Mapping Pedestrian Behavior With Wi-Fi

Wireless access points can track the daily walking routes of crowds, allowing urban planners to build for better flow.

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A sign advertises wi-fi service in the Times Square subway station in New York. (Reuters/Brendan McDermid)

Every time you go online, you leave behind a digital trail. Even if you’re not consciously connecting to the internet, having a smartphone while passing through the many wi-fi networks out there means your daily route can easily be tracked. This detailed look at human mobility, as CityLab’s Laura Bliss previously reported, can give all sorts of valuable information to private companies—sometimes at the expense of consumers’ privacy and security.

But all that readily available data can also be used for the public good, argues Antonin Danalet, a mobility researcher at the École Polytechnique Fédérale de Lausanne in Switzerland. In particular, it can help urban planners design better train stations, hospitals, or even entire cities. “We are surrounded by wi-fi access points, [so] can we use them to know something about pedestrian behavior?,” he says. “It would be cheap and we don’t need to install anything.”

For his doctoral thesis, Danalet decided to put his thinking to the test. He reconstructed the routes of roughly 2,000 people using the school’s 789 wi-fi
access points. (He maintained the subjects' anonymity by classifying them only as either a student or staff.) He then combined those with data about the campus layout, purchases made at 21 restaurants on campus, and class schedules.

The results gave him a detailed look at pedestrian behavior. For example, by studying where students chose to eat, Danalet learned that the type of food wasn’t as big of an influence on choice as the price of the food, the restaurant’s proximity to the student, and the size of the restaurant. (The thinking: The larger the space, the faster the lines will move.)

“We can’t say anything about pedestrian walking behavior because its not precise enough,” Danalet tells CityLab. “But you can say a lot about stops, how people choose their activities and destinations.”

Wi-fi testing of this sort can help planners figure out the best ways to distribute devices and staff at a crowded hospital, or to better direct the flow of people at music festivals.

It could also help Swiss Federal Railways (SBB), which introduced free wi-fi at 100 of its stations between 2013 and 2015. With the number of regular passengers expected to nearly double on certain lines by 2030, SBB plans to expand at least one of its stations by then. "It’s a billion-dollar project, so you would like to know more about how people move inside so that the billion dollars you’re investing will [be used efficiently],” says Danalet, who says part of his funding as a teaching and research assistant came from SBB.

Analyzing wi-fi access points inside a station can tell designers where to place ticket machines, shops, and cafes to corral foot traffic. "You have some hot spots where you have congestion and other places where it might be more empty," he says. "So you would want to put something that is not necessarily needed in the [latter] area."

As Danalet puts it, “To understand the behavior of people moving, you need to understand the motivation of their trips, and why they want to go where they go.”