



Inspiring Better Cities.

The New Cartographers

How a Mapping Renaissance Is Changing the Way We See Cities

STORY BY **Joanna Mikulski** PUBLISHED ON **Oct 13, 2014** SPONSORSHIP POLICY

In 2013, [Chris Whong](#), a self-proclaimed “urbanist, mapmaker and data junkie,” sifted through the data on 170 million yellow cab trips in New York City. From these, he selected 30 taxis, and created a [hypnotic visualization](#) that recorded the activity of each of those cabs as they roamed the city for 24 hours. It was an exercise “to see how and when taxis move around New York,” and an example of how modern cartographers are using data to spark a mapping renaissance that’s changing the way we interact with our cities.

There has never been more open data available than at this moment in time, and everyone from global NGOs to armchair hobbyists are using that data to create maps. In the developing world, where many cities still have large swathes of uncharted territory, broad efforts are underway to map those cities’ streets, neighborhoods and systems. And in the West, new mapping ventures seek to demystify the way the city works, from tracking health outcomes by neighborhood in Chicago to pinpointing street hazards block by block in New York.

Platforms like [OpenStreetMap](#), a free and open map of the world that’s celebrating its 10th anniversary this year, have made much of this work possible. OpenStreetMap’s community of enthusiasts, GIS professionals, engineers and humanitarians use aerial imagery, GPS devices, manual surveys and good old-fashioned pencil and paper to map non-proprietary data on practically anything: roads, hospitals, schools, barbecue spots in Austin, obscure museums on the Jersey Shore, kid-friendly sights in Pittsburgh. After mappers collected data that proved critical to responding to the 2010 earthquake in Haiti, even huge institutions like the World Bank started to incorporate OpenStreetMap into their disaster risk-reduction efforts.

This kind of open mapping has a way of inspiring change. “When you have facts, it anchors the

discussion,” said Mikel Maron, a co-founder of the [Map Kibera](#) project, an ongoing initiative to map the slums of Nairobi. City officials are embracing that, as they discover that the data collected by residents is helpful in solving persistent problems like traffic congestion and crime. In New York, Memphis and Miami, residents are using a map to locate where drivers frequently speed or fail to yield, and to offer ideas on how to strengthen neighborhoods and how to improve public spaces.

“When you build a map, people think you own that entity,” said Sarah Williams, a researcher at the Massachusetts Institute of Technology who helped lead [Digital Matatus](#), a project that mapped informal bus routes in Kenya.

Detailed and accurate maps are so fundamental to sound urban planning, so essential to making smart decisions about where to build the next library, clinic or bus station, that it’s hard to believe how often they don’t exist. In this story, we present five examples of how a growing community of activists, developers, youth, government officials and others is helping cities around the world see what’s really there by mapping it — and allowing them to tackle new urban challenges along the way.

Youth Mapping in Rio de Janeiro: Why Kids Can See What Grown-Ups Can’t

Maps often tell only part of the story. Sometimes neglected swathes of the city are missing from official records altogether, and even if they can be found on a map, they’re deceptively rendered. Neighborhoods with few city services are drawn just like wealthy neighborhoods with lots of amenities. And maps almost never show what people in the community — particularly the poor, the disadvantaged or the young — really care about.

In recent years, projects like Map Kibera have shown how collaborative mapping can bring attention to neglected neighborhoods. Using OpenStreetMap, an open-source mapping platform increasingly popular for these sorts of projects, Map Kibera allowed residents of that Nairobi slum to collect key information about their community, including the locations of facilities like hospitals, water-collection points and gender-based violence support centers. It’s helped support efforts to monitor and keep the peace during elections and fostered the growth of a strong [citizen journalism community](#).

Luciana Phebo, chief of the UNICEF office in Rio de Janeiro, is hoping the [Voices of Youth Maps](#) project can replicate some of that magic. She thinks that youth can be particularly good at catalyzing change where they live. “Children can see what adults aren’t seeing anymore,” she said. They’re not yet numb to their communities’ problems. “They feel uncomfortable with things that adults are comfortable with.”

So starting in 2011, UNICEF partnered with local non-profit Centro de Promoção de Saúde, or the Center for Health Promotion (CEDAPS), to engage youth in the favelas of Rio de Janeiro. The program tasked the youth with mapping environmental and safety hazards in their communities, harnessing their un-jaded perspectives to pick up on things the adults had started seeing right through. The Voices of Youth Maps project began in 10 communities, all of which were vulnerable to disasters — one had suffered a landslide the year before that killed several people.

“These kinds of places are often not on the map of the city,” said Phebo.

The program trained 250 youth as mappers — 10 in each of 25 communities — who identified a range of hazards like faulty stairs, sanitation problems and garbage accumulations. The youth used an Android application built by UNICEF and [InSTEDD iLab](#), a non-profit that develops open technologies to support services for vulnerable populations, to track locations while they walked through their neighborhoods. Kites with cameras attached created by [Public Lab](#), a non-profit that develops open-source tools for environmental exploration and investigation, were used for aerial mapping. And a grant from the John S. and James L. Knight foundation allowed UNICEF to work with InSTEDD and the [MIT Mobile Experience Lab](#) to deepen the information on the map by developing a way to rank hazards according to urgency. (Disclosure: Next City receives funding from the Knight Foundation).

With the maps in hand and the hazards identified, the project then broadened its scope to include more youth in the community, asking them to review the maps and discuss what the data revealed to them. From there, these youth developed an action plan to take to the government. The youth in an area of the city called Morro dos Prazeres, for instance, identified a day care center with 200 children located in an unstable area at high risk for landslides. They presented the issue to the city’s Civil Defense Secretariat, and three months later, the agency built a safety wall. Youth mobilized the same community to deal with a growing trash pile, and out of that grew a new recycling business.

Despite these success stories, change often doesn’t happen as quickly as everyone hopes. Ives Rocha, a monitoring and evaluation manager at CEDAPS, noted that three months is a very quick response time from the perspective of the government, but for people who live with the risk everyday, it can seem like an eternity.

“It’s a long way to the power for kids who want results right now and right here,” said Rocha.

Phebo views the mapping and planning process as a way to cultivate a sense of citizenship in the youth who participate. Through the mapping, kids “start knowing the place where you live,” said Phebo. “You develop a sense of belonging.” And both Phebo and Rocha believe that the maps have played an important role in helping inspire action by the city government, particularly in places like Morro dos Prazeres.

“When you have a map, it’s something concrete to show,” said Phebo. It makes it more difficult for local agencies to ignore what’s going on.

In the end, however, it’s often hard to know what impact a mapping project really had. Getting the data is just the first step in a long process to bring more resources and attention to marginalized communities, and the relationship between the government and the mapping projects is often complicated.

But this may be improving. Mikel Maron, a co-founder of the Map Kibera project and [Ground Truth Initiative](#), said that even though that initiative is often portrayed in the media as running counter to the authorities, he’s seen a change in how the local government has viewed their work over time.

“It takes a long time for governments to develop,” said Maron. But after a certain amount of time, relationships build. Local officials realize they need more information to engage with the community. Today, with the support of the Gates Foundation and the approval of local education officials, Map Kibera is working to locate and map information on all educational facilities in the region.

For UNICEF, the Voices of Youth Maps project is just one effort among many to empower and advocate for poor youth in the community. It’s looking to expand its efforts in Brazil by bringing the mapping project to schools through a partnership with the Ministry of Education. The organization has also deployed the technology in other countries, including Haiti, Madagascar and Bhutan.

“We want to transform this into public policy,” said Phebo.

New York City Vision Zero: Eyes on the Street, Block by Block

One of the consequences of being America’s most pedestrian-oriented city is that cars mow down those pedestrians at a rate that boggles the mind. Every year, more than 250 people — more than half are pedestrians — die in traffic collisions in New York City, and public pressure has mounted in recent years to bring that number down.

Mayor Bill de Blasio wants to bring it down, too — to approximately zero. This spring, he announced how he intends to accomplish that feat: through an initiative called [Vision Zero](#). The effort borrows its name and approach from Sweden, which views all traffic collisions as inherently preventable. To succeed, however, New York needs to know where those collisions are most likely to occur.

The New York City Department of Transportation has stats on crashes, of course. The missing component was eyes on the street — a five-borough citizen army reporting how drivers and pedestrians actually behave.

So between May and July, the transportation agency invited the public to provide input on traffic hazards in their neighborhoods through an online interactive map. The agency used [Shareabouts](#), an online tool developed by [OpenPlans](#), to collect more than 10,000 responses. Another 2,000 comments were submitted during more traditional public meetings.

For the city, the online map has become invaluable. Officials view it as a way to get deeper, street-level public input, adding nuance and context to traditional top-down data collection. “Basically, [the data] is going to tell a story about how residents in each borough feel about their streets,” said Ryan Russo, assistant commissioner for traffic and planning. “What issues are more important than others? Speeding traffic versus turning vehicles or failing to yield?”

The agency is currently analyzing the data collected through the online map and the public meetings with the aim of completing borough action plans by the end of the year. But already, the initial review is providing insights about the different boroughs’ streets. For instance, a quarter of the responses in Queens and Staten Island had to do with speeding, compared to only 13 percent of Manhattan’s. And residents in the Bronx were more likely to complain about the width of their streets than residents of Brooklyn.

Even a cursory glance at the map should get a lot of New Yorkers nodding their heads. In Chinatown, where shops take deliveries at all hours, double parking is rife. Waiting for the walk signal on the West Side Highway takes roughly forever. And still other findings seem to beg the kind of debate New Yorkers love: Are all the jaywalking reports in the West Village a result of the neighborhood’s easy-to-

dash-across streets, or a, shall we say, refined population that likes things tidy and orderly?

The DOT is comparing the public comments to its own data on traffic crashes, and so far, it's seen a match between the complaints people are making and what the department's data reveals. Overall, the most common complaints were about speeding and failure to yield — a result consistent with the Mayor's campaign to address those issues. The data will also be used to kick off the conversations DOT has with local communities as it develops street improvement projects. "We're trying to marry an input-driven process to a data-driven process," said Russo.

As it did with the Vision Zero initiative, OpenPlans has collaborated with cities to develop software tools that allow them to gather public input in a way that meets their needs. New York has also used the tool to ask citizens how to spend \$1 million, Chicago has employed it to identify where to place new bike racks, and Miami used it to gather ideas for how the city could improve public spaces. Everything that OpenPlans builds is open-source and freely available for communities to use without their assistance, assuming that the locality has the technical capability to do so.

For Frank Hebbert, the director of OpenPlans, these initiatives show how urban planning is becoming more dynamic and participatory. "Responsiveness was impossible until a few years ago," he said.

But even with these tools, Hebbert acknowledged, many cities still have a hard time closing the loop on participation. Capacity and access continue to be major challenges. He said that some neighborhoods have what he called a "planning proficiency gap" — they haven't gotten engaged in the planning process before to improve their neighborhood, so they don't understand why they should get involved now.

"People are extremely rational with time allocation," said Hebbert. "The challenge with these tools is to show why getting involved matters."

In still other cities, government officials resist using such tools because they fear opening a Pandora's box of citizen complaints that then, God forbid, need to be dealt with. For Russo, that's not a problem. "We don't mind having a public that will provide input and improve the streets," he said, noting that New York has had time to figure out how to deal with large volumes of resident complaints and feedback through its 311 system.

To deal with accessibility, OpenPlans is exploring how to make its tools more intuitive. One way it's doing that is by incorporating Google Street View into the tool, a feature more people are familiar with.

"For people who spend all day working with maps, maps are a very natural way to look at the world," said Hebbert. "But that's not universal."

The Open Cities Project: Kathmandu's Search for 100,000 Buildings

In 1934, Kathmandu was hit by a catastrophic earthquake that killed more than 4,000 people. Virtually

every standing structure in the city was reduced to rubble. Since that time, the Nepalese capital has become one of the fastest growing cities in South Asia, its population **ballooning** from 1.6 million in 2001 to 2.5 million today. If a comparably sized quake were to hit Kathmandu now — a distinct possibility, as **scientists estimate** earthquakes of that strength occur roughly every 80 years in the region — up to a quarter-million people could be killed.

Whether that catastrophe happens depends largely on how well the city prepares. The problem is, urban data in Kathmandu has historically been pretty scant, and without hard data, it's hard to even determine which structures the city needs to fortify. "If the World Bank is going to invest hundreds of millions into a retrofitting project [for earthquakes], we need this data," said Robert Soden, a consultant with the World Bank's Global Facility for Disaster Risk Reduction.

In part because of this, in 2012, Kathmandu became the pilot site for the **Open Cities** project, a World Bank initiative to create, manage and use open data to support urban planning and disaster risk reduction in South Asian cities. By using open data and mapping technologies, the World Bank and its partners — including **Humanitarian OpenStreetMap Team**, **Development Seed** and **USAID** — hoped to redesign the typical disaster risk assessment process so that it leads to a better response and engages a much broader segment of the community.

"So often in these projects, you bring in a GIS consultant who brings in the data," said Soden. "Then the data just dies on somebody's hard drive," rather than reaching the government officials, community leaders and entrepreneurs who could use it.

The team in Kathmandu wanted to see if they could fix that. Nama Budhathoki, a Nepalese expert in crowdsourced mapping projects, was tapped to help lead a core team of about a dozen mappers, who then trained more than 2,000 local volunteers to use OpenStreetMap. Over the course of eight to nine

months, they mapped every educational and health facility in the Kathmandu Valley. Today, there are more than 100,000 buildings mapped in the region. The mappers didn't just collect location data, but also a range of information about each structure — building material, wall type, number of stories — that would help determine whether it would stay standing during an earthquake.

The World Bank's funding for the data collection effort has now ended; it's now working with the government on a disaster risk-reduction assessment using the data. Soden said that that assessment would be completed in the "medium term," but a specific timeline for completion is not yet set.

The project was designed to live on after the World Bank's support ended, and Budhathoki is now the head of "Kathmandu Living Labs": <http://www.kathmandulivinglabs.org/>, an organization that champions the use of open data, open maps and open-source applications to support urban resilience and civic engagement in Nepal. The group now wants to expand the breadth and depth of what's available on OpenStreetMap for Kathmandu and the rest of the country.

It's also developing applications that demonstrate the data's many potential uses. For instance, to help residents or tourists deal with dishonest taxi drivers, Kathmandu Living Labs built an Android application that passengers can use to determine the correct fare according to government regulations.

"This open data movement is an attempt to transform society," said Budhathoki. "We're very optimistic in the next couple of years that we'll be able to expand to all of the country and prove that [OpenStreetMap] is an important part of the infrastructure, particularly for developing countries."

There are obstacles to making that vision a reality, though, not least of which is navigating the endless maze that is the Kathmandu Valley government, a crazy quilt of three districts, five municipalities and more than 130 wards. Simply finding the people who can help put the data to use is a major hurdle. Despite the logistical challenge, however, Budhathoki says partnerships are emerging.

"Government here is still very traditional, like government all over the world," he said. "But we're trying to sensitize them... show them that citizens are tracking data every day, and it allows citizens to interact with the government in a way that was never imagined before."

Kathmandu Living Labs also needs to figure out how to fund its work moving forward. Even volunteer mappers aren't free — they need training so they'll input quality and reliable data. And Budhathoki questions how far a project like this can go relying on unpaid workers alone. "You can't expect everything from volunteers," he said. "Mapping all of Nepal, this is a project with a huge budget."

For Soden, making sure data is open is the key to ensuring that projects like Open Cities continue to exist, even if in a different or unexpected form. "If the only thing that is left is the report on the shelves, that is very different from having data that everyone can use," he said. "Sustainability is seeing that the investment that you make can have unexpected benefits."

Mapping Manila's Transit: Can an App Untangle a City's Disorderly Transportation System?

In many cities, the public transportation system is one big, unmapped enigma. Multiple modes of informal transit ply seemingly random routes with no clear stations or endpoints. Until recently, Manila was like this. The city lacked a consolidated map for the routes that the city's thousands of trains, buses and jeepneys took through its streets. (**Jeepneys**, known for their flamboyant colors and crowded seating, are cultural icons and an essential element of Manila's transit network, particularly on narrow roads that buses can't fit through.)

"You had no idea what to take, when it's coming, if it's coming at all," said Patricia Mariano, a project development officer at the Philippines Department of Transportation and Communications.

An estimated 70 to 80 percent of trips are taken via public transportation in Metro Manila, a sprawling array of 16 cities containing more than 10 million people. While the government had long collected data on the routes in the bus and jeepney franchise agreements, it didn't know where stops were located or whether operators were even following the routes they had agreed to. The lack of an updated map of the system made dealing with problems like traffic congestion and fatalities far more difficult. "Most agencies in developed countries use data regularly. In the developing world, it is rarely if ever collected," said Holly Krambeck, a transportation economist at the World Bank. "If data is collected, it's often not in a useable format."

In several cities, including Nairobi, Dhaka and Mexico City, transportation economists, government officials, open data experts, researchers and others from the local community have partnered in an effort to solve this problem. Their projects take advantage of an open and easy-to-use data standard, the **General Transit Feed Specification** (or GTFS), originally developed to support trip planning in Google Maps.

The country's Department of Transportation and Communications, along with the World Bank, leveraged a grant from the Australian Agency for International Development, [AusAID](#), to support a project to map all of the rail, bus and jeepney routes in the metro area, and to explore whether, in the process, they could reduce the financial and technical barriers to data collection.

Students from the University of the Philippines toting GPS devices rode every bus and jeepney route they could find in the city, creating a database of more than 900 routes. While other projects have begun to take advantage of the ubiquity of cell phones to make data collection easier — projects like Digital Matatus, for which researchers used a cell phone application to map Nairobi's mini-bus routes — the team in Manila created their database “the old-fashioned way,” said Krambeck, by manually entering all the data they collected into an Excel table and ArcGIS.

But even this “old-fashioned” data is proving useful for the Department of Transportation and Communications. When the project team compared the routes mapped by the students with those in the franchise agreements, they found that they didn't match up. The operators of the buses and jeepneys had changed their routes over time in response to demand.

This was good information in and of itself. “[The data] gives you an idea of where people are,” said Mariano. “The franchises we issued before don't reflect reality.” Now the data collected by the students is informing an ongoing review of the franchise agreements. The agency is also exploring how to use the data — in combination with other transit studies and analysis — to make tweaks to the city's transportation system. For instance, said Mariano, “The data shows us what areas we're really not able to reach. Some areas have lots of public transport, others don't have any.”

In the meantime, the agency sponsored a transit hack-a-thon last year, inviting developers to create applications with the data. [Sakay.ph](#), a web-based trip planner, won the open community award.

To build the app, the developers had to contend with data limitations and quality issues. The students riding the buses and jeepneys, for instance, had made assumptions about where the stops are and how often a jeepney would pass. Generally the data assumed a stop every 200 meters or at major landmarks. But, as with public transportation everywhere, the actual service intervals depended on traffic, density and other factors. Data collection wasn't always precise, either — at times, it showed routes passing through a building instead of on the street in front of it.

Philip Cheang, one of the developers of Sakay.ph, said that despite the limitations, he believes the app has proven useful for people trying to decipher Manila's jumbled transportation system. In July, the site had 25,000 visits, and the total number of requests was about 320,000 from October 2013 to June 2014.

Mariano agrees that the apps are useful. “At least now I can figure out where to transfer,” he said. “I can see the connections between buses and jeepneys. I could have never figured this out before without asking every person I meet on the road.”

Perhaps the biggest problem is figuring out how to keep the data up to date. It's been a year and a half since the data collection began, an eternity in an endlessly morphing city like Manila. [TransitWand](#), an open-source Android app to collect real-time data like routes, speed and bus stops, has eased data collection in similar projects in Mexico City and Haiphong and could help Manila update its data more efficiently in the future.

But questions remain about how to best collect transit data in an ongoing fashion. For all of its advantages, GTFS also presents challenges. Krambeck notes that the data standard isn't great for capturing systems that have fixed routes, but not fixed stops — which is, of course, a defining feature of informal and semi-formal transportation systems around the world. GTFS databases are also not very easy to build.

"We've all come up with different types of workarounds" to use GTFS to map transit systems, said Krambeck. "There is a large community that supports fixing this." In the meantime, it's a little bit easier for the residents of several cities to get around.

The Chicago Health Atlas: Can Open Data Make a City Healthier?

Chicago Mayor Rahm Emanuel came into office with a pledge to make the city government — not known for its strong ethical standards, historically — more transparent. In a statement this spring, he said that "the city's open data efforts are part of my commitment to an open, accountable administration that empowers residents to take part in government and enables developers to create innovative applications that improve the lives of Chicagoans." Today the city's open data portal includes more than 200 datasets that capture everything from building permits and fixed potholes to crime reports and library locations. Chicago is part of a broader trend of cities opening up their data, which is part of what's driving so many mapping initiatives across the country.

All this open data has fostered the growth of a civic technology movement in Chicago. [Open City](#), a group of developers, designers and other interested citizens, meets every Tuesday night to develop applications that tell Chicagoans when heavy rain is causing sewage overflow, help them decipher the city's zoning laws, and encourage them to explore their built environment.

Today, with the [Chicago Health Atlas](#), the [Smart Chicago Collaborative](#), a civic technology organization, is leading an effort to see whether open data can help make the city healthier.

“Our first intention was to provide a public-facing platform for regular Chicago residents to view health information about their community,” said Kyla Williams, a program officer with Smart Chicago. “We had a very simple goal. There was no central repository that had the visualization of health data that we had in mind.”

Funded by the Otho S.A. Sprague Memorial Institute, the Chicago Health Atlas displays a range of aggregate health information on a map of the city, along with resources in the community. Visitors can look up the prevalence of chronic diseases like asthma, diabetes and hypertension in specific neighborhoods. The site also includes data on crime rates, environmental risk factors like blood-lead levels and the number of uninsured residents.

While datasets released by the city, like birth and death records, provide a foundation for much of the site, Smart Chicago has also built partnerships with universities, hospitals and a start-up providing data on community health resources to enhance the maps, a process that took time and care, as universities and researchers, who get grants on the condition that information remains confidential, are fiercely protective of their health data. The project had to first get buy-in and build trust from partners to release it, even in aggregate form. Essentially, they had to show “we would do no harm,” said Williams.

These partnerships were crucial to the effort, said Williams. Smart Chicago believes that making typically private health data more open could have a major positive impact.

Putting out free and available data is “a paradigm shift that we’re trying to influence,” said Williams. “Open health information and letting people across the continuum get involved is one of the ways that we can really have some health gains.”

Today the site gets about 1,800 hits per month, and Williams receives another 20 to 30 direct requests or inquires about data presented on the website. She estimates that about half of the people using the site are residents using it for basic health information, while the remainder are researchers, Ph.D. students, or other people using it for academic purposes.

“We think it speaks not just to whether someone is individually healthy, but whether the community is healthy,” said Williams. “It puts their health within the context of community health.”

Now, through a project called [Smart Health Centers](#), the organization is testing whether the maps —

and the open health data displayed on them — can help influence people to change their behavior. The program places specialists at health clinics in low-income neighborhoods, and they use the maps to start conversations with local residents dealing with health conditions.

The navigators display the data in a particular community and then ask residents to reflect on what might be driving a specific health problem. They might ask, why do people in the neighborhood have a high rate of diabetes? Is it because they eat bad food or don't exercise? By getting people to reflect on what's going on in their communities, the Smart Health Centers project hopes to inspire individuals to make personal changes.

Williams believes that the data is having an impact. She told a story about a bilingual clinic, where a health navigator used the Chicago Health Atlas to help out a woman dealing with a chronic health condition. “The woman told everyone in her family about the information,” said Williams. “That next day, the health navigator was bombarded by 24 of the woman’s family members who had the same condition and wanted to know what they needed to do.”

Moving forward, Williams said that the group is aggressively pursuing getting more data onto the site. In September, it made available a range of new data on diagnosis codes for chronic diseases. The group wants to release at least three new datasets every month, but staff capacity is a challenge.

“We’re on the search for new partners,” said Williams.

The Forefront series is made possible with generous support from The Ford Foundation.



Joanna Mikulski is a Berlin-based writer and social entrepreneur interested in how cities can drive social change. She is the program director for WithoutViolence, an initiative to build more support for effective solutions to prevent violence against children, and worked on education, labor and youth policy issues at the White House Office of Management and Budget.

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