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Accessible accessibility research challenges

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ABSTRACT

Accessibility is a key concept in the field of transport geography. There is a rich, though not very mature, body of literature on this topic which is largely application-driven. The focus in the literature is generally on methods and concept and/or on applications. Applications generally focus on *ex ante* or *ex post* evaluations of the implications for accessibility of (candidate) policy plans. An important question is which are the main challenges in the area of accessibility research? This paper aims to examine this question and provide a research agenda for the coming one or two decades or so. The focus is on putting relatively new topics on the agenda, rather than making suggestions for improvements of given accessibility indicators. The paper does not aim to provide a complete list, but rather proposes avenues for future research focusing on (1) indicators to express accessibility, and (2) evaluation. In the area of indicators the challenges include the impact of ICT on accessibility; the inclusion of the robustness of the transport system in indicators; comparing perceptions of accessibility and traditional accessibility indicators; the option value; and the indicators of accessibility for goods transport, air transport, and slow modes. In the area of evaluation the paper discusses the pros and cons of the logsum as an accessibility measure, ethical aspects, comparisons of accessibility indicators to evaluate a specific case, and the needs of the clients of accessibility research.

1. Introduction

In order for societies to function adequately a certain level of accessibility to destinations by different modes, for both goods and people, is required. Accessibility is therefore a key concept in transport policies across the world. The main aim of Ministries of Transport throughout the world is to improve accessibility. Additional aims relate to reducing the negative impacts on the environment and safety. Because of the huge importance of accessibility for policy makers and society, transport geography and other research areas have studied accessibility in many ways, ranging from defining it, translating definitions to indicators, discussing the pros and cons of indicators, methods to calculate indicators, and applying indicators in real world cases. For an overview of the literature on accessibility indicators see, for example, Handy and Niemeier (1997), Geurs and van Wee (2004), or Páez et al. (2012).

During the past two decades considerable progress in the academic literature on accessibility has been made. For example, advances in time-space geography have been made (e.g. Neutens et al., 2008 who focus on joint activity participation; Lee and Kwan (2011) who studied visualization options; and Farber et al. (2013) who developed a method for social interaction), the logsum has been proposed and discussed as a measure to value accessibility (e.g. De Jong et al., 2007; Chorus and Timmermans, 2009), and data availability has improved, as in many other areas partly fuelled by the use of ICT and by the increasing availability of 'big data'.

Nevertheless several challenges remain. This paper aims to give an overview of a selection of research challenges for the next two decades or so. The focus is on putting relatively new topics on the agenda, not on suggestions for improvements to given accessibility indicators. The paper mainly aims to inspire researchers rather than provide a complete list, although practitioners and policy makers could also benefit. I focus on overland and air transport, excluding water transport.

Section 2 discusses research challenges in the area of indicators for accessibility, Section 3 the challenges related to evaluation. Some concluding remarks are presented in Section 4. Several of the ideas presented in this paper have been discussed in recent literature, not only by me and co-authors, but also by others. Therefore I do not claim to present a list of *new* ideas, but rather to give a comprehensive overview.

2. Indicators

A very fundamental question is: What is accessibility? Or: How do we define accessibility? In his seminal paper Hansen (1959:73) defined accessibility as 'the potential of opportunities for interaction'. But there are many more definitions. Most include both destinations or activities, as well as travel resistance. The more options to reach candidate destinations or to fulfill activities, and the lower the travel resistance (time, costs, effort), the higher the level of accessibility. For example, Geurs and Van Wee (2004: 128) define accessibility as "the extent to which

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land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s)." Once a definition is chosen, indicators need to be specified before the concept of accessibility can be operationalized. This section discusses the challenges related to different indicators.

2.1. Short distances, slow modes

Traditionally the accessibility literature has not focused much on short distances and slow modes, two closely-related areas, although over the last decade or so interest in this area has increased significantly, examples being Lundberg and Weber (2014), Boussauw et al. (2014), Krizek and Johnson (2006), Forsyth and Krizek (2010), Manaugh and El-Geneidy (2013), Moniruzzaman et al. (2014), and Owen et al. (2014). Research in these areas should be trip purpose/activity specific. For example, it is important in research into job accessibility to realize that most people do not have a job in the direct vicinity of their home and that many people do not want a very short commuting time or distance (Redmond and Mokhtarian, 2001; Mokhtarian and Salomon, 2001; Ory et al., 2004). Having activities such as (primary) schools, kindergarten, grocery shops, and basic medical services available close to home is likely to be more important. But in some cases visits to such local destinations and to jobs can be interrelated, because people can combine, for example, shopping and a commute trip, as shown by Widener et al. (2015). Despite the increasing attention paid to short distances and slow modes in the accessibility literature, I think important gaps remain. One gap is the importance of context — a lot of literature focuses on one case or area (city, region, country), and, because of the significant differences in climate, walking and cycling cultures and slow mode infrastructure across the world (and even within countries), questions remain on the importance of context. A next gap relates to the valuation people make of different accessibility levels for slow modes.

Related research questions include:

- How important are context factors for (the valuation of) the accessibility of destinations at short distances and of slow modes?
- How important is it for people (and for which groups of people?) to have destinations like shops, schools and medical services available at, for example, 500 m instead of 1 km?
- How important is it to be able to walk or cycle to such destinations?

2.2. Multiple modes

Most accessibility analyses focus on one mode only. A challenging research field is the development of indicators and methods to express access in the situation when multiple modes are available. This research should also take into account the fact that combinations of modes can be relevant in multiple ways. Firstly, people can choose between multiple modes, and thus have multiple options for single mode trips. The logsum approach (see below) includes multiple travel options, but only due to the uncertainty of the modeler. Without this uncertainty, only the most attractive option would be included. This contradicts the idea that people value having multiple options available even if they do not currently use some of them, as expressed by the option value (see below). And they may value a higher value of robustness, which benefits from having multiple options available (see also below). Secondly, they may combine modes in multimodal trips. In that case multimodal accessibility is relevant. This is particularly relevant for people traveling by train because they need to travel to and from the railway stations both at their point of origin and their destination. Thirdly, it is important to note that single mode transport systems can have mutual influences. Let us assume a researcher is interested in the improvement in accessibility resulting from the potential opening of a regional airport. Let us also assume that the city already has a High Speed Rail station. The opening of the airport might result in a decrease in the services provided by the HSR, due to competition. On the other hand, the HSR could also be a feeder for long distance air travel, in which case new HSR services could also be added (Dobruszkes et al., 2014; Albalate et al., 2014). If such interactions are ignored the accessibility analysis may be flawed. Fourthly, the transport and the land use system interact. Coming back to the example just introduced: due to the combined presence of HSR and an airport, the region could become more attractive both for companies and individuals, leading to land use changes. These changes could have an impact on some forms of accessibility.

Related research questions include:

- Which accessibility indicators express multimodal accessibility best and in which cases?
- How important, and for which categories of people/companies, is the availability of multiple modes of travel to destinations? For which category of activities?
- In which cases and to what extent do different modes complement or substitute each other, and what does this mean for accessibility analyses?

2.3. ICT

In this section I will firstly discuss the impact of ICT on accessibility, and secondly the importance of ICT for the generation of data useful for accessibility analyses.

Information and Communication Technologies (ICT) have increasingly become a part of life, in several respects. Many people can e-work, e-shopping is rapidly becoming more common, e-learning is discussed in many universities world-wide, if not: implemented, and further implementation can be expected in the near future. People communicate via smartphones and Skype. People traveling by public transport can make their travel time productive or more attractive using ICT, e.g. by working online or contacting others online. Satnav systems reduce not only travel times but also travel time uncertainties and discomfort because, for example, drivers do not have to plan their route or search for a parking place. ICT enables people to plan more easily and improve their travel and maybe even activity schedule, pre- and on-trip. In other words, linking such developments to the core parts of accessibility presented above, ICT intervenes at both the activity and resistance side.

Indicators need to include ICT's impact on accessibility, at least for some applications. But the literature on how this could or even should be done, is still in its infancy (Van Wee et al., 2013). With respect to activities it is important to realize that at the conceptual level this may already be possible. At the more practical level the impact of ICT on activities is growing rapidly, so the value of an accessibility indicator including ICT may change rapidly in the coming years or decades. At the conceptual level ICT's impact on travel resistance can be included relatively easily via the concept of Generalized Transport Costs (GTC), and the components of GTC: ICT can impact travel times, the marginal value of travel time savings, travel costs, and effort.

Examples of important research questions related to ICT's impact on accessibility include:

- What is the impact of ICT on people's access to which (categories of) activities?
- To what extent and under which conditions is ICT a substitute for or complementary to physical access? (see for example pioneering work by Mokhtarian and Salomon, 1997; Mokhtarian, 2003; see Van Wee et al., 2013, for a discussion).
- Are there differences between generations of people with respect to the use of ICT and the impact of ICT on their (perceptions of) accessibility? This topic is sometimes discussed in the context of 'peak car', or 'peak travel', suggesting that young people are less car oriented than in the past, and that the increasing use of ICT is