption and effective usage as the desired endpoint and interprets non-use as a shortcoming. Such framings risk overlooking the situated and heterogeneous ways in which older adults relate to travel apps in distinct ways in their everyday travel. Simultaneously, the relationship between older adults' engagement with travel apps and tangible mobility outcomes remains insufficiently understood. This paper presents a systematic review of the literature examining older adults' engagement with travel apps and the associated mobility outcomes, such how individuals perceive their access to potential interactions. Studies were identified through structured searches of Scopus and Web of Science using a Population-Concept-Context framework, combining terms on older adults, digital travel apps, and mobility or accessibility. Records were screened following PRISMA guidelines, with relevant studies supplemented through backward and forward citation tracking (n= 20). Data on study characteristics, patterns of engagement, influencing factors, and mobility-related outcomes were extracted and synthesized thematically. The findings reveal that engagement patterns are heterogeneous and shaped by strongly interrelated contextual, motivational, and digital literacy factors, suggesting that digital divides in later-life mobility reflect differentiated, situated practices rather than linear stages of adoption. Furthermore, the findings reveal that research on travel app use among older adults rarely examines tangible mobility outcomes such as perceived accessibility and travel behavior directly. Instead, mobility outcomes are most often inferred indirectly from measures such as usage frequency, perceived usefulness, or ease of use, therefore drawing conclusions based on implicit assumptions rather than analytically examined data. Our findings highlight the need to move beyond adoption-focused metrics and to investigate how digital engagement shapes older adults' actual mobility experiences and outcomes. We argue that older adults' engagement with travel apps and how this relates to their

perceptions of accessibility is best understood using a digital divide framework that takes perceived accessibility and actual travel behavior as its tangible outcomes. Future research should adopt longitudinal, context-sensitive approaches to examine how experiences, skills, motivations, and situational conditions interact over time, providing a more nuanced understanding of how travel apps can meaningfully support older adults' mobility. In addition, improving understanding of the relationship between travel apps and older adults' perceptions of accessibility can support professionals and decision-makers in developing transport policies and digital tools that promote increased and equitable (perceived) access to opportunities, enhance mobility, and ultimately improve quality of life.

Towards global modelling of pleasant accessibility for walking and cycling

Cluster 6

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It is well established that active mobility behaviours are determined not only by urban proximities, but also by travellers' perceptions of the environment they move through. For accessibility studies, realistic assessments of pedestrian and cyclist access to urban destinations must go beyond travel times and distances to consider perceptions of route safety, aesthetics, and other environmental characteristics. Recent advances in geospatial and AI-based methods combined with the growing availability of global and open datasets on land use and transport offer novel possibilities to address this challenge across cities and regions. Together, these developments allow us to revisit two core questions in modelling pleasant accessibility: 1) how to capture multidimensional environmental perceptions that contribute to pleasant experiences during active mobility across population groups, and 2) how to combine these perceptions with urban scale accessibility evaluations.

In this presentation, we draw on our empirical research in the ERC GREENTRAVEL project addressing these interlinked questions. First, we present multiple approaches to modelling environmental pleasantness during active mobility at the urban scale, including the use of proxy indicators like greenery, probabilistic predictive models based on land use data, and multimodal large language models and other AI and machine learning techniques. We then focus on integrating modelled perceptions with urban scale accessibility evaluations. We illustrate this with our recent work on examining associations between walking accessibility and greenery across large European cities at high resolution, as well as with the application of environmentally aware Green Paths routing software to model opportunities for pleasant active commuting in the Helsinki region.

Our results show that computational approaches to capturing environmental perceptions correspond generally well with surveyed measures, allowing the prediction of pleasant experiences across entire urban areas with high accuracy. However, spatial biases and demographic representation remain common issues with these approaches, highlighting the need for critical examination when applying them. Furthermore, our results focusing on the role of greenery show that while it is among the key determinants of pleasant travel experiences, it is also negatively correlated with walking accessibility levels across European cities.

We conclude our presentation by discussing current challenges and limitations of existing approaches to modelling pleasant accessibility, as well as their transferability and applicability across contexts. Our presentation provides methodological insights into integrating environmental perceptions with accessibility evaluations at varying levels of complexity and sophistication. More broadly, the results support planning efforts to promote sustainable

mobility in cities by helping to assess the potential for accessing destinations by active modes more realistically

Exploring the relationship between car dependence and accessibility by public transit in Canadian regions

Cluster 6

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Car dependence poses a major challenge for sustainable mobility, contributing to environmental degradation, public health issues, and transport inequities. Previous studies investigated car dependence using objective (built environment and car ownership) or subjective measures (attitudes and perceptions). There has been minimal focus in the literature on the relationship between car dependence and regional accessibility, travel identities, residential self-selection, and socio-demographic factors.

This research addresses this gap through analyzing data from the 2024 Canadian Mobility Survey (CMS), a bilingual online survey conducted in large (Toronto, Montréal & Vancouver), medium (Ottawa-Gatineau, Calgary & Edmonton), and small (Québec, Hamilton, Halifax, Victoria & Saskatoon) metropolitan regions across Canada. We use data from 15,912 respondents who reported their perceived car dependence, travel identities, residential self-selection, and socio-demographic characteristics. For perceived car dependence, participants were asked to rate the statement "I need a car to do many things I like to do" on a Likert scale. For calculated accessibility, we use cumulative accessibility by public transit to employment with the travel time threshold of 45 minutes in large, 40 minutes in medium-size, and 35 minutes in small regions. These thresholds were identified as they represent the median travel time in each region, which was recommended by previous research. Accessibility was computed at the dissemination-area level using r5r. We used weighted logistic regression with perceived car dependence as the dependent variable and ran nine models stratified by region size group (large, medium, and small) and household income (low, medium, and high).

In all models, higher accessibility was associated with lower odds of perceived car dependence. In large regions, a 1% increase in jobs accessible by public transit was associated with a statistically significant 2% reduction in the odds of perceived car dependence, *ceteris paribus*; such negativity stayed for medium and small regions. Travel identity was the strongest predictor of perceived car dependence across all models. Identifying as a car user increased the odds of perceived car dependence between 3.99 and 8.57 times. Contrarily, cycling and public transit identities were associated with lower perceived car dependence. Car ownership doubled the odds of perceived car dependence across regions, with strong effects observed in small regions among middle-income respondents ($OR = 3.04$). Respondents who indicated that they selected their residents to be in a car-oriented neighbourhood experienced higher increase in perceived car dependence, especially in large metropolitan regions ($OR = 2.93$). Socio-demographic effects were relatively minimal in our models. Young respondents reported higher perceived car dependence, while gender and household size showed limited explanatory power.

Overall, accessibility and travel identity were the crucial predictors of perceived car dependence across Canadian regions. These findings underscore the necessity of improving public transit accessibility to reduce perceived car dependence, particularly in medium-sized and small metropolitan regions. Getting travellers to use public transit and identify as users will help in reducing the perception of car dependence, especially among higher-income groups in small regions. Findings from this research can be of value to professionals working towards increasing the use of sustainable modes of transport.

CLUSTER 07

Social and Health Issues in Transportation: The
lived experience of mobility and its
impact on equity and well-being



Analysis of Socio-Economic Vulnerability to Transport Disruptions in the European Union

Cluster 7

Begic, Hamza

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This research investigates the multidimensional nature of transport vulnerability among socio-economic groups across the European Union (EU), focusing on their exposure and adaptability to transport disruptive events. A comprehensive framework is developed to measure transport vulnerability through three core pillars: affordability (financial constraints and car ownership), adaptability (workforce capacity for remote work), and system resilience (the recovery potential of public transport systems). Using a macro-level analysis of pan-European datasets, the COVID-19 pandemic is employed as a universal stress test to evaluate these dimensions. As a first step in interpreting these impacts, the spatial distribution of socio-economic deprivation is examined, revealing a clear divide between Western and Eastern Europe: deprivation is predominantly urban in Western Europe and largely rural in Eastern Europe.

Building on this spatial context, workforce adaptability is assessed through changes in teleworking capacity relative to pre-pandemic baselines. The results reveal a pronounced adaptability gap. Western and Nordic European countries experienced larger increases in teleworking during the COVID-19 period, indicating a strong capacity to absorb mobility-related shocks. In contrast, Southern and Eastern European countries show lower increases in telework adoption, reflecting limited structural flexibility in labor market arrangements. Although a general trend toward a return to on-site work is observed across countries after the pandemic peak, differences in the magnitude of teleworking uptake persist. Consequently, populations in lower-adaptability regions remain more exposed to disruptions that restrict physical access to workplaces, including health crises, extreme weather events, or infrastructure failures.

Transport system resilience is further evaluated through public transport modal share percentage recovery trajectories. While all EU countries experienced a severe initial decline during the pandemic, recovery paths diverged noticeably. Several Western European countries recovered and surpassed pre-pandemic ridership levels, reflecting strong institutional and operational capacity. Conversely, many Eastern European and Baltic states continue to show persistent deficits, with public transport share percentage remaining below 2019 levels several years after the shock. This prolonged underperformance suggests systemic weaknesses that constrain public transport's role as a reliable alternative during future disruptions.

These dimensions are synthesized to identify distinct vulnerability profiles, highlighting a critical hotspot characterized by low teleworking capacity and low transport affordability, concentrated in Southeastern Europe and the Baltics. Populations in these regions face a compounded disadvantage: they cannot substitute disrupted travel through remote work, nor can they rely on

private car ownership or resilient public transport systems. This “non-teleworkable, car-less” profile represents the most severe form of transport vulnerability observed in the EU.

A comparative assessment of post-pandemic trajectories reveals a persistent resilience gap between this vulnerable group and the EU average. Vulnerable countries show weaker recovery in both teleworking adoption and public transport modal share, limiting their ability to respond effectively to future disruptions. Overall, the findings demonstrate that transport vulnerability is shaped not only by exposure to disruption but also by structural differences in adaptive capacity. The analysis supports a context-specific approach to mobility justice, emphasizing that effective policy interventions must be aligned with national infrastructure and institutional capabilities.

Proximity Is Not Enough: Understanding Older Adults' Perceptions of Urban Accessibility

Cluster 7

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As urban populations age, ensuring equitable access to everyday destinations becomes increasingly dependent on the quality of nearby urban spaces and the lived experience of mobility. In mid-density cities, where services are relatively close but urban form and infrastructure remain strongly car-oriented, proximity alone does not guarantee accessibility. This research explores how the design and use of public urban space shape the everyday mobility experiences of older adults in Geretsried, Germany, a mid-density city characterized by spatially spread urban form, segregated land uses, and low-quality, discontinuous pedestrian and cycling networks.

The research adopts a qualitative, experience-based approach to investigate accessibility by proximity beyond conventional distance or time-based metrics. Methods include non-participatory observations, walking along interviews with older residents and semi-structured interviews, and a participatory wishing tree mobility workshop with seniors. Together, these methods captured how older adults perceive, navigate, and adapt to the built environment in their daily routines, and how spatial qualities influence feelings of comfort, safety, autonomy, and social connection.

Empirical observations focus on the interaction between older adults and urban space, including sidewalk continuity, crossings, surface quality, lighting, green infrastructure, seating, and points of conflict between walking, cycling, and motorized traffic. Particular attention is given to moments of pause, hesitation, detours, and avoidance, as well as to informal practices of rest and social interaction. The findings reveal that the quality, continuity, and legibility of public space play a decisive role in shaping perceived accessibility, often outweighing objective proximity to services. Deficiencies such as missing benches and toilets, poorly designed crossings, conflicts with cyclists and motorized vehicles, and monotonous or exposed walking environments can significantly limit older adults' willingness to walk and experience the city, even over short distances.

The research argues that planning for accessibility in mid-density contexts requires a stronger focus on the everyday, lived experience of walking and moving through public space. By foregrounding older adults' everyday encounters with urban space, the study contributes to debates on inclusive and age-friendly mobility transitions. It highlights the need for small-scale, place-based interventions that enhance comfort, dignity, and ease of movement, and support a shift from abstract accessibility targets toward human-centered evaluations of mobility and wellbeing.

Towards Equitable Regional Rail: Accessibility in French Low-Income Neighborhoods and the Service Express Régional Métropolitain (SERM) 2040 Deployment

Cluster 7

Cissé, Ndèye

Authors: Cisse, N.A

Transit-Oriented Development (TOD) has emerged as a key strategy for sustainable mobility transitions, yet questions remain about who benefits from such investments. Mobility justice research in France demonstrates that low-income neighborhoods face reduced access to decarbonized transportation and disproportionate social, psychological, cultural and administrative obstacles in their motility. This dual inequality—limited access to decarbonized transport combined with structural car-dependency pressures—raises urgent equity concerns, highlighting the paradox between environmental policy goals and socio-economic realities.

The Hauts-de-France region illustrates this tension. Low-income neighborhoods (Quartiers Prioritaires de la Politique de la Ville - QPV) concentrate high transit dependence (29-41% car-free households), yet show underrepresentation among regional rail (TER) users despite high bus ridership. This matters critically as the region plans a major rail service project—Service Express Régional Métropolitain (SERM) for 2040. Understanding current TER barriers is essential to avoid reproducing inequalities in this future network.

This study examines barriers preventing QPV residents from accessing regional rail through three objectives: (1) characterize TER-adjacent QPV areas using the Node-Place Model to assess spatial accessibility potential; (2) identify economic, informational, socio-cultural, urban design, and service barriers; (3) analyze barrier variations across contexts to inform equitable SERM planning.

We employ mixed methods across three contrasting sites: Lille-Sud (metropolitan context), Saint-Amand-les-Eaux (medium-sized city), and Lens-Liévin (post-industrial conurbation). Data collection includes Node-Place characterization; 6-8 focus groups with QPV residents; 20+ biographical interviews with diverse profiles (regular users, occasional users, former users, persons with reduced mobility); stakeholder interviews; walking observations; and travel survey data.

Early interviews identify multi-dimensional barriers operating cumulatively: Economic—fare fragmentation creates unaffordability perceptions; Informational—limited TER awareness and digital exclusion; Socio-cultural—rail perceived as "complicated" versus bus as working-class necessity, with surveillance experiences and non-belonging feelings; Urban design—station

peripherality and unsafe routes; Service—schedule-work misalignment and limited destination connectivity. Critically, biographical narratives expose how driving license requirements in job postings force car dependency even among transit-captive households, illustrating a mobility-employment bind that undermines both social inclusion and environmental transition goals.

Findings suggest spatial Node-Place potential, while necessary, proves insufficient for equitable access. We propose enriching TOD frameworks with social accessibility dimensions: affordability, usability, and cultural legitimacy. For SERM 2040, preliminary recommendations include integrated fare structures; culturally-targeted communication co-designed with communities; pedestrian infrastructure improvements; participatory service design; coordination with employment policies to reduce car-dependency requirements; and anti-displacement protections. Without proactive equity measures, regional rail expansion risks reproducing existing inequalities, with decarbonization investments benefiting already-mobile populations while reinforcing car-dependency norms that exclude transit-captive communities from employment, deepening mobility poverty traps.

This research contributes empirically to mobility justice literature on transportation transitions, theoretically to equitable TOD frameworks beyond metropolitan contexts, and operationally to inclusive regional rail planning.

Transport-related social exclusion in Latin America: A multilingual scoping review of modal choice and travel behaviour

Cluster 7

Cunha, Isabel

Authors: Cunha, I., Humberto, M., Hook, H., Liu, G., & Psyllidis, A.

Transport-related social exclusion has garnered increasing attention in academic research over the past decade, yet empirical evidence remains predominantly drawn from Global North contexts. In contrast, studies focusing on the Global South, particularly Latin American cities, remain considerably limited. While existing research from Latin American cities has largely focused on transport disadvantage and transport-related social exclusion through the lens of infrastructure provision and accessibility inequities, comparatively little attention has been paid to the structural and systemic factors that influence travel mode choice and everyday mobility. This study reviews the literature on transport-related social exclusion in Latin America, with particular focus on how modal choice and travel behaviour shape access to urban opportunities for marginalised groups.

The methodological novelty of this review lies primarily in its inclusion of literature from often overlooked databases, such as SciELO, which contains a substantial body of locally produced Spanish- and Portuguese-language research that rarely appears in Web of Science or Scopus. This research adopts a multilingual search strategy, systematically reviewing literature in Spanish, Portuguese, and English to ensure comprehensive coverage of regional scholarship, challenging dominant narratives and broadening the epistemological scope of transport equity research, which has been strongly shaped by Global North perspectives.

Searches were performed across SciELO and Web of Science databases, using a multilingual query strategy to ensure broad regional representation and identify relevant publications from 2015 to 2025. Search terms combined keywords and Boolean operators as follows: (transport OR mobility OR "travel behavio*") AND (exclusion OR poverty OR inequality OR inequity OR equity OR marginaliz* OR vulnerab* OR disadvantage*) AND ("Latin America" OR Caribbe* OR Argentina OR Brazil OR Bolivia OR Chile OR Colombia OR "Costa Rica" OR Cuba OR "Dominican Republic" OR Ecuador OR "El Salvador" OR Guatemala OR Haiti OR Honduras OR Mexico OR Nicaragua OR Panama OR Paraguay OR Peru OR Uruguay OR Venezuela). The search terms were also translated into Spanish and Portuguese. The selected literature was reviewed according to a threefold focus: theoretical contributions, intersectional analyses, and empirical evidence related to mobility and social exclusion among marginalised groups.

This review makes three contributions to the field of transport equity. First, it advances theoretical understanding by linking behavioural determinants of transport mode choice, such as affordability, safety, and cultural norms, with broader processes of social exclusion in Latin American urban contexts. Second, it introduces a methodological innovation by systematically incorporating underrepresented literature from the SciELO database, which includes valuable

empirical work from Latin American scholars writing in Spanish and Portuguese. This multilingual strategy enables a more inclusive and regionally grounded evidence base, addressing the epistemic bias that often marginalises Global South contributions in transport research. Third, it develops a conceptual framework that connects behavioural factors with structural inequalities, offering guidance for both researchers and practitioners aiming to design more equitable and locally responsive transport interventions. By highlighting knowledge produced in Latin America, this review contributes to the broader goal of decolonising transport studies and offers a pathway for future research that is both context-sensitive and globally informed.

Flexibility for whom? Rethinking Demand-Responsive Transport through lived experiences

Cluster 7

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It is widely acknowledged that bus-based public transport (PT) is predominantly used by passengers without feasible alternatives. While PT is an essential service for accessing life opportunities, providing sufficient service levels remains challenging, particularly in rural and peri-urban areas. In these regions, the car is the dominant mode of transport, as available alternatives are often perceived as inadequate, even by those who depend on them.

In response, demand-responsive public transport (DRT) has been implemented as a mobility solution for population groups with limited access to other modes of transport. Originally introduced as a social policy intervention, DRT services have more recently been framed as an 'innovative' component of broader 'smart' mobility agendas, intended to provide first- and last-mile connections to scheduled PT services as an alternative to car travel for a wider range of users. Whether implemented primarily for social or environmental reasons, DRT schemes are typically justified by operational and economic arguments related to the financial viability of PT. As a result, DRT is often deployed either as a replacement of scheduled PT services, or as a low-cost alternative.

While this rationale appears sensible in theory, questions remain regarding the extent to which DRT services adequately meet the needs of people who strongly depend on PT. Enhancing the attractiveness and the viability of DRT requires greater attention to user characteristics and needs in planning processes. While the nascent literature on DRT is increasingly diverse both empirically and methodologically, there remains a lack of studies that adopt a clearly user-centric perspective, in which day-to-day user experiences, needs, and preferences are explicitly elicited and interpreted. Additionally, limited attention has been paid to user groups that most critically depend on DRT services to participate in society. This gap reflects broader critiques of transport planning practices for their reliance on technical and rational forms of knowledge. Planning to address transport-related social exclusion (TRSE), however, requires a different knowledge base: one that captures the social realities of how accessibility constraints impact people's everyday opportunities.

This research addresses this gap by eliciting the lived experiences of users of a DRT service in Flanders, Belgium. Drawing on focus group data, the findings reveal tensions between users' expectations of and experiences with DRT. For the majority of users, DRT represents the only available mobility option, either temporarily or permanently. Issues related to the availability and reliability of DRT cause stress, and dependence on DRT is described as given rise to persistent everyday worries and anxiety. While users articulate clear ideas for improvement of the DRT service, they also express frustrations of not being heard.

By foregrounding users' lived experiences in the production of transport knowledge beyond aggregated quantitative accessibility models, this study contributes to enhancing epistemic justice in transport discourse. It adds nuance and complexity to the often overly optimistic portrayal of DRT in mobility planning as a panacea for accessibility issues, and calls on transport planners to more explicitly recognise lived experience as a critical source of knowledge in the pursuit of just transport planning.

Driving factors for the gender use gap in shared micromobility

Cluster 7

Hook, Hannah

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Shared micromobility, such as (e-)bikes and e-scooters, is rapidly emerging as an inclusive and accessible option relating to environmental, social, and digital transitions in urban areas. However, a gender gap persists in the use of these transport options. This study investigates the factors that encourage or discourage shared micromobility use among Brussels residents, with a focus on the gender use gap, particularly why women tend to use these modes less frequently. The research uses a mixed-methods approach by combining survey data (n=163), distributed between November 2023 and February 2024, and in-depth interviews (N=12) using a storyboarding design, conducted in February and March 2024, with women who live, work, or study in the Brussels-Capital Region. Independent samples t-tests were conducted to identify significant differences between men and women regarding travel time and attitudes toward shared micromobility. The findings indicate that women find shared bikes less comfortable than men, while men report longer commute times, potentially influencing their transportation choices. Although a higher percentage of women than men have used shared micromobility overall, the gender gap remains evident for shared e-bikes and e-scooters, while shared bikes still have a majority of female users.

Key barriers for women include cost, availability, discomfort, and safety concerns. Both survey and interview data suggest that improved infrastructure and safer traffic conditions would encourage greater female participation in shared micromobility. The study concludes that addressing these external factors, rather than focusing solely on the vehicles themselves, is essential to reducing the gender gap and promoting more inclusive mobility in Brussels.

Invisible injustices: Operationalising mobility of care for critically scrutinising blind spots in national travel surveys

Cluster 7

Kawgan-Kagan, Ines

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Mobility of care describes everyday mobility practices related to unpaid care work, such as escorting children or dependent adults, household shopping, and care-related visits. Feminist geographers have long emphasised how the gendered nature of mobility of care (re)produces social inequalities in access to and experiences of mobility, and in control over time and resources. Mobility systems are planned for typically male mobility patterns. As a result, caregivers experience frictions in their specific travel patterns, which are characterised by the coordination of multiple activities under temporal and spatial constraints. Mobility of care is also insufficiently represented in national travel surveys, limiting the ability of mobility research and transport planning to identify and address mobility-related inequities linked to unpaid care work. To address this issue, we developed a framework to operationalise mobility of care that allows us to assess in how far national travel data surveys are designed in a way that makes it possible to identify and analyse mobility of care.

We developed our framework through an iterative procedure. First, we identified relevant categories by reviewing existing literature on mobility of care, and through qualitative interviews with rural and peri-urban residents in Southern Germany. Second, we conducted pilot assessments of national travel surveys, to further refine our categories and framework. The framework identifies core dimensions of care-related mobility, including trip purposes, escorting and relational travel, trip chaining, temporal and spatial organisation, individual care responsibility, and access to mobility resources.

Importantly, it also accounts for the embedding of mobility of care in everyday practices, as well as its emotional and moral dimensions, which are central to experiences of autonomy, stress, and ease of travel but remain largely absent from quantitative mobility data. We applied the finalised framework to critically scrutinise and compare national travel surveys of Western European countries, to systematically assess how far the survey designs render invisible or account for the specificities of mobility of care.

With our study, we contribute to identifying blind spots in existing mobility data that marginalise mobility of care in transport planning and policy, thereby reproducing and maintaining gendered mobility injustices.

Furthermore, we provide a transferable framework and checklist for evaluating the representation of mobility of care in national travel surveys.

In this sense, our approach deliberately takes a step back by emphasizing the need to first establish a robust data foundation and to sharpen the analytical focus of survey instruments in order to better capture everyday mobility practices related to mobility of care. Only on the basis

of improved national travel surveys can meaningful insights be derived regarding issues such as inequity, mobility-related stress, and satisfaction.

Emotional Travel Experience by Difference Modes: Evidence from Rural Ireland

Cluster 7

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Abstract: Daily travel is essential in everyday life by connecting people to various life needs. The benefits of positive emotional experiences during daily travel are found to be related to people's well-being and have been one of the motivations for travel mode shifts from private cars to sustainable modes. In recent years, the focus has expanded to encourage modal shift not only in urban but also in rural areas. As previous studies on travel experience have primarily focused on urban regions, this study aims to examine the changes in emotional travel experience in a rural context. Specifically, we researched how positive (feeling happy, excited, relaxed, energetic) and negative emotions (feeling sad, bored, stressed, tired) before, during, and after the trip influence travel experiences and travel satisfaction. Using an online survey, we collected data from 386 respondents living in Dingle, a rural peninsula on the west coast of Ireland. We used the Day Reconstruction Method (DRM) in the survey by asking participants to recall their most recent trip and report relative information, such as feelings throughout the trip and trip attributes. We applied two-level mixed-effect regression modelling, and preliminary results show that active travel modes, particularly cycling, evoke more positive emotions during trips. People tend to feel more energetic during walking and cycling trips. Interestingly, feelings of both boredom and relaxation increased during bus trips, whilst cycling was associated with both heightened excitement and stress compared to other modes. We conclude that emotions play an important role in travel satisfaction and that sustainable modes can bring more emotional benefits compared to cars in rural areas. We suggest future rural transport policies and strategies to encourage sustainable travel behaviour shifts by emphasising the emotional benefits and further improving the travel experience of cyclists and public transport riders.

Mobility of care, urban proximity, and suppressed travel: How spatial context shapes caregivers' mobility horizons.

Cluster 7

Mombelli, Serena

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Transport research has traditionally focused on observed travel, overlooking the unrealised dimension of everyday mobility, trips that individuals wish to undertake but are unable to. Suppressed travel captures trips that remain unrealised due to mobility barriers. Recognising suppressed travel as a form of mobility deprivation broadens discussions of transport-related social exclusion and mobility justice by highlighting the social, spatial and infrastructural factors that constrain people's access to essential destinations.

Although research on suppressed travel is growing, the role of active travel barriers remains underexplored. In addition, while studies have focused on the elderly and people with disabilities, caregivers, who also face mobility constraints and risk social exclusion, have received limited attention. These constraints often result in trips being cancelled, postponed or not attempted at all. Consequently, caregivers' and their dependents' everyday mobility and travel horizons remain poorly understood.

This study examines suppressed travel in the context of mobility of care –the gendered, relational mobility associated with unpaid caregiving responsibilities. It investigates how proximity to everyday destinations may alleviate mobility constraints and reduce suppressed travel. To do so, it employs data from a survey examining five dimensions of mobility—realised, scheduled, tentative, aspirational, and unimagined—among caregivers living in different proximity conditions in Barcelona and its metropolitan area. The survey addresses personal and household mobility as well as the mental labour involved in planning. Structural equation modelling is employed to analyse the relationships between urban proximity, travel suppression, and care. It is expected that caregivers in low-proximity environments will report higher levels of suppressed travel, particularly for personal trips, although shared caregiving responsibilities may mitigate these effects.

By situating suppressed travel within the context of mobility of care, this research reveals how urban proximity shapes both realised and unrealised mobility, guiding the development of inclusive, resilient, and care-sensitive mobility systems.

Access to opportunities and employment outcomes

Cluster 7

Pereira, Rafael

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Where people live can importantly affect their social, economic and health outcomes. Studies in North America and Europe have demonstrated that individuals' employment outcomes are shaped by the neighborhoods they live in because residential location determines higher or lower job search costs. Nonetheless, there is limited empirical evidence on the role of such neighborhood effects in shaping employment outcomes in cities in the Global South. We investigate how spatial access to job opportunities shapes employment outcomes in Brazil's 18 largest metropolitan areas, comparing unemployment duration (spell) between individuals living in high- and low-accessibility areas. Using record linkage between national administrative records on social welfare and the labor market, we track between 2013 and 2019 the residential location and the employment status of over 9 thousand socially vulnerable individuals who experienced a mass layoff event, in which firms unexpectedly terminate a great portion of their workforce. Using survival models, we show that even though less than half the workers return to formal employment in the first 12 months after separation, those living in areas with access to more jobs (4th quartile of employment accessibility) can be up to 14 percentage points more likely to return to the labor market in that period than individuals living in low-accessibility areas. By showing that proximity to job opportunities sharply shortens unemployment spells for low-income workers, the study underscores the value of integrating transport and land use policies that raise job accessibility for vulnerable populations, so that cities can cushion the shock of layoffs and foster quicker, more equitable labor-market recovery.

Negotiating Perceived Accessibility in Practice: Older Adults' Experiences with Community Bus Transport

Cluster 7

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Authors: Pieters, P., van Lierop, D., van Hees, S., & Bailey, A.

Older adults' ability to travel and maintain social relations within their communities is a key determinant of autonomy, social participation, and wellbeing. However, age-related life changes often complicate the use of conventional transport modes such as public transport, driving, cycling, and even walking, limiting access to shops, healthcare, and social networks. Community bus services (also known as specialized transport services or paratransit) are often presented as inclusive alternatives, offering small-scale, demand-responsive, door-to-door travel that better aligns with older adults' needs and preferences. This paper examines the lived experience of community bus use among older adults in The Hague, the Netherlands. The study uses mixed-methods and draws on full participant observations conducted as a driver on a community bus once a week for eight months, 12 semi-structured interviews with frequent travelers, co-drivers, planning staff, and board members, and forthcoming co-creation workshops exploring future scenarios. Together, these methods allow for an in-depth analysis of how older adults navigate and make sense of community transport in their daily lives. The analysis applies the concept of perceived accessibility to understand how the community bus provides opportunities for travel, paying attention to how on-board interactions, booking procedures, and operational zones shape experiences of travel and travel-related wellbeing. This approach highlights accessibility as something that is experienced and negotiated in practice by the users and volunteers of the community bus, rather than determined solely by transport system design. The findings show that while digitalizing planning and booking procedures could improve perceptions of accessibility for older adults by making the ride-schedule more time-efficient, both travelers and volunteers strongly value the informal, makeshift, and voluntary character of the service. Older adults who use this community bus service often prioritize being recognized and cared-for over speed or reaching all desired destinations, even if this occasionally leads to unmet transportation needs. Many older adults describe the community bus as a lifeline, arguing that the community bus symbolizes the only form of autonomy they have left when it comes to independent travel. At the same time, rigid booking procedures, fixed operating zones, and limited flexibility in terms of departure times require older adults to adopt coping strategies, reducing feelings of autonomy and increasing feelings of stress and anxiety. Thus, while the community bus does help older adults reach desired destinations, its use does still come at a significant emotional cost, requiring older adults to constantly negotiate between perceived benefits and perceived costs, and therefore contributing simultaneously to feelings of 'being old' and excluded, as well as feelings of 'care' and inclusion. These experiences reveal how transport equity is not only about physical access, but also about emotional comfort and the ability to

travel without undue mental burden. We argue that amid increasing digitalization, transport equity cannot be reduced to time-efficiency or system-wide optimization, but is negotiated through everyday practices of care, adjustment, and coping-mechanisms. This requires sustained attention to how everyday travel is experienced emotionally and psychologically, and how travel-related wellbeing needs to be considered an important factor in future socially and environmentally sustainable mobility systems.

Designing Inclusive Rural Mobility through Demand-Responsive Transport Services

Cluster 7

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Authors: Ryghaug, M., Karlsson, H., Babri, S., & Diez, M.

Designing Inclusive Rural Mobility through Demand-Responsive Transport Services

Rural mobility transitions raise critical questions of equity, autonomy, and social inclusion, particularly for user groups whose mobility needs are poorly served by conventional public transport. This paper presents findings from the Horizon Europe-funded STORCITO project, which aims to co-design an inclusive, demand-responsive transport (DRT) service tailored to children, youth, seniors, low-income families, and newly arrived immigrants. Drawing on workshops, qualitative interviews, surveys in Norway and Spain, and stakeholder consultations, the study examines how DRT can enhance wellbeing, reduce social exclusion, and support more equitable participation in everyday life.

Findings show that children and youth experience significant constraints in accessing leisure activities and upper-secondary school due to sparse bus services, long travel times, and limited alternatives, generating emotional stress and restricting independence—especially in remote villages. Parents report substantial time pressure and logistical strain when coordinating children's activities, often amplifying existing socioeconomic inequalities. Families without reliable car access, including many newly arrived immigrants, face additional challenges in participating fully in education, employment, and social life, making inclusive DRT a potential enabler of autonomy and wellbeing.

Seniors report relatively high current independence due to car access but express concern about future loss of autonomy. They emphasize short walking distances, safety, flexibility, and non-digital booking options as essential for preventing mobility-related isolation. Across user groups, concerns about digital exclusion—particularly among seniors, low-income households, and migrants—highlight the need for multilingual interfaces, universal design, and alternatives to app-only booking.

Survey data identify convenience, reliability, and guaranteed seat availability as core motivators for DRT adoption, while barriers include cost sensitivity, digital literacy, distrust in new services, and high private car ownership. Users across age groups also stress the social and emotional dimensions of mobility: transport must feel safe, predictable, and socially pleasant.

Theoretically, the paper draws on mobility-justice perspectives, which argue that equitable mobility involves not only the fair distribution of opportunities but also recognition of diverse needs and participation in shaping mobility systems (Sheller, 2018; Lucas 2012; Martens 2016). Complementary work on multidimensional justice further highlights the importance of procedural and epistemic fairness in mobility transitions. These perspectives illuminate the tensions observed between efficiency and fairness, digitalization and accessibility, and universal access and targeted prioritization—dilemmas reflected in stakeholder consultations.

Overall, the results underscore that inclusive DRT is not merely a technical innovation but can act as social and emotional infrastructure. When co-designed with users, DRT can be more closely aligned with their needs, enhancing its relevance and effectiveness. Such tailored plan can effectively lead to outcomes such as to reduce mobility-related stress, enhance independence for children and seniors, broaden access to education and social networks, and strengthen community cohesion. The paper concludes with design recommendations for inclusive rural DRT, highlighting how attention to autonomy, emotional experience, digital equity, and social inclusion can inform human-centred mobility transitions.

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The Day the Train Stopped: Social Inclusion After the Loss of Rapid Transit

Cluster 7

Singer, Matan

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This study examines the rare and abrupt permanent closure of the Scarborough Rapid Transit (SRT) line in Toronto, Canada to highlight the role of public transit in enabling social inclusion. While prior research has largely focused on the impacts of new transport infrastructure or on short-term service disruptions (Canales et al., 2019; Tyndall, 2017), less is known about the consequences of unplanned, permanent service cancellations. Accordingly, this study examines how such closures affect the quality of life of vulnerable populations, treating the service cancellation as a mobility shock that reveals the role of transit in enabling employment, healthcare access, social connection, and household financial stability.

This study exploits the sudden closure of the SRT in July 2023, following a derailment attributed to inadequate maintenance, after the line had operated for roughly a decade beyond its intended lifespan. Prior to its closure, the SRT provided a critical rapid transit service for several underserved, socio-economically disadvantaged neighbourhoods in Scarborough. Although bus services were introduced to fill the gap, the impacts of the loss of rapid transit on local residents remain largely unexplored. Using Wave 2 of the Scarborough Survey data (N=609) collected in 2025, this study examines how the closure affected activity participation and transport affordability among former SRT users and nearby residents.

Preliminary results from the 2025 survey indicate that 56% of respondents used the SRT at least three times per month prior to its closure, and nearly 30% of users shifted to cars following the shutdown. Compared with non-users, former SRT users reported greater difficulty conducting daily activities (14% vs. 10%) and easily reaching destinations (21% vs. 12%), indicating a measurable decline in perceived accessibility.

We divided respondents into three areas based on proximity to the former SRT corridor to examine spatial variation in exposure. Among prior SRT users, a larger percentage of respondents living closer to the line reported barriers to activity participation and transport affordability. Across all three areas, one third of respondents reported that the SRT closure negatively affected their ability to find or maintain employment. Residents living closest to the SRT experienced the largest impacts on commute time (46% vs. 36%) and were also more likely to report missing meetings (45% vs. 30%). Affordability impacts were widespread across all areas, including increased transport costs (48–50%), car purchases (35–40%), and car debt (12–22%), with the strongest effects observed among low-income respondents and those without access to a private vehicle. Taken together, these findings suggest that the SRT closure functioned as a localized mobility shock, with the largest impacts concentrated among residents living closest to the corridor and among those most reliant on public transit for employment and daily activity participation.

The findings underscore the importance of sustained funding and the maintenance of public transit infrastructure in an era of fiscal austerity and widening socioeconomic inequality. Ongoing work will incorporate Wave 1(pre-closure) data to estimate multivariate models of post-closure outcomes and to explore more causal before-and-after comparisons enabled by repeated respondents across survey waves.

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In the Era of Heat Emergencies: Proposal for a Climate-Sensitive Accessibility Model to Urban Green Spaces as Potential Climate Shelters

Cluster 7

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The increasing frequency and magnitude of extreme heat events are leading to high levels of morbidity and mortality during the summer season. The presence of public green spaces inside cities can be very beneficial for mitigating the effects of climate change and protecting most vulnerable people.

Green spaces can act as a system of climate shelters, as it has already been proposed by cities such as Barcelona and Paris, given their evapotranspiration and shading qualities, but also because they are open and welcoming to all kinds of population groups, including elderly, children, women, people from ethnic minorities or of low-economic status. Unfortunately, these kinds of spaces are often characterised by limited accessibility, mainly for vulnerable population groups due to their slower walking speed.

The objective of the current work is to develop a climate-sensitive accessibility model able to better estimate the actual levels of accessibility to green spaces as potential climate shelters. Indeed, this model succeed in reflecting both the beneficial cooling effect of the green spaces and the changes of the walking speed of their users induced by heat stress in accessing these areas.

Thanks to an extensive review of the literature, the new proposed model was decided to be based on the Gaussian Two-Step Floating Catchment area method (G2SFCA). This is one of the most widely used methods for evaluating the accessibility to green spaces, it allows incorporating a great variety of attractiveness variables and takes into account the relationship between supply and demand. Within the original G2SFCA both the correlation existing between the walking speed and thermal comfort conditions and the cooling effect of the greenery were integrated.

The model was applied to the city of Turin, Italy, for estimating the accessibility to green spaces during both a typical summer day and the hottest day of 2023. The results prove the effectiveness of the model, from one side demonstrating in most areas of the city a significant decrease of accessibility for a typical summer day, which gets even more accentuated under extreme climate conditions. From another side it shows a slight increase of accessibility in some specific areas of the city given by the very strong cooling effect of some of the green spaces located in those areas.

The main research limit is the need of further empirical data specifically regarding the changes of walking speed under various levels of heat stress for population groups which are different in terms of nationality (to be investigated in future studies).

The originality of the proposed heat-related integrations into accessibility models, a research gap in the literature until the current moment, can be considered as the additional value of this work. This new accessibility model would be of great help in supporting the regeneration and future planning of green spaces, as potential climate shelters, with the aim of creating more just and healthier cities.

Hindering and promoting factors for walking in the City: Comparative results from Walk-Along-Interviews with older adults and families across Vienna, Münster, Groningen, Lisbon and Ankara

Cluster 7

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How public space can be used by citizens influences the quality of life in cities and the extent to which cities enable participation, autonomy and wellbeing. A good objective and perceived (walking) accessibility supports social inclusion and can have positive effects on individual wellbeing. Hence, it is important to recognise (walking) accessibility as one of the basic prerequisites for social participation and as one of the primary objectives of sustainable transport planning. Walking plays a particular important role, as it is healthy, environmentally friendly, free of charge and a travel mode which almost everyone can readily use. However, common instruments tend to approach society as homogeneous and overlook needs, abilities and perceptions of vulnerable groups.

As part of the AccessCity4All project, we conducted qualitative Walk-Along-Interviews (WAI) with senior citizens and families with small children which are considered more vulnerable in terms of their mobility. The interviews were conducted in autumn 2024 in five cities/regions: Vienna (Austria), Münster (Germany), Groningen (Netherlands), Lisbon (Portugal) and Ankara (Turkey). While walking together in the neighbourhood and directly experiencing the urban environment, the interviews centred around walking experiences, ease of travel and the emotional and social dimensions of moving through public space (e.g., safety, stress, confidence, enjoyment) with the aim to better understand the mobility needs of the target groups and the perceptions at the street-level.

In our presentation we will report key findings from our WAIs in the five case study cities. We will look into similarities and differences from a cross-country comparison. We identify promoting and hindering factors for walking and look into similarities and differences by target group. This presentation will provide examples of perceived accessibility and discuss the special needs and perceptions of the vulnerable groups regarding autonomy and participation. The results imply, for example, that perceived unsafe conditions, conflicts with other road users, lack of pedestrian infrastructure, difficult weather conditions or fear of crime are hindering factors for walking and contribute to stress and avoidance. On the other hand, the provision of important facilities in the neighbourhood, separated walking routes, nicely designed green spaces and atmosphere

enhance perceived ease of travel and encourage walking as a positively experienced everyday practice. In our conclusion, we will emphasise possibilities on the integration of our findings into future research and planning practices and therefore enable walkable neighbourhoods and foster the wellbeing in urban spaces where citizens enjoy the experience of walking.

Bridging Capabilities and Mobility Justice: Integrating Syntactical and Microscale Analysis for Evaluating Just Streets

Cluster 7

Tan, Wendy

Authors: Nag, D. & Tan, W.

Recent debates in transport and mobility studies argue that conventional accessibility metrics are insufficient to explain unequal mobility outcomes. While network-based measures may indicate high accessibility, many individuals remain unable to participate meaningfully in daily activities due to structural, environmental, and social constraints. Building on the capability approach (Sen, 1993), De Vos et al. (2025) distinguish between the ability to reach destinations and the ability to travel, emphasising that mobility justice depends not only on the distribution of transport resources but also on people's capacity to convert opportunities into actual movement. Complementing this perspective, mobility justice scholarship highlights how spatial configurations, policies, governance practices, and socio-cultural factors interact across scales to produce systematic inequalities in mobility (Hidayati, Tan, et al., 2021; Verlinghieri & Schwanen, 2020).

A persistent challenge in planning practice is the lack of methods that can simultaneously address macro-scale network accessibility and microscale street-level conditions. Streets that appear well-connected in structural analyses may present significant local barriers for pedestrians, cyclists, or marginalised users, while streets with favourable local environments may remain structurally disconnected. This paper presents a multi-scalar methodological framework that directly responds to this gap by integrating space syntax-based analysis with microscale environmental and observational indicators. Developed within the Horizon Europe project JUST STREETS, the framework operationalises the dual capability concepts of reaching and travelling in spatial terms and contributes to ongoing calls for methodological diversification in mobility justice research.

The methodology combines syntactical analysis and geospatial analytics through a four-step workflow. First, study areas are defined using buffered urban extents and open-source spatial data, primarily from OpenStreetMap, processed in QGIS. Second, space syntax measures—such as integration and choice—are computed across multiple radii to capture potential for walking, cycling, and vehicular movement. Third, these network-level indicators are integrated with microscale street conditions using a spatial multicriteria framework applied to standardised grid cells, allowing the identification of convergences and mismatches between structural accessibility and local travel conditions. Finally, results are visualised to support transparent interpretation and stakeholder engagement.

The framework is tested in Riga, Latvia, a city characterised by a historic medieval core and post-socialist expansion. This morphological diversity provides an ideal context to examine how different street structures interact with microscale conditions to shape mobility capabilities.

Riga also faces uneven distribution of transport resources and technical capacity constraints within municipal agencies, making the emphasis on open-source, reproducible workflows particularly relevant.

The results demonstrate how integrating macro- and micro-scale analyses reveals spatial mismatches that single-scale approaches might miss. Streets with poor local conditions that weaken network connectivity, or areas with good street environments but lacking structural integration, can be systematically identified and prioritised for intervention. Combining technical analysis with stakeholder-informed weighting and accessible visualisation supports evidence-based, equity-oriented decision-making. While primarily grounded in objective spatial indicators, the framework also provides a robust foundation for future research that incorporates perceptions, lived experiences, and temporal dynamics. Overall, the study advances a practical, capability-oriented approach to evaluating just streets, turning mobility justice theory into a useful planning and policy tool.

The first national survey on transport poverty: Design, implementation and findings from Canada

Cluster 7

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Transport poverty is a complex, multidimensional issue that remains loosely defined and inadequately measured. Persistent challenges related to data quality, consistency, and comparability, highlighted by the European Commission, continue to limit effective policymaking. Despite increasing attention to equity in transport research and practice, most countries still lack standardized national datasets that can capture the scale and severity of transport poverty.

This paper presents the design and implementation of the first large-scale survey on transport poverty and transport-related social exclusion worldwide, developed by the Mobilizing Justice (MJ) Partnership across all of Canada. We describe a multi-phase process involving collaborative workshops, input from a community advisory group, a pilot study, and a robust data collection strategy, including a comprehensive sampling and weighting process. The resulting dataset, covering over 27,000 respondents and openly available to researchers, decision-makers, and the public, offers extensive spatial and demographic coverage, enabling robust and policy-relevant analysis.

A snapshot of findings reveals pronounced socioeconomic and demographic inequalities in Canada. Car ownership remains substantially lower among lower-income Canadians (under 70%) compared to higher-income groups (94%), while transit pass possession is more common among lower-income respondents. Approximately one in four participants experience modal dissonance, though its prevalence does not differ by income; instead, reasons behind this mismatch vary, with lower-income groups citing affordability constraints, whereas higher-income groups attribute mismatches to convenience and time considerations. Significant disparities in perceived safety were observed across gender, with non-binary individuals reporting the lowest levels of perceived safety, followed by women, and men reporting the highest.

Satisfaction with transport conditions increases with age, with younger groups reporting consistently lower satisfaction. Racial disparities were evident in reported employment impacts, as Indigenous respondents and visible minorities were more likely to report declining job opportunities due to transport barriers. Housing affordability concerns were most acute among recent immigrants, who more frequently reported spending beyond their means on housing. Spatial analyses further demonstrate strong geographic variability in transport disadvantage, particularly in patterns of forced car ownership, suggesting the need for further exploration into the sociodemographic characteristics of this phenomenon, moving beyond

solely built environment factors. Finally, accessibility to everyday destinations generally improves with city size, with larger metropolitan areas offering more consistent access than smaller towns and non-CMA areas.

Looking ahead, we view this work not as a conclusion but as the beginning of a broader research and policy agenda. The MJ Partnership is well-positioned to advance this mission by developing tools, standards, and frameworks that help planners and decision-makers set and monitor equity-based transportation goals across Canada. In the short and medium term, the partnership will focus on producing survey-related outputs such as scorecards, an online data visualization tool, and accessible data stories and reports. These efforts will reach policy, academic, and advocacy audiences, raising awareness of the key issues highlighted by the survey and fostering a national conversation around equitable and inclusive mobility. We hope to contribute to the transformation of transportation systems so that they better serve all Canadians, irrespective of income, geography or mobility constraints.

Accessibility and care in the 15-minute city

Cluster 7

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The concept of the 15-minute city seeks to ensure that all residents can reach the services and amenities that they need regularly in a sustainable manner. While it is often understood to include at least cycling and walking, some debate exists on the addition of public transportation into the model (Arias-Molinares et al., 2025). Furthermore, there is some discussion as to what amenities can be considered essential, as well as what can be considered a viable threshold for accessibility, as this can differ strongly from person to person. Furthermore, it is well-known that routes and destinations follow gendered patterns, with women performing more trip-chaining and having a smaller radius (Ortega Hortelano et al., 2019). As such, it is important to analyse various views of, and needs for accessible amenities.

In this study, we consider how to integrate the needs of caregivers into the 15-minute city approach. While 'mobilities of care' (Sánchez de Madariaga, 2013) have been increasingly studied, no clear definition of the term exists, but it is often understood to include childcare and care for elderly family members. Due to these elements having strong gendered links, the focus of care mobilities studies often lies on women, more specifically (heterosexual) mothers. In this research, the scope of care is widened to include various types of care, beyond the immediate family and gendered expectations.

We use the 'Flowers of Proximity' method, developed by Büttner et al. (2025) to visualise the current and ideal neighbourhood accessibility for caretakers in the Brussels Capital Region, in order to analyse what their regular needs for amenities and infrastructure are. The results of this study aim to improve the knowledge on care mobilities beyond the family scope, and insights as to how the needs of caretakers can be adequately integrated in 15-minute city planning approaches to foster equitable cities.

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Mobilising Well-Being through Active Mobility To and from School in Vulnerable Communities

Cluster 7

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Urban mobility is facing critical challenges in conventional planning under intersecting pressures from climate change, public health imperatives, and social inequities. Active Mobility to and from School (AMTS) (walking and cycling) is a daily practice with the potential to reduce carbon emissions, improve access to education, and support young people's physical and mental well-being. Yet in many low income and marginalised contexts, children and adolescents walk or cycle because they have no realistic alternative. This can increase exposure to unsafe road environments, extreme weather, and social risks such as harassment, crime, and abuse. Understanding how AMTS can support well-being, and for whom, is therefore essential for designing fair and effective mobility transitions.

The On the Way to School implementation research project is an interdisciplinary study examining the feasibility, acceptability, and adaptability of AMTS interventions in vulnerable urban and peri urban communities in Bogotá, Colombia, and Maputo, Mozambique. In Bogotá, we assess well-being outcomes associated with established AMTS programmes that have operated for over a decade. In Mozambique, we worked with local stakeholders and the community to co-design a locally grounded AMTS pilot and evaluated potential effects on participants' well-being and social cohesion. The study combines mixed methods to capture both measurable changes and lived experiences of mobility, including gendered perceptions of safety and autonomy.

This paper compares observable effects of these interventions on children's and households' well-being, and explores how outcomes differ by programme design and mode of travel. Early results indicate that sustained engagement with schools, communities, and public authorities improves acceptability and strengthens contextual fit. Tailored strategies can support greater independence in children's journeys and can shift how young people perceive their neighbourhood environment. In Bogotá, walking journeys highlight important gender differences. Girls report higher burdens related to distance, traffic exposure, and land use patterns, alongside heightened concerns about personal safety. Cycling shows different patterns of perceived barriers by gender, while reported well-being outcomes appear more similar across girls and boys. Across both contexts, adolescents who were actively involved in shaping the intervention describe improvements in overall well-being, particularly in their sense of comfort, confidence, and connection to place. Parents, caregivers, and school communities in both cities also recognise benefits beyond the individual child, noting strengthened communal care practices, greater social cohesion, and increased trust.

These findings position AMTS as more than a transport or road safety tool. They suggest AMTS can operate as a household and community intervention with under recognised potential to advance well-being and equity. By linking implementation processes to well-being outcomes across two contrasting settings, this research offers practical insights for planners and policymakers seeking to embed active travel within sustainable, inclusive urban mobility strategies.

From Objective to Perceived Walkability: A Street-level Study of Walking Experience in London

Cluster 7

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Walking is one of the most common forms of sustainable mobility and its popularity is strongly shaped by the walking environment. To understand how urban environments encourage walking, the concept of walkability has been widely used, typically measured through a set of macro-level, objective indicators, such as street connectivity, density, and land-use diversity. These approaches tend to describe areas with high land-use mix and high density as highly walkable, because they allow pedestrians to easily reach daily destinations. However, these approaches assume that walkability levels are similar for people living in the same place. However, people may evaluate their walking environments differently depending on their specific needs on safety, comfort, or aesthetic qualities. To promote walking, we need to understand what pedestrians actually need from their walking environment and how they perceive walkability. Perceived walkability refers to individuals' subjective evaluation of how supportive their environment is for walking. It may influence walking behaviour, health, and well-being in ways that objective data cannot fully explain. Although research on perceived walkability has increased, two key gaps remain. First, most studies rely on neighbourhood-level surveys, which fail to capture street-level experiences and hardly consider urban design qualities such as enclosure, imageability and human scale. Second, perceived walkability does not always align with the objective environment, yet little is known about such mismatches. While individual attributes have been widely studied, the effects of social factors, such as peer effects and community identity, remain underestimated.

To address these gaps, this study focuses on perceived walkability at the street level in Greater London. It is guided by two research questions: (1) how can perceived walkability be measured at the street level, and which environmental features are most influential? (2) where and why does perceived walkability diverge from objective walkability, and how do personal and social factors shape these differences?

To address the first question, we develop a comprehensive framework that captures perceived walkability across five dimensions: feasibility, accessibility, safety, comfort, and pleasurability. Perceptual data are collected through an online survey in which participants draw their most frequently used walking routes and rate them across these five dimensions. Objective walkability is measured using both GIS-based indicators and features extracted from street view imagery (SVI). The analysis identifies which environmental attributes are most strongly associated with perceptual scores and examines whether perceptions are shaped more by the best, worst, or average street segments along a route. To address the second question, this study examines the mismatch between perceived and objective walkability and explores its spatial and social

patterns. A series of regression models is then used to test how personal and social factors contribute to these differences.

Although the empirical analysis is ongoing, several expected findings can be anticipated. The study is expected to show that micro-level and design-related features play a crucial role in shaping perceived walkability. It is also expected that mismatches will cluster spatially and socially, with certain groups more likely to underestimate walkability in specific urban contexts. By bridging objective environments and perceptions, this research helps explain why physical improvements do not always translate into better walking experiences and supports more inclusive, equitable street design and planning policy.

Perceived Fairness and Acceptability of Car-Restrictive Policy Packages and Implications for Behavioral Responses

Cluster 7

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Car-restrictive policies play a central role in contemporary efforts to address congestion, air pollution, and support sustainable transport transitions. Despite their growing prominence, existing research pay limited attention to the multidimensional impacts of car-restrictive policies and how these impacts vary across population groups. In particular, less is known about which policy-induced impacts matter for whom in shaping perceptions of fairness, and how these perceptions translate into policy acceptability, with potential implications for subsequent behavioral responses. To address this gap, this paper investigates how different car-restrictive policy packages influence perceptions of fairness and policy acceptability across heterogeneous personal contexts. Methodologically, the study draws on a survey conducted in the Netherlands in which respondents are presented with hypothetical policy scenarios that vary in the stringency of three commonly used car-restrictive measures, including access restrictions, parking restrictions, and pricing charges. For each scenario, respondents evaluate perceived fairness and policy acceptability, while also indicating anticipated behavioral adjustments as potential downstream responses. Heterogeneity is examined along dimensions of income, car dependency, and travel constraints. By examining perceptions of fairness and levels of policy acceptability within a single analytical framework, this paper moves beyond treating perceived fairness and acceptability as direct responses to individual policy instruments. Instead, it foregrounds how the multidimensional impacts associated with car-restrictive policies are experienced and evaluated differently across population groups, revealing the trade-offs between policy-induced outcomes for different types of travelers. The results illustrate which policy-induced impacts matter for whom in shaping perceptions of fairness, and how these evaluations translate into policy acceptability, with possible implications for anticipated behavioral responses. This perspective highlights the need for more impact-sensitive approaches to assessing perceived fairness and acceptability in the design of car-restrictive policy packages aimed at promoting sustainable transport transitions.

CLUSTER 08

ICT and AI for Urban Mobility: Exploring
Transitions & Uncertainties



From Digital Mobile Phone Traces to Credible Travel Patterns: What Transfers Across Places?

Cluster 8

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Mobility research is increasingly shaped by “digital traces” such as data from mobile phone networks (MPN). These data can help describe when and where people move at a large scale, offering a valuable complement to travel surveys and traffic counts. MPN traces are typically sparse and irregular: they record a device only when it interacts with the network, which may be minutes apart or longer. These limitations are acute when labelled ground-truth trajectories are scarce or unavailable, motivating methods that generalize across geographic and infrastructural contexts. Turning such traces into credible representations of travel on a road network remains difficult, and results can vary greatly depending on the assumptions.

A core step is Map-Matching, which links each recorded location to plausible roads and routes. While map-matching methods are developed and tested in one place and reused elsewhere, street layouts, travel speeds, land-use patterns, and even how the mobile network “sees” movement change across countries and cities. This raises an under-discussed concern: how well do methods transfer across contexts, and how confident should we be in the outputs when local ground truth is limited or unavailable?

We examine these questions through a demanding “transfer” setting. We start with a model trained on a large set of labelled trajectories from one region (China) and then apply it as-is to MPN data from another one (Sweden), without collecting new labelled routes or recalibrating the model. In machine-learning terms, this is a zero-shot setting. Swedish MPN traces are 3G/4G mobile network events from a major operator (~10-20% of the market), pseudonymized and regenerated daily, stored and managed in the secure MIND infrastructure at Uppsala University. Three modelling strategies are tested to improve transfer and reduce sensitivity to local differences. (1) Broader training experience without local labels. We enrich the model’s prior “experience” by using large collections of synthetic routes built from an open global road database, thereby exposing it to a broader range of street patterns and movement styles and improving its ability to cope with unfamiliar settings. (2) Stronger behavioural plausibility checks. We add a transparent statistical layer (Hidden Markov Model – HMM) which acts as a disciplined “reasonableness filter,” helping prevent implausible jumps that can arise from noisy observations by preferring sequences of road links that are connected and consistent with feasible travel behaviour. (3) Context from the built environment. We incorporate information from satellite imagery to capture urban form context (e.g., dense centres versus suburban layouts), which shapes how movement is expressed in the data. We compare these strategies in terms of spatial accuracy, route plausibility, and the consistency of inferred travel patterns.

The contribution is twofold: empirically, we provide evidence on what helps (and what does not) when applying trace-based mobility inference across countries; conceptually, we frame transferability and uncertainty as central concerns for demand-side analytics based on digital traces. The findings are intended to support more credible use of MPN data for transportation policy and planning—with direct implications for data-scarce regions and privacy-preserving urban mobility analysis.

Revisiting Built Environment Effects on Shopping Trips: The Mediating and Moderating Role of E-Shopping

Cluster 8

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Proximity to in-store retail has long guided land-use and transport policies aimed at reducing travel distances, supporting local economies, and promoting sustainable mobility. Planning paradigms such as the X-minute city assume that dense, mixed-use urban forms ensure access to everyday retail through walking or cycling. However, the growing prevalence of hybrid retail environments—where e-shopping dynamically interacts with in-store consumption—challenges this spatially deterministic view. While the built environment remains central to shaping shopping-related travel behavior, its influence is increasingly mediated and conditioned by digital retail engagement.

Existing empirical research has not fully captured this transformation. Much of the literature implicitly assumes uniform effects of built environment characteristics, expecting factors such as retail density or accessibility to influence shopping behavior similarly across individuals. At the same time, it often disregards a structured causal relationship linking retail environments, digital practices, and shopping travel behavior. By treating e-shopping as a control variable, prior studies overlook the digital layer as an intervening mechanism, leading to oversimplified interpretations of substitution and complementarity in hybrid retail systems.

This study investigates the mechanisms through which digital retail engagement reshapes the relationship between built environment characteristics and in-store shopping frequency, asking through what underpinning mechanisms—mediation or moderation—e-shopping influences this relationship. The analysis focuses on the municipality of Madrid, Spain, a highly urbanized metropolis characterized by strong contrasts in urban morphology, retail accessibility, and digital engagement, making it a suitable natural laboratory for examining hybrid retail dynamics. The study adopts an observational case-study design using a bottom-up empirical strategy. Individual-level data from the E-MORES survey (October–December 2022) are combined with an ad-hoc spatial database at the postal-code level. The analytical sample includes 7,749 residents and integrates information on shopping behavior, e-shopping frequency, socio-demographics, and neighborhood built environment attributes. A dual Generalized Structural Equation Modeling (GSEM) framework is employed, estimating mediation and moderation models to disentangle indirect effects and conditional relationships.

Results show that built environment characteristics remain central predictors of in-store shopping frequency, but their effects are neither uniform nor direct. Mediation effects indicate that residential areas with limited retail and business-dominated districts indirectly push individuals toward e-shopping, reducing physical store visits, while additional effects reflect

showrooming patterns for home and decor products. Moderation effects reveal substantial social and behavioral heterogeneity: local retail strongly supports in-store shopping among less digitally engaged residents, but this influence weakens among frequent e-shoppers, particularly for convenience goods. Conversely, complementarity emerges for experience goods, and public transport accessibility plays a key moderating role in supporting flexible hybrid routines and enhancing retail resilience.

Overall, the findings demonstrate that e-shopping operates simultaneously as a bridge and a filter between urban form and shopping-related mobility, cautioning against one-size-fits-all spatial strategies and highlighting the need for integrated planning approaches that account for functional retail diversity, social heterogeneity, and transport infrastructure.

Assessing the impacts of app-based incentives on travel behaviour and sustainability

Cluster 8

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This paper discusses the potential contribution of smartphone app-based incentives such as notifications, challenges, point or monetary rewards to sustainable transport. Previous research showed that such incentives can encourage users to choose more sustainable modes to a limited extent but relied on fixed incentives. In the AI-CENTIVE project, AI-based methods were developed and tested to provide more user-relevant incentivisation, building on previous user behaviour data and enhanced travel behaviour prediction. This paper reports the results from the assessment of the piloted incentives on travel behaviour and ultimately of their potential to improve sustainability aspects of transport.

Case study: Users of an existing travel incentivisation smartphone app were invited to participate in a specific AI-CENTIVE community. They could earn rewards when travelling sustainably (i.e. walking, cycling, public transport or ridesharing). Different types of incentives to encourage the use of these modes were tested in two pilots, including challenges and notifications. A sophisticated AI model was applied to generate user-oriented encouragements. **Data and methods:** For the assessment we used data from a user survey and from the incentivisation app, containing information on recorded activities and available incentives for almost 500,000 trips from January 2024 to May 2025. We applied econometric modelling to analyse the impacts of the different types of incentives. We then defined rollout scenarios to predict the potential number of participating users of a similar incentive scheme in Austria and the overall effect on predefined sustainability indicators.

Main results: Challenges were revealed as the most effective incentive type, with users responding best to challenges with higher reward budgets and a greater number of winners, while the size of the main prize had minimal influence. For notifications, timely and personalized notifications proved most impactful, especially those sent close to planned activities. Individual trip rewards had a strong influence primarily on ridesharing. The rollout scenarios we used to upscale the results to Austria focused on companies subject to CSRD reporting requirements, with participation rates set at 10% (S1), 25% (S2), and 100% (S3), with a proportional number of users joining via other communities. This leads to a predicted total number of participating users in Austria of approximately 1% (S1), 2.5% (S2) and 8.5% (S3) of the population. Applying moderate mode switch rates from literature and average Austrian emission rates leads to 0.05% to 0.5% of CO₂ emissions from passenger transport in Austria. Further positive impacts are increased levels of physical activity and reduced need for parking spaces.

Conclusions: Although the contribution to climate change mitigation in our rollout scenarios appears to be limited, the findings highlight the potential of AI-based incentives to encourage

the use of sustainable mobility options at individual level. Effective incentive design should focus on gamification, timely notifications, and providing users with clear and achievable goals. In the long run, this creates positive attitudes and supports establishing successful business models for the use of persuasive technologies in transport.

Comparative Modelling of Cycling Route Choice for Bikes and E-Bikes Using GPS Data

Cluster 8

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Cycling is a key component of sustainable urban mobility, and understanding cyclists' route choice behaviour is essential for designing effective and attractive cycling infrastructure. The rapid growth of e-bikes further transforms urban cycling by enabling longer trips and reducing physical effort, yet transport models often continue to treat cyclists as a homogeneous group. This study investigates differences in route choice behaviour between conventional bicycle and e-bike users using high-resolution GPS data from Tartu, Estonia. While cycling route choice is widely studied, relatively few studies focus on e-bikes, and even fewer directly compare route choice behaviour between e-bike and conventional bicycle users. Furthermore, this is the first cycling route choice study conducted in Estonia and, to our knowledge, in the wider Central and Eastern European region.

The study aims to assess how built environment and environmental factors, including pollution, and greenery, shape cycling route choice and how these effects differ between e-bike and conventional bicycle users. In addition, it examines the influence of age and gender on cycling usage and route choice, including differences in bicycle type, route selection, and sensitivity to route attributes across demographic groups.

The analysis uses revealed-preference data from Tartu's bike-sharing system, combining GPS trajectories with socio-demographic information. Cycling routes are map-matched to the street network using a hidden Markov model, and alternative route choice sets are generated using a Breadth-First Search Link Elimination approach. Cyclists' route preferences are estimated using a path-size logit model that accounts for spatial overlap between alternative routes. At the current stage, the analysis is based on a balanced subset of approximately 5,000 trips, evenly split between conventional bicycles and e-bikes, which is used to develop and validate the modelling framework prior to scaling up to the full 2024 dataset of over 630,875 trips.

Preliminary results indicate that cyclists strongly prefer shorter routes and consistently avoid main roads and poor-quality surfaces, particularly cobblestone. High-quality cycling infrastructure substantially increases route attractiveness, with cycle tracks and footway-cycleway shares showing the strongest positive effects. Clear differences emerge between bicycle types. E-bike users are less sensitive to route length and are more willing to take detours compared to conventional cyclists. At the same time, e-bike users show substantially stronger avoidance of cobblestone surfaces and a higher preference for high-quality, separated cycling infrastructure. These patterns suggest that electric assistance reduces distance-related constraints while increasing sensitivity to surface quality and infrastructure design.

Overall, the preliminary results show that high-quality, well-separated cycling infrastructure is important for both conventional bicycles and e-bikes, while e-bike users display some distinct route choice preferences. A full analysis using the complete 2024 dataset is currently underway and will allow for more robust results and a clearer assessment of differences across age and gender groups, helping to better inform cycling infrastructure planning and policy decisions. By using high-resolution digital trace data and behavioural route choice modelling, the study directly contributes to ICT-enabled analyses of urban travel behaviour and supports data-driven planning of sustainable cycling systems.

Quantifying urban proximity in hybrid environments: An Augmented Accessibility framework for identifying space-time thresholds

Cluster 8

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Contemporary approaches to proximity planning remain grounded in physical mobility, assuming accessibility is achieved mainly through spatial proximity, as reflected in concepts such as the 15-minute city and superblocks. Meanwhile, the growth of e-activities (e-work, e-shopping, e-leisure) has created a mixed physical-digital realm where digital and in-person participation coexists and compete, reshaping how proximity and accessibility are produced. Yet current research largely ignores the role of e-activities in urban proximity planning. To address this gap, this study seeks to answer the following research question: At what spatio-temporal thresholds does digital participation become more advantageous than physical interaction, generating time savings and shaping the maximum proximity distances required across different transport modes? These thresholds are estimated for four major daily activities (daily and non-daily shopping, work and study, and leisure) and four transport modes (walking, cycling, driving, and public transport).

Grounded in the conceptual framework of Augmented Accessibility, the research draws on 803 travel surveys collected in Zaragoza, Spain. The survey was structured in three different blocks: (i) socio-economic characteristics of the participants; (ii) daily travel habits, including transport choice and origin-destination locations for the above-mentioned activities; (iii) habits and attitudes towards digital activities participation. At methodological level, elasticity analyses served to identify the spatio-temporal thresholds, capturing non-linear changes in accessibility as travel distance increases. Before running elasticity, a three-step methodological approach was applied: (i) estimation of origin-destination matrices, capturing variations in opportunity density, diversity, and distance to transport stops in the city; (2) standardization of those matrices through a probability density function, enabling comparison across individuals and spatial contexts; and (iii) calculation of the Feasible Opportunity Set (FOS), representing all activity locations and public transport stops potentially accessible within a fixed distance from a given location.

The results indicate that spatiotemporal thresholds vary by activity type and transport mode. Daily shopping operates within very local neighbourhood ranges, identifying the spatio-temporal thresholds at 1.36 km (median value), while non-daily shopping extends up to 2.73 km (median value). Mandatory activities such as work and study reach larger thresholds (median 6.00 km), likely reflecting limited flexibility in destination choice, whereas leisure spans broader

discretionary spaces (median 4.50 km) due to the dispersed location of specialized facilities. Regarding transport modes, walking corresponds to highly local accessibility (median 1.36 km), reflecting compact urban form and central density. Cycling enables intermediate accessibility (median 2.73 km), supported by flat topography and expanded cycling infrastructure. Public transport provides network-scale accessibility (median 4.50 km), structured around North-South tram and high-frequency bus corridors, while driving defines the outer spatial limit (median 8.19 km) for reaching dispersed development around peripheral areas.

The identified thresholds provide operational benchmarks for policy and planning, specifically by indicating the distance limits where digital substitution becomes more advantageous than physical travel. By identifying these tipping points, the Augmented Accessibility framework highlights opportunities to reallocate travel time savings toward other, closer activities. Consequently, this approach translates accessibility analysis into implementable planning tools that foster a more efficient integration of physical and digital spheres.

Framework and Methodology for Transforming Mobile Phone Data into Activity Space-based Population Statistics

Cluster 8

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Motivation and objective

Both evidence-based decision-making and impactful social science research rely on high-quality population statistics. Traditionally, such statistics are derived from registers and census data, which describe de jure residential and workplace locations, providing a largely static snapshot of population distribution. However, contemporary societies are increasingly mobile, and population presence is highly dynamic, while decision-making often requires timely information. ICT-based data sources, such as mobile network operator data, offer new opportunities to capture the dynamics of population distribution and to complement traditional population statistics.

This study introduces a holistic and globally replicable framework for producing activity-space-based population statistics using mobile network operator data. Moving beyond a home-based perspective, the framework captures both temporary and long-term dimensions of population presence and incorporates multiple key locations within individuals' activity spaces. It provides a structured workflow and methodology suitable for official statistics, enabling more comprehensive, inclusive, and timely representations of de facto population distribution. Despite the growing availability of data and methods in the era of "data abundance," a unified methodological approach for dynamic population statistics that accounts for the full activity space of individuals is still lacking.

The objectives of this study are to:

1. introduce a universal conceptual framework for generating activity space-based population statistics;
2. operationalise this framework by developing a workflow and methodology and demonstrating its feasibility for official statistics, offering a more nuanced population representation than traditional approaches.

Data and methods

The study is based on raw mobile phone data from one Estonian mobile network operator, commonly referred to as passive mobile positioning data (CDR, DDR). The framework is grounded in time geography and builds on the activity space approach by identifying activity locations—so-called anchor points—that reflect the full spatial footprint of individuals. In addition to residential locations, these include secondary homes, workplaces, other regularly visited places, and mobility between main activity locations (such as residence and workplace), covering both short- and long-term patterns.

The methodological framework for producing activity space-based population statistics includes the following steps: data quality assurance of the raw mobile phone data, data import and cleansing, identification of country of residence, spatial interpolation, detection of longitudinal anchor points, and aggregation and extrapolation to the general population. Outputs of the methodological workflow were then compared with the official population statistics.

Results

A comparison with the official population statistics from Statistics Estonia shows that the correlation for home and work locations is higher in administrative units that have a higher population and weaker in areas where the area and population size are smaller. Instead, they provide complementary insights, such as secondary home and work locations and other regularly visited places, into population distribution, thereby enhancing the analytical value and accuracy of official statistics.

Impact

While previous studies have proposed methodological frameworks based on mobile network operator data—for example, to estimate present population density or produce tourism statistics—this study advances the field by offering a more comprehensive, inclusive, and dynamic approach to capturing de facto population distribution. By systematically integrating the activity space concept and multiple key locations across individuals' activity space, the proposed framework contributes to the development of next-generation population statistics suitable for official use.

From Pixels to Planning: AI and Computer Vision Analysis for Understanding Cyclist Perceived Safety and Infrastructure Needs in the Streets of Chicago

Cluster 8

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Biking in the city of Chicago has continued to grow year over year. The Department of Transportation of the City of Chicago (CDOT) has implemented a cycling strategy to achieve an equitable cycling network. One of the pillars for this strategy is safety. In recent years, the city has made several efforts to expand its bicycle infrastructure, but little has been done to analyze user perceptions of safety. In addition, several city reports and crash data indicate that despite a reduction in bike fatalities, the number of accidents and incidents has increased in number and severity. As a result, many people in the city of Chicago use video recording as a tool to track their commuting trips and to keep a record in case of liability.

The aim of this research is to address the lack of knowledge in perceived safety and to inform policy and infrastructure measures that could help improve the biking situation in the city of Chicago. To achieve this goal, we analyzed biking video records from two commuters from 2022 to 2024. The analysis used AI-video processing tools and computer vision analysis methods that allow us to identify (1) the proximity of other vehicles to cyclists and (2) infrastructure obstructions that create nuisances while bike riding, which can cause the

Results show that, on average, in a 25-minute commute trip, a cyclist is in close proximity (under 1 meter) of a moving vehicle for about 35% of the trip, and that this number becomes more significant when there are parked cars and no bike lane protection. This figure is supported by Cyclist, who state that the main reason why they stop biking or don't allow their kids to bike on the roads is that cars are too close to bikes and they don't feel safe. In addition, data shows that during Fall and Winter, even protected bike lanes are not well-maintained, forcing cyclists to share the road with cars, vans, and trucks.

This work has served to analyze data in an efficient manner, but most importantly, to help provide information on policy measures that could help improve the situation of biking in the City of Chicago.

GENERAL TOPICS



Registry-Based Activity Spaces for Population-Scale Mobility Research

General

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Location awareness has considerably advanced mobility and contextual exposure research. However, most studies continue to characterise individuals primarily by their residential address. This home-centric approach overlooks that people spend substantial portions of their time elsewhere—at workplaces, schools, and visiting family—where they encounter different physical, social, and economic environments.

Activity space research addresses this limitation by mapping the spatial extent of daily life beyond the home. Traditional methods, however, face constraints: GPS tracking typically reaches hundreds of participants; travel diaries suffer from recall bias; mobile phone data lack sociodemographic context. We propose administrative registries as a complementary approach that captures anchor points—meaningful locations structuring regular mobility—at population scale.

Drawing on Hägerstrand's time geography, we operationalise activity spaces through anchor points that registries systematically record: residential addresses, workplaces, and schools. Importantly, registries also contain parent-child and partnership linkages that allow construction of family trees. Through these genealogical connections, we can identify the residential and workplace locations of grandparents, adult siblings, and other kin—substantially extending the set of anchor points that structure household mobility patterns.

Using Estonian linked administrative data for 1.3 million residents, we model household activity spaces as weighted networks. Nodes represent anchor points; edges capture connection frequencies reflecting visit patterns (daily commutes versus weekly family visits). This framework enables geometric measures (convex hulls, standard deviational ellipses) characterising spatial extent, alongside network metrics (density, centrality) describing structural complexity.

As mentioned earlier, the home location alone provides an incomplete picture of spatial behaviour. Workplace environments may account for exposure times comparable to those of home neighbourhoods, yet workplace characteristics rarely feature in contextual exposure studies. School and after-school activity locations shape children's daily environments in similarly important ways. Extended family anchors—such as grandparents and siblings—generate regular mobility patterns that remain invisible in home-only analyses, yet may be particularly important for childcare arrangements and social support networks.

Life course events systematically restructure activity spaces. Partnership formation introduces new workplace and family anchors, often connecting previously separate spatial networks. Childbirth typically contracts spatial range, before school enrolment expands it again. Parental death removes anchor points permanently. Because these transitions are recorded precisely in vital statistics, they enable longitudinal tracking of how households reorganise their spatial

behaviour over time—something cross-sectional mobility data cannot capture. Identifying key anchor points thus improves not only our understanding of residential and activity-space patterns, but also of mobility in society more broadly.

Long-term strategies for sustainable metropolitan mobility: The role of HOV lanes

General

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Metropolitan mobility is one of the main issues in sustainable territorial development. Population growth and urban sprawl are leading to greater car dependency, resulting in increasing congestion and polluting emissions. In this context, the key challenge is promoting the use of public transport by making it more attractive than the car for metropolitan trips. To this end, a good strategy is to implement High-Occupancy Vehicle (HOV) lanes that ensure priority for public transport services and improve their reliability. The objective of this research is to analyze the long-term impact of implementing HOV lanes on mobility patterns in metropolitan corridors.

This research was conducted in Madrid Region, where the HOV lane on the A-6 corridor, one of the first HOV lanes in Europe, was implemented in 1995. Based on its success, two new HOV lanes are currently being built on the A-2 and A-5 corridors. This research uses the Madrid MARS model, a Land Use and Transport Interaction model, to simulate the long-term evolution of mobility and explore the impact of these HOV lanes on the modal share of metropolitan trips.

Trips in the A-2 corridor will increase to almost 35,000 by 2040. Car use will increase and remain predominant, reaching a modal share of 73%. Public transport shows a long-term decline to 27% of the modal share. According to simulations, the HOV lane has an impact on mobility from the first year of implementation. In the long term, it reduces car trips in the corridor by 27%. The forecast shows that it causes an 80% increase in public transport trips in the corridor. This changes the modal share in the corridor, raising the public transport share from 27% to nearly 50% by 2040, balancing the shares of car and public transport.

The A-5 corridor will have more than 39,000 daily trips in 2040. Although the modal share in this corridor is more balanced, the car will be the predominant mode of transport with 54% of the modal share. Public transport will continue to play an important role in the corridor, with 46% of the modal share. The simulations show that the HOV lane will reduce car trips by 22% and will increase public transport trips by 73%. This will cause the modal share to change significantly with a decrease in the car share to 36%, while the public transport share increases to 64%. This results in a modal change of 19% and makes public transport the preferred mode of transport for metropolitan trips, outperforming car use in this corridor.

This research showed that HOV lanes are highly effective in improving the sustainability of metropolitan mobility. Their performance in promoting public transport increases its use and reduces car dependency. This causes an improvement in the modal share, with better results in corridors with a higher public transport share before the implementation. Furthermore, this research contributes to the development of strategic planning tools and demonstrates their potential for analyzing the long-term impacts of mobility and land use management strategies.

Using open-source fleet modelling to understand the carbon consequences of future mobility scenarios

General

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Using open-source fleet modelling to understand the carbon consequences of future mobility scenarios

Abstract

This paper introduces a national-scale vehicle-stock model which has been built to enable the analysis of the whole-life carbon impacts of different pathways for future mobility for GB. The paper will set out how we have built an open-source model to represent the current dynamics of vehicle purchasing and scrappage across different technology types.

The model is built from a time series of vehicle registration and test data, which captures vehicle size, fuel type, and miles driven. It is impractical to build a life cycle assessment of each of 30 million plus vehicles, and so the paper describes the simplifying assumptions to cluster vehicles into meaningful groups. With a stock-flow model of vehicle type, technology, age and mileage we are able to apply CO₂ emission factors for in-use emissions. The next stages, which will be complete by summer 2026 will be to add in the upstream and downstream emissions related to vehicle construction, maintenance, and scrappage.

The model is being built to inform the exploration of a range of transport futures and to provoke a wider debate about the future of the private car beyond how quickly we electrify the existing fleet and mobility practices. The INFUZE project, which this is part of, takes a co-design approach to explore the potential for positive post-car ownership futures. This may involve greater use of shared access to mobility on demand. Such changes might radically alter the size of the vehicle fleet, the vehicle mix which is purchased, and the intensity with which vehicles are used (and therefore scrapped). The model is important in ensuring that we take a holistic view as to the potential and pitfalls of these alternative futures. The paper will explore some early scenarios which compare different ownership assumptions with the anticipated transition pathway based on the national Zero Emission Vehicle Mandate, which sets the timing for the phase-out of fossil fuel vehicles.

Strategic Foresight 2040: Analyzing Structural Interdependencies in European Port Competitiveness via Cross-Impact Balance

General

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The European port system stands at a critical juncture, increasingly pressured by the convergence of geopolitical instability (e.g., Red Sea crisis), environmental regulations, and the rapid acceleration of digitalization. However, traditional quantitative methods often fail to capture the complex, non-linear interactions between these disruptions and logistics performance. This study aims to bridge this gap by assessing how global trade reorganizations and structural inefficiencies across maritime, port, and hinterland scales influence the future resilience and competitiveness of European ports.

To move beyond static forecasting, this research utilized the Cross-Impact Balance (CIB) methodology implemented through Scenario Wizard software to identify how different strategic drivers interact to shape the future of maritime logistics through 2040. The study defined five key descriptors: Maritime Routes, Port Operations Strategy, Automation, Hinterland Connectivity, and Systemic Governance. Data collection was conducted in a two-stage process. First, surveys were administered to industry experts (representing port authorities, operators, and shipping lines) to assess 20 specific cross-impact judgments on a standardized scale from -3 (strongly restricting) to +3 (strongly promoting). Subsequently, collaborative workshops were organized to validate these inputs and refine the narratives of the resulting scenarios, ensuring the translation of structural consistency into cognitive coherence.

The CIB analysis aggregated expert judgments to rank system configurations based on internal consistency, revealing significant structural tensions. Preliminary results indicate that "Route Diversification" (e.g., Cape/Arctic routes) strongly promotes (+2) "Fragmented Governance," as irregular arrivals and higher costs favor non-EU hubs like Tanger Med over EU gateways. Furthermore, the analysis highlights a critical trade-off: while "Green/Energy Priority" strategies are desirable, they show a tendency to restrict competitiveness unless paired with "Full Automation." Specifically, expert judgments suggest that without "Full Automation" to offset labor disadvantages and facilitate "Synchromodality" via Port Community Systems, a strict green focus risks accelerating carbon leakage to peripheral ports. Conversely, scenarios combining "Full Automation" with "Integrated Systemic Governance" emerged as the most resilient, effectively counterbalancing the volatility of maritime routes.

These findings may suggest that European port resilience relies less on stabilizing external maritime routes and more on enhancing internal technological and modal integration. The study suggests that to prevent carbon leakage and economic fragmentation, strategic planning must prioritize vertical integration and automation to internalize costs and maintain connectivity.

A decision-support framework for rapid mobility impact assessment during crises

General

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Urban mobility systems are increasingly exposed to disruptive events such as natural hazards, infrastructure failures, and cascading network breakdowns. In such contexts, planners need fast, flexible methods to explore how changes in transport networks may affect mobility patterns across a city. While common mobility simulation models provide rich and micro-scale behavioral realism, they are often computationally intensive, too detailed, data-hungry, and not well-suited for time-critical decision-making during crises. Conversely, aggregate indicators and static accessibility measures can be produced quickly but fail to capture how individuals actually adapt their travel behavior when networks are disrupted.

Our recent work has introduced the concept of “the Mobility Oracle”: a routing-based framework for generating synthetic multimodal mobility patterns without relying on observed trajectory data. The Mobility Oracle is grounded in the idea that actual trips are not globally optimal routes, but adjusted routes that balance travel time with human mobility preferences. These preferences capture factors such as walking and cycling distance and number of transitions between modes, and are encoded as cost adjustments within a multimodal routing framework. By sampling thousands of routes from this preference-aware routing space, the oracle can generate large sets of plausible routes that approximate observed mobility patterns under normal conditions.

A key strength of this approach is its suitability for scenario-based analysis. Because mobility patterns are generated directly from the transport network, the framework allows public transport lines, stations, or links to be easily added, removed, or modified. This makes the Mobility Oracle particularly attractive for applications in crisis and uncertainty contexts, where rapid assessment of network disruptions (e.g., line closures or temporary service changes) is required. By comparing synthetic mobility patterns before and after network modifications, planners can quickly gain insight into the spatial redistribution of travel demand across modes and corridors.

However, the usefulness of such routing-based decision support during crises depends critically on how human mobility preferences are represented. Preferences calibrated for everyday travel behavior may not hold under conditions of uncertainty. Empirical research suggests that during disruptive events, individuals place greater emphasis on perceived safety, risk avoidance, reliability, and trust in infrastructure, potentially overriding typical time- or convenience-based considerations. Applying average, normal-condition preferences in such situations may therefore lead to misleading assessments.

This paper proposes an extended Mobility Oracle for times of uncertainty, which retains the original routing-based structure but adapts the underlying cost functions to reflect crisis-specific mobility preferences. Instead of assuming static, average behavior, the extended oracle

incorporates preference profiles informed by empirical findings on mobility behavior and perception under uncertainty. These profiles can be selectively activated depending on the type and severity of disruption. This enables rapid exploration of alternative behavioral assumptions alongside network changes.

By shifting the focus from increasing model complexity to adapting human preference representations, this work positions the proposed extended Mobility Oracle as a flexible decision-support layer that complements detailed simulations, enabling planners to better anticipate mobility dynamics in uncertain urban futures.

Beyond measured change: Integrating microscale audit evidence and resident perceptions around light rail stations in Montreal, Canada

General

Anabtawi, Rim

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Light rail transit (LRT) investments can be catalysts for neighborhood improvements. Their construction are usually accompanied by changes in the built environment to increase access to stations. Such changes can be measured through detailed built environment audits overtime. Yet the extent these changes are felt by residents over time is a gap in existing literature. Montreal's Réseau express métropolitain (REM) provides a valuable context for addressing this gap. The REM is a CAD \$9.4 billion automated light rail project designed to improve regional connectivity and support transit-oriented development across the region. The REM began partial operation in 2023 and expanded with the opening of its second branch in 2025, introducing new stations into both established neighborhoods and areas undergoing urban transformation.

This study examines the relationship between microscale changes in the built environment and residents' perceptions of neighborhood changes around newly opened REM station areas. Microscale built environment changes were assessed using the Microscale Audit of Pedestrian Streetscapes-Mini (MAPS-Mini) (N=1,866) street segments within 1 km of REM stations at two time points (2022 and 2025). Segment-level scores captured changes in pedestrian safety, comfort, and streetscape quality and were classified as positive, neutral, or negative over time following rigorous data cleaning and inter-rater reliability testing. Audited street segments were spatially linked to responses from a bilingual travel survey conducted in Montréal, Canada in 2025 (N = 173), capturing residents' perceptions of change in neighborhood conditions within 50 m of the audited segments. Perceived changes were classified using the same three categories as the street audits: positive, neutral, or negative.

Results indicate that between 2022 and 2025, only 28.9% of audited segments (N = 539) experienced measurable microscale-built environment change, while most segments remained unchanged. Despite this limited level of audited change, substantial discrepancies were observed between audited and perceived neighborhood change across station areas. Survey results show that only 41.0% of respondents (N= 71) exhibited alignment between perceived and audited change, whereas 59.0% (N= 102) demonstrated discrepancies between lived experience and measured conditions. Among respondents exhibiting misalignment, negative perceptions occurred more frequently than positive perceptions, with 33.5% (N= 58) reporting conditions as worse than suggested by audited measures, compared to 25.4% (N= 44) reporting conditions as better. This mismatch was then modeled using a multinomial logit to better understand the

factors leading to the positive and negative mismatch between perceptions and actual changes in the built environment.

The findings from this research suggest that residents interpret neighborhood transformation through broader experiential and contextual factors beyond what microscale audits capture, highlighting the limitations of relying solely on objective measures to evaluate LRT impacts. The divergence between audited and perceived change indicates that neighborhood transformations are not experienced uniformly, with social position, daily mobility practices, and local context shaping how change is perceived. These findings can be valuable for professionals working towards increasing the benefits associated with LRT investments in station areas.

Do Boulevards Attract More Walking? A multi-scale study Using GPS-Derived Big Data

General

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Authors: Angel. A.

Cities increasingly prioritize pedestrian-friendly environments to enhance sustainability and accessibility. Boulevards are widely regarded as iconic elements of urban design, celebrated for promoting pedestrian activity through features such as wide sidewalks and greenery. They are often highlighted in urban planning literature as spaces that balance vehicular traffic with vibrant pedestrian environments. However, despite their reputation as key pedestrian corridors, there is limited empirical evidence supporting this notion with pedestrian count (PC) data. While previous studies underscore the general role of street design in influencing walking behaviour, few have employed large-scale or temporally dynamic pedestrian data, and even fewer have focused specifically on boulevards. Are boulevards truly the pedestrian corridors they are often assumed to be? Does their role as pedestrian hubs remain consistent across temporal variations? These questions challenge long-standing assumptions about their function in urban systems.

This study investigates pedestrian activity on boulevards using GPS-derived data collected over an extended period. The analysis focuses on Tel-Aviv, Israel, a city known for its historical legacy of boulevards and green infrastructure network. By comparing boulevards to other streets across different temporal contexts (weekdays vs. weekends, different seasons) and spatial scales (city-wide, neighbourhood, and street segment), the analysis offers empirical lens on boulevard performance. In addition, the study incorporates urban variables—such as network centrality, land use proxies, trees, building height, bus stations and lighting—to explore the relationship between street characteristics and walking volumes at the segment level. This approach provides new insights into whether and under what conditions boulevards serve as meaningful pedestrian corridors, and how they compare to adjacent or parallel streets that serve similar spatial functions.

City-scale findings show that boulevards attract more pedestrians on weekdays, with no statistically significant differences observed on weekends in most seasons. Furthermore, the role of boulevards within their neighbourhood varies over time - some function as key pedestrian routes during specific times, e.g., certain seasons or weekdays vs. weekends, while the majority showed no notable difference compared to nearby streets. A detailed examination of PC in selected boulevards and their parallel streets suggests that while boulevard-specific design features—such as medians or enhanced landscaping—may improve walking experience, it does not necessarily translate into increased walking volumes. Streets with basic pedestrian-supportive features can be just as attractive for walking, even without the formal design of a boulevard.

This study provides a comprehensive, data-driven analysis of the role of boulevards as pedestrian corridors, offering new insights into their association with pedestrian movement across urban scales, temporal contexts, and design characteristics. To the best of the author's knowledge, this work provides the first systematic, comparative assessments of boulevards' pedestrian role using actual pedestrian count data, challenging urban paradigms and moving the discussion from normative assumptions toward empirically grounded evaluation.

Where are young adolescents in urban mobility planning? A critical review of policy goals, targets and KPIs for youth-inclusive 15-minute cities

General

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The 15-minute city (15mC) is increasingly promoted as a planning approach to improve quality of life while addressing environmental, social, and health challenges through proximity-based access to daily needs. Yet persistent questions remain about how 15mC strategies account for diverse capabilities, perceptions, and acceptance, and how they translate into effective behaviour change towards active and sustainable travel, given the normative assumptions embedded in current planning and evaluation practices (particularly for groups whose mobility is often planned for, rather than planned with). Young adolescents (YA; ages 11–15, and more broadly under 18) are a critical but underrepresented population in mobility and city planning, despite the importance of this life stage for habit formation and emerging independence in travel choices.

This paper presents a critical literature and policy review that examines to what extent, and in what ways, YA are explicitly included in urban mobility and spatial planning policies, and how such inclusion is operationalised through appraisal-relevant planning goals, impact target levels, and key performance indicators (KPIs). The review is designed to support the development of youth-inclusive intervention portfolios within the i-MOBYL project, which aims to co-create and implement acceptable, evidence-based interventions that promote active and multimodal travel among YA across diverse European contexts.

Methodologically, we combine (i) a structured review of academic and grey literature on youth-inclusive mobility planning and behaviour-oriented interventions (with particular attention to school and everyday activity travel), and (ii) a comparative review of national and/or major metropolitan policy documents from multiple European contexts. For each document, we extract: (a) the extent of YA recognition (explicit age definitions, rights/roles, participation requirements), (b) the framing of problems and solutions (safety, autonomy, health, equity, accessibility), (c) the presence and specificity of YA-relevant goals, targets and KPIs (e.g., modal split, active travel frequency, perceived/actual safety, independent mobility), and (d) evidence of participatory or co-creative mechanisms with YA. This framework enables analysis of how knowledge about YA mobility is constructed and prioritised within formal evaluation structures. Our results highlight a systematic youth-inclusion gap: YA are frequently acknowledged indirectly (e.g., “families”, “students”, “vulnerable users”) but rarely addressed with dedicated objectives, measurable targets, or monitoring indicators that reflect their lived priorities and capabilities. The paper discusses implications for appraisal and evaluation practices in multi-

actor planning environments, showing how prevailing evaluation approaches reproduce implicit power asymmetries between planners, adult decision-makers, and young users. We conclude by outlining a practical set of recommendations and a preliminary indicator typology to support planners in embedding YA perspectives upstream in deliberative visioning, policy design, and evaluation frameworks for 15mC-oriented mobility transitions.

The Near, the Far, and the Digital: How E-Shopping Reshapes Urban Retail Proximity

General

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Proximity has become a central goal in contemporary urban planning, embodied by concepts like the X-Minutes City. In particular, the retail built environment constitutes a structural determinant of accessibility, governing how theoretical proximity translates into effective access. This is exemplified by the morphological dichotomy between pedestrian-oriented high streets and car-dependent peripheral centers that inhibit proximity-based access. However, the rise of e-shopping has emerged as a disruptive force reconfiguring established spatial dependencies. By fostering substitution and complementarity effects, digital retail alters the functional dynamics of proximity shopping, thereby modulating the extent to which consumption is bound by the morphological constraints of the built environment. Despite the substantial expansion of both proximity-oriented research and e-shopping literature, these domains have largely evolved in isolation. Although proximity-based planning remains anchored in the physical form, digitalization introduces a virtual layer where spatial and digital dimensions increasingly coalesce. Within this hybrid context, existing research often fails to disentangle whether substituted/complemented shopping trips are local or distant. This distinction is crucial, as e-shopping reconfigure travel frequency and spatial reach, thereby modulating both active mobility patterns and engagement with neighborhood retail.

Based on these important issues, this paper examines the extent to which e-shopping modifies the influence of the built environment on shopping behaviour. To this end, a survey was disseminated within the spatial laboratory of Madrid, yielding a final sample of 7,296 residents. The data collection focused on three key dimensions: (i) individual socioeconomic characteristics; (ii) e-shopping habits; and (iii) shopping-related travel behaviour. Additionally, spatial data across four categories of goods (groceries, perishables, experience, and household items) served as the basis to estimate indicators of the retail built environment, including density, diversity, and proximity to public transport. Methodologically, a Generalized Structural Equation Model (GSEM) links built-environment characteristics with e-shopping attitudes, socioeconomic factors, and e-shopping habits.

The results indicate that while the retail built environment remains a central determinant of proximity-based shopping, its influence is transmitted through mediated causal pathways rather than direct links. Crucially, this mediation is not uniform; rather, it is jointly conditioned by the interplay between gender and product type. Gender emerges as a significant moderator that disentangles these complex effects: among women, e-shopping tends to reduce the reliance on local proximity for 'experience goods' (negative effect), whereas it appears to reinforce it for 'search goods' (positive effect). These findings underscore that retail proximity is a socially

differentiated outcome, shaped by specific combinations of digital practices and socioeconomic context.

From a policy perspective, digitalization should therefore be incorporated into proximity agendas not as a competitor to local retail, but as a supportive layer that fosters proximity-oriented consumption. Accordingly, public administrations could promote digital solutions explicitly anchored in local ecosystems. Potential initiatives might include neighborhood-based online platforms, hybrid click-and-collect models, or shared delivery services linked to local stores, rather than prioritizing generic, large-scale e-commerce infrastructures.

Revisiting rail-based Transit-Oriented Development (TOD) policies through a Lefebvrian lens: Planning ideals and everyday lived realities

General

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This study employs Henri Lefebvre's concept of 'spatial triad' to examine rail-based TOD as a spatial planning concept in India. Drawing on Lefebvre's formulation of conceived, perceived, and lived spaces, the study analyses the disjuncture between how TOD is imagined and formalised by elite planning actors and how railway station neighbourhoods are actually produced and inhabited by marginalised urban populations. The paper first applies the notion of conceived space to understand how TOD has been framed in policy discourse as a strategy for the redevelopment of railway station areas. It then examines how these neighbourhoods are produced in reality as complex socio-spatial ecosystems through the everyday activities of marginalised actors.

Methodologically, the study comprises two complementary components. First, it conducts a systematic analysis of publicly available grey literature on rail-based TOD and station area redevelopment in Indian cities to unpack dominant representations of space and examine how TOD is articulated by policy and planning institutions. Second, the Lefebvrian framework is applied empirically to a medium-sized Indian city named Siliguri, focusing on its railway station neighbourhoods. Following Indian TOD policy guidelines, 800-metre buffers around three selected railway stations in Siliguri are used as study sites. Siliguri is selected due to its historical identity as a 'railway town' and its prototypical, organically evolved station neighbourhoods that emerged in the late nineteenth century. To limit the scope, the analysis focuses on two marginalised actor groups i.e. slum dwellers and owners of informal commercial establishments which form some of the largest and most economically significant clusters in the city. This spatial pattern is common across Indian cities, where station areas have historically attracted dense informal housing and commerce and where such groups are disproportionately affected by redevelopment initiatives, including TOD. Accordingly, the empirical analysis draws on interviews with 400 slum households and 391 informal shop owners, supplemented by non-participant observation to document everyday practices and their relationship with the human-built environment in Siliguri's station districts.

Document analysis shows that rail-based TOD is largely conceived in terms of the internationalisation of railway stations and their surrounding areas, with anticipated benefits framed around achieving so-called 'global' standards. Within this conceived space, TOD planning is primarily reduced to questions of physical restructuring, beautification, and visual order, while the role of station neighbourhoods as long-inhabited spaces that support the livelihoods and

everyday lives of marginalised populations is largely ignored. In contrast, the empirical findings demonstrate that these neighbourhoods constitute lived and perceived spaces of urban marginalisation, where slum dwellers and informal commercial actors have, over time, developed dense, interdependent ecosystems of existence rooted in proximity, accessibility, and everyday use of space. Read through a Lefebvrian lens, this illustrates how dominant representations of space systematically marginalise lived realities.

Overall, the paper highlights the contrast between policy-led conceptions of TOD and the realities of space as perceived and lived on the ground. In response, the paper suggests addressing both procedural and substantive gaps in TOD practice by fostering more inclusive, bottom-up planning processes and by rethinking TOD as a gradual, context-sensitive approach that engages with the lived and perceived realities of railway station neighbourhoods.

The (rail)road to work? Individual labour market effects of a new railway station in Dronten, the Netherlands.

General

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Authors: Wetering, A. & J. Bastiaanssen

Investments in rail infrastructure are generally seen as a plausible policy lever to improve labour market outcomes, but little empirical evidence exists of such effects, in particular outside urban areas. This study utilizes the opening of a railway station in 2012 in Dronten, a town located in a less urbanized part of the Netherlands, as a quasi-experiment to empirically examine the effects on individual labour market outcomes. While previous studies assumed improved job accessibility following new rail infrastructure, we first empirically assessed the impact of the railway station on public transport job accessibility from each neighbourhood in Dronten. Next, we combined a difference-in-difference analysis and matching strategy using administrative micro datasets spanning the period 2006 to 2018, to examine individual labour market effects among residents of neighbourhoods where public transport job accessibility had improved due to the new railway station. Despite a substantial increase in public transport job accessibility, we found no statistically significant increase in employment probability or average hours worked among the residents of those neighbourhoods compared to a control group residing in neighbourhoods where job accessibility remained unchanged. We did find a statistically significant increase in average hourly wage, which may follow from improved accessibility to better paid jobs. These varying effects could relate to the high share of car-owners in Dronten and that many jobs are located outside the catchment areas of the railway stations along the Hanzelijn. Investments in new rail infrastructure are therefore not necessarily enough to improve labour market outcomes outside urban areas.

Antwerp's Velo system: the gold standard of shared mobility or the end of the line for public transport?

General

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The last decade has seen a sharp rise in shared micromobility systems. Whether or not these systems complement or compete with public transport is the subject of ongoing debate. Lauded, rightfully so, for their potential as complementary services, (e-)bikes and scooters can fill gaps in the public transport system in time and space, and thrive when public transport use is high (Montes et al., 2023). At the same time, shared micromobility systems can act as formidable substitutes in areas with underdeveloped transit systems, drawing riders away from public transport and potentially contributing to a vicious cycle of declining ridership (X. Liu et al., 2025). As a result, while (e-)scooters and bikes are popular in underserved areas or as first/last-mile connections to public transport, many of their trips could realistically have been taken by public transport alone (Aarhaug et al., 2023).

Despite a quadrupling of publications containing the terms “micromobility” or “shared mobility” over the past decade in Web of Science records, and a doubling of bike-sharing systems over the same period (Meddin, 2024), empirical evidence on how to effectively integrate micromobility with legacy services into an holistic urban transport system remains limited (Attard & Balbontin, 2024). This issue is also pertinent in Antwerp, Belgium's second largest city. Antwerp hosts three shared e-scooter systems, a moped-sharing system, and three bike-sharing systems, including Velo, a public docked bike-sharing system with over 7 million trips in 2024. The city has adopted an active micromobility policy, including the introduction of geofencing to mitigate unsafe riding and improper parking. At the same time, ridership on the city's bus and tram network has shown a steady decline over the past 15 years.

While the wide range of available modes suggests a high level of accessibility for residents and visitors, competition among these modes—across both public and private operators—raises concerns about financial sustainability and the effective use of public funds. Using a shared mobility origin-destination (OD) dataset covering trips in Antwerp between June 2022 and August 2023, combined with self-reported travel behaviour data, this study examines usage patterns across modes to assess mode- and user-dependent accessibility. It addresses the following research question: should local authorities treat micromobility as a public transport service and invest in it accordingly?

Results show a strong spatial overlap between public shared bicycle and shared e-scooter use, with similar patterns of high and low activity across origin and destination areas. Nonetheless, distinct usage profiles emerge: shared e-scooter trips are predominantly short (0–10 minutes) and cover distances mainly between 500 and 2,500 m, whereas public shared bicycle trips more often last 5–15 minutes. Trip generation is highly concentrated for both modes, though shared e-

scooter origins are more tightly clustered in the city's central avenues, while public shared bicycle trips are generated across a broader set of locations within the broader city. Origin-destination imbalances indicate that public shared bicycles more frequently connect residential areas to major stations, touristic and event-related destinations, and outer-ring neighbourhoods, whereas shared e-scooters show a stronger association with central and touristic areas and exhibit a more pronounced shift towards weekend use.

Building on this descriptive analysis, we calculate micromobility-generated accessibility using a gravity-based model. By relating accessibility outcomes to mode-specific investments, we compare the accessibility benefits per unit of investment across transport modes. The manuscript concludes by drawing lessons on the cost-effectiveness of public intervention in different modes, contributing to ongoing debates on contemporary urban mobility governance.

“Identifying Cycling Accident Hotspots through Spatio-Temporal Network Kernel Density Estimation: A Comparative Analysis of Madrid and Paris”

General

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The promotion of active mobility, particularly cycling, has become a growing priority in European urban policies, driven by environmental, social, and public health benefits. However, the growth in urban cycling has been accompanied by persistent concerns about road safety, particularly accidents involving cyclists. In this context, it is essential to understand the spatial and temporal patterns of these accidents to develop more effective preventive strategies.

In a previous study, using exclusively open data sources, namely the urban network and georeferenced cycling accident data of the city of Madrid (Spain), between 2019 and 2024, the authors applied the Spatial-Temporal Network Kernel Density Estimation (ST-NKDE) methodology to identify in detail the density of cycling accidents across the urban network. The results revealed a marked seasonal pattern, with lower accident densities during the winter months, and identified two critical high-density segments along Calle de Fuencarral and Calle de Alcalá. Based on the results and potential demonstrated, this study proposes applying the same methodology to a second European capital, Paris (France), during the same period.

Unlike traditional density methods based on Euclidean space, ST-NKDE identifies accident hotspots along road segments, respecting the actual structure of the urban network and capturing relevant temporal variations, such as hourly, daily, or seasonal patterns. The analysis was carried out in two stages: in the exploratory phase, heat maps identified priority intervention areas; in the subsequent phase, ST-NKDE provided a detailed representation of accident densities, with bandwidth selection determined through leave-one-out cross-validation. This methodological replication strategy aims to assess the robustness and transferability of ST-NKDE for analysing cycling accidents across different urban contexts.

The expected results include identifying critical segments of cycling accident risk, comparing patterns across different urban contexts, and analysing spatial and temporal similarities and differences between the two cities under study. This comparative approach contributes to a better understanding of the contextual factors associated with accident risk and to knowledge transfer between European cities.

The proposed approach highlights the importance of incorporating spatial-temporal dimensions to achieve a more robust analysis of accident risk, providing valuable evidence to support urban planning by prioritising interventions in cycling infrastructure and defining sustainable mobility policies, such as traffic calming measures and road safety improvements. Thus, the study reinforces the relevance of using open data, ensuring not only the reproducibility and

transparency of research but also highlighting the importance of sharing information in open formats to support decision-making by public authorities, urban managers and researchers.

“It’s not the place, it’s the crowd”: an explorative study on queer mobilities and spatial practices in Brussels, Belgium

General

Betancur Arenas, Juliana

Authors: van Vessem Charlotte., Betancur Arenas, J & Keserü, I

Mobility research is increasingly focusing on justice and inclusivity, resulting in studies that analyse mobility in relation to factors such as gender, income, ethnicity, age, and health. Within the mobility justice paradigm, queer mobilities examine how gender identity and sexual orientation shape everyday mobility. However, this area remains underexplored in academia, often focusing on gay and lesbian experiences, and with very few empirical examples to date (Cubells et al., 2025; Weintrob et al., 2021).

Our project is the first academic study of queer mobilities in Brussels. It has two primary objectives: (1) to map and explore how queer people navigate everyday mobility and public space in the city and (2) to visualize both current and imagined futures of queer mobility through artistic practices. Following a thorough literature review, we conducted five focus groups with queer residents of Brussels, integrating traditional qualitative methods with artistic elements. A local visual harvester documented these discussions in real time, while participants also engaged in map-drawing exercises to trace their daily mobility patterns and associated feelings. As part of the participant recruitment strategy, we collaborated with the Brussels Queer Film Festival “Pink Screens” (November 2024) to create a community-generated map of queer-friendly spaces. We also conducted an additional round of semi-structured interviews with queer participants from hard-to-reach groups, including elderly people, migrants, and parents.

The results showcase the dualities of everyday mobility for queer people, as well as the coping strategies they use to navigate challenges when moving through and occupying public space. Although each identity brings a different relationship with the built environment, being visibly queer often involves a continuous tension between safety and self-expression. In some situations, reducing visibility becomes a coping strategy to avoid risk, while in others, choosing visibility through symbols or the way people dress, serves as an act of resistance and representation. This apparent dichotomous behaviour was common across all groups and was influenced by factors such as time of day, weather and season, choice of transport mode, and especially, the social environment (e.g., crowd composition).

These findings contribute to the emerging field of queer mobilities by identifying visibility management, practices of inclusion and exclusion and intersectional positioning as key factors influencing mobility experiences. They also reveal that mobility practices are shaped not only by infrastructure, but by a range of affective experiences such as perceived safety, comfort, vulnerability and ease, with important implications for wellbeing and autonomy in everyday movement through public space.

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NOTE: Dear Cluster 7 team, by mistake, I initially submitted our application to Cluster 4 (we were deciding between the two options). I just wanted to clarify that we intend to apply to Cluster 7. Thank you for your understanding.

Driven by Need or Perception? Modelling Perceived Car Dependence, Car Availability, and Mode Use in a Hybrid Choice Framework

General

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The private car remains the dominant mode of transport despite its well-documented negative consequences for society and the environment. In transport research, this dominance is often framed through the concept of "car dependence," defined as the inability to participate in activities without a car. However, a critical ambiguity persists in the literature: research frequently treats car dependence and car use (or ownership) as synonymous, using one as a proxy for the other. This approach is problematic because high car use can result from preference rather than dependence, while high dependence does not always lead to use—as seen in cases of car deprivation. Consequently, conflating these concepts risks misidentifying the adequate policy interventions to reduce one or the other.

This study addresses this gap by disentangling the relationship between perceived car dependence (PCD), car availability, and actual mode use frequency. While previous studies have established strong links between the built environment ("spatial car dependence") and travel behaviour, they often overlook the psychological mechanisms through which these spatial constraints are interpreted. We test the hypothesis that PCD is not merely a reflection of spatial conditions but an independent psychological construct that shapes travel behaviour both directly and indirectly.

Data were collected via a two-wave survey in Dortmund, Germany, yielding a final sample of 498 respondents. We employ a recursive Hybrid Choice Model (HCM) to analyse the determinants of car, public transport, and bike use frequencies. The framework explicitly models PCD as a latent variable structurally determined by individual socio-demographics, psychological traits, and spatial car dependence. Similarly, we also treat car availability as an endogenous binary mediator determined by PCD and other individual characteristics.

Our results from the hierarchical HCM indicate that PCD is a strong, significant predictor of travel behaviour, retaining a significant effect even when controlling for spatial, individual, and psychological factors. We find that PCD positively influences car use frequency and negatively influences the use of public transport and bikes. Furthermore, the model confirms a partial mediation effect: PCD strongly predicts the likelihood of having a car "always available", which in turn acts as a prerequisite for high-frequency car use. However, the impact of this mediator varies by mode. While high car availability significantly reduces public transport frequency—indicating a substitution effect—it shows no significant impact on bike use, suggesting that cycling decisions are driven more by attitude than by vehicle access constraints.

Based on these findings, this study provides new insights and important policy implications. Since PCD shapes behaviour independently of spatial constraints, infrastructure improvements alone may be insufficient to reduce car use and encourage alternative modes; they must be complemented by "soft" interventions (e.g., mobility coaching) to align subjective perceptions with objective accessibility. Additionally, the strong mediation via car availability suggests that policies should aim to disrupt "default" access, for example, by promoting car-sharing to decouple ownership from use.

BRI Transport Infrastructure Reduces Gender Employment Inequality

General

Cui, Xinxin

Authors: Cui, X., & Liu, Q.

The Belt and Road Initiative (BRI) represents an unprecedented global endeavour that has profoundly reshaped the economic and social landscape of a wide range of countries through large-scale cross-border investments in transport infrastructure. These vast projects, spanning roads, railways, ports, and airports, are championed for their transformative potential: reducing transaction costs, enhancing market access, and integrating hitherto peripheral regions into global value chain. However, existing discussions of the BRI have largely focused on economic efficiency and environmental consequences, leaving a critical gap in our understanding of its social implications. In particular, little is known about how these massive infrastructure investments affect one of the most persistent structural challenges in labour markets: gender employment inequality.

To address this gap and provide credible causal evidence, our study constructs a novel cross-country panel dataset by identifying the first overseas transport infrastructure projects undertaken by Chinese firms under the BRI framework. These project-level data are merged with sex-disaggregated employment indicators from the International Labour Organization, enabling a systematic examination of gendered labour market outcomes. Exploiting the staggered timing of project initiation across countries, we adopt a quasi-natural experiment design that treats project groundbreaking as an exogenous shock. We implement a staggered Difference-in-Differences (DID) approach to account for treatment timing heterogeneity and potential variation in treatment effects across countries, thereby strengthening causal identification in a multi-period setting.

Our results reveal a robust and statistically significant finding: the initiation of BRI transport infrastructure projects reduces gender employment inequality in participating countries. Importantly, this effect exhibits a pronounced lag, indicating that labour market adjustments unfold gradually over time. The findings remain stable across an extensive set of robustness and sensitivity checks. Further heterogeneity analysis shows substantial cross-regional variation. More pronounced reductions in gender employment inequality are observed in Europe, Central Asia, Latin America, and the Caribbean, while early-stage effects in the Asia-Pacific region and Africa sometimes suggest a temporary widening of inequality, reflecting context-specific constraints. Moreover, countries with higher government effectiveness and better baseline transport infrastructure experience stronger inequality-reducing effects. Overall, this study contributes novel cross-country causal evidence on the social dimensions of the BRI, offering important insights into gender equality and the broader pursuit of socially sustainable infrastructure-led development.

Up in the air? Price elasticities of air travel demand for direct and indirect travel: theoretical framework and meta-analysis

General

de Graaff, Thomas

Authors: de Graaff, T, & A. Pels

Air transport policy requires precise information on the price elasticity of air travel demand. This paper provides a systematic overview of the current literature on the price-elasticity of aviation demand.

First, a theoretical model describes how prices in direct and indirect markets may influence each other. Here, capacity on a given flight is limited, and seats are allocated according to demand characteristics in the different markets served with the flight under consideration. In the next step, the theoretical model is translated to an empirical model that is used to explain why and how price elasticities differ across markets.

Second, we provide a meta-analysis, a comparative and quantitative reevaluation of previous research on, in this case, the price elasticity of passenger air transport. Following a systematic literature search, estimates of price elasticities as well as information on geographic, economic and demographic sample variables and moderator variables are recorded from the literature. A flexible and robust estimation method is used to predict how prices elasticities in direct and indirect markets vary around the sample mean, whilst controlling for study specific effects and heterogeneity.

This is not the first meta-analysis on this topic. But there have been new empirical findings in the field in the last 20 years, so an update is necessary. Moreover, the distinction between direct and indirect markets is novel and has been an issue in policy making for years: what is the effect on demand if transfer passengers pay the same tax as origin-destination passengers?

Perceived transport equity and its impacts on travel behaviour and perceptions

General

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Authors: De Vos, J. & Hook, H.

Transport equity has been the focus of many studies in the past decades. However, it is generally measured objectively, thereby disregarding important subjective elements potentially hindering people's travel abilities. Additionally, the impact of transport equity on travel behaviour, but also perceptions such as satisfaction and perceived accessibility, has not been adequately analysed. In this study we use a sample of 2,593 students and staff of University College London (UCL). Based on a factor analysis of nine statements, we detected two dimensions of self-reported transport equity, i.e., travel freedom and desired travel. Linear regressions showed that both dimensions are positively affected by living in Greater London and access to public transport and shared e-bikes. Two-way ANOVAs revealed that travel freedom and desired travel have a positive influence on active travel, travel satisfaction, and perceived accessibility, while negatively impacting train use and travel distance/duration. A cluster analysis based on the created factors identified four profiles of respondents: desired captive travellers, desired choice travellers, undesired choice travellers, and undesired captive travellers. Policy interventions are especially relevant for members of the last cluster, characterised by long train journeys, and low levels of satisfaction and perceived accessibility. Their transport equity could be improved by a more fine-grained public transport network and more (affordable) housing, ideally around public transport nodes or closer to Central London.

This study is one of the first that tries to quantify and explain self-reported transport equity, which may capture transport limitations better than objective measures (such as car ownership and public transport services). Additionally, this study has examined the impact of transport equity on multiple travel outcomes simultaneously (behaviour, satisfaction, and perceived accessibility), contributing to existing studies mostly exploring the link with single travel elements. Outcomes indicate that transport equity can be regarded as an important predictor of travel behaviour and travel experiences, thereby impacting people's quality of life. Since we used a convenience sample of university students and staff in a large city, we recommend that future studies also analyse perceived transport equity with a more representative sample in various geographical locations.

Do Transit Accessibility and Proximity Matter? Understanding Household Local Car Travel Behavior within the Concept of the 15 Minute City

General

Diab, Ehab

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The concept of the 15 minute city (15MC) has increasingly influenced planning policy and practice worldwide. Using household travel surveys, many researchers have examined who live a 15MC lifestyle by identifying individuals whose trips occur predominantly within 15 minutes of home using active modes. Others have explored determinants of local active travel, highlighting factors related not only to the built environment but also to household characteristics. Despite extensive research on commuting behavior, far less is known about the determinants of non-work car trips across different trip distances and particularly how household, neighborhood, proximity, and transit accessibility factors interact to influence short-distance car use. Accordingly, this paper examines household-level, built-environment, proximity, and transit accessibility factors associated with using cars for short-distance trips within 1,200 meters (15-minute walk), 1,600 meters (20-minute walk), and 2,400 meters (30-minute walk) in Saskatoon, the largest city in Saskatchewan, Canada, with a population of 280,000. Multiple data sources were integrated, including the 2023 Saskatoon Household Travel Survey (SHTS), Statistics Canada's proximity and transit accessibility measures, and land-use characteristics. The SHTS captures household composition, personal characteristics, and detailed information for each trip (distance, duration, purpose, mode). Proximity indicators were calculated for different amenities such as grocery stores, pharmacies, health care, childcare, schools, parks, and transit stops. Gravity-based accessibility by transit was calculated using GTFS data and the *r5r* package in R for each minute between 7:00–9:00 AM (peak) and 2:00–4:00 PM (off-peak) on weekdays. For analysis, households were classified into categories based on the predominant main mode used for their trips within the three spatial thresholds (1,200, 1,600, and 2,400 meters). Summary statistics were used to explore associations between household travel behavior and various factors. Multilevel logistic regression models were then developed to identify factors associated with the likelihood of households making most of their short-distance trips by car versus sustainable modes (walking, cycling, or transit). A random intercept for Saskatoon neighborhoods was included to account for spatial clustering. The initial results indicate that household composition and vehicle availability are consistently strong predictors of car use across all distance thresholds. In contrast, larger household size and on-campus student housing are associated with lower car use. Associations with dwelling type were mixed, with townhouse and semi-detached residents showing increased odds of making longer car trips. Notably, while proximity and transit accessibility measures suggested some positive patterns,

they were not significant predictors of reducing short-distance car trips when controlling other factors. This suggests that other influences may outweigh proximity and transit accessibility in shaping short-distance car use. This study provides planners and policymakers with an enhanced understanding of the determinants of local car travel. Findings highlight the need for policies that focus not only on improving transit accessibility and proximity, but also on reducing the attractiveness and convenience of car use itself. In other words, improvements to accessibility and proximity alone may have limited impact on decreasing dependence on cars for short trips, highlighting the importance of behavioral and perceptual considerations for planning and policy development.

Cross-Border TEN-T Nodes Data Integration: A Methodological Framework

General

Fernández-Lobo, Allison

Authors: Monzon, A.

Designing Mobility Operational Data Spaces for Cross-Border TEN-T Nodes

Allison Fernandez-Lobo, Andres Monzon. – Universidad Politécnica de Madrid

A key priority in the European Union is the development of more efficient and sustainable transport systems through the digital transformation of the sector, with data acting as a central enabler. In cross-border transport nodes, mobility management is strongly shaped by the coexistence of different governance systems. Each side of the border operates under distinct institutional structures, regulatory frameworks, and data management practices, creating significant technical and governance-related challenges for data integration. To foster effective cooperation at the European level, particular attention must be given to these nodes, where the analysis of passenger mobility, logistics flows, and associated emissions is critical to understanding transport dynamics and developing a unified view of the cross-border territory. In this context, Mobility Data Spaces (MDSs) serve as a technical solution to ensure transparent access to interoperable and reusable data across a wide range of transport applications available for all involved partners.

The objective of this study is to design transport-related datasets for enabling the transparent integration and harmonisation of heterogeneous transport-related datasets across cross-border territories. The proposal encompasses the selection of representative use cases and the design of a comprehensive data workflow covering data process stages. It aims to overcome institutional and technical fragmentation by defining common data structures that provide integrated information to support coordinated data-driven actions between administrations, such as improving traffic management, passenger and freight transport, and ultimately enabling the implementation of policies. This approach is aligned with European standards and lays the technical foundations for the implementation of MDSs.

The methodological design is being developed and tested using selected nodes within the TEN-T network connecting Spain with France and Spain with Portugal as case studies. Common data specifications and requirements are defined according to a set of key performance indicators (KPIs) to assess services related. The process draws on data collected from national traffic administrations, public transport authorities, transport and environmental observatories, regional data providers, and European open data sources. An initial diagnostic phase is conducted through a systematic mapping of data sources, incorporating Exploratory Spatial Data Analysis (ESDA) to validate spatial consistency, coverage, and identify data gaps across territories. Subsequently, data preprocessing and harmonisation procedures include the definition of a common data model, semantic alignment of variables, temporal and spatial normalisation, and metadata enrichment to achieve data integration.

Preliminary findings highlight relevant differences in the harmonisation potential of the datasets involved. Emissions-related data show a higher degree of comparability across countries, largely due to the use of international standards. In contrast, transport-related data exhibit greater heterogeneity, particularly in terms of data formats, temporal resolution, and the variables considered by each administration, which poses additional challenges for integration. Overall, these findings demonstrate that the proposed methodological framework enables the design of interoperable MDSs, offering a scalable and replicable approach across the TEN-T network. It supports data integration and delivers actionable insights for policymakers and operators, enabling cross-border mobility analysis and coordinated transport management across Europe.

Critical Data Sources and Tools for Monitoring Transport Service Reliability across Complex Domains

General

Ferretto, Laura

Authors: Bruzzone F., Cavallaro F., Ferretto L., Gasparetto M., & Nocera S.

Disruptive events –ranging from infrastructure failures and extreme weather to operational and systemic disturbances– require robust monitoring approaches to identify and quantify their effects on transport services. A critical prerequisite for such approaches is a clear understanding of the data sources and analytical tools currently used to support the assessment of transport service reliability. Preliminary activities within the Horizon Europe project SCUDO (Safe and Comprehensive Urban Development and transport management for Disruption-resilient Operations) indicate that responses to disruptive events by authorities and decision-makers are often fragmented and insufficiently coordinated, highlighting the lack of a shared and systemic monitoring perspective.

This contribution focuses on the identification and critical assessment of existing data sources and tools used to monitor service reliability across different transport domains, including land- and water-based public transport, waste collection, and freight. Highway traffic at the regional level is also included. The paper systematically analyses a broad range of resources, including scientific literature, established monitoring models, and statistical datasets. These sources are examined in terms of their role in detecting disruptions, measuring service performance, and supporting reliability assessments under both normal and disrupted conditions.

The proposed work aims to develop a structured overview of how transport service reliability is currently monitored across domains, by systematically mapping and relating existing performance indicators, models, and measures. The goal is to assess their consistency, complementarity, and transferability across domains, identifying common elements that could support the development of a more unified monitoring framework, while still accounting for domain-specific characteristics. Particular attention is given to key challenges related to data availability, quality, temporal and spatial resolution, interoperability, and comparability. Moreover, the analysis seeks to identify gaps and limitations in existing data ecosystems, including difficulties in capturing cascading effects, cross-mode interactions, and systemic vulnerabilities during disruptive events.

By critically evaluating data sources and tools, this contribution provides a basis for the development of more advanced, integrated and coherent monitoring frameworks for transport reliability. The findings aim to support future methodological advances in disruption monitoring and assist transport planners in developing data-driven approaches that can improve the reliability and adaptability of transport systems.

Transformative for All? Evaluating Epistemic Justice in European Urban Mobility Transition Policies.

General

Gupta, Mallika

Authors: Gupta, M., Baumgartner, A., Soria-Lara, J. A., & Lanzendorf, M.

Socio-ecological urban mobility transitions are widely framed as essential for achieving climate, equity, and public health goals. Yet growing evidence shows that these transitions often reproduce, rather than reduce, social and spatial inequalities. In most cities, transition agendas have been dominated by technocratic definitions and a focus on green or smart technologies which are distributed inequitably in areas with individuals who have higher incomes and higher access to technology. These processes tend to neglect how mobility is shaped by intersecting factors including race, household incomes, gender, or migration status. At the same time, transformative planning approaches have emerged that seek systemic change beyond incremental improvements, for example through street space reallocation, radical street experiments, and efforts to build institutional transformative capacity. However, empirical evidence on whether these policies meaningfully address social vulnerability remains limited, particularly from an equity and justice perspective.

This paper investigates the question, how are transformative transportation policies in European cities attempting to respond to the diverse mobility needs of socially vulnerable communities? Situated within debates on just transitions, transport-related social exclusion, and transformative planning, the study examines how equity and justice considerations are embedded in policy design, implementation, and measuring impacts. The research draws on semi-structured expert interviews conducted in four European cities Copenhagen, Vienna, Madrid, and Frankfurt am Main, with transport planners, policymakers, political actors and mobility advocates involved in planning and implementation processes. The interviews are used to develop a systematic inventory of current transformative processes and to analyze how planners conceptualize "inclusion," identify vulnerable groups in their cities, and address intersectional dimensions such as income, migration status, gender, age, language, and ability in the design of mobility policies.

The findings highlight a persistent gap between the transformative narrative of mobility transitions and the political priorities, institutional constraints and structural inequalities that continue to restrict transformative change. The paper also finds that despite growing discourse around inclusive planning, certain communities remain systematically underrepresented in both policy design and anticipated beneficiaries. The paper argues that accelerating inclusive mobility transitions requires moving beyond universalistic green-policy logics toward context-sensitive, justice-oriented planning approaches that center the differentiated mobility needs of socially vulnerable communities throughout all stages of policy development and implementation.

Trip-level analysis of mobility situations in Montevideo: revisiting transport, urban structure, and socioeconomic factors

General

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The ease of access to urban opportunities results from the interaction between land use, the performance of transportation networks, and individual attributes. A wide range of measures has been developed to capture this capability as a place-based variable. In Latin America, several studies have examined the potential to reach destinations using metrics such as cumulative opportunities and gravity-based measures. However, fewer studies have explored commuters' lived experiences as reflected in observed travel times and distances. This paper addresses commuting experiences in Montevideo, the capital of Uruguay. Adopting a mobility situations framework to analyze observed configurations of work-related travel, it examines diverging time-distance patterns in home-to-work trips. This framework distinguishes four types of mobility situations according to whether travel time and distance are above or below their respective averages: short commutes (below-average time and distance), long commutes (above-average time and distance), wormholes (above-average distance and below-average time), and travelscarps (below-average distance and above-average time).

This work examines the factors explaining different mobility situations among commuters in Montevideo. Complementing existing literature, which relies on aggregate indicators at the level of spatial units, this analysis focuses on individual trips. This methodological strategy provides empirical evidence that avoids potential ecological fallacies while revealing explanatory mechanisms that are only observable at the individual level. The study also extends the mobility situation framework to a mid-size Latin American city, complementing previous research on diverging mobilities conducted in Denver, New York and Mexico City. Montevideo, as a relatively small capital city in the Global South with a pronounced monocentric urban structure, offers a distinctive case for exploring these dynamics.

We estimated three multinomial logistic regression models to assess the relationship of transport, land use, and socioeconomic variables on commuters' mobility situations. Our findings indicate that mobility situations are primarily influenced by transport-related variables. At the same time, the results also highlight the crucial role of urban structure, demonstrating that transport factors alone are insufficient to explain mobility outcomes. Although commuters' socio-economic characteristics exhibit limited explanatory power overall, some variables are statistically significant, particularly in accounting for less favorable mobility situations such as long commutes and travelscarps. While these results may initially appear to contrast with previous studies, they are ultimately complementary, reinforcing the idea that transport mode and infrastructure are central but must be analyzed in conjunction with land-use dynamics. Moreover, under specific conditions, socioeconomic attributes determine the type of mobility

situation an individual is most likely to experience. These findings open several avenues for further research on urban structure, travel behavior, travel time, and transport equity.

From a policy perspective, our findings challenge the intuitive assumption that workers' mobility experiences are shaped by transport policy alone. Instead, the results underscore the critical influence of urban structure and socioeconomic factors. This evidence shifts the emphasis away from narrowly conceived, infrastructure-based transport solutions and highlights the need for an integrated dialogue between spatial and transport planning, prioritizing alternatives that go beyond simply reducing travel time over long distances.

The multifaceted dimension of walkability: does everyone have an equal chance to walk/wheel?

General

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In the last decades, mounting evidence makes the case for walking as a sustainable form of active travel, easily combined with other transport modes. Cohort studies, systematic reviews, and meta-analyses show that incorporating physical activity in one's daily routines has multiple benefits to physical and mental health. As little as 11 minutes of daily brisk walk is sufficient to reduce the risk of early death, including lowering the risk of stroke, heart disease, and a number of cancers. Besides individual and collective health gains, walking offers planetary gains, by potentially replacing short carbon-based trips with this healthier alternative.

Walking is a transport mode that should be available to everyone at no cost. This means walking should be an option for every individual and should be part of everyone's modal choice set. To see if walking is part of this choice set, the Capability Approach can be applied. With this approach it can be assessed whether a behavior is an option for an individual, considering different personal and environmental factors and resources. The capability approach was used in this research to evaluate the match between the environment and the potential of an individual to walk. Exploring this relationship sheds light on the role of the immediate surroundings in making walking a real opportunity in everyone's modal choice set. This led us to the following research question: Can every inhabitant of Rotterdam walk to destinations in their immediate surroundings to fulfil their basic daily needs?

We defined walkability as the ability to independently walk (or wheel) to specific destinations relevant to one's daily functioning, enabled by the unconditional provisioning of basic infrastructure (i.e. quality of the network for walking/wheeling and the availability of destinations within a reasonable time). We do not make a distinction whether individuals make use of such infrastructure, but we measure whether the provision of such infrastructure is equally available across cities, towns, and villages in an urban region.

To measure the quality of the network, we combined open and restricted datasets to [1] enrich a pedestrian routable network for the municipality of Rotterdam and [2] create group-specific 'meaningful' destinations. The pedestrian network quality was measured as the net-available sidewalk width (i.e. excluding both permanent and semi-permanent obstacles) aggregated at 10-meter intervals. A segment had 'good' quality with net width $\geq 1,2$ meters, to accommodate people with reduced mobility or traveling with a companion. Additionally, a segment had 'good' quality for net width $\geq 0,9$ meters, to accommodate people without reduced mobility. The second component of measuring walkable environment was the presence and number of group-specific 'meaningful' destinations (e.g. schools, convenience stores or general practitioners) within reasonable reach. Destination reach was measured as the network-bounded distance

from each neighborhood's weighted origin centroid at a time cutoff. Group-weighted centroids were created using the Centraal Bureau voor Statistiek neighborhood level age groups (0-15; 16-25; 26-66; 67+). We assigned path-finding net width penalties based on the portion of the neighbourhood population receiving disability benefits or belonging to the youngest group. Our proposed neighborhood-level walkability index accounts for different population sub-groups, more objectively quantifying the quality and reachability of neighborhoods.

Designing accessibility-oriented neighborhoods tool through facility location and network design optimization

General

Kamoun, Cyrine

Authors: Kamoun, C. & Duran, D. & Weik N.

Proximity-oriented neighborhood design is increasingly integrated into urban planning, allowing the population to access their basic needs nearby with active mobility. However, as neighborhood design often relies on expert-oriented processes such as urban design competitions, these methods can be time-consuming and may favor conventional layouts over accessibility-oriented solutions. This can emphasize urban form while overlooking the measurement of population movement and demand satisfaction at the planning stage.

To complement current practices, this study suggests two optimization models to design an accessibility oriented neighborhood. The model focuses on walking as a travel model. The first model, the Facility Location Network Design (FLND) model, identifies optimal facility locations and designs a street network to connect the surrounding areas to these new facilities within a maximum travel time. Accessibility for new residents is measured using an Euclidean distance, and residential distribution is assumed to be fixed and uniform in the new development area.

The second model, the Facility Location Network Design with Layout Design (FLND-LD) model, extends the FLND by allowing for variable residential distribution. It also connects new residents of the development area to the street network, generating a final network layout and a sketch map of the new neighborhood. Additional constraints are introduced to improve urban form, such as the creation of green spaces and the approximation of urban block layouts.

The models are applied to Lerchenauer Feld, a 25-hectare site surrounded by urban areas in Munich, and compute in around 40 minutes. Compared to the area's current development plan, the models provide higher levels of accessibility. By focusing on accessibility, facilities are located in a more polycentric distribution when multiple amenities of the same type are built, or in a more central location when only one facility is constructed—compared to the current plan. However, trade-offs between accessibility and broader urban planning criteria must be further addressed to improve the model's usability.

The resulting layouts can be used to guide early-stage neighborhood planning toward accessibility-oriented solutions. They can also be used in visual, interactive public participation processes to elicit residential preferences. Additional metrics (KPI) on the output model can be used to evaluate the suggested design in terms of accessibility, build road length, connectivity, or further criteria. In this context, a more dynamic format can be suggested. Rather than having a static number of amenities and travel thresholds or residents, the model can allow these variables to be defined by the planner, and the most optimal build environment inputs can be defined by comparing layouts and the KPIs.

Is it a match? A stated choice survey on carpooling to compare riders' willingness to pay with drivers' willingness to accept

General

Kinigadner, Julia

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Private cars remain the preferred mode of travel in many regions, yet their occupancy rates are persistently low. At the same time, public transport often fails to offer an attractive alternative in low density areas, leaving carpooling as a potential solution to reduce vehicle kilometres and improve accessibility for individuals without a car. We define carpooling as private car journeys in which free seats are offered to other people. Carpooling is frequently promoted for its potential to save time, money, and emissions while improving transport supply. Despite these apparent advantages and the availability of digital platforms that facilitate ride matching, uptake remains limited. Previous research attributes low adoption to factors such as reduced flexibility, privacy concerns, and social discomfort. This study focuses specifically on the monetary dimension, which is often cited as the most compelling argument for carpooling. In particular, we investigate through a stated preference study how much money drivers would need to receive to be willing to take a rider, and how much riders would be willing to pay. There is only a match if there is an overlap in the price, given a spatial and temporal match of demand and supply. The objective is to estimate willingness to pay from the rider's perspective and willingness to accept from the driver's point of view. We designed a discrete choice experiment comprising two scenarios: (1) choosing between driving alone or carpooling as a driver, and (2) choosing between driving alone or carpooling as a rider.

The carpooling context was defined as an app based service, reliable, pre booked, and used for regional commuting or leisure trips. The alternatives in both scenarios were only solo driving and carpooling. Opt out or additional modes such as public transport were not included, as the choice situation should reflect a typical context of a car driver. Each alternative was characterised by three attributes: travel cost, travel time, and detour time. Trip parameters for work and leisure trips were defined based on realistic assumptions verified by carpooling platform providers. Ngene was used to create a random design. The survey was implemented in LimeSurvey in German and English. It consisted of socio-demographic questions, the mode choice experiment, and attitudinal items. Data were collected from an online panel in Germany between 5 and 7 November 2025. Eligibility criteria required respondents to be employed or enrolled in higher education, thus having a commute, and to have access to a private or company car. Quotas ensured approximate representativeness regarding age and gender. A total sample of around 1,000 respondents was obtained.

Preliminary descriptive results show that reliability and punctuality were rated as the most important factors, followed by guaranteed return journeys. Monetary incentives ranked only moderately. What may be surprising, a substantial share of respondents indicated willingness to

carpool: in Scenario 1, 40% of choices favoured carpooling, compared with 55% in Scenario 2. Among respondents, 357 individuals always chose solo driving and 181 always chose carpooling in Scenario 1, while 501 exhibited trading behaviour. In Scenario 2, 277 always chose solo driving, 340 always chose carpooling, and 422 traded. Initial multinomial logit models were estimated using only traders. The models, estimated with the Apollo package in R, confirm expected effects: higher travel cost and longer travel or detour time reduce utility. Estimated values of travel time savings are higher for carpooling than for solo driving, suggesting lower comfort or higher perceived inconvenience associated with shared travel. Further model refinements will examine whether the monetary expectations of drivers and the payment willingness of riders converge sufficiently to make the carpool a match.

What route-level built environment drives shared e-bike route choices in a tourist destination? Comparative analysis of tourists and locals using large-scale data

General

Kita, Mizuki

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Over the past decade, shared e-bike systems have expanded rapidly as part of broader efforts to promote healthier and more environmentally sustainable urban mobility. Against this, tourism-intensive destinations face pressure on daily mobility and the local environment from tourist travel, highlighting the potential role of shared e-bike systems in mitigating tourist-induced challenges. Despite their potential in tourism contexts, existing research on cycling behavior has predominantly focused on local residents and commuters, largely due to limitations in data availability. As a result, tourists' cycling behavior within destinations, particularly their route choice remains underexplored.

This study investigates how route-level built environment and contextual factors shape route choice behavior among tourists and locals using multi-source data and route choice modeling, with implications for promoting shared e-bike use in tourism-intensive destinations. First, GPS data collected by Bolt in Seville, Spain, between April 1 and May 26, 2025, are cleaned and aggregated to the trip level. Using the Open Source Routing Machine, actual travel routes are reconstructed through Hidden Markov Model-based map matching, and plausible alternative routes including navigation-based and shortest-distance routes are generated and further cleaned, resulting in 8,803 trips retained for analysis. Navigation-based routes are included as realistic alternatives especially for tourists. The estimated route distances of navigation-based routes are further validated using a sample of 50 trips against Google Maps, with 82% of the sampled trips falling within a 10% deviation. As a next step, route-level attributes are constructed by integrating road network characteristics, Points of Interests, and street-level environment features, leveraging open-source data and computer vision technologies. Road network data are obtained from Geofabrik, POIs are from OpenStreetMap. We utilized deep learning semantic segmentation models to extract various street features from 1.1 million street view images. Together, these attributes comprehensively characterize the built environment of routes. Shared e-bike mobility patterns are then analyzed using descriptive statistics and a Path Size Logit model.

The results reveal systematic differences between tourists and local users. Tourists exhibit relatively synchronized travel patterns, with trips concentrated during the day and little variation in deviation from navigation-based routes across day types. Route choice model estimations further reveal positive associations with bicycle lanes, greenery, and service-related facilities, reflecting preferences for safe, lively, and visually rich route environments. In contrast, local

users' trips are more evenly distributed throughout the day, and their deviation from navigation-based, efficiency-oriented routes decreases on working days, highlighting more diverse trip purposes and a stronger focus on travel efficiency. While local users also exhibit positive associations with bicycle lanes and service-related POI density, no significant positive association with greenery is observed.

These findings highlight that certain route-level environments can play a key role in promoting shared e-bike use in tourist-intensive cities, while also revealing differences in route choice behaviors between tourists and local users. Enhancing greenery or service-related facilities along cycling routes may encourage tourist cycling. Moreover, the consistent results for bicycle lanes among both tourists and local users suggests that investments in cycling infrastructure may promote cycling uptake and support the sustainable urban transition.

Using crowdsourced data to derive urban cycling patterns and exposure to greenery at pan-European scale

General

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A growing body of evidence shows that greenery can enhance urban cycling experiences and increase the likelihood of choosing cycling as a mode of transport. Research on the interconnections of cycling and greenery depends largely on available data, especially for urban or inter-urban scale analyses. While data on the spatial distribution of greenery has become accessible through multiple channels, options for modelling spatial cycling patterns at urban scale remain challenging, often due to limited data access. Hence, large scale assessments on urban spatial cycling patterns and the collective exposure of urban cyclists to greenery have been few.

Here, we present a study that aims to narrow this gap. We developed and systematically validated a framework to derive cycling patterns at an urban scale. We used the cycling layer of the openly accessible Strava Global Heatmap and weighed it with Points of Interest data from OpenStreetMap to estimate the spatial distribution of cycling volumes. These estimates were validated against cycle count data in 29 cities globally. We then applied the described approach to derive cycling patterns in 86 European cities and classify the cyclable network into deciles by cycling volume. Finally, we overlaid the classified segments with NDVI data retrieved from Sentinel-2 satellite imagery to assess cycling exposure to greenery at pan-European scale.

Our findings demonstrate that, especially in European cities, Strava heatmap refined with POIs can accurately represent spatial cycling patterns at an urban scale, with $\rho > 0.8$ in most cities. The strength of the association between the weighed heatmap and official count data furthermore correlated with the cycling modal share ($r=0.64$). Our greenery exposure assessment showed a clear overall tendency with declining NDVI for the most cycled parts of the street networks across European cities. While this trend persisted in most cities, some exceptions occurred with an equal distribution of greenery throughout the cycling network, notably in the cities of the Iberian Peninsula and in the United Kingdom.

These findings have two major implications: (1) Our presented approach to derive spatial cycling patterns can be applied with relatively low time and cost effort to support the planning of urban cycling, reducing the data availability gap where official cycling counts are sparse. (2) Overall, this study reveals a mismatch between cycling volumes and availability of greenery in most European cities. Current urban transportation systems are not providing green travel environments on routes that cyclists mostly use. We conclude with a call for cities to prioritize adding greenery to the most cycled streets and paths, since these parts of the network are currently the least green.

Scaling Individual Traces to Regional Realities: Quantifying the Gap Between Transit Availability and Realized Mobility

General

Kotov, Egor

Authors: Kotov, E.

Planning equitable mobility and accessibility means accounting not only for the opportunities that are available at different locations across space, but also for people's individual needs and constraints that influence where they travel or don't travel to. These constraints vary greatly from person to person depending on their socio-economic status, lifestyle, caregiving responsibilities, work hours etc. However, characterizing individuals' activities throughout the day remains a methodological challenge as researchers must typically choose between fine-grained but not population-representative GPS trajectories that lack demographic variables and coarse mobility surveys which lack daily trajectories. Here we take advantage of the NetMob25 dataset, which represents a rare source of data stemming from the passive tracking of a weighted and known sample of the population. Specifically, the dataset consists of 7 days of validated GPS tracking at 2–3 second intervals obtained as part of the Enquête Mobilité par GPS ("Mobility Survey by GPS", EMG 2023) from 3337 individuals living and/or working in the Île-de-France region. Unlike the opportunistic convenience samples often used derived from GPS mobility datasets, this survey recruited participants using quota sampling to represent the region's total population of around 9 million people using weighting variables.

The dataset includes a post-stratification weights that adjusts for census under/overrepresentation of the survey participants by marginal distribution of department of residence, age, gender, socio-professional category, size of household, car availability and diploma. Additionally, there is also a weight called that adjusts for day-to-day variability. As our analysis treats weekdays and weekends separately, we use both weight factors to generalize from the sample of observed travelers to the behavior of the overall population of Île-de-France. Drawing on the time-geography frameworks, we examine how accessibility interacts with individual coupling constraints to determine mode choice. We measure the extent to which differences in accessibility are reflected in differences in mobility outcomes when also considering constraints, by comparing respondents' accessibility (potential mobility) to their observed travel behaviors (actualized mobility) at population scale.

Evaluating theoretical accessibility against achieved mobility through weighted analysis reveals notable disparities at the population level. Our preliminary findings suggest that spatial inequities in the outer suburbs relate to increased levels of behavioral immobility among lower income populations. We also find that household structure often dictates "choice" around sustainable modes: participants with strict coupling constraints (caring for children or others) were found to be statistically more dependent on private automobiles, despite living in accessible areas.

Exploring the relation between car dependency, the built environment and the exposure to Low Emission Zones in Madrid, Spain

General

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Low Emission Zones (LEZs) have become one of the most widely implemented policy instruments to address traffic-related air pollution and their derived health problems. Demonstrating these benefits has become key for counteracting the intense political and social controversy about the unequal social impacts of access restrictions to most polluting cars. Critics argue that LEZs may disproportionately affect certain population groups, especially those with fewer alternatives for daily mobility and resources to adapt. Literature supporting air-quality benefits establishes a trade-off with accessibility impacts, placing social impacts at the negative side of the balance. We argue that re-framing previous research on the root issue of structural car dependency is a way to connect pro-environmental and social arguments from the side of sustainable mobility. Despite the importance of built environment and car dependency is widely recognised in LEZ literature, research exploring social vulnerabilities use to focus on socio-economic and travel variables, paying less attention to the role of the built environment. This research seeks to address this gap by examining the relationships between the built environment, private vehicle use, and residents' exposure to access restrictions associated with LEZ deployment in the city of Madrid (Spain). An empirical analysis is undertaken on the 131 neighbourhoods of the central municipality. The analysis departed from a principal components analysis to identify main patterns in neighbourhood-level urban characteristics, capturing dimensions related to urban centrality, compact urban morphology, and proximity to suburban rail environments. The resulting components are then incorporated into a structural equation model that allows for the examination of how built-environment components mediate the effects of socioeconomic and mobility-related factors on private vehicle use, which in turn influences the probability that residents are affected by access restrictions in each phase of LEZ deployment.

The results demonstrate that the built environment plays a significant role in shaping residents' exposure to LEZs, augmenting or counteracting the influence of socioeconomic characteristics alone, such as income or car ownership. Among the identified components, urban centrality emerges as particularly influential in the outer rings of the city, contributing to lower levels of private vehicle use and, therefore, lower exposure to LEZ restrictions. These results are consistent with existing research highlighting the criticality of LEZ expansion to the periphery, where accessibility differences are critical and the variability of urban morphologies is greater.

Incorporating built-environment considerations into LEZ design and implementation may help prevent social impacts in car-dependent areas as well as increasing the effectiveness of mitigation measures for reducing social impacts.

Understanding sustainable and just transport accessibility to sports facilities. A case study of Gothenburg urban region, Sweden.

General

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Almost a third of the Swedish population are members of a sports association and involved in organised activities. A vast majority of these activities are performed on weekday evenings or weekends, by children and youth practitioners. This is especially important since most young sports practitioners become dependent on adults with cars if opportunities are located outside of the immediate proximity of home or school. This means that enabling access to sports facilities is a key concern in supporting young people's physical activities.

Research finds a positive relationship between access to sports facilities and the level of activity among young people. There is also evidence that people living in areas with low socio-economic conditions engage less in organised sports. However, given the extent and significance of sports in youth leisure activities in a Swedish context, there is surprisingly little attention given to these questions in local spatial planning. Therefore, a better understanding of the nexus between youth sports and sustainable mobility is key to support planning for equal access for all to sporting opportunities.

The aim of this work is to understand differences in potential access to sports activities based on transport opportunities and socio-economic factors in different geographical contexts, and how this is reflected in practical local planning policies.

We combine data on accessibility to sport facilities by mode (i.e. walk, cycle, public transport and car), socio-economic data and a unique national dataset of youth sporting attendance. All data is available in a high geographical resolution. Local planning policies on sports, facilities and mobility is collected and systematised based on planning documents from 13 municipalities in the Gothenburg urban region.

This is currently work in progress but there are indications that local municipal planning for sports facilities is following a concentration logic. New investment in football fields, swimming pools or ice rinks is often located together in one central location, while more peripheral locations find themselves lacking sporting facilities.

Given that leisure activities are integrated with other every-day activities we find that the car is almost a requirement to coordinate access sports facilities for a large part of the population. Overall, cycling provides a promising sustainable alternative in terms of travel time, reach and health effects. However, especially for children, the interpretation of accessibility by cycling involves for example safety concerns that go beyond pure travel time and distance measures.

Further analysis will focus on the relationship between potential access levels, socio-economic spatial structure and sports participation. Is concentration of opportunities, lower access and lower participation addressed by planning policies? Special focus will be on the role of sustainable mobility alternatives.

The impacts of e-bike acquisition on attitudes, travel behaviour and support for cycling policy – A longitudinal investigation using the Swiss Mobility Panel

General

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E-bike ownership and use is rising across Europe. E-bikes can increase active travel among diverse populations by overcoming many barriers of traditional bicycles: long distances, hilly terrain, physical effort, poor health, carrying cargo or children. Their potential contribution to a low-carbon mobility transition and healthier cities depends on the extent to which e-bike trip replaces car trips. Recent reviews on the subject conclude that substitution do occur, with level varying by local and individual context as well as baseline travel behaviour (Bourne et al., 2020; Chevance et al., 2025). This study investigates two aspects that have received less attention in the e-bike literature.

The first is the relationship between e-bike acquisition and cycling attitudes. Do people who acquire an e-bike already hold positive attitudes toward cycling? Do cycling attitudes become more positive after acquiring an e-bike? While some prior studies suggest that perception of e-bikes become more positive following e-cycling trials (Bourne et al., 2020), very few studies have used high-quality longitudinal data to investigate how travel behaviour and cycling attitudes co-evolve before and after acquiring an e-bike. Furthermore, do e-bike usage patterns moderate these changes? Which other characteristics might affect them?

This fits within the broader ongoing conversation about the relationship between attitudes and travel behaviour: which one changes first? Understanding the processes of change has important implications for designing effective policies to increase e-bike adoption and use.

The second is the extent to which e-bike acquisition and use can influence support for protected cycling infrastructure. Safety concerns, often linked to the lack of or the poor quality of cycling infrastructure, are cited as key barriers to e-cycling (Bourne et al., 2020). What remains unclear is how much the perception that better infrastructure is needed changes after acquiring an e-bike. For example, in places without high-quality cycling infrastructure, does the inadequacy of the current infrastructure become more salient when people integrate e-bike in their mobility patterns? From a mobility transition, this has important implications since cycling infrastructure implementation often faces “bikelash”, notably in car dependent areas (Wild et al., 2018; Wilson & Mitra, 2020). Thus, if e-bike experience and acquisition lead to increased support for cycling

infrastructure development, the rising popularity of e-bikes could facilitate urban transformations in favour of active travel.

To investigate these questions, we use multiple waves of the Swiss Mobility Panel between 2020 and 2025. We first examine the relationship between changes in travel behaviour and changes in cycling and car attitudes before and after e-bike acquisition. We then investigate changes in support for cycling network expansion and the creation of cycle lanes separated from motorized traffic.

Costs nothing ≠ worth nothing: public transport satisfaction in Luxembourg after fare abolition

General

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In recent years, fare-free public transport (FFPT) has gained visibility and political appeal worldwide, yet it is frequently criticised on the grounds that removing fares will “devalue” public transport by worsening crowding and on-board conditions and ultimately undermining perceived service quality. Because these concerns directly shape public acceptance and policy feasibility, understanding how passengers perceive quality after fare abolition is crucial. However, systematic evidence remains limited. To date, few studies have examined passenger satisfaction with robust before/after FFPT comparisons, and even fewer assess whether changes differ by mode (bus versus train) and user type.

This paper examines the case of Luxembourg, the first country to abolish public transport fares nationwide. We use passenger satisfaction as a proxy for perceived service quality and assess whether satisfaction changed after fare abolition, distinguishing between bus and train services and between frequent, regular, and rare public-transport users. Using two commuter survey waves collected immediately before the reform (February 2020) and again after the policy had matured (spring 2023), we compare evaluations across core service performance (frequency, reliability, travel time, transfers), on-board conditions (seating availability, cleanliness, comfort), and perceived safety (at stops/stations and on board). For frequent and regular users, we additionally capture trip-related emotions to test whether fare abolition is associated with more negative affective travel experiences.

Findings provide little support for a generalised “devaluation” narrative. Satisfaction with the operational backbone of public transport is stable or improves after fare abolition, with the most consistent gains among frequent and regular users, especially for reliability, frequency, and transfers. Post-reform strains are instead concentrated in the everyday experience of travel, particularly on buses: ratings of cleanliness and comfort decline, and perceived on-board safety worsens across user groups. Train evaluations remain largely stable, with safety concerns more pronounced among rare users. Importantly, trip-related emotions are largely unchanged, indicating no systematic rise in stress or worry in the post-reform period.

Overall, the Luxembourg case suggests that perceived value is not mechanically tied to paying at the point of use. While core operational performance remains stable or improves, the results highlight where further gains in passenger satisfaction are most likely to come from: the micro-level conditions through which “quality” is experienced, particularly on buses, where density and social exposure are greatest.

Of hypermasculinization and bahatost: Unpacking the cycling gender gap in a post-socialist city of Belgrade

General

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With the increase in understanding factors influencing willingness to cycle, substantial inequalities have been identified, especially those around gender, with women having lower willingness to cycle (Banerjee et al., 2022; Giacomantonio et al., 2024; Goodman & Aldred, 2018; Goel et al., 2022; Pearson et al., 2022; Prati, 2018; Ravensbergen et al., 2019). Despite the plethora of studies across Europe, research in from South-East Europe (SEE) is largely missing. Some recent examples from eastern Europe, highlighting some similarities with other European studies on inequality, include studies from Poland (Iwińska et al., 2018), Chechia (Kaplan et al., 2019), and the Balkan peninsula (Pojani et al., 2017). Those studies point out that besides infrastructural and broader built environment aspects, there are further personal and cultural factors lowering the willingness to cycle.

This research focuses on Belgrade, capital of Serbia, where there is an ongoing effort to develop cycling infrastructure and culture. Given the lack of studies in SEE in general, and in Belgrade in particular, this research aims to provide an initial study on residents' perspectives regarding their willingness to cycle. The research focuses on both the extent of the gender gap in cycling and the underlying factors shaping that gap. In order to address these questions, research methodology triangulates the analysis of online questionnaire (N = 817) and semi-structured interview (N = 18) data. Questionnaire data has been analyzed using descriptive statistics, the Chi-square test of independence, McNemar Bowker test of paired samples, and multinomial logistic regression. Interview data has been analyzed using qualitative content analysis based on social practice theory as the analytical lens.

The findings show that in comparison to male respondents, female respondents have a smaller chance to start using bicycles ($p=0.001$). In addition, the gender gap still exists, even when the respondents are provided with information about benefits from cycling as well as when taking into account possible infrastructural interventions. The interview analysis does highlight the challenges with cycling infrastructure, but also shows that there is a range of other barrier factors. On the one hand, these factors related to hypermasculinity norms and associated conflicts in public space. On the other hand, overall degradation of solidarity and a lack of trust, defined as "bahatost", has been similarly related to both automobility planning but also more broadly to toxic political atmosphere. Overall, these findings confirm similar findings in other southern and eastern European cities with low cycling rates, while also deepening the case specific cultural challenges. This research highlights the need for further studies in the post-socialist cities, which have the possibility to expand the understanding of underlying factors affecting the cycling gender gap.

Lessons from Canada: Drivers of transit construction inefficiency and their impacts

General

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The accessible city depends on the continuous expansion of rapid transit. Half a century of car-centric development has stretched the city across sprawling distances, organizing urban regions around automobile ownership and leaving those without a car cut off from opportunity. Reform cannot be achieved through land use alone; it demands corrective action that shrinks effective distances, and rapid transit expansion is the most powerful tool for collapsing travel times across this inherited urban fabric. Yet the pace at which cities can deliver that infrastructure varies enormously worldwide. In Canada and across the English-speaking world, transit construction costs have outpaced inflation and international benchmarks for decades while timelines have lengthened. This is not an acute shock but a slow-burning structural crisis: every cost escalation shrinks the network that gets built. The consequences fall hardest on equity-deserving communities where poverty is suburbanizing; while public trust in the institutions and governments tasked with delivering the vital infrastructure decays.

We present findings from an 3-year intensive mixed-methods research program examining why some jurisdictions deliver rapid transit efficiently while others do not. Drawing on a global project database with 1100 projects across 60 countries and stakeholder engagement with more than 90 practitioners across 18 jurisdictions, we compare cost, time, and scope outcomes internationally. Our research re-interprets the classic "iron triangle" of project management not as a fixed set of tradeoffs but as a jurisdiction-specific window of possibility: countries such as France, Spain, Italy, Turkey, South Korea, and China routinely deliver larger, more complex projects faster and at a fraction of the cost of Canada, the USA, and other Anglophone nations. These jurisdictions did not treat each project as unique; they codified institutional learning into mature technical standards, built owner-side capacity, and widened supplier competition. By contrast, our root-cause analysis of underperforming jurisdictions – using Canada as a detailed case study – identifies fragmented and inconsistently applied standards, overdesign and risk-averse interpretation of requirements, weak knowledge retention, opaque cost data, and misaligned procurement as the predictable drivers of inefficiency.

We then outline actionable reforms and discuss their transferability across jurisdictions. The stakes are material rather than technical: cities that build transit faster and cheaper can guarantee better outcomes for residents in accessibility, employment access, equity, quality of life, and economic growth, while cities that cannot recede with every budget overrun. Delivery efficiency, we argue, is among the highest-leverage and most transferable strategies available for expanding mobility accessibility, and the comparative evidence shows that the crisis of slow, expensive transit construction is a solvable institutional problem, not an inevitability.

From conceptual framework to survey development: A co-creation approach to a household travel survey capturing children's and youths' experiences

General

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Children's and youths' travel behaviour is shaped not only by their individual characteristics but also by household dynamics as well as the wider mobility and built environment systems surrounding the household. Household survey tools that move beyond adult-centric travel reporting offer a way to account for children's and youths' actual and desired mobility within diverse contexts. However, practical guidance on designing such surveys remains limited.

This paper proposes a methodological approach for developing a multi-respondent household travel survey that situates children's and youths' travel experiences within broader household travel practices. The approach begins with the establishment of a conceptual framework linking household travel practices, children's mobility experiences, and broader systemic influences. The socio-ecological framework (Bronfenbrenner, 1979) serves as the overarching structure, complemented by social learning theory (Bandura, 1963), the theory of planned behaviour (Ajzen, 1991), and the capability approach (Sen, 1995).

The conceptual framework informs the structure of the household survey and is operationalized by organizing key determinants of children's mobility across the five nested levels of the socio-ecological model: (1) personal, (2) interpersonal, (3) community, (4) built environment, and (5) policy. Social learning theory aligns with the interpersonal level, emphasizing how children acquire mobility behaviours through observing parents and peers. The theory of planned behaviour highlights the role of both children's and caregivers' intentions, shaped by attitudes, subjective norms, and perceived behavioural control. Attitudes emerge primarily at the personal and interpersonal levels; subjective norms at the interpersonal and community levels; and perceived behavioural control is shaped by personal, built environment, and policy contexts. Finally, drawing on the capability approach, independent active mobility is conceptualized as a capability that enables children to access opportunities, participate socially, engage in physical activity, and enhance their well-being.

While theory guides the framing of the survey design, the survey questions are developed through an iterative co-creation process involving policymakers, planners, and other mobility and built environment stakeholders, with the aim of enhancing relevance for policy and planning applications. Specifically, in dynamic in-person and online co-creation sessions with stakeholders, participants develop questions sets designed to collect complementary perspectives from children and caregivers, focusing on individual-level factors, including psychological and developmental attributes (e.g., confidence and travel attitudes), well-being

outcomes (e.g., feelings experienced when travelling), interpersonal factors (e.g., mobility permissions and safety concerns), community influences (e.g., informal social control), and sociodemographic characteristics (e.g., income). Once the co-created surveys are developed, they are piloted with children from diverse regions and household structures through structured interviews conducted under caregivers' or teachers' supervision. This interview-based piloting approach allows children, youths, and caregivers to elaborate on their experiences, helping to identify potential gaps in the survey.

By grounding survey design in a conceptual framework and engaging stakeholders through a co-creation process, we ensure that household surveys capture both theoretical determinants and lived experiences of children's, youths', and caregivers' mobility. Such methodologically rigorous and participatory surveys are essential for generating high-quality data that can inform policies and interventions to support safe, inclusive, and context-sensitive travel opportunities for active travel users of all ages.

Disciplining dangerous or vulnerable road users? Assessing the equity of urban traffic fines

General

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Existing research on traffic policing and enforcement is dominated by technical studies in the field of traffic safety. As this body of research shows, effective legislation and policing can play a crucial role in increasing road safety and reducing traffic fatalities. While such research provides key empirical evidence to inform traffic legislation and policing, it also tends to reproduce an uncritical road safety discourse which sees reducing traffic violations as its main goal. As critical accounts from historical and social sciences perspectives have argued, the performative nature of conventional road safety discourse is problematic in many respects. Although they are often presented as natural, dominant road engineering and traffic legislation practices are the product of historical choices which have led to the prioritisation of the interests of automobility over other users such as pedestrians and cyclists. In this context, traffic enforcement and fining practices can play a key role in sustaining (or dismantling) automobility, discouraging or enabling the use of alternative transport modes. Despite the potential relevance of traffic fining practices to issues of transport equity and mobility justice there remains a lack of empirical studies exploring the implications of the existing distribution of urban traffic fines for equity between transport modes.

Our study seeks to address this research gap through an exploratory analysis of traffic fines registered in Barcelona (Spain) for the years 2022-24, recently published in the city's Open Data portal. This data set includes information on the date, time and geocoded location of the fine, as well as details on the type of vehicle, fine category and amount, and issuing method (e.g. police patrol, speed camera). The size of this data set is substantial, with a total of 2.8 million individual records for the three study years before applying any type of filter. In the context of increased policing campaigns specifically targeting cyclists and e-scooters, we examine whether these two transport modes are being disproportionately targeted by traffic enforcement compared to motorists relative to their trip volumes and participation in traffic accidents. Our findings show that cyclists and especially e-scooters are indeed overrepresented in traffic fines if we only look at manually issued fines, but not if we also include fines issued through automated traffic enforcement. Critically, the average monetary amount for fines issued to cyclists and e-scooters is much higher than for car drivers and motorcyclists. These disparities, we suggest, raise important questions regarding the fairness in the treatment of traffic offences between transport modes, hinting at an unspoken disciplining logic which sees traffic violations from cyclists and e-scooters as deserving exemplary punishment regardless of their actual impact on traffic safety or public space.

Bridging the Gap in Active Mobility: A Citizen Science Approach to Thermal Comfort and Urban Co-Design

General

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Active travel is widely recognised for its environmental and health benefits, prompting cities to develop policies and strategies to promote active mobility and create liveable and healthy urban spaces. However, when reviewing the impacts of the implemented street transformations that promote active transportation, two major drawbacks persist: insufficient public engagement and a lack of thermal comfort considerations. The absence of citizen involvement has led to lower acceptance and satisfaction with the interventions. At the same time, these transformations often fail to quantitatively address the heat stress mitigation, an important determinant in the usability of outdoor spaces. To overcome these issues, this study proposes a citizen science framework that combines public engagement with the scientific data to support decision-making. Participatory approaches that integrate community perspectives can enhance the acceptance and usability of public spaces, ensuring their alignment with local needs while addressing the impacts of climate change. Within the Interreg Alpine Space project COMMONAIR, we have implemented a citizen science methodology focused on microclimatic measurements while walking and cycling. This approach has increasingly been utilised and studied as a method of empowerment, promoting behavioural change and collective action, while simultaneously increasing knowledge and awareness of the public and crowdsourcing data for research purposes. Citizen engagement process consists of three distinct phases: mental mapping, thermal walks and co-design. Mental maps were recognised as a valuable tool in participatory planning and climate adaptation, facilitating public engagement and co-creation. This tool was used to obtain an overview of people's experiences and perceptions of the target area by identifying hotspots, cool spots, comfortable and uncomfortable spaces. These maps emphasise the psychological and contextual aspects of thermal perception, which might differ from the objective data gathered through measurements. The activities were followed by the thermal walks, a method that captures people's instantaneous thermal perceptions and sensations while walking, accompanied by a microclimate monitoring device. This technique is increasingly being used to assess dynamic thermal experience, emphasising the importance of thermal perceptions and sensations for overall thermal comfort. In the project, we adapted the method to a more participative framework by involving citizens in both measurement and subjective assessment during their daily activities and including both pedestrians and cyclists. The aim of this method is twofold: to collect dynamic thermal experience data and to help raise citizens' awareness of the excessive heat issues. The measured data were overlapped with the initial mental maps, revealing certain discrepancies in the measured data and the personal experiences. Finally, the outputs of these activities serve as data for co-design scenarios of

adaptation. By bridging the gap between the citizens, experts and public administration, this framework facilitates the development of common, data-driven strategies. This approach contributes to a scientifically robust and socially inclusive climate adaptation in the active mobility environments.

Community-Led Transport Reform in Suburbia: A Case Study of Better Buses for Melbourne's West

General

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Transport policy remains stubbornly wedded to the private car to provide access to opportunities in suburban contexts. This is a problem, with car-based suburban transport widely understood as detracting from social equity and having an outsized environmental impact, especially greenhouse gases. While the provision of effective and attractive public transport service is widely acknowledged as being a critical element in the creation of just and equitable communities, such a solution is all too quickly dismissed as being infeasible and unaffordable.

This research examines community-led policy change efforts in suburban Melbourne, Australia. Melbourne is the equal most populous urban area in Australia, having experienced rapid and sustained growth in the first quarter of the century. Despite long-standing policy settings that aim to direct urban growth into existing areas, the creation of car-based suburbia at Melbourne's fringes continues apace. New suburbs are usually provided with a bare bones public transport network, often in the form of dial-a-ride services at first, with eventual provision of low-frequency fixed-route service only coming well after residents and households have established travel behaviours based on private car use. In response to these challenges, several community groups that advocate for radical improvements to public transport service provision have formed. Better Buses for Melbourne's West (BBMW) is one such group.

This presentation details a qualitative study of the BBMW group and campaign. Drawing on semi-structured interviews conducted with key actors in the advocacy campaign, with supplementary analysis of news media, the study interrogates the factors that enable and inhibit successful grassroots transport advocacy.

Early findings indicate a novel and innovative approach to community advocacy that has had some success in shifting the public discourse about buses. BBMW has sought to reshape the public narrative about the western suburban bus network and to place its improvement on the political radar. In particular, the campaign's novel use of proprietary public transport scheduling software to present policy alternatives, in partnership with local academics, has helped to reshape the public conversation about suburban public transport. However, this has not yet translated into meaningful improvements to the bus network.

This work suggests that grassroots planning initiatives can be a critical front in reshaping public storylines about urban mobilities, especially when allied with supportive local institutions. Rapid policy change is however not guaranteed, so such initiatives need to be prepared for a very long campaign.

Personalizing Mobile Gamification for Urban Walking: Evidence from a Field Experiment

General

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Walking offers health, environmental, and social benefits, yet most adults don't meet the WHO's physical activity guidelines. settings. Mobile apps have emerged as a promising tool for promoting physical activity (PA) and active travel (AT), with gamification, the use of game mechanics in non-game environments, becoming one of the most prevalent strategies employed by approximately 50% of active travel promotion apps.

The HEXAD framework, which classifies users into six motivational categories- Achievers, Players, Free Spirits, Philanthropists, Socializers, and Disruptors- is the most extensively employed method for user-type-based personalization. Studies investigating HEXAD-based personalization report encouraging findings. However, these largely rely on surveys and interviews rather than functional applications. To date, in the field of walking promotion, only a single study has evaluated a HEXAD-based mobile application outside the laboratory, with limited integration and inconclusive results due to a small sample size.

In this research, the authors created two fully functional gamified apps to promote walking with HEXAD-aligned mechanics. The first, Stepit, targets Achievers and Players via pedometer challenges of varying steps, duration, and distance. The second, Changeit, appeals to Free Spirits and Philanthropists through urban exploration missions that require photos of city features, such as trees or shaded spots. Both, built with Flutter and Firebase, share gamification elements such as points, leaderboards, progress bars, and challenges, differing only in content and motivation.

A randomized controlled field experiment with adults aged 20 to 60 assessed how applications affected different HEXAD user types. After initial questionnaires on HEXAD-24, place attachment, walking, and demographics, participants were randomly assigned to an app. The study had two five-day periods: a baseline for step monitoring and an active phase with four daily challenges. Data collected included daily steps, GPS, photos (for Changeit), and challenge completion. Post-intervention assessments examined user experience, perceived behavioral changes, and personal suitability.

The study, conducted from August to September 2025, involved 93 participants. Findings on Game Type Effects showed that the two games created different experiences. The Challenge game was seen as easier and led to higher success rates, while Influence required more effort but boosted civic awareness and environmental responsibility. Participants in the Challenge group increased their daily steps by an average of 1,632 (29%; $p < .001$), whereas the Influence group showed no significant change.

Analysis showed correlations between HEXAD dimensions and game preferences. Player scores are linked to competence and improvement, reflecting performance. Socializer, Free Spirit, and Philanthropist showed strong ties to value alignment, lifestyle fit, and personal importance, indicating that intrinsically motivated players see Influence as aligned with their prosocial values.

Examining daily step counts, baseline-constrained longitudinal mixed-effects models revealed a significant three-way interaction between time, game type, and Player personality ($F=6.47$, $p=.013$), with no other HEXAD dimensions showing significant interactions. A simple-slopes analysis demonstrated that participants with low Player scores walked significantly more in Influence than in Challenge ($p=.046$), whereas participants with high Player scores walked significantly more in Challenge ($p=.001$). This selective pattern provides evidence for personality-matched personalization in promoting walking behavior.

Perceived Accessibility from the Capabilities Approach: Results from a Choice Experiment

General

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In transport planning, the ease of reaching destinations is at the core of the design and evaluation of policies aimed at improving the connectedness of people and enhancing well-being. As a result of the shift towards people-centred transport planning, the individual component has received greater attention, especially in studies aimed at understanding perceptions of accessibility and its relationship with travel behaviour and well-being. Perceptions of accessibility are known to be explained by attitudes (i.e. preferred transport mode), transport mode availability, and socio-economic factors (i.e. gender, income) rather than proximity to amenities.

In this paper, a theoretical framework is developed to conceptualise perceived accessibility as a capability, defined as the perceived ease of reaching destinations constrained by spatial, digital, temporal, and mobility resources, enabled by individual characteristics. The framework is based on the concept of accessibility as a capability from Vecchio & Martens (2021), where an individual's accessibility is the product of resources (transport and land use systems) and conversion factors (e.g. skills, preferences, or sociodemographic characteristics).

In the study, the proposed framework is also operationalised to improve understanding of the interplay between the availability of resources and the conversion factors of individuals. The novelty of this study lies in collecting data through a choice experiment survey to examine how changes in resources such as travel time, number of opportunities, opening times, and online access affect perceived accessibility to amenities in the Dutch context. Additionally, to the best of our knowledge, this is the first study to explicitly examine the role of the digital component on perceptions of accessibility.

At the time of submission, this study is still in the data-collection phase; however, results and further conclusions from the data analysis will be presented. The aim is to discuss the findings from a mixed-logit modelling approach applied to the choice experiment data. This method allows the estimation of the extent to which changes in available resources (travel time, number of available options, opening times, and the possibility of doing it online) impact perceptions of accessibility and to highlight the nuances of the relative importance of each resource in the context of perceived accessibility across trip purposes (daily/non-daily shopping, healthcare, and services).

Regarding the contributions of this paper, the proposed framework operationalises the capabilities approach to gain further insights into how perceptions of accessibility are shaped. Moreover, the results provide evidence of the interplay between available resources and their relationship to perceptions of accessibility from a bottom-up perspective.

Reassessing the 15-Minute City: Air Pollution Exposure Along Children's School Commutes

General

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The 15-minute city has emerged as a central paradigm in contemporary urban policy, promoting spatial proximity as a pathway to sustainability, equity, and improved quality of life. Its foundational assumption, that short-distance accessibility inherently delivers healthier mobility, has rarely been tested against the environmental conditions experienced along daily travel routes. This study addresses a critical gap by examining whether proximity-based accessibility ensures safe access when air pollution exposure is explicitly considered. Focusing on children's school commutes, it assesses whether the 15-minute city delivers healthy access per se or if this depends on other boundary conditions that should thus be considered in urban planning as well.

Our research develops a high-resolution, route-based exposure framework that moves beyond static, residence-based metrics, integrating pedestrian network analysis, atmospheric dispersion modelling, and sociodemographic data. It quantifies children's exposure to fine particulate matter (PM_{2.5}) and nitrogen dioxide (NO₂) along likely school travel routes. Two health-relevant indicators are calculated: cumulative inhaled pollutant dose and time spent above World Health Organization (WHO) guidelines. The framework is applied to Barcelona, a city recognized for proximity-oriented planning initiatives such as superblocks. Both walking-only trips and public transport commutes, including access, egress, and waiting times, are modeled to reflect realistic mobility.

Results reveal a clear air pollution paradox within proximity-only-based planning. Although 78.4% of Barcelona's census tracts contain a school within a 15-minute walking distance, children traveling along most of these routes are exposed to pollutant concentrations far exceeding health-based standards. Mean exposure levels along walking routes reach 2.71 times the WHO for PM_{2.5} and 2.56 for NO₂. Children spend, on average, approximately 10 minutes per commute in air quality conditions classified as harmful. Importantly, excessive exposure is not limited to isolated hotspots. Overall, 21.6% of census tracts fall into the above 15-minute exposure category, encompassing 22.3% of the city's child population (85,634 out of 385,074 children). In summary, nearly one in five children faces elevated pollution exposure on their daily school journey.

Comparisons across travel modes further demonstrate that healthy mobility is highly conditional. Walking-only trips generate, on average, a 40% higher cumulative pollutant dose than public transport commutes. Public transport provides partial protection, reducing exposure duration to approximately 6 minutes per trip, particularly in well-served central areas. However, this protective effect is spatially uneven. These findings show that the health benefits commonly attributed to active travel depend critically on the environmental quality of the route

network rather than on travel time alone. Risk is primarily structured by urban form, including proximity to traffic-intensive corridors and the constrained routing logic of pedestrian networks. While localized clusters of compounded risk exist, the dominant finding is the widespread normalization of chronic exposure across the city. Overall, proximity alone is insufficient to ensure healthy urban accessibility. When environmental exposure is not explicitly considered, the 15-minute city may inadvertently institutionalize health risks within mobility. To avoid this, the proposed framework offers a transferable method for integrating air pollution exposure into accessibility planning, enabling targeted interventions such as clean-air school routes and strategic transit investment.

When do perceived costs become opposition? Frames, values and backlash to proximity planning interventions in Barcelona

General

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Transformative urban mobility interventions have increasingly become the focus of intense public contestation, often framed in political and media debates as evidence of widespread social backlash. However, it remains unclear whether opposition to such interventions is truly dominant or whether it is simply more visible and louder than support. While prior research has recently started to understand the rationales behind policy acceptability and opposition, it has paid far less attention to the emotional states that fuel critical stances, and how these emotions may help explain why certain forms of criticism become particularly salient or persistent. Seeking to address this gap, this paper unpacks the structure, intensity, and social composition of backlash by providing an empirical snapshot of public reactions to four transformative mobility interventions implemented in Barcelona: superilles (superblocks), pedestrianisations, bike lanes, and protected school programmes. Using data from a large-scale survey administered to 2000 individuals (1500 city residents and 500 non-residents), the study first aims to assess the overall balance between support and opposition, uncovering how backlash varies across intervention typologies. Second, our analyses aim to examine the dominant arguments underpinning criticism for each type of intervention, distinguishing between functional concerns, justice- and distribution-related claims, and broader narratives of loss or imposition. Finally, the study seeks to connect these patterns of opposition to both sociodemographic profiles and emotional reactions. Our main hypothesis is that opposition is not homogeneously distributed across interventions but shaped – in volume and intensity – by its typology and symbolic or “emblematic” character. In fact, regarding the nature of the backlash, certain “emblematic” interventions are expected to be more strongly associated with specific argumentative frames than more conventional pedestrianisation or traffic-calming measures. Finally, the paper advances the hypothesis that patterns of opposition are socially and emotionally structured. Specifically, it is expected that criticism towards different interventions will be unevenly articulated across sociodemographic groups, and that distinct forms of backlash will systematically co-occur with specific emotional responses, such as anxiety, frustration, or feelings of impotence, rather than constituting a purely rational or homogeneous opposition. By linking intervention typologies, argumentative frames, and emotional responses to the social characteristics of those expressing opposition, the paper seeks to contribute to a better understanding of urban mobility backlash as a socially structured and emotionally grounded phenomenon rather than a homogeneous rejection of urban transformation. From a

public policy perspective, these findings suggest that recognising the emotional and social foundations of backlash can help anticipate where and why contestation emerges, thereby informing the design, communication, and long-term political sustainability of transformative urban mobility interventions.

Comparative Analysis of Urban Traffic Behavior Within Cities of Different Planning Structures

General

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Over the last decades, transportation research has increasingly recognized the limitations of purely mathematical models, emphasizing the need to rely on empirical data, to account for spatial structure, and to adopt comparative approaches. In this study, we build on these developments and examine traffic patterns across cities with different spatial configurations, focusing on the relationship between traffic speed and intensity.

The study investigates traffic behavior in London, Berlin, and Montevideo using traffic detector data from 2021–2024. To analyze these patterns, we apply multiple time series analysis techniques and statistical tests within a contextual framework, enabling a comparative assessment of traffic behavior across cities at the system level. Particular attention is given to variations in speed–intensity relationships across road categories—highways, arterial, district, and local roads.

The results indicate that traffic dynamics differ substantially across the three cities. Each city exhibits distinct traffic behavior across road categories, reflecting unique combinations of patterns. Time series analysis reveals systematic differences in traffic behavior by both city and road category. These differences are attributed to urban spatial structure, which acts as a relatively stable factor shaping the long-term redistribution of traffic within cities.

This research contributes to a broader understanding of cities as complex systems, with practical implications for long-term transport and spatial planning. Future research may extend this framework by comparing cities within the same typological group or by focusing on shorter time periods. Overall, the study advances comparative urban traffic analysis by integrating real-world traffic data with a performance-oriented perspective on road networks across cities with different spatial characteristics.

Adaptive planning for a BRT system under uncertainty: strategies to manage challenges, risks and pitfalls

General

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Recent years have seen a sharpened focus on strategic planning under uncertainty. Significant changes to what we as societies plan for and how we plan are required in order to achieve a more sustainable future. Transport and land use planning is often characterised by path dependence, where approaches are shaped by and follow a trajectory from which it is difficult to deviate. However, approaches based on business-as-usual perspectives are ill-equipped as a basis to plan for visions that deviate from – and require deviations from – what and how we have traditionally planned. Several argue that this transition should also be a just one, characterised by efforts to bring about social justice (e.g. Ternes et al. 2024).

This study builds on the case of planning for the Metrobus system in the Gothenburg area of Sweden. The Metrobus system consists of a form of Bus Rapid Transit (BRT) involving the redistribution of motorway-standard road space to be used by public transport. The Metrobus system can thus be described as transformative in that it seeks to facilitate: (1) a reduction of carbon emissions and (2) the fairer use of transport infrastructure.

The strategic planning approach (termed ‘phased implementation’) adopted by the newly established Metrobus Group (the planning actors) was followed using a combination of (1) systematic observation conducted through attending the dedicated meetings that took place within this group during May 2024–June 2025 and (2) interviews with people working in or adjacent to the Metrobus Group. With this study, we shed light – both theoretically and empirically – on how the substantive (what is being planned for) and the procedural (how it is being planned for) interact with each other. In following the dynamics between planners’ agency and the structure in which they work, we provide perspectives on what strategic work involves in practice. A framework inspired by both strategic spatial planning (Healey 2009) and decision-making under deep uncertainty (Walker 2019) was applied in the empirical analysis.

We found that the shared vision document functioned as a strong basis for collaboration in the group. However, there were differing perspectives on the rationale behind the Metrobus concept, with such perspectives influencing ideas about the extent to which different aspects of the original Metrobus concept could be compromised on during the planning process. We found that the group’s approach was shaped in order to be able to plan for the Metrobus system – but that the Metrobus system as a concept was in turn (re-)shaped in order to facilitate collaboration between the planning actors in the group. The level of ambition of the system appeared to be successively lowered during the process. This illustrated the potential pitfall of adapting (too much), where the transformative elements of the concept itself risk being lost in the process. Other challenges such as laying claim to space where other (statutory) planning

processes are currently underway were also evident, as were other risks. However, the group adopted adaptive strategies to overcome such challenges.

With this study, we provide insights into the struggles between agency and structure where transformative work seeks to break path dependence and no longer reinforce the structures upholding the existing use of infrastructure.

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From Pilot to Policy? Autonomous Public Transport and Multi-Stakeholder Perspectives in Malta

General

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The introduction of autonomous public transport is increasingly framed as a solution to congestion, sustainability, and accessibility challenges in urban contexts. However, the appraisal and evaluation of such projects often rest on assumptions of technical and operational efficiency. This research critically examines how autonomous public transport is perceived, negotiated, and contested in Malta, focusing on the pilot deployment of an electric autonomous bus within the metaCCAIZE project.

The study adopts a qualitative, exploratory approach. It draws on semi-structured interviews with a diverse set of mobility stakeholders, including public authorities, transport planners, operators, technology providers, community representatives, and tourism-sector actors. The research investigates how different actors construct and evaluate the value of autonomous public transport, highlighting areas of agreement and contestation. The analysis is informed by the Multi-Level Perspective (MLP) on socio-technical transitions. The autonomous bus pilot is considered a niche innovation embedded within Malta's existing transport regime and shaped by broader landscape pressures such as small-island geography, demographic change, and tourism intensity.

The findings show that while automation is often justified through quantitative indicators such as traffic reduction, emissions, and operational efficiency, these metrics tend to overlook distributional impacts, lived mobility experiences, and the risk of digital or spatial exclusion. Participatory and deliberative spaces for contesting appraisal assumptions remain limited. This raises questions about the inclusivity and democratic legitimacy of current evaluation practices. The paper concludes that piloting autonomous public transport can inform policy, but only if evaluation frameworks actively incorporate diverse stakeholder perspectives. It highlights the need for more reflexive, multi-actor approaches to ensure that technological innovation aligns with social inclusion and local priorities.

From Potential to Mobility: Who Realizes Accessibility Gains from the Deutschlandticket?

General

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Transport planning and policies can change land-use and travel costs, i.e., jointly considered in accessibility, but in practice, individuals do not always realize these theoretical gains. Germany's Deutschlandticket, a nationwide flat-fare public transport subscription introduced in May 2023, has been shown to reduce the financial burden of travel and to allow ticket holders to take more trips with the same budget. Empirical evidence on whether monetary accessibility gains translate into realized spatial behavior remains scarce. While accessibility can be a policy goal, mobility policies should also be evaluated for their impact on realized access, e.g., as measured in activity spaces. These insights are relevant given the ongoing debate about the Deutschlandticket's effectiveness and fairness. This leads to the research question of this study: whose accessibility increases due to the Deutschlandticket, and who realizes how much of it?

We explore this using revealed travel data from the multi-month tracking panel "Mobilität.Leben". Overall, more than 1,200 individuals were tracked via a semi-passive smartphone app over 18 months from 05/2022 to 12/2023. We use a subsample of 493 users with 31230 trips, excluding respondents who tracked fewer than 2 trips on at least 3 days each week during the respective month. Further, we only consider local and regional trips below 80km, as well as residents of the area served by the Münchener Verkehrsverbund (MVG). While the strict filtering restricts representativeness, it ensures consistent observation of individual activity spaces over time.

For this study, we define accessibility as the area reachable within an individual's temporal and monetary budget, given their availability of cars and public transport. Individuals' time budgets are derived from their revealed travel behavior before the introduction of the Deutschlandticket and income, assuming that purchasing the Deutschlandticket will not, in the short term, alter the time and money available for transport. We calculate the accessible area for car and public transport as isochrones from the residence within the time budget overlapping with the area reachable with a specified income share. Cycling and walking are considered cost-free; other mobility modes are neglected.

We calculate the activity spaces using the convex hull, enabling us to compare the accessible and accessed areas for each individual before and after the introduction of the Deutschlandticket. It also provides ample opportunity for further analysis, e.g., considering points of interest, circularity, or longest-edge metrics. We use the difference-in-differences (DiD) approach to control for external and seasonal effects.

Initial results suggest that activity spaces increase most for Deutschlandticket holders whose accessible areas were predominantly constrained by fare prices and less for those without a Deutschlandticket or who were limited by time rather than money. In the full paper, we will analyze heterogeneity across sociodemographic groups in more detail. Our results provide novel evidence for the attractiveness of the Deutschlandticket from an accessibility perspective, as well as the impact of the Deutschlandticket on spatial travel dimensions across various user groups. The indicator can be used to evaluate policies altering travel costs or the ability to access specific areas. This is particularly relevant given that the Deutschlandticket is facing ongoing price increases.

An open-source tool for classifying streets according to “Link” and “Place” functions

General

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Road network hierarchy has been classified based on the mobility and access functions. However, this classification does not acknowledge that the street is also a space for socializing, resting, and living. Previous work by Prof. Peter Jones has proposed a methodology of classifying streets according to the “link” and “place” functions recognizing streets as places for movement, but also for stay. While streets are widely recognized as both mobility corridors and social destinations, their translation into scalable quantitative frameworks remains limited, with most applications focused on qualitative, detailed, street-level assessments. Still the methodology lacks clear quantitative criteria remaining not scalable to different cities worldwide. In this context, this work proposes a reproducible, city-scale, and context-specific method to quantify the “link” and “place” functions of streets using only OpenStreetMap (OSM) data and open-source Python packages. This study addresses that gap by introducing a transparent and generalizable methodology that computes “link” and “place” indicators for every street segment in a city, relying exclusively on freely accessible geospatial data.

The “link” function is derived through PCA using simplified potential capacity estimates, edge betweenness centrality, OSM road hierarchy, and speed limits as proxy indicators. The “place” function is computed using the CRITIC method based on the density and diversity of points of interest, and design-related features such as greenery and urban furniture presence, road hierarchy and speed limits. Both approaches are scalable with respect to the number of input indicators.

Applied to the Portuguese municipality of Lisbon as a case study, the method produces continuous distributions of “link” and “place” values and a classification matrix that identifies structural mobility corridors, local activity clusters, and mixed-function urban avenues. By relying solely on open data and open-source computational workflows, the approach supports replication across any territory with OSM coverage and facilitates early-stage policymaking by providing a clear, interpretable, and scalable diagnostic tool for screening street functions. Also, it allows policymakers to identify streets that require interventions (e.g., increase greenery) according to place function values to have more livable streets. Future work should refine indicators and incorporate perceptual data to extend the analysis. Additional case studies should also be tested for comparison and validation.

Transit Infill: Potentials of applying compact-city principles to public transport networks to enhance accessibility

General

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Urban "redensification" has been established as a central strategy in urban settlement planning. Identifying and activating building potentials – such as infill housing lots, potentials for additional storeys, or disused buildings – within the existing urban perimeter can help to conserve undeveloped agricultural and forest land and reinvigorate urban areas. Urban planning offers a range of instruments to promote and steer such compact-city development under the principle "inside before outside". From a mobility perspective, such redensification is considered advantageous as well, as it tends to increase the utilization of existing transport infrastructure and services and generally contributes to proximity-based accessibility and social desegregation.

Can this redensification logic be transferred to urban mobility, and specifically to public transport? Recent literature calls for a stronger integration of mobility into the inner-development agenda, particularly regarding the redesign of public space. However, there is (currently) limited attention to how existing public-transport networks at city or city-regional scale could strategically be improved through small-scale measures both theory and practice. Although numerous initiatives since the mid-20th century sought to improve spatial, temporal, financial and organizational coordination between different modes and providers of public transport, e.g. by promoting multimodality and integrated fare systems – many of these measures remained unfinished and today often lack sufficient momentum. Integrated transport plans – such as SUMP or local public-transport plans – often lack a systematic analysis to identify (small-scale) measures that potentially improve accessibility. Instead, individual projects are proposed by different stakeholders and evaluated separately, without guarantee that all relevant measures are captured.

Applying the redensification principle to transport networks reframes priorities in transport planning: instead of focusing on large-scale expansions, attention shifts to exploiting numerous small-scale improvement potentials. These include creating new interchanges at line crossings, modest inner-city extensions, or relocating stations, to improve network effects and coverage. Together, this contribution hypothesizes, such measures can substantially increase accessibility at a fraction of the cost of major expansion projects, while improving overall efficiency.

Arguably, a strategy that prioritises incremental steps is well suited to current uncertain and complex economic and political contexts. Supporting the mobility transition primarily through more efficient exploitation of existing infrastructure and spatial proximities can maximise the utility of current energy resources and may yield positive effects for spatial equity. Optimising

existing networks from a long-term perspective emphasises the resilience and agility of transport systems by favouring targeted improvements over large-scale expansion.

This paper develops an indicator for “redensification potentials” in existing transport networks, applies it to several European cities using open data, and assesses whether the identified measures are already reflected in official public-planning documents. The paper calls for a renewed focus on potentials in existing systems to strengthen sustainable spatial development.

Teaching Justice Through Co-Creation: A New Path for Mobility Education

General

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Urban planning systems are increasingly challenged by complex, interconnected uncertainties, from climate change to demographic shifts and social inequality. Yet, planning education often reproduces epistemic hierarchies, marginalizing the lived experiences of those most affected by mobility exclusion. This paper critically examines a transdisciplinary co-creation process embedded in a mobility planning seminar, where 15 co-creators, including people with physical disabilities, older adults, youth representatives, and experts in universal design and participatory planning as well as mobility researchers, collaborated with students to identify and research challenges of people with reduced mobility capacities.

Over a semester, student groups developed awareness-rising outputs through iterative cycles of feedback and peer review. Data from field memos, student reflective notes, and post-seminar workshops were analyzed using thematic analysis to explore power dynamics, knowledge exchange, and the feasibility of co-creation in academic settings. Findings reveal that while co-creation enabled new forms of knowledge exchange, such as identifying overlooked barriers like poor pavement design and lack of security feeling in public space, it also exposed persistent power asymmetries. Co-creators reported feeling “involved,” but many noted limited influence over final decisions, which remained under lecturer control. The students demonstrated an increased awareness of systemic exclusion but had difficulty translating this into actionable design proposals due to disciplinary limitations and time constraints.

This study does not present co-creation as a sole solution for mobility justice, but as a place of negotiation where power, voice, and legitimacy are contested. It reveals that co-creation in education is not inherently transformative; without structural support, it risks becoming symbolic inclusion. Yet it also created space for critical reflection, mutual learning, and the emergence of new narratives about mobility justice. The results of the evaluation will inform the redesign of the new seminar series, which will launch in winter 2026. This demonstrates that while co-creation in education cannot alone transform urban mobility systems, it can serve as a critical incubator for future planners, equipping them with the ethical, relational, and critical competencies needed to navigate uncertainty and challenge dominant planning paradigms.

This study contributes to NECTAR '26 by demonstrating how transdisciplinary collaboration in planning education, though complex and contested, can serve as a foundational site for cultivating the relational and ethical competencies essential for navigating uncertainty and advancing mobility justice.

Intersectionality for Sustainable Urban Mobility: A Systematic Literature Review

General

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Despite growing attention to social inequities in sustainable urban mobility, research remains methodologically fragmented, often isolating a single dimension of disadvantage (e.g., older people, women, or children). Such approaches ignore how intersecting systems of oppression, including patriarchy, racism, and classism, compound to produce unique and often hidden forms of mobility disadvantage, creating policy blind spots that fail the most marginalized groups. This paper addresses the absence of a clear research agenda for integrating intersectionality into sustainable urban mobility by conducting a systematic literature review of how intersectionality has been conceptualized and operationalized in this field. Following PRISMA guidelines, the review searched Web of Science and Scopus for papers published between 2013 and 2024 that explicitly operationalize intersectionality by analyzing at least two co-constituted social positions in relation to structural systems of oppression. Nineteen papers met these criteria. Across them, seven recurring themes emerged: security, care, negative attitudes and social expectations, socio-spatial exclusion, economic constraints, limited knowledge and assumptions, and infrastructure. Gender, particularly when intersected with class, ethnicity, migration background, disability, and caregiving, is consistently associated with constrained mobility experiences. Patriarchy, racism, and classism are the dominant systems shaping inequity. The findings reveal methodological fragmentation and underscore the need for a multi-scalar, mixed-methods approach. The paper concludes by proposing a structured research agenda to guide systematic integration of intersectionality into future mobility scholarship and policy.