Are big-city transportation systems too complex for human minds?

February 19 2016

Credit: Scott Meltzer/public domain

Many of us know the feeling of standing in front of a subway map in a strange city, baffled by the multi-coloured web staring back at us and seemingly unable to plot a route from point A to point B.

Now, a team of physicists and mathematicians has attempted to quantify this confusion and find out whether there is a point at which navigating a route through a complex urban transport system exceeds our cognitive limits.

After analysing the world's 15 largest metropolitan transport networks, the researchers estimated that the information limit for planning a trip is around 8 bits. (A 'bit' is a binary digit - the most basic unit of information.)

Additionally, similar to the "Dunbar number", which estimates a limit to the size of an individual's friendship circle, this cognitive limit for transportation suggests that maps should not consist of more than 250 connection points to be easily readable.

Using journeys with exactly two connections as their basis (that is, visiting four stations in total), the researchers found that navigating transport networks in major cities - including London - can come perilously close to exceeding humans' cognitive powers.

And when further interchanges or other modes of transport - such as buses or trams - are added to the mix, the complexity of networks can rise well above the 8-bit threshold. The researchers demonstrated this using the multimodal transportation networks from New York City, Tokyo, and Paris.

Mason Porter, Professor of Nonlinear and Complex Systems in the Mathematical Institute at the University of Oxford, said: "Human cognitive capacity is limited, and cities and their transportation networks have grown to the point where they have reached a level of complexity that is beyond human processing capability to navigate around them. In particular, the search for a simplest path becomes inefficient when multiple modes of transport are involved and when a transportation

system has too many interconnections."

Professor Porter added: "There are so many distractions on these transport maps that it becomes like a game of Where's Waldo? [Where's Wally?]

"Put simply, the maps we currently have need to be rethought and redesigned in many cases. Journey-planner apps of course help, but the maps themselves need to be redesigned.

"We hope that our paper will encourage more experimental investigations on cognitive limits in navigation in cities."

More information: Lost in transportation: Information measures and cognitive limits in multilayer navigation, *Science Advances*, dx.doi.org/10.1126/sciadv.1500445

Provided by University of Oxford

Citation: Are big-city transportation systems too complex for human minds? (2016, February 19) retrieved 26 April 2024 from https://phys.org/news/2016-02-big-city-complex-human-minds.html