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## Accessibility and equity

### A conceptual framework and research agenda

van Wee, Bert

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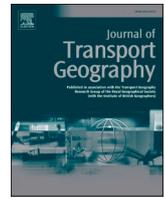
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# Accessibility and equity: A conceptual framework and research agenda

Bert van Wee\*

Transport and Logistics Group, Faculty Technology, Policy and Management, Delft University of Technology, Jaffalaan 5, 2628 BX Delft, the Netherlands

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## ABSTRACT

This discussion paper proposes a conceptual model for the factors influencing ethical concerns regarding accessibility, building on the idea that people should have a minimum level of access to some destinations (founded in the ethical principle of sufficientarianism), and secondly from the idea that differences in levels of accessibility between (groups of) people could be relevant from an equity perspective (founded in the ethical principle of egalitarianism). The four components of accessibility introduced by Geurs and van Wee (2004) – the land use system, the transport system, the individual, and the temporal component – are included in the conceptual model which additionally disentangles the individual component, includes context factors (such as culture/religion), digital access options, perceived accessibility and normative judgments. In addition, this paper proposes a research agenda suggesting several types of quantitative and qualitative methods to study the complex relationships proposed in the model, and research to address those parts of the model for which limited knowledge is currently available.

## 1. Introduction

In the policy analysis literature it is generally recognized that ‘sound’ policies should meet three criteria: they should be effective, efficient, and fair (Young and Tilley, 2006). Though not exact synonyms of each other, the terms fairness, equity, and ethics are used interchangeably in the transport community, aiming to express moral judgments. In this paper I use the term ‘equity’ to address this topic. Equity aspects of the transport system have increasingly gained attention over the last decade. The literature has largely focused on accessibility and equity (Martens, 2016; Banister, 2018; Lucas et al., 2019), although there is also literature on equity and safety (for example, Ryan et al., 2021), and the environmental implications of transport (Van Wee, 2011). To illustrate the increasing attention paid to accessibility and equity, a search in SCOPUS (assessed 10-2-2022) with the search string *accessibility AND equity AND travel* revealed 361 hits, of which 302 had been published since 2011 (84%) and 361 (72%) since 2016.

Following Geurs and Van Wee (Geurs and van Wee, 2004: 128) I define accessibility as ‘the extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s)’. Differences in accessibility levels are unavoidable. It is impossible to provide equal levels of access for all people to all destinations.

The question is: when is there an ethical problem with respect to

accessibility, or differences in accessibility? The answer to this question depends on normative judgments. One could argue that what matters is only the question of whether some people have ‘too low’ accessibility levels (Cooper and Vanoutrive, 2022). A ‘too low’ level of accessibility occurs when the people facing that level of accessibility could experience social exclusion. This focus matches a sufficientarianist approach to accessibility – sufficientarianism states that priority should be given to people below a certain threshold: all people should have a certain minimum threshold level which is considered to be ‘sufficient’ for fulfilling basic needs (for example, Lucas et al., 2016). Others might argue the egalitarian view, that differences in accessibility levels are unfair in themselves. Egalitarianism states that people should be treated equally (Thomopoulos et al., 2009; Lucas et al., 2016; Martens, 2016). These two perspectives dominate the accessibility and equity debate, and are the starting point of this paper.

The literature in the area of accessibility and equity generally takes an empirical, theoretical, or policy/planning perspective. In the case of an empirical perspective scholars calculate the differences in accessibility levels and/or how many people face accessibility levels below a certain threshold, focusing on one or multiple destinations (see, for example, Boisjoly et al., 2020; Cheng et al., 2021; Lucas et al., 2016, 2019) or on travel options (for example, Liu et al., 2020; Abdelwahab et al., 2021). Literature discussing equity and accessibility from a theoretical perspective generally links moral questions to ethical lenses

\* Corresponding author.

E-mail address: [g.p.vanwee@tudelft.nl](mailto:g.p.vanwee@tudelft.nl).

(for example, [Martens, 2016](#)). The policy and planning oriented literature often studies accessibility and equity in policy plans (for example, [Doran et al., 2021](#); [Martens and Golub, 2021](#)), and discusses such plans.

To the best of my knowledge the literature so far has not systematically integrated all the dominant components important for moral judgments about accessibility. This discussion paper aims to fill that gap by proposing a conceptual model for accessibility and equity. It also proposes a research agenda based on the conceptual model and weaknesses in current knowledge on parts of the model.

[Section 2](#) presents the model, [Section 3](#) discusses avenues for future research, and [Section 4](#) finishes with some concluding remarks.

## 2. A conceptual model

[Fig. 1](#) presents the proposed conceptual model, starting from the notion, as introduced above, that equity-related accessibility could be the result of people having too low levels of accessibility, leading to social exclusion or at least undesirable situations (a sufficientarian view), or from undesirable differences in accessibility levels (an egalitarian view). To add the label ‘social exclusion’ to a situation, or to add the label ‘unfair’ to differences in accessibility levels implies moral judgment, conceptualized by the outgoing arrow from ‘(normative) judgments’.

A second block in the model is the assessment of the accessibility levels. Following [Geurs and van Wee \(2004\)](#), accessibility is determined in [Fig. 1](#) by a land use, transport and temporal component (clustered), and an individual component (another block in [Fig. 1](#)). The relevance of the transport and land use systems are self-explanatory, considering the definition of accessibility introduced above.

The individual component is set apart from the other components as it is important for digital access (see below). The individual component needs disaggregation and a bit more explanation. First, socio-economic and demographic variables influence levels of accessibility. For example, a person who is too young to get a driver’s licence cannot drive a car (age), or a person with a very low income may not be able to afford to travel by car or public transport. Not being able to drive a car (frequently) influences access to destinations. Focusing on the importance of destinations: the accessibility of a university for education purposes (Ba, MSc, PhD) is generally only relevant for people between the age of 18–30.

Secondly attitudes, preferences and needs matter. People have preferences for specific activities and ways of travelling regardless of their socio-demographic characteristics ([Kitamura et al., 1997](#)).

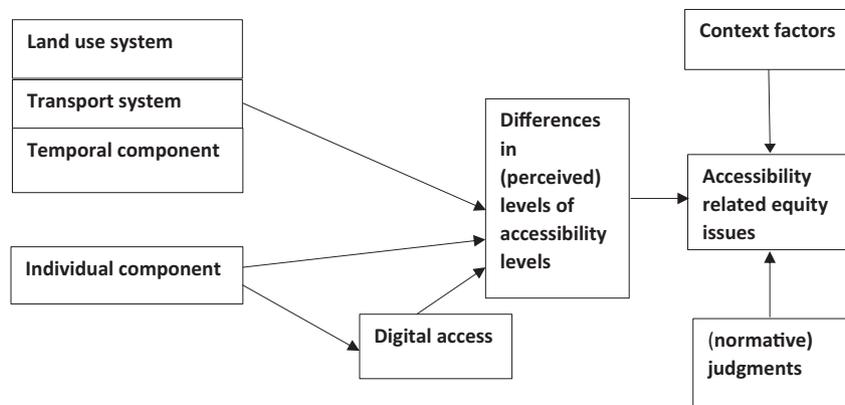
Thirdly, for a person’s level of accessibility and the question of whether a given low level of accessibility is problematic, person-specific flexibility and the ability to deal with options to substitute parts of a trip or a whole trip or activity pattern, as expressed by the concept of substitutability ([Van Wee et al., 2019](#)), are important. Flexibility is also

related to the concept of ‘option values’ (for example, [Geurs et al., 2006](#)), expressing that people add value to having options available even if they do not (yet) use them. A first type of flexibility concerns the residential location. If a person could easily change her residential location but does not do this, this is a sign that a low level of accessibility probably is not a big problem for her. Also destinations could be substituted. For example, for some people the religious standing of the primary or secondary school that their children go to may be a priority, whereas for others this is not important and they are flexible in that respect. Another form of flexibility concerns the way of travelling. If a person can easily switch between modes (car, bike, public transport, shared mobility options, in the future maybe MaaS or automated vehicles), a low level of accessibility by one specific mode is probably less problematic. Note that for levels of flexibility not only the individual characteristics matter, but also the other three components of accessibility.

Fourthly, peoples’ capabilities matter for their accessibility levels. The accessibility and equity literature increasingly recognizes that not only accessibility indicators matter, calculated from spatial and transport system data, but also the capabilities of people ([Sen, 2009](#); [Nussbaum, 2011](#); for applications in the transport domain see, for example, [Cao and Hickman, 2019](#); [Nahmias-Biran and Shiftan, 2020](#); for a review of the literature see [Vecchio and Martens, 2021](#)). As an extreme example, a person that is blind is not capable of driving a car or riding a bike, reducing access to destinations as a car driver or cyclist to zero.

Finally, people’s social networks matter because others may provide help to overcome barriers to reach activity locations (see [Dugundji et al., 2011](#) for a special issue on social interactions and transport). Maybe a person cannot travel to a shop or pharmacy, but a neighbour or relative can do the shopping for her. Or other people can drive her to the activity locations she needs or wants to go to. Social networks can also provide a reason for people to avoid changing their residential locations as discussed above, for example in case of a person who needs to take care of her old parents who live nearby. And social networks can even lead to a person avoiding leaving home for a (number of) day(s), for example because she needs to take care of persons nearby too frequently. It may be that the care is not needed, but being available is necessary. Extending social networks to family members and interactions between household members is relevant for several reasons, for example the availability of travel modes (for example as in case of a family owning one car – see [Kim et al., 2015](#)), but also because family members can do groceries or buy other goods.

In the case of these personal factors it is important to realize that these not only individually influence accessibility levels, they also interact. For example, capabilities do overlap with socio-demographic variables, as in the case of a person being too young to be a car driver. And the combination of socio-demographic variables and flexibility also influences capabilities. The person that is too young does not have the



**Fig. 1.** A conceptual model for accessibility and equity.

flexibility to switch from public transport or a bike to a car.

Now that the four components of accessibility have been explained it is important to realize that perceived accessibility matters. There could be differences between the levels of accessibility calculated based on spatial data and the characteristics of the transport system on the one hand, and accessibility as perceived by people on the other hand (Lättman et al., 2018; Pot et al., 2021). This can apply to all four components of accessibility. It could be that people are not aware of travel options or are not capable of dealing with them, are not aware of destination options (land use component), or of the time-of-day availability of options (for example opening hours of shops and services). People's awareness of these three components, as well as the relevance of having access to specific destinations, depends on individual characteristics (individual component). A discrepancy between accessibility as perceived by people and as calculated based on spatial data does not necessarily mean that people's perceptions have limitations. It may be that the perceptions of people more accurately express their accessibility levels than the calculated levels of accessibility (Pot et al., 2021). For example, a person may be aware of a supermarket being accessible, but the opening hours do not match that person's options for doing her shopping.

Now that accessibility has been discussed the next block that matters is digital access. Physical access can to some extent be complemented or substituted by digital (ICT-based) access, teleworking, e-shopping, e-learning and e-consults being examples – see Choo et al. (2005), Lavieri et al. (2018), Lee et al. (2017), Lyons and Davidson (2016), Shi et al., 2021 and Van Wee et al. (2013). The better the options for electronic accessibility being a substitute, the less the negative effect of a low level of physical access has. As explained above and conceptualized in Fig. 1, the extent to which digital access can be a substitute for physical access first of all depends on personal characteristics. Not all people are equally capable to handle, nor have equal access to, digital opportunities. Secondly context factors matter, for example the price of hardware and software, the quality of digital services (WIFI and others), and the options provided for digital access (teleworking, online shops, consults, family and friends being able to communicate online, ...), but for simplicity this is not made explicit in Fig. 1.

I now move to a new block of factors in Fig. 1: context factors. Above I made explicit that the available substitution options, together with the personal flexibility of people, matter because the combination of both leads to substitution options that a person can (not) make use of. In addition, the importance of reaching specific destinations / activity locations is context specific, at least partly due to cultural (including religious) factors. In countries where it is obligatory to vote in elections, access to voting locations is more important than in countries where people may choose whether to vote or not. So the context factor of 'being obliged to vote' influences the importance of access to locations where one can vote, and therefore also the question of whether there are related equity issues. Religion is also a (culture related) context factor. The importance of being able to visit a mosque, church or other religious building or event depends on the importance of the religion in the country, region or city/town, and can also change over time. Next, and especially for inequalities in levels of accessibility, the role of comparing one's level of accessibility with that of others could differ between cultures. In countries with a more egalitarian culture (like Scandinavian countries) differences between levels of accessibility could be more problematic than in countries with a less egalitarian culture. To generalize, accessibility can in some cases be a positional good (Van Wee, 2021): in the case of a positional good the utility of that good for a person depends on the distribution of that good over the population (Hirsch, 1977).

### 3. Research challenges

The model proposed leads to several challenges for future research. A first challenge would be to study accessibility and equity in a more

mature, comprehensive way, addressing large parts of the conceptual model, or even the full model. Estimating the full model quantitatively is probably not possible, but should be possible for parts of the model, structural equation modelling (SEM) being a candidate option to do this. Qualitative methods probably give more options to study the full model, interviews and Focus Group Meetings being options for this. Not only is studying accessibility and equity in a given situation following Fig. 1 of interest, so is the evolution over time, showing how equity aspects of accessibility could change depending on changes in for example context factors, perceived accessibility, and improved digital access.

Secondly, several ingredients of the model have only been studied in a limited way so far, providing avenues for future research. This relates to several personal factors, more specifically to 'attitudes / preferences / needs', 'flexibility in changes of residence, activities/destinations, travel options, ...', the 'level to which choices are made voluntary', and 'social networks'.

Thirdly, as explained above, interactions between personal factors also influence accessibility levels. But so far research has poorly addressed such interactions in the context of equity and accessibility, making this an interesting avenue for future research.

Fourthly, I recommend research studying the importance of context factors for equity and accessibility because so far these factors have been addressed in only a limited way. This relates at least to substitution options and cultural factors.

Fifthly, options to substitute physical to online accessibility have been discussed and addressed in several publications (for example, Lavieri et al., 2018; Lila and Anjaneyulu, 2016; Sajwani et al., 2015), but more research needs to be done focusing on questions like: which activities can be substituted by online activities, for whom, when and under which conditions? More importantly, the implications of the interactions between digital and physical access for equity analyses have been poorly addressed, although there are some studies in this area, often with a focus on education (for example, Chen et al., 2022; Cowin, 2020).

For the latter four topics both qualitative and quantitative methods could be utilised, as are often applied in travel behaviour and transport research, examples being interview, Focus Group Meetings, and surveys/questionnaires.

In addition, in line with Rawls (1971) who introduced the concept of primary social goods, arguing that not all goods are equally important for people, and following Van Wee and Geurs (2011) I argue that from an equity perspective not all destinations / activities are equally important. Access to groceries, schools, medical services, jobs and important social contacts is more important for people in general, and also from an equity perspective than being able to go on vacation to the South pole or very expensive concerts. Future research could reveal which activity destinations are more important for the well-being of people or groups of people. Discrete choice and ranking methods are a plausible way to study the importance of activity destinations for people. In addition it is an option to ask politicians for their priorities in this respect, and the comparison between preferences of people and of politicians is interesting in itself, because of the importance of normative judgments to come to conclusions about the occurrence of accessibility issues.

Finally, it seems plausible to assume that the heterogeneity of people is great regarding accessibility needs and access to different types of destinations by different modes. Unravelling this heterogeneity, as well as exploring options for aggregations, is a challenge. From a policy perspective such aggregations are unavoidable, especially when policy measures need to be ex ante evaluated to explore their potential to reduce accessibility issues. Aggregation unavoidably comes at the cost of a loss of information/insights, so it is important to find the 'right' aggregation balance.

#### 4. Concluding remarks

The proposed conceptual model includes the dominant factors relevant for equity and accessibility, but not all factors. More factors and relationships can be added. For example, the level of digital access can impact residential choice, at least for (tele)working (Mokhtarian et al., 2004). And normative judgments could also influence the transport and land use system via related policies. Cultural factors could influence normative judgments. So it is important to realize that the model is not 'complete', it aims only to conceptualize dominant relationships. Future revisions could therefore be desirable, depending on the evolution of factors and relationships relevant for accessibility and equity, and depending on the specific purpose of research or other applications of the model.

It is way easier to conceptualize all the dominant factors relevant for equity of accessibility than to accurately address them in empirical research. And it is very understandable that researchers do not include all factors in their empirical research. If so, the conceptual model can be helpful to make explicit what is (not) included, and researchers can discuss the importance of factors or relationships not included in their research.

The model also aims to be useful from a theoretical perspective. It can be helpful do disentangle which factors and relationships should (not) be included to come to moral judgments with respect to equity and accessibility. It can help to make explicit which factors to (not) include when considering and applying general ethical principles like sufficientarianism, egalitarianism, the capabilities approach, and maybe other principles (like utilitarianism) in the context of equity and accessibility – see, amongst others, Banister (2018), Martens (2016) and Van Wee (2011) for books in this area. How this could be done is beyond the scope of this paper.

For the question of whether a low level of accessibility is problematic, it is important to know whether people got into the position of low level accessibility voluntarily or not (Van Wee, 2011). If a person voluntarily moves to a remote residential location because she prefers to live in a rural area, even though it comes at the cost of a low level of accessibility, that low level of accessibility is probably not problematic, or at least it is balanced out by other amenities. And even if that person does not like her low level of accessibility it is questionable whether policy makers should introduce policy measures to improve accessibility for such persons. This could be the case, for example, for a new residential area in the countryside that aims to offer housing for non-local people. For someone who has always lived in a rural area and needs to support old parents and therefore cannot move to another place, it could be really problematic that shops, schools, medical services etc. have closed down and public transport services have been cut, leading to a low level of accessibility. These two examples are clear stereotypes, but in practice a choice being voluntary or not is not a 0–1 variable, it is more a gradual concept. Take the first example introduced above. This person moved to a rural area voluntarily. However, if after her move the local shops and medical services close down and house prices went up in candidate towns and cities to move to, a change in residential location might become impossible for her, making her locked into her situation. Her original choice was a voluntary choice, but living in that area is then not a voluntary choice anymore.

#### Author statement

Bert van Wee: all work.

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