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Overview of special issue on urban cycling: Rationalities, justice, safety, and geographical analysis

Today we are experiencing extreme heat and increased natural disasters because of climate change (IPCC, 2022). Moreover, other types of pollution including air particulates also have negative impacts on the environment and public health. A large share of particulate air pollution and greenhouse gas (GHG) emissions comes from the transport sector. Cycling is a highly sustainable mode of transport and provides many positive benefits to society beyond improved environmental quality and health (Koglin and Raustorp, 2019; Buehler and Pucher 2021). In terms of research, cycling is a growing scholarly field, but often remains a marginalised mode of transport in many cities in the world. This is the case not only in countries with a very strong car culture, but also in countries with reasonably developed cycling infrastructure like Denmark or Sweden (Koglin, 2020; Koglin and Glasare 2020; Koglin and Rye 2014).

The focus of this special issue is on the theoretical and empirical analysis of urban cycling, its effects on sustainable mobility, how cycling is handled in urban and transport planning, what rationales, programs, and initiatives support urban cycle planning and how cycling is treated within the broader context of urban mobility. The Special Issue (SI) also promotes interdisciplinary exchange of knowledge, policies, and experiences on sustainable urban cycling. The articles included in this SI cover very different perspectives and geographical areas. It includes articles with focuses on European, Asian, and North and South American contexts and both qualitative and quantitative approaches. The idea, however, is that all articles included have a high policy relevance to the understanding, development and implementation of better cycling and sustainable transport systems.

The articles published in this SI can be categorised into 3 overarching themes. The first one is *transport rationalities and transport justice*. The second theme addresses *infrastructure and safety* while the third includes papers on *geographical analysis and statistical modelling*.

Transport rationalities and transport justice

In transport planning and policy making certain rationalities play an important role in how the transport system is planned and what transport policies are developed. Usually transport rationalities are focused on motorised modes of transport and planning/making policies accordingly (see Koglin, 2017). Those rationalities are rooted in modernistic thinking and have a major impact on how our transport systems are planned today. The dominance of motorized over non-motorized transport has had a major impact on mobility and transport justice since it excludes sustainable modes of transport, such as cycling from the transport systems and make the urban space and transport systems more unjust and unsustainable (Koglin and Rye 2014; Paterson, 2007; Koglin and Mukhtar-Landgren 2021).

In our SI some articles take up the rationalities behind transport planning and policy making. Silonsaari et al. (2022) have researched the rationalities behind promoting cycling to children in order to develop a more sustainable and healthier lifestyle. The authors argue that cycling promotion must stretch beyond different contexts and include the cycling experience of children. It also needs to include children as independent cyclists. The article shows that alternative rationalities like positive emotions, children's autonomy and friendships were regarded as the most important drivers of new cycling practices. The authors conclude that children's autonomous mobility is one of the most appropriate terms to portray children's cycling.

Irwan (2022) extends the analysis of children's mobility by examining the perceived barriers to cycling to school among school students in Yogyakarta, Indonesia. After modelling results from a survey of students, Irwan finds "two latent variables constructed from ten observed variables of the perceived disadvantages of bicycle use" were significant: "(1) environment and constraints, and (2) attitudes" (p. 5). In terms of these barriers, Irwan finds that the perception that "cycling makes the body dirty" (p. 3), the perception that "cycling makes carrying bags more difficult" (p. 3), and respondents' perceptions "that the weather conditions and temperatures were not conducive to cycling to school" were the most important barriers to cycling. Irwan found that these perceptions when combined with the habitual use of motor vehicles, particularly family use of motorcycles in Indonesia, acted together to prevent cycling uptake among students.

Brezina et al. (2022) investigate the urban–rural gradient in three Austrian municipalities to identify what barriers planners experience when planning for cycling. Their research shows that there are mental barriers that provide planners to implement more cycling infrastructure. Those barriers derive from traditional planning ideas and classical transport rationalities. Brezina et al. (2022) argue that in order to develop more progressive planning policies for cycling planners and policy makers need to overcome these mental barriers.

Bruno (2022) distinguishes between cycling innovations that support a transition to sustainable transport and cycling infrastructure designed to more safely place cyclists away from autos. Bruno argues that "innovations designed to increase the efficiency of the system of automobility cannot be considered effective tools for achieving a transition to sustainable of mobility" (p. 20). Using a series of three case studies of traffic roundabouts, Bruno explores transition theory literature to show how these processes function. Bruno finds that the well-known Hovenring elevated roundabout in Eindhoven is designed to "separate out

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bicycle traffic in order to improve traffic flows at the intersection" (p. 8). This is compared to the continuous priority cycling roundabout design in Zwolle that provides priority to cyclists at all crossing points. Bruno contrasts these Dutch examples with a new roundabout in San Francisco. This roundabout, while not up to the standards of the Zwolle example, represents movement towards "the sustainable mobility paradigm principles of slowing traffic down and improving accessibility for all road users" (p. 10). Overall, Bruno's approach of "applying sustainability and transitions theories directly to cycling innovations allows for a better understanding of which innovations are most likely to support a transition to sustainable transportation systems" (p. 12).

Leyendecker and Cox (2022) examine how cycle activist groups have changed over time in the UK. The paper "considers how knowledge and understanding emerge in campaigning communities, the forces that shape it and how these perspectives address the city." The authors identify a key divide between two sets of cycle campaigners in the UK. The first set is the more traditional set of campaigners who tend to be older, white males promoting vehicular cycling. This group promotes the concept "that cyclists gain respect and space on the road by behaving like a vehicle." On the other side, is a new set of campaigners who argue that the most effective way to create just mobilities is through the creation of dedicated cycle facilities like cycle tracks. They argue that these types of facilities create safe spaces for all residents. The authors use interviews with female campaigners and autoethnographic methods to understand the "power, space, and gender" of cycle campaigners and build a deeper portrait of the changing nature and goals of advocates seeking to address spatial inequalities.

Morgaji (2022) examines cycling use in Lagos, Nigeria. Using ethnographic methods, fieldwork, and semi-structured interviews, the author examines a set of cycling initiatives to understand key barriers and challenges to cycling uptake. The author finds that micro, macro, and *meso* factors act as barriers. At the micro level, individual challenges like experiences of cycling as child or access to a bike provide key frameworks for opening or closing off opportunities. In addition, lack of perceived safety and gender discrimination act to limit prospects for cycling. At the *meso* level, the Morgaji (2022) finds that any social expectations limit cycling. These include stigmatization of cyclists and motorists lack of respect for cyclists. Finally, at the macro level, the author finds that numerous structural barriers limit cycling. Morgaji (2002 argues the "most significant concern is around the insufficient cycling infrastructures in the city. The security of cyclists is put at risk because of the lack of cycle lanes, parking, and routes" (p. 9).

Mohiuddin et al. (2022) continue the analysis of barriers to cycling with a case study of cycling barriers in Rajshahi, Bangladesh. The authors surveyed area residents to determine trip choice and perceived characteristics of the built environment. Integrated Choice and Latent Variable models were developed to better understand choices to cycle or not cycle. The result of the models "indicates that women are more likely to choose a bike for commuting trips compared to men. This is a very surprising finding given the limited mobility pattern of women in the developing country context" (p. 6). The authors point to some local characteristics of Rajshahi that may contribute to this finding. The authors also find that changes in the perception of the built environment through policy interventions to improve cycling conditions can help spur increased use. The authors note that achieving higher levels of cycling requires the "provision of adequate infrastructure (and) an assurance of the safety of different bicycle users" (p. 8).

Infrastructure and safety

The second key theme is the *significance of infrastructure and safety*. Bicycle infrastructure in urban areas around the world has been changing quickly. While protected bicycle facilities were relatively rare in the early 2000s, they are now mainstream urban designs in many cities with projects being linked together into connected urban bicycle networks. The pandemic in particular has been a catalyst for these types of changes with many cities building and expanding bicycle networks to provide safe access for active transportation. The growth has, however, been uneven. While best practice leaders have bounced forward creating these protected systems, many if not most cities continue the practice of providing limited and unconnected bicycle facilities as standard practice. The authors in our SI examine these issues through analysis of the impact of bicycle infrastructure on usage patterns and assess the underlying issues of safety particularly for vulnerable populations.

Fields et al. (2022), for example, explore the impact of new cycling facilities implemented as part of the US federal funding of the Nonmotorized Transportation Pilot Program in Mineapolis, MN. The authors find that small changes each year in bike infrastructure led to significant changes in use over time at the corriodr level (53 % increase in bicyclists over 6 years). They also find that bike lanes can be useful at spurring increased use (26 % increase in cyclists counted on street with bike lanes), but protected bicycle facilities are more impactful (69 % increase in cyclists counted on streets with these facilities). Overall, the authors find that "inherited design characteristics from decades of previous infrastructure construction" (p. 6) are difficult to dislodge in a short pilot program making it difficult to find large mode share change at the community level. Despite the limitations associated with these inherited designs, Fields et. al. find that the impacts of building dense, connected systems of protected facilities can still be identified at the corridor level helping to create the conditions necessary for larger community shifts in the future.

Wysling & Purves (2022), on the other hand, examine a new method for identifying locations for improvements in the cycling infrastructure. The authors test their intended method in Paris as the city has shown improvements in their cycling infrastructure. Their methods build on data that usually is available, like existing cycling infrastructure and data from OpenStreetMap and important destinations cyclists might want to reach. The authors modelled bikeability for the city and showed where planners could investigate to improve the cycling infrastructure. The test in Paris shows that the method produces reliable and replicable data/maps.

Rérat et. al. (2022) analyze the effects of the COVID-19 pandemic on cycling in Geneva and Lausanne, Switzerland, with regard to pop-up bike lanes. Both cities have implemented pop-up bike lanes and the authors did survey studies targeting cyclists in the cities. The results show a resilience in terms of cycling levels in time of crisis. The research also shows that through the new bike lanes cyclists experience was improved when it comes to safety, connectivity, and general cycling practice. Nevertheless, the new bike lanes were not without contestations. They were not accepted by all, which depended on mobility habits and political views. Generally, Rérat et al. (2022) conclude that the pandemic shock strengthened the vélomobility system in the two cities. Nevertheless, the authors see that the system is still fragile, which can be seen in the relatively low share of cycling in the mode share and the struggles cyclists experience of the road space.

Meng (2022) takes a broader view of infrastructure and examines the underlying political economic rationalities of transport infrastructure investment. Meng identifies the perceived competition for space between car and bicycle infrastructure as a key barrier. To help determine how to allocate this limited urban space, Meng examines a series of economic rationalities to create a framework for more rational decision making. From this analysis, Meng argues that comparing social costs of car and bicycle can help to "maximise utilisation values for both parties" (p. 6). This leads to proposals for more dedicated bicycle space as the social costs are lower.

In terms of safety, Keliikoa et al. (2022) examine media coverage of motor vehicle crashes involving bicyclists and pedestrians in the U.S. state of Hawaii. The authors use content analysis to determine "language patterns, and public health framing elements" (p. 1) used in media reports of these crashes. The authors argue that "(m)edia framing shapes public perceptions of crashes involving" vulnerable road users and that most of the "local news coverage misses the opportunity to illuminate

the need for funding and implementing public health solutions that will prevent the deaths and serious injuries of the most vulnerable users of public streets" (p. 9).

Geographical analysis and statistical modelling

Advanced geospatial analysis and modelling can play a major role in providing evidence related to various aspects of cycling, from transport behaviours to environmental exposures and health outcomes. Sophisticated analytical approaches and statistical methods are the third key theme of this SI with four articles adopting different perspectives. In addition to the potential dangers from motor vehicle crashes, cyclists are also exposed more than other road users to air and noise pollution. However, modelling such exposures is fraught with methodological discrepancies, a limited number of comparative studies, and underrepresentation of cities in the Global South. Gelb and Apparicio (2022) perform a comparative analysis of seven cities (Paris, Lyon, Copenhagen, Delhi, Mumbai, Montreal and Toronto) that considers both noise and air pollution exposure with a uniform methodology that allows for generalization of the results. They find that noise depends more on characteristics of the micro-scale environment in which exposure occurs, compared to air pollution, while air pollution at the micro-scale environment only has a significant impact in Mumbai and Delhi. In addition to the statistical analyses, they present the results of their modelling as maps of relative potential exposure that can aid planning at different geographical scales, from the regional to the local levels.

Gelb and Apparicio (2022) collected cycling movement data painstakingly, but for similar studies to be developed further, it is important to tap into the opportunities afforded by crowdsourced cycling data. Two articles make use of the Strava fitness app data, within different contexts. Fisher et al. (2022) evaluate changes in spatial patterns of bicycling during the first wave of the COVID-19 pandemic (2020) in Vancouver, Canada, against spatial interventions in the form of street reallocations that facilitated cycling. Comparing streets with and without interventions, they demonstrate that older adults (55 +) and women increased their cycling near green and blue spaces and on street reallocations facilitating access to parks. Importantly, there was consistent increase of cycling on pre-existing or provisional bicycling facilities, especially on high-comfort facilities, demonstrating the usefulness of Strava data for detecting and monitoring changes in cycling behaviours following spatial interventions. Kwigizile et al. (2022) take such analyses a step further by exploring how cycling volume measures can be improved through incorporating crowdsourced Strava data into cycling volume estimations. They developed a predictive model approximating the hourly cyclist volume using crowdsourced data and incorporating weather data, bike facility, land use, and census demographics. Their comprehensive tool can improve the usability of the model by planners and engineers for bicycle-related projects at various scales, ranging from segment to network level.

Although large datasets and crowdsourced data can provide evidence for general trends and changes in group behaviours following interventions, it is also important to assess such interventions through experimentation in realistic settings. For example, marked on-road infrastructure for bicycle riders can influence riding and driving behaviours towards cyclists, potentially leading to safer cycling. Huemer et al. (2022) evaluate the effects of different on-street markings on cycling behaviours, one in a cycling simulator and an online survey under experimental conditions. They demonstrate that stronger visual separation between flowing traffic and parked cars, alongside a cycling icon on the street induces greater lateral distance of bicycle riders from parking cars, while on ground cycling marking is perceived as safe, comprehensive, and comfortable by the cyclists. The studies performed by Huemer at al. (2022) offer a fast and cost-effective approach for evaluating multiple scenario of proposed cycling infrastructure, so that less favourable options can be ruled out at the early stages of the design process.

Summary: Diverse perspectives and experiences support cycling research

The three overarching themes of this SI demonstrate the vibrancy of recent research and policy approaches related to urban cycling. We observe that although researchers approach the cycling-related issues from different disciplinary perspectives, using diverse methods within very different contexts, there is continuous dialogue and a common understanding in terms of what is needed for pushing forward this important field of mobility research and policy: theories informed by *transport rationalities and transport justice,* supported by empirical evidence from sophisticated *geographical analysis and statistical modelling* to support planning and transport policies that understand *the significance of infrastructure and safety* for urban cyclists. Further analysis, evaluation and convergence between researchers, practitioners, cyclists, transport sector specialists and the broader community will support and sustain advancement of urban cycling.

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