Special Issue "Walking and Cycling for better Transport, Health and the Environment"
Editorial

Introduction

Walking and cycling for transport have gained considerable importance in research and policy making in recent years. Empirical research on correlates of active travel is increasing at a significant pace. Attention has spread from an initially quite dominating focus on cycling now also to include walking and integrated approaches. It has also extended beyond single disciplinary investigations to inter- and transdisciplinary research. Very encouragingly, research now takes place across the globe, rather than just in countries such as the USA with substantial cycling research and European countries with greater affinity with cycling. Policy makers, particularly at the local level, recognise the importance of active travel not only as an efficient means of transport, but also as an important component of urban planning, quality of life, public health, economic development and environmental quality. There are many parallels between developments in research and practice; for example, in their enlarged geographical scope and in their early firm focus solely on cycling. Policy making for promoting walking and cycling for transport moves increasingly towards integrated approaches that address the whole transport system with all its physical and digital components. These integrated approaches are based on collaborations between the different planning disciplines of transport, urban planning and structure, environment and public health.

We already knew a lot about the correlates of walking and cycling (see e.g. Götschi et al. 2016, Handy et al. 2014, Koszowski et al. 2019). Various conceptual frameworks illustrate the variety of factors to be considered, and also their interdependencies and relationships (Götschi et al. 2017). The influence of the built environment is particularly important; this has been described as the "5Ds" of density, destination accessibility, design, distance to public transport, and diversity (Cervero & Kockelmann 1997, Ewing and Cervero 2010). In countries with high levels of cycle use, there is less difference in use according to gender and there is a wider distribution of use by age compared to low cycling countries. In general, females make more walking trips than men when it comes to physical activity. Children and adolescents who have high levels of active travel carry their learned behaviours into later life stages. Senior citizens reduce their overall trip rates compared to earlier periods in their lives, but walk a lot and are a main user groups for pedelecs and e-bikes. Income effects are mixed because of two interacting influences: higher income correlates with higher levels of car ownership and hence use, but higher income also correlates with higher education, which then correlates with use of active travel. Significant correlations between socio-psychological variables and active travel have been found with bi-directional causes and effects: behaviour has impacts on attitudes, and vice versa (Kroesen et al. 2017). Research has also consistently demonstrated the positive impacts of active travel particularly for public health (Götschi et al. 2016, Mueller et al. 2018), including when possible negative impacts such as increased exposure to air pollution or collisions are accounted for (Mueller et al. 2015, Schepers et al. 2015).

Open questions for research still remain. Data and knowledge are far less comprehensive for walking compared to cycling. Walking is a major component of trips including public transport. These walking stages "disappear" in official statistics which focus on the trips' main transport modes. Walking can be an efficient, fast, direct and safe purpose-oriented movement from an origin to a destination. It can also be performed for its own merit, for example, for leisure purposes or for physical exercise. Walking does not require any specific skills or equipment; most people can walk: it is a very normal and everyday activity that can be accomplished even when

infrastructure is not very supportive, resulting in pedestrians often having to put up with the quality that is provided.

More theoretically well-founded insights on determinants of walking and cycling including the directions of cause and effect would help to better understand how interventions and policy measures impact on behaviour and can be designed to purposefully reach desired policy objectives (Foster et al. 2018). As yet, there are only a few methodologically sound evaluation studies, and the broader and complex context within which policies are implemented and influence individual and collective decision making remains under-studied (Foster et al. 2018, Panter et al. 2017). These are major research gaps that are hard to address but important for facilitating evidence-based policy making.

This Special Issue contributes to this research agenda and aims to close some of the research gaps. Its papers emerged from the International Cycling Conference which took place from 19 to 21 September 2017 in Mannheim, Germany, and a parallel call for papers. 87 papers were submitted, which shows the great interest in the topic of active travel. The papers finally included in the Special Issue still reflect the dominance of cycling in research on active travel. Three out of the 20 papers deal solely with walking, eight with both walking and cycling, and the remaining nine papers focus on cycling issues. The papers cover a wide geographical scope including Australia, Belgium, Canada, France, Germany, South Korea, Switzerland, The Netherlands, the UK, the USA and Vietnam. The papers originate mainly from the discipline of transport studies, but the valuable insights of other disciplines, such as economy, social sciences and public health, are also represented. Analyses and policy evaluations investigate either a whole population, or focus on specific user groups including children, adolescents, students, working people, senior citizens and public transport users.

In this overview of the Special Issue on active mobility, papers are grouped according to topics dealing with 1) correlates of walking and cycling, 2) impacts of active travel, and 3) policy measures relating to promotion, governance issues and evaluation methods.

Correlates of walking and cycling

Ton et al. (2019) present a comprehensive consideration of many sorts of correlates for both walking and cycling, based on data from The Netherlands Mobility Panel (MPN) in combination with an additional survey focused on active modes of transport. Travel time is found to be the most dominant determinant. This confirms the importance of travel distances and the built environment for both walking and cycling. For many determinants, differences were found between walking and cycling. The impact of individual characteristics is, for example, much stronger for cycling than for walking. The provision of safe and comfortable infrastructures is more important for cycling than for walking; the "5Ds" and particularly density, destination accessibility, diversity and distance to public transport are of highest relevance for walking (Cervero & Kockelmann 1997, Ewing and Cervero 2010). Consequently, both modes should be treated separately in policy making because, otherwise, desired policy objectives might not be achieved. Also, each active mode should be distinguished in estimations produced by modelling.

Sener et al. (2019) examine primary children's mode choice to and from school with a focus on active travel and the role of parental influence. Findings are in line with the literature, showing, for example, that boys are more likely to travel actively than girls, and distance is of great importance for school mode choice. Active travel rates were found to be most prevalent in distances below two miles. The study adds for the first time a detailed analysis of parents'

influence on children's mode choice, and includes a mode choice model for the parents. Parents' characteristics and attitudes are found to have substantial influence on children's mode choice decisions. Concerns on traffic safety are a major barrier for both fathers and mothers. Specifically for mothers, concerns regarding traffic conditions in the neighbourhood can discourage children's active mode use. For fathers, work-related characteristics are more important; children with self-employed fathers' were more likely to walk or bike to/from school.

Fitch et al. (2019) focus on teenage travel, which has been far less studied than primary school age travel, but deserves the same attention. Adolescence is the first life stage with largely independent travel decisions. Behaviours and attitudes formed during this period impact substantially on later life-cycle stages. The authors find stronger relationships between attitudes and bicycling as compared with relationships between road environments and bicycling. While travel distances and road environments also matter, perceived social pressure on students to bicycle is shown to have a stronger association with bicycling.

Leung & Le (2019) investigate correlates of adolescents' active travel in the Vietnamese context with its specific mobility culture around motorcycles, walking and cycling. The results illustrate the importance of peers and parents, but also positive associations of active travel with favourable built environments (urban density, obstruction free pathways, food attractions and tree cover), and negative associations with traffic, air pollution and prior collision experiences.

Thipgen (2019) examines cycling behaviour, skills and attitudes for undergraduates at UC Davis (USA) based on a longitudinal approach that allows an analysis of the impacts of childhood experiences as well as behavioural changes resulting from beginning to study at a very cycling-friendly university. The authors show that learned behaviour in teenage years is particularly influential in later life stages. Riding a bicycle at any point during college years increases both pro-bicycling attitudes and bicycling skills. Exposure to high levels of bicycling appears not to influence attitudes or skills. Overall, the association found between bicycle use and attitudes is consistently strong with a bi-directional relationship; bicycling behaviour supports pro-bicycling attitudes and vice versa.

De Geus et al. (2019) study the association of psychosocial and environmental factors with adult residents' cycling in the Brussels Capital Region and whether these associations differ between those who never cycle for transport purposes (non-cyclists) and those who used the bicycle at least once a week in the previous 6 months (cyclists). Psychosocial factors were significantly different between cyclists and non-cyclists whereas the physical environmental factors were not significantly different between these two groups. The influence of individual and social factors seems thus to be better at distinguishing between cyclists and non-cyclists than the physical environment in the specific local context.

Rerat (2019) focuses on cycling to work and draws on Cresswell's conceptualisation of mobility as a combination of physical movement, meaning, and embodied and experienced practice. The author identifies four types of cyclists according to their motivations: active, civic, independent and enthusiast(ic). Motivations to cycle to work refer to well-being (both physical and mental), independence and civic engagement. Barriers relate to weather conditions, safety, logistical constraints and comfort. Based on the insights gained from the analysis, the author stresses the importance of integrated strategies for promoting cycling to work. A cycling policy should focus on movement (a network of direct and well-maintained routes), experience (safe and pleasant routes designed for all types of cyclists) and meanings (by promoting cycling to various audiences and assessing the legitimacy of cycling as a fully-fledged means of transport).

Buehler et al. (2019) take the public health perspective and present an analysis of weekly time spent on walking and cycling for transport compared to the WHO recommendation of at least 150 minutes of moderate physical activity per week. Based on a nationally representative panel-survey of daily travel in Germany, the authors analyse the absolute levels of walking and cycling travel times in both cross-sectional and longitudinal perspectives of two subsequent years of panel participation. About half of respondents achieved 150+ minutes of active travel per week in their first year of panel participation. Of those, about three-quarters were 'high maintainers' with 150+ minutes of active travel also in the 2nd year. These people were more likely to be aged 30 years or older, not employed, have a monthly public transport pass, live within 2 km of a shopping destination, and less likely to own cars. 'Low maintainers' did not report significant levels of transport-related physical activity in either year, and should thus be targeted with higher priority by policy interventions.

Impacts of active travel

The literature identifies various positive impacts of active travel for the transport system, the built environment, the economy, the environment and individuals' health. Curl & Mason (2019) investigate the relationship between (1) the built environment, (2) walking behaviour and (3) perceived wellbeing for older adults living in a deprived urban area. The authors demonstrate pairwise associations between these three factors, and also address the three concepts in an integrated manner, using structural equation modelling to explore walking as a mediator between the perceived social and built environments, and mental wellbeing. The authors find direct and indirect relationships between neighbourhood perceptions and wellbeing. Walking partially mediates relationships between social contact, neighbourhood quality, local amenity use, safety and mental wellbeing. Although neighbourhood problems, and the quality of local services and amenities, are associated with mental wellbeing, walking is not identified as an explanatory pathway in their models. The relationship between walking and wellbeing is weaker than the authors expected.

In a case study of Cardiff, Wales (UK), Brands & Neves (2019) investigate the potential for greenhouse gas (GHG) emissions savings from replacing short car trips with walking and cycling. The authors find significant potential for active travel to substitute short car trips, with sizeable impacts on carbon emissions from personal travel. Half of all car trips were less than three miles long and embedded into tours with all their trips having suitable distances for walking or cycling. Taking into account individual travel patterns and constraints, walking or cycling could realistically substitute for 41 percent of short car trips, saving nearly 5 percent of CO2e emissions from car travel. This is on top of five percent of 'avoided' emissions from cars due to existing walking and cycling.

Policies, governance and evaluation

Aldred & Croft (2019) conducted a longitudinal study of individuals sampled from households in so-called 'mini-Holland' boroughs (intervention sample) and from non-'mini-Holland' Outer London boroughs (control sample). The 'mini-Hollands' programme comprises various infrastructure schemes and also supporting measures. The infrastructure changes include redesigned town centres, with cycle hubs at tube and rail stations; measures to reduce and calm motor traffic in residential areas; and physically protected cycle lanes along main roads. Many schemes also seek to improve the walking environment and public realm quality. Around one third of the measures were either complete or under construction when the empirical work for

the analysis presented in the paper was carried out. The results show that one year's worth of interventions was associated with a significant increase in active travel among those living in areas defined as 'high-dose' neighbourhoods. Specifically, those in high-dose areas were 24 percent more likely to have undertaken any past-week cycling at follow-up, compared to those living in non-mini-Holland areas. Positive changes in respondents' views about local environments were recorded in intervention areas, driven by a perceived improvement in cycling-related items. Controversy related to the interventions is reflected in a growth in perceptions that 'too much' money is spent on cycling in intervention areas; however, there is also a reduction in perceptions that 'too little' money is spent.

Sersli et al. (2019) present a scoping review to identify and describe evidence of changes in bicycling frequency associated with bicycle skills training for children or adults. The authors' search of six electronic databases, grey literature websites, Google Scholar, and citations in relevant articles for pre- and post-test studies of bicycle skill training interventions led to 12 studies that were finally included into the review. The studies, with very few exceptions, report increases in bicycling as the result of the training but information about the statistical significance of these results was sometimes missing. Studies describe intervention content adequately, but poorly report details about intervention theory and context. The second aim of the review could therefore not be completed, which was to have been a comparison of the components—theory and content—of bicycle training interventions, and the related bicycling uptake.

Kim et al. (2019) explore the relationship between built environment attributes and pedestrian volumes on weekdays, based on a unique large-scale daytime pedestrian count, which was measured at 10,000 locations in Seoul Metropolitan City. Four groups of independent variables were considered: street-level physical design conditions, network & transit attributes, land use attributes, and socio-economic features. The authors apply geographically weighted regression (GWR) which computes individual coefficient values for each survey location and in addition considers relationships between the survey location and surrounding areas. The most important variables (company density, distance to nearest subway station, sidewalk width) correspond well with the "5 Ds" as introduced above. The hypothesised influence was also confirmed for adjacent areas on walking pattern at the survey location. The findings of this study are of high relevance for policy making: Strategies for supporting walking are more effective on the regional level compared to isolated single-location measures. The importance of specific built environment variables for pedestrian volumes varies between the survey locations which means that different strategies could be recommended at each different location.

Bornioli et al. (2019) explore the influence of affective experiences of the walking environment on walking intentions. The authors conducted an experiment involving virtual exposure to one of five environments with a sample of adults working or studying in Bristol (UK). Participants were asked to evaluate their affective experience and to report intentions to walk in each of the settings. A sub-sample participated additionally in photo-elicited semi-structured interviews. Multiple regression analyses show that affective experiences of walking have influence on walking intentions. Overall, the findings indicate that safety, comfort, and moderate sensory stimulation are crucial elements for the walking experience, and should be considered when designing infrastructure for pedestrians. The role of motor traffic, city 'busyness', and poor aesthetics were particularly highlighted in the interviews.

Based on an innovative data set of metro interruptions announced in Twitter communication by the Parisian metro operator and usage data on the Vélib public bike sharing system, Klingen (2019) find substantial increases in the use of Vélib public bicycles in case of metro interruptions

close to the affected metro stations. Public rental bikes are a local substitute for the metro service in these situations. They can thus alleviate time losses stemming from interruptions in public transport and therefore should be well integrated with public transport service provision.

Branion-Calles et al. (2019) examine the association between availability of bicycle infrastructure and perceptions of bicycling safety amongst bicyclists living in large Canadian and US cities. The authors find that, within cities, bicyclists with greater bicycle infrastructure availability had improved odds of perceiving bicycling as safe. Specifically, a 10-unit increase in Bike Lane Score was associated with six percent higher odds of a bicyclist perceiving the safety of bicycling as safe compared to neutral. Bicyclists who are male, younger, lower income, have young children, have a high-school education, and bicycle more frequently are predicted to be more likely to perceive bicycling in their city to be safe. These findings suggest that increasing the availability of bicycle facilities by expanding bicycling networks may result in increases in perceptions of bicycling safety for existing bicyclists, but also that individual characteristics play a substantial role in bicycling safety perceptions.

Dean et al. (2019) explore the potential of e-bikes for seniors to support their independent mobility and active ageing in Canada's car-dependent context. The findings highlight the importance of cycling life histories, social connection, and physical limitations to maintaining or newly adopting cycling later in life. Facilitators for adopting the e-bike technology comprise increased convenience, reduced physical exertion, reduced reliance on a vehicle, and fun. Barriers include cycling infrastructure and road safety, regulation, and stigmatization barriers. Overall, the potential of e-bikes to support sustainable and active transport objectives in the older adult population is found to be substantial in general, but also more specifically in the rural and car-dependent context.

Measures for promoting active travel generate various impacts, including both benefits and costs. Standen et al. (2019) present an innovative method for valuing the user benefits of new active transport infrastructure, and thus address an emerging research area of specific importance. The traditional methods used for the assessment of transport infrastructure investments, with their focus on travel time savings and related effects, are not suitable for valuing measures for promoting active travel. Using the case study of a new separated cycleway in Sydney (Australia), the authors find that the value of user benefits, measured with the logsum measure of consumer surplus, can be significant—of a similar order of magnitude to the estimated value of the public health benefits—and it becomes more pronounced as cycleways are integrated into a connected network. The method could be used to inform transport investment policy decisions in other jurisdictions, where suitable travel survey data are available.

Biehl et al. (2019) apply an interesting combination of traditional qualitative discourse analysis and quantitative text-mining tools to collect a rich dataset on residents' views on the local mobility culture, embedded norms and values associated with acceptance of active travel modes, and on preferences and priorities for actions needed to promote active travel. The implementation of the empirical work in two communities with various differences, for example in unemployment rates, education and income, reveals both similarities and differences. Participants from both community areas emphasise the contentious nature of multi-modalism through its requirement that travellers learn to negotiate a 'shared space' inclusive of all modes. Both community areas face dilemmas regarding the interaction of vehicle parking, bike lanes, and bus lanes at the nexus of the street and the sidewalk. Additionally, there is agreement that today's youth deserves a society that encourages eco-friendly mobility patterns that promotes active accessibility and hence individual well-being. Participants also stressed that greater

investment in public transport should be a priority on a citywide scale. This research expands on the walking and cycling literature by providing novel insights regarding the perceived benefits of, and barriers to, equitable promotion of these modes and at the same time, the developed methodological approach could be applied in various contexts.

Assunçao-Denis (2019) investigates the different factors that contributed to the substantial increase in utilitarian cycling between 1996 and 2015 in ten communities of various sizes and locations across Canada. The analysis is based on expert interviews with engineers, planners, activists, politicians and academics that were conducted to assess which factors were important in changing cycling practice. The results show that although the story varies from case to case, some factors were more relevant than others. Factors to a certain extent beyond the control of local actors, such as cultural, demographic and economic changes, contributed substantially to an increase in utilitarian cycling in all case studies. In addition to these macro-trends, locally-adopted measures were also thought to be effective. The development of pro-cycling policies and programmes and the expansion of cycling infrastructure seem to have heavily influenced cycling in several communities. In some case study areas, the activities and advocacy of cycling groups were thought to have been very influential. In a few cases, such as two small mountain communities, a specific event triggered the increase in cycling in the area. More often, however, it was a combination of government-controlled factors, and larger macro-scale trends, which created an environment favourable to cycling for transport in the study municipalities. The conclusion is that there is rarely one factor that triggers change: it is the mix that matters. Macro-trends might not be enough to significantly boost cycling and bring more people onto streets that are not designed for cyclists and pedestrians, and vice versa.

Concluding remarks

The papers in this special issue confirm the positive and dynamic research and policy making associated with active travel. Research and practice have gone a long way, but still we are not there. Local stakeholders worldwide are engaged in promoting active travel but continue to face major barriers. Research can support their efforts by improving data sources for walking and cycling, providing sound theoretically-based evaluation studies to support evidence-based policy making and by generating more insights on correlates and impacts specifically for walking. Inter- and trans-disciplinary approaches are paramount for successfully bridging the gap between the different relevant disciplines of transport, urban planning and public health, and for engaging with practitioners. Future developments for active travel face various challenges, such as ageing societies, but also substantial opportunities, for example from changed mind sets or emerging technologies. We hope this Special Issue will contribute to the scientific and social discussions on active travel, and so help to transform opportunities in successes.

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