

New understanding of mobility paves way for tomorrow's transport systems

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In recent years, big data sets from mobile phones have been used to provide increasingly accurate analyses of how we all move between home, work and leisure, holidays and everything else. The strength of

basing analyses on mobile phone data is that they provide accurate data on when, how, and how far each individual moves without any particular focus on whether they are passing geographical boundaries along the way—we simply move from one coordinate to another in a system of longitude and latitude.

"The problem with existing big data models however is that they do not capture what geographical structures such as neighborhoods, towns, cities, regions, countries etc. mean for our mobility. This makes it difficult, for example, to generate good models for future mobility. And it is insights of this kind we need when new forms of transport crop up, or when urbanization takes hold," explains Sune Lehmann, professor at DTU and at the University of Copenhagen.

In fact, the big data approach to modeling location data has erased the usual dimensions that characterize geographical areas and their significance for our daily journeys and patterns of movement. In mobility research, these are known as scales.

"Within mobility research, things are sometimes presented as if scale does not come into the equation. At the same time, however, common sense tells us that there have to be typical trips or patterns of movement, which are determined by geography. Intuitively it seems wrong that you cannot see, for example, that a neighborhood or urban zone has a typical area. A neighborhood is a place where you can go down and pick up a pizza or buy a bag of sweets. It doesn't make sense to have a neighborhood the size of a small country. Geography must play a role. It's a bit of a paradox," says Laura Alessandretti, Assistant Professor at DTU and University of Copenhagen.

Finds new, natural, and flexible geographical boundaries

The authors of a paper published in *Nature* have therefore developed a new mathematical model that defines new geographical scales from mobile tracking data, and which in this way brings the geography—the usual sizes and length —back to our understanding of mobility.

The model uses anonymized mobile data from more than 700,000 individuals worldwide and identifies scales—neighborhoods, towns, cities, regions, countries—for each person based on their movement data.

"And if you look at the results, it's clear that distance plays a role in our patterns of movement, but that when it comes to travel there are typical distances and choices that correspond to geographical boundaries—only it's not the same boundaries you can find on a map. And to make it all a bit more complex, 'our geographical areas' also change depending on who we are. If you live on the boundary between city districts, your neighborhood is located with, for example, a center where you live and includes parts of both city districts. Our model also shows that who we are plays a role. The size of a neighborhood varies depending on whether you are male, female, young, or old. Whether you live in the city or the countryside, or whether you live in Saudi Arabia or the UK," explains Sune Lehmann.

Important for the green transition and combating epidemics

The new model provides a more nuanced and accurate picture of how we move around in different situations and, not least, it makes it possible to predict mobility in relation to geographical developments in general. This has implications for some of society's most important decisions:

"Better models of mobility are important. For example, in traffic

planning, in the transport sector, and in the fight against epidemics. We can save millions of tons of CO₂, billions of dollars and many lives by using the most precise models when planning the society of the future," says Ulf Aslak Jensen, Post Doc at DTU and Copenhagen University

Fact box: The borders move depending on who you are

In the article, the researchers use i.a. the [model](#) to study mobility differences in different population groups in 53 countries. Among other things, they find that:

- Women in 21 of the 53 countries surveyed daily switch between more geographical levels than men
- Women move within smaller distances than men
- The local areas of the rural population are larger than those of the urban population.

More information: Laura Alessandretti et al, The scales of human mobility, *Nature* (2020). [DOI: 10.1038/s41586-020-2909-1](https://doi.org/10.1038/s41586-020-2909-1)

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