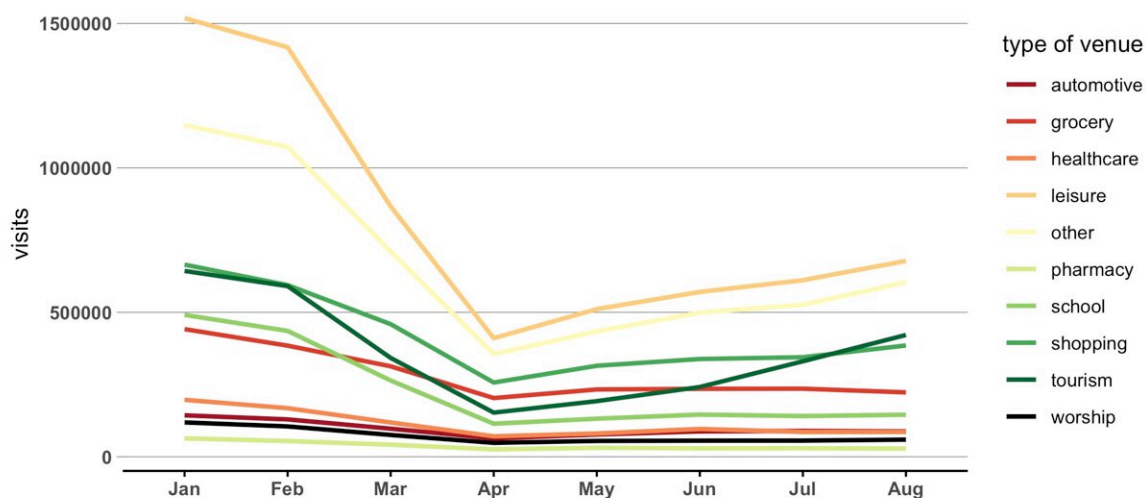


How has COVID-19 changed 'superstar cities?'

May 11 2021, by Erica K. Brockmeier



Aggregated visits by industry type. Stay-at-home orders reduced visits to all industries overall last spring, and some venues, such as leisure (which includes restaurants and bars) remaining well below their pre-pandemic levels as of late last year. Credit: Andrew Renninger and Ken Steif

Just over a year since the pandemic led to shut-downs and stay-at-home orders across the world, the rollout of vaccines and gradual reopening of long-shuttered parts of the economy have many wondering when life will return to a pre-pandemic normal. But amidst the numerous changes this

past year to how people work, shop, travel, and go about their day-to-day routines, how close is society to getting back to the way things were before COVID-19?

In an analysis presented at the GISRUK conference, geospatial researcher Andrew Renninger found that overall mobility in [large cities](#) in the United States has yet to return to pre-pandemic levels. Using tools from geographic information system (GIS) analysis and data science, this study also found that some of these cities are experiencing changing segregation patterns, with potential implications on the structure of metropolitan areas that could last well beyond the pandemic.

Renninger is a senior research coordinator at the Wharton Geospatial Initiative, a team that helps researchers in economics, business, and [real estate](#) incorporate spatial analysis into their work. He is also working towards a degree in the Master's of Urban Spatial Analytics (MUSA) program in the Stuart Weitzman School of Design and the Penn Institute for Urban Research and is studying the impacts of COVID-19 on mobility with Ken Steif, MUSA program director and associate professor of practice.

In March of 2020, SafeGraph reached out to the Wharton GIS Lab with an interest in understanding the impact of the pandemic on mobility and provided Renninger and his team with a massive dataset of mobile phone counts. Renninger decided to focus his analysis on "superstar cities," a term coined by economists in a 2006 paper for cities with high real estate demand and inelastic supply that leads to rising housing prices relative to median income, with examples in the U.S. including San Francisco, Seattle, and New York.

"There's a huge debate raging in terms of if these expensive cities will ever get back to their 2019 baseline or if people will flee for good," says Renninger. "What we want to look at is whether the pandemic is going to

change these big cities forever or will they bounce back, which is why we're looking at big cities in particular."

Starting last spring, Renninger began to analyze millions of individual smartphones at different locations. Using this dataset, Renninger can study movements between an individual's point of origin and destination to see if there were any changes to mobility networks across time and space in 100 of the largest cities in the U.S.

One of the things that immediately stands out to Renninger is how "night and day" mobility still is in large U.S. cities. In Philadelphia specifically, leisure industries, such as restaurants and bars, are still experiencing greatly reduced footfall from January of last year, and the Center City area of Philadelphia has seen more than a 70% reduction in traffic from its typical peak. "The data tell a stark story of how little we are doing compared to before the pandemic," he says. "The visuals show a huge drop, and it probably will take a long time for things to get back to normal."

In addition to this general and continued reduction in movement, Renninger's analysis showed an increase in segregation in cities like San Francisco and New York. In these cities, there was an increase in community homogeneity, with people less likely to interact with neighborhoods that differ from their own. Renninger also found that degree centrality, or how many other neighborhoods a person visits outside their own, and network density, or how connections between neighborhoods became sparser or denser, both decreased dramatically during the pandemic and have yet to return to pre-pandemic levels.

"As visits declined, neighborhoods realigned," says Renninger. "People are going to fewer new neighborhoods, and the consequence is that people are less likely to interact with people from other races, so we've become more segregated. That has profound consequences in terms of

the purpose of a [city](#), and it's a big deal if people don't interact with each other."

This analysis and the methods developed by Renninger to obtain insights from this complex dataset have potential implications for city planners and officials who will need to understand the way that large cities might be changing because of COVID-19. This could include shifting transportation needs, better access to green space, and providing more decentralized amenities such as restaurants and gathering spaces if downtowns fundamentally change post-pandemic.

Continued monitoring of mobility patterns will also be crucial to understand, track, and test hypotheses around how cities might be changing moving forward, Renninger says. "The task for the next year will be to keep monitoring if people are going back to what they were doing or if there's going to be a drift, and this data really calls to that," he says.

More information: The Pandemic and Changing Patterns of Segregation in America. [DOI: 10.5281/zenodo.4669958](https://doi.org/10.5281/zenodo.4669958)

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