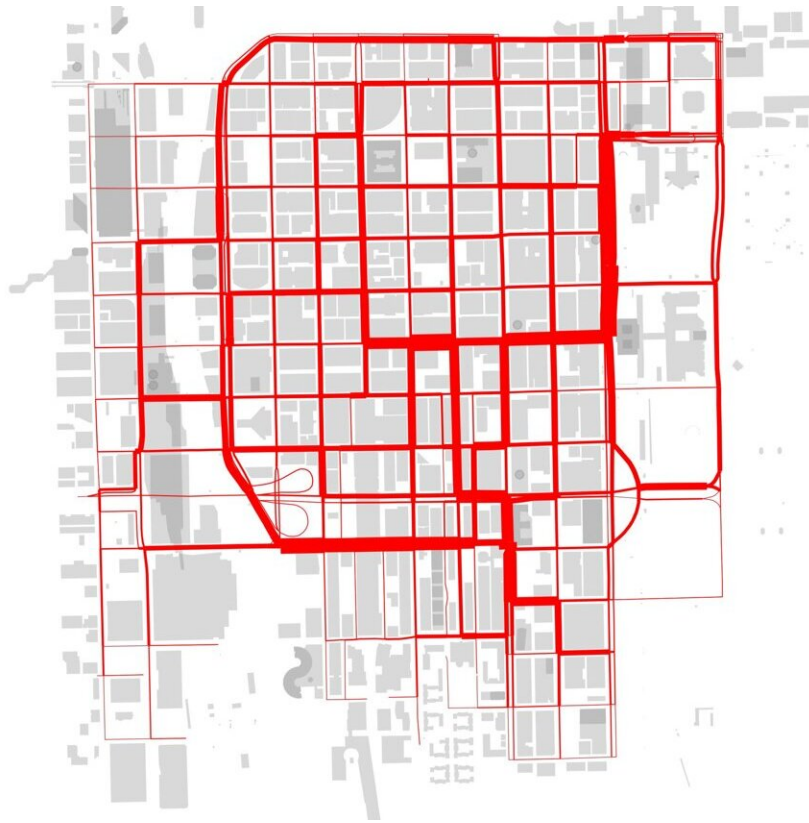


Growing up in rural or suburban areas improves spatial navigation

March 30 2022



This image showing 1000 random trajectories in Chicago (griddy city). Credit: Created by Ed Manley

People who grew up in rural or suburban areas have better spatial navigation skills than those raised in cities, particularly cities with grid-

pattern streets, finds a new study led by researchers at UCL, University of Lyon and the University of East Anglia (UEA).

The researchers also found that people whose home cities had grid layouts were slightly better at navigating similarly organized street patterns, despite having poorer performance overall, as early childhood environments influence not only navigation ability, but navigation styles as well.

The study, published in *Nature*, involved nearly 400,000 participants from 38 countries who played the Sea Hero Quest [mobile game](#), a citizen science venture designed for [neuroscience research](#), created by Deutsche Telekom in partnership with Alzheimer's Research UK, UCL, UEA and game developers Glitchers.

Lead researcher Professor Hugo Spiers (UCL Psychology & Language Sciences) said: "We found that growing up outside of cities appears to be good for the development of navigational abilities, and this seems to be influenced by the lack of complexity of many street networks in cities.

"In our recent research, we have found that people's spatial navigation skills decline with age, starting in early adulthood. Here, we found that people who grew up in areas with gridded streets can have comparable navigation skills to people five years their senior from [rural areas](#), and in some areas the difference was even greater."

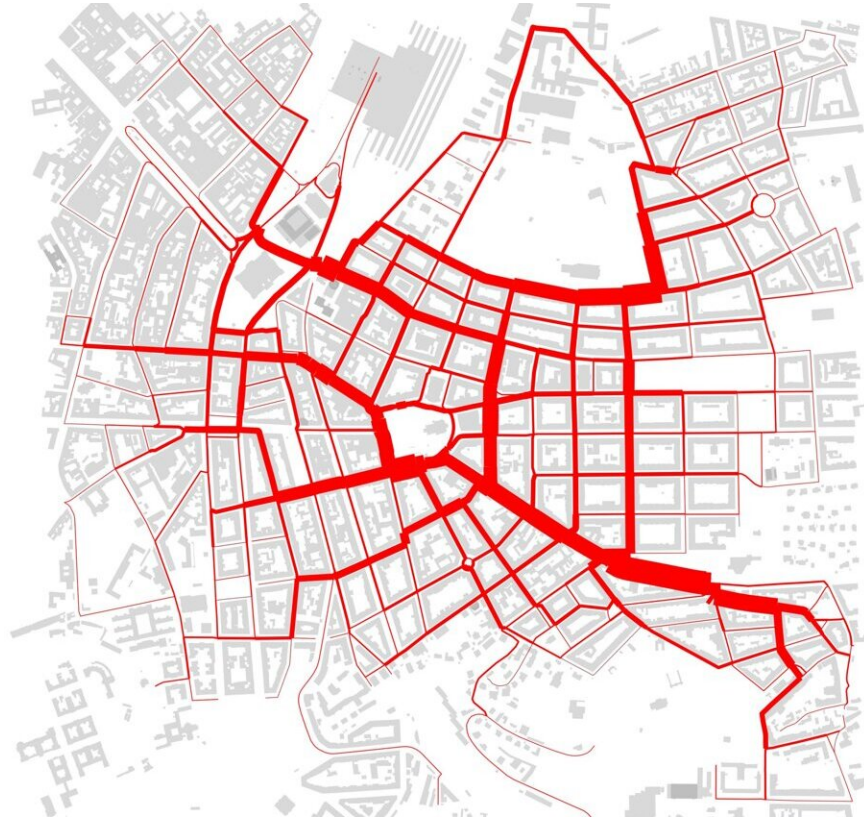
For the study, people played a game featuring a wayfinding task, requiring them to navigate a boat through a [virtual environment](#) to find checkpoints shown on a map.

The researchers found that where people grew up influenced their performance in the game, after controlling for confounding effects of age, gender and [education levels](#), while their current place of residence

did not affect their scores.

The researchers compared the home cities of the study participants by analyzing the entropy (disorder) of the street networks, to gauge the complexity and randomness of the layouts. People whose hometowns had lower entropy—ordered grid layouts like in Chicago or New York—were worse at completing the wayfinding task. Those from cities with organic, less ordered street layouts, like Prague, performed only slightly worse than those from rural areas.

To test if people from cities could more effectively navigate environments comparable to where they grew up, the researchers developed a [city](#)-themed version of Sea Hero Quest, called City Hero Quest, requiring participants to drive around city streets in a virtual environment that varied from simple grids to more winding street layouts. People who grew up in cities with grid layouts were slightly better at navigating similar environments, although the difference was not as great as their inferior performance in Sea Hero Quest.



This image showing 1000 random trajectories in Prague (more entropic city).
Credit: Created by Ed Manley

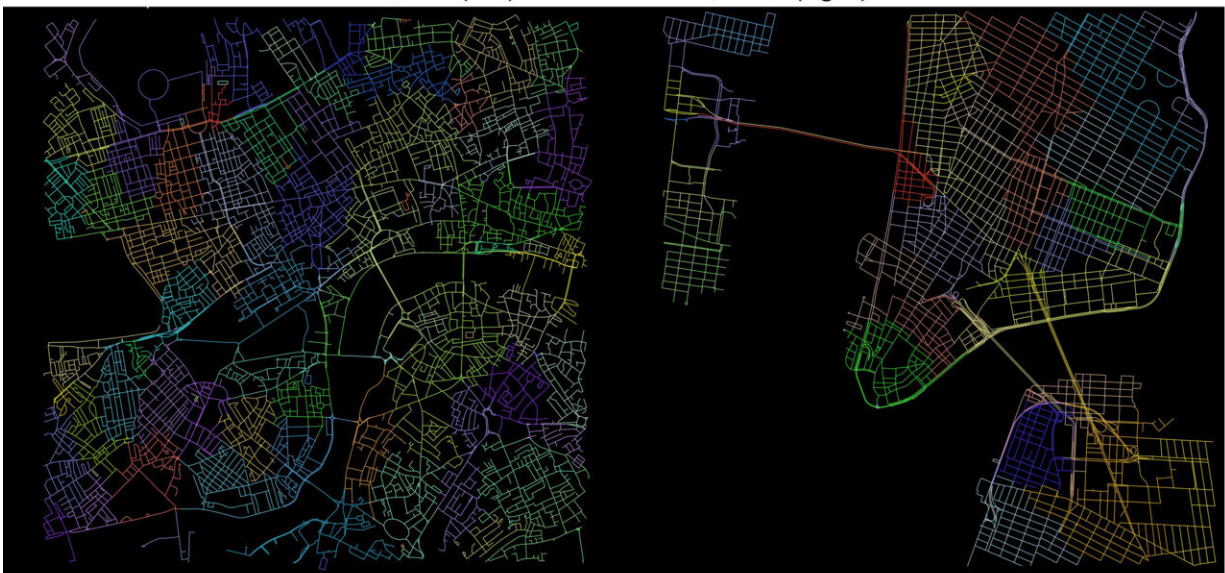
Co-lead author Dr. Antoine Coutrot (CNRS, University of Lyon) said:
"Growing up somewhere with a more complex layout of roads or paths might help with navigational skills as it requires keeping track of direction when you're more likely to be making multiple turns at different angles, while you might also need to remember more streets and landmarks for each journey."

The Sea Hero Quest project was designed to aid Alzheimer's research, by shedding light on differences in spatial navigational abilities. Over four million people have played the game, contributing to numerous studies across the project as a whole.

Joint senior author Professor Michael Hornberger, a dementia researcher at UEA, said: "Spatial navigation deficits are a key Alzheimer's symptom in the early stages of the disease. We are seeking to use the knowledge we have gained from Sea Hero Quest to develop better disease monitoring tools, such as for diagnostics or to track drug trial outcomes. Establishing how good you would expect someone's navigational to be based on characteristics such as age, education, and where they grew up, is essential to test for signs of decline."

The scientists are continuing their research into predictors of navigational ability, including how sleep impacts navigation skill in different countries and across the lifespan.

a - Road Networks of London, UK (left) and New York, USA (right)



b - Road Networks of major cities in Argentina (top) and Romania (bottom)



This image (extended data figure 5) showing the street networks of different griddy and entropic cities. Credit: Created by Antoine Coutrot and Ed Manley

Dr. Susan Kohlhaas, Director of Research from Alzheimer's Research UK said: "Thanks to the amazing response to Sea Hero Quest, the team have now been able to collect data from over four million players equating to nearly 2,000 hours' worth of lab-based research. If we're to understand dementia it's vital that we have participation from as many people as possible with [diverse backgrounds](#) and experiences and this study demonstrates why that's important.

"In this study, researchers found that spatial navigation is different in those with a rural background but we cannot conclude that living in a rural area will help guard against dementia. Dementia risk is a complex mix of age, genetics and lifestyle and where we live has a number of impacts on our health.

"Further research will be needed to unravel this complex mix of risk factors, however, Sea Hero Quest is an amazing example of how mass participation in research can help scientists get us one step closer to breakthroughs."

Wolfgang Kampbartold at Deutsche Telekom AG said: "Sea Hero Quest is a key example of digital optimism in action—demonstrating the potential of innovative cross sector partnerships, connectivity and big data to tangibly impact global societal issues."

More information: Antoine Coutrot, Entropy of city street networks linked to future spatial navigation ability, *Nature* (2022). [DOI: 10.1038/s41586-022-04486-7](https://doi.org/10.1038/s41586-022-04486-7).
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