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URBAN INFRASTRUCTURE IN TRANSPORT STUDIES AND PLANNING

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Transport studies and planning's engagement with urban infrastructure is mostly based on policy-oriented perspectives. However, the field is conceptually rich, includes fundamental critiques of business-as-usual infrastructure development and has been heavily influenced by normative social and environmental discourses. Over the last decades, transport studies has also broadened its relationship with other disciplines and established a stronger relationship with urban studies, design and planning (Banister 1997, Gertz 1997, Cervero 2001). On the infrastructural side, it has branched out and built connections with economic geography and econometric analysis (Baum-Snow 2007, Duranton and Turner 2012), development studies (Vasconcellos 2001, Hickman, Givoni et al. 2015) and environmental science (Dora, Phillips et al. 2000, Banister 2002). As part of a mobility service perspective, transport research borrow concepts and methodologies from sociology, psychology and behavioural economics (Metcalfe and Dolan 2012, Gehlert, Dziekan et al. 2013), and more recently from computer science (Batty 2013, Bettencourt 2013). The 'mobilities' subfield in transport (Urry 2007) which emerged during the late 1990s may come closest to critical and conceptual work beyond an inherent techno-policy bias of this field of academic inquiry.

The diversity of these cross-disciplinary connection points reflects the field's complexity. Transport infrastructure systems feature several unique characteristics compared to other utilities. In contrast to water, sanitation, electricity and communication services, transport infrastructures are heterogeneous structures and exposed to a diversity of uses, their flows usually involve people, and definitions of related policy objectives are difficult and contested. Transport infrastructures also give shape to cities (Hamilton and Hoyle 1999), usually determining the location of other infrastructures and share with communication infrastructure a particularly rapid technological change of user equipment. Finally, unlike the demand for water, transport is largely derived demand or a means to an end, i.e. not desired in and of itself but as a result of a demand for accessibility. The provision of access to other people, goods, services and information underpins socio-economic well-being (Vickerman 2000) and at the same time is exposed to entrenched levels of inequality (Vasconcellos 2001). Improving and establishing more equitable access is considered a critical factor of development particularly in lower income countries (Hickman, Givoni et al. 2015).

Over the last decades, transport planning theory has engaged more proactively with the field's complexity and as a result been confronted with a fundamental reframing of its main assumptions and developmental objectives. The conventional, modernist assumption suggests that transport infrastructures are above all an instrument for increasing travel speeds, reducing the costs of travel, mostly time, and thus improve accessibility. Based on a 'predict-and-provide' approach for the link between a given location A and B, transport planning focussed on the narrow facilitation of accelerated movement driven by a desire of 'time-space compression' (Harvey 1990, Urry 2001). Respective transport infrastructure appraisals are usually based on a costs-benefit analysis focussing on user benefits in terms of travel time savings. This analysis is aligned with the sector's tradition of employing quantitative methods, models, engineering approaches and technical calibration (Cervero, Guerra et al. 2017). Thus, conventional transport planning has been described as a mechanistic and positivist approach overtly relying on cause-and-effect models, simple forecasting, and technical rationality (Graham and Marvin 2001).

By contrast, a 'new realism' in transport planning which emerged in the early 1990s (Goodwin, Hallett et al. 1991, Owens 1995, Docherty and Shaw 2008) recognises that the traditional transport model has ultimately failed to address and in some instances has even exacerbated many transport concerns, in particular traffic congestion, road accidents, loss of productivity and transport inequalities (Hajer and Kesselring 1999, Vasconcellos 2001, World Bank 2002, Litman 2011). More fundamentally, modernist transport planning has been unable to address broader accessibility goals as well as increasingly urgent requirements for resource, energy and carbon efficiency. Transport is the fastest growing emissions sector globally, already accounting for 23 per cent of global CO_2 emissions, and predicted to increase by 50 per cent by 2035 and almost double by 2050 under a business-as-usual scenario (Dulac 2013, IPCC 2014). In addition, life cycle analysis suggests that carbon emissions embedded in transport infrastructures[1] are substantial, typically adding another 63 per cent for on-road and 155 per cent for rail in addition to emissions from vehicle operations (Chester and Horvath 2009).

As a result, transport planning theory has turned to an emerging 'accessibility paradigm' (Topp 1994, Houghton 1995, Gertz 1997, Simpson 2004, Duranton and Guerra 2016, Gutman and Tomer 2016, Cervero, Guerra et al. 2017) which is centrally attached to transport's core purpose of increasing access to goods and services and between opportunities. But instead of only considering movement as part of facilitating access, questions of the physical proximity between different opportunities are equally considered. Therefore, the 'accessibility turn' places a greater focus on demand management and land-use planning. This turn also emphasises the difference between transport related terminologies which are often used interchangeably: traffic (focus on level of service of roads and vehicle speeds), mobility (focus on multi-modal, door-to-door movement), connectivity (focus on ease of exchange between fixed locations) and accessibility (focus on travel costs and time to reach destinations) (Venter 2016, Litman 2017).

The overarching societal objective of enhancing accessibility also establishes the particular relationship between transport and cities summarised by Ed Glaeser (2003) as "cities exists to eliminate transport costs for people, goods and ideas" (p84). In cities, accessibility is co-produced by transport services and urban form. Certain urban form, such as greater densities and mixed use, can act as substitutes for transport infrastructure and mobility services. Higher densities also establish the preconditions for viable high-capacity public transport and fast regional connectivity. Other urban forms, e.g. suburban housing and business parks, entirely depend on transport services. As the combination of land use and transport, accessibility has also been centrally linked to these two primary urban consumption goods (Duranton and Guerra 2016) establishing an important condition for economic development via scaling effects, agglomeration benefits and labour force specialisation.

Accessibility planning establishes new combined discourses around transport infrastructure and the city. At the metropolitan scale, these include compact urbanism, transit-oriented development (TOD), and smart growth (Rode 2018) while at the local scale, accessibility has been framed through concepts such as complete streets, road diets, urban acupuncture, and new urbanism (Cervero, Guerra et al. 2017). All share the idea that for the city as a whole as well as for transport infrastructures, movement and place functions need to be negotiated, recalibrated and ultimately be addressed at the same time. They also consider the provision of transport infrastructure as a critical strategic policy tool shaping cities and coordinating urban futures as they create lock-in effects which can determine future development for decades. The 'urban constituting' characteristic of transport infrastructure – which mostly continues to induce urban sprawl – is then instead exploited for achieving objectives beyond urban accessibility ranging from social inclusion to a more efficient use of land.

Thus, for transport infrastructure development, the accessibility turn implies a reordering of priorities. A central test for this reordering is the degree to which place making rather than the facilitation of movement is being supported (Cervero, Guerra et al. 2017). This implies a break with business-as-usual infrastructure development as most transport infrastructures have an embedded bias towards greater regional connectivity at the expense of local level accessibility. For some commentators, this reordering needs to be part of what Cervero et al (2017) refer to as urban recalibration, "not necessarily a seismic shift but rather a rebalancing of priorities that gives at least as much urban planning and community design attention to serving people and places as to mobility" (p2). Others have explored a more wholesale transformation where transport plays a central role of environmental transitions and ecological modernisation (Geels 2012, Rammler).

More generally and also beyond the specific urban context, transport infrastructures share a complex relationship with its moving parts and users. The particular distinction between infrastructure stocks and flows is a unique feature of transportation systems and a critical aspect of related coordination efforts. These efforts are usually confronted with more rapid technological change of mobile units (cars, trains, ships and airplanes) compared to fixed structures (roads, railway tracks, canals, ports and airports). Furthermore, closed transport systems, above all railways, require a considerable degree of calibration between rolling stock and infrastructure (track gauge, gradients, curve radius, power supply, etc.) and are often managed by one organisation. More open systems, above all roads but also canals, ports and airports accommodate a greater diversity of mobile equipment and allow for a greater separation of infrastructure stocks and service provision. In the case of urban streets, infrastructures also accommodate stationary uses which are not transport related.

The most contentious relationship between transport infrastructure and its moving parts is that of city streets and the automobile (Rode 2017). Mass motorisation in cities implied the privatisation of public space and a disregard for extreme levels of negative externalities while the underlying promise of liberation could ultimately not be kept. Calibrating the city, its streets, facilities and buildings in accordance to the technical requirements of the automobile imposes a type of urban development which replicates the 'anti-urban' character of driving: it requires segregation, dispersal, privatisation, isolation, detached buildings and vast amounts of space for movement and parking. As Lewis Mumford (1963) described it "the right to have access to every building in the city by private car …is actually the right to destroy the city" (p11).

In terms of providing transport infrastructure across different transport modes, commentators usually highlight the central role of governments and public delivery given the prevailing role of transport infrastructures as public goods (above all roads) and with non-excludable access (Collier and Venables 2016). In addition, the central role of public transport in cities provides a strong link to state provision – although the publicness of public transport operates based on a sliding scale (Paget-Seekins and Tironi 2016). This allows us to consider critical questions of state capabilities and capacities at different levels of government. Among these, coordination requirements for producing urban accessibility by joining-up planning, design and transport are among the most difficult (Rode 2018). Similarly, the provision of appropriate financing models presents governments with overwhelming complexities. To address both land use coordination and finance, transport infrastructure funding may increasingly require new forms of land and property tax (Collier and Venables 2016), greater shares of general taxation spent (Ahmad 2017), reducing costs by increasing densities and mixed use and tapping into rents from resource extraction (Collier and Venables 2016, Fuss, Chen et al. 2016).

The fundamental role of governments as part of transport infrastructure development also explains a considerable interest in defining and reforming appraisal methods which can support effective decision making. Attempts of embracing an accessibility perspective as part of these appraisals try to consider broader societal and city-wide impacts of transport programmes beyond direct user benefits, including benefits resulting from land use changes and agglomeration (Venables 2017). Defining appropriate levels of access in cities through a range of proxy indicators has also become an important contribution of transport studies. While transport, unlike other infrastructure sectors, does not have a distinct goal as part of the Sustainable Development Goals, transport perspectives are included as sub-goals[2] as part of the 'urban' SDG 11. One indicator for this sub-goal currently under discussion is the "percentage of people within 0.5km of public transit running at least every 20 minutes" (SDSN 2018).

To conclude, the field of transport studies and planning has embraced new and old complexities and the sector's co-dependencies by engaging in far more interdisciplinary research. It has also overcome its peripheral and insulated role as part of urban studies still evident in the 1990s (Hamilton and Hoyle 1999). Furthermore, it is engaging with urban infrastructures in a way that considers a shift from a focus on mobility and movement to a broader perspective focussing on the underlying question of accessibility. This is turn is also becoming a more relevant category in policy making building on the field's strong policy connection.

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Endnotes

[1] Embedded emissions are upstream CO2 emissions from energy used for transport, housing or the production of goods and services. These also include emissions that occur as part of constructing or building transport infrastructure or vehicles.

[2] SDG Goal 11.2 "By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons"

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