

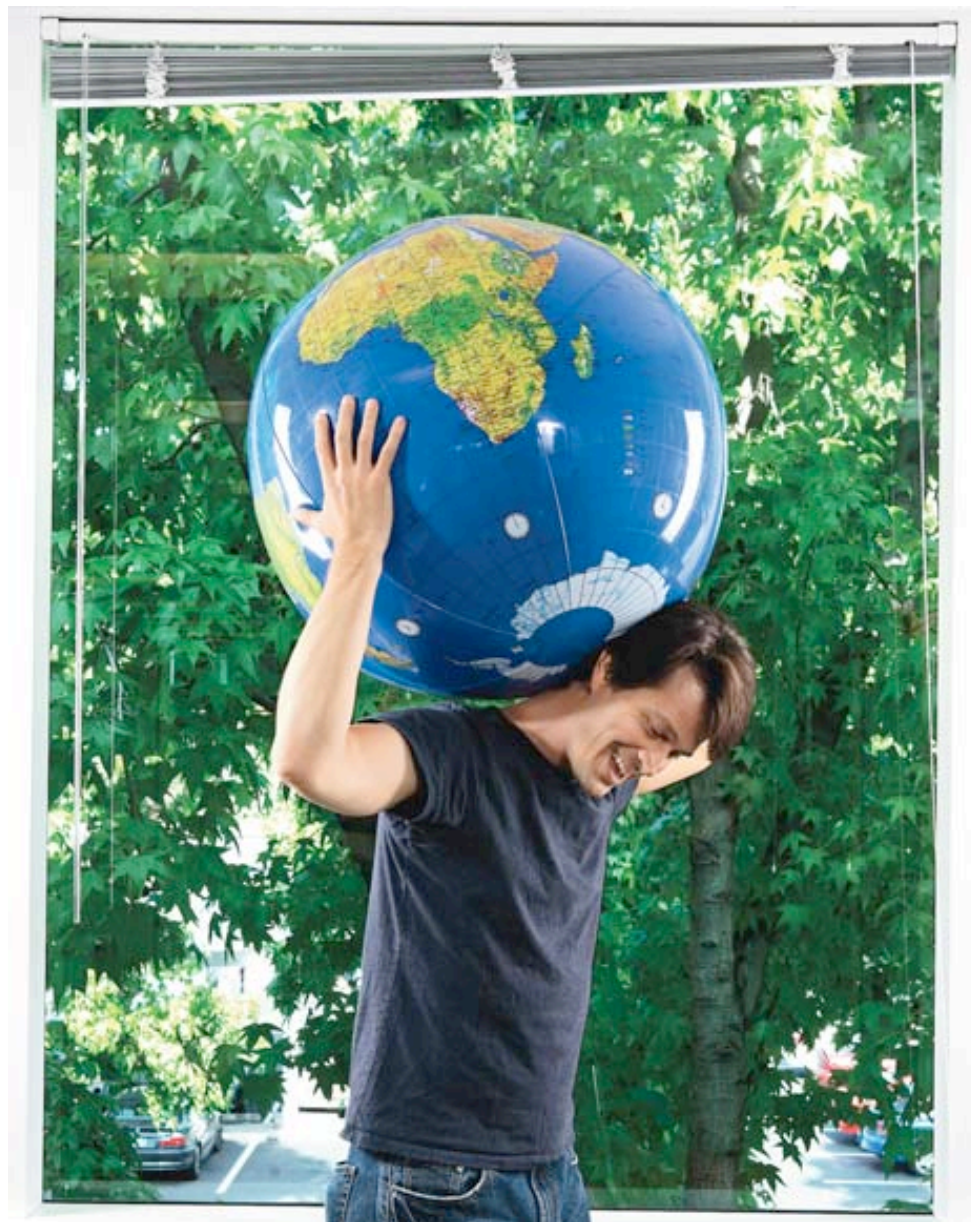
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## Google Maps Is Changing the Way We See the World

Evan Ratliff 06.26.07 | 2:00 AM



**In 1765, a 22-year-old British naval officer named James Rennell set out to map the entire Indian subcontinent.** Traveling with a small party of soldiers, he used the advanced technologies of the day: a compass and a distance-measuring wheel called a perambulator. During the six-year journey, one soldier was killed by a tiger, five were mauled by a leopard, and Rennell was wounded in an attack by angry locals. He survived, and his detailed maps and atlas, published in the 1780s, defined British understanding of India for generations. Years later, a British geographer wrote that, to Rennell, "blanks on the map of the world were eyesores." More than two centuries later, within the

decidedly safer confines of Building 45 on Google's Mountain View, California, campus, John Hanke clicks the 3-foot image of Earth projected on his office wall and spins it around to India. Hanke, the director of Google Earth and Google Maps, zooms in for a closer look at Bangalore. At first, the city appeared in Google Earth as little more than a hi-res satellite photo. "Bangalore wasn't mapped on Google's products," he says, "and it really wasn't very well mapped, period."

Now, however, hundreds of small icons pop up on the screen. Pointing at one brings up a text bubble identifying a location of interest: a university, a racetrack, a library. An icon hovering over the Karnataka High Court calls up a photo of its bright red exterior and a link to an account of its long, distinguished history. Another, atop M. Chinnaswamy Stadium, links to a Wikipedia entry about the legendary cricket matches played there. "As you can see, it's very well mapped now," Hanke says, pulling up a photo of a Hindu temple.

The annotations weren't created by Google, nor by some official mapping agency. Instead, they are the products of a volunteer army of amateur cartographers. "It didn't take sophisticated software," Hanke says. "What it took was a substrate — the satellite imagery of Earth — in an accessible form and a simple authoring language for people to create and share stuff. Once that software existed, the urge to describe and annotate just took off."

### **Discovering the New World**

7 glimpses into the hyperlocal future.

#### **The Internet of Things**

What if you could walk down an unfamiliar street, use your camera phone to take a picture of a building, and instantly know everything about it, from the architect to the list of tenants. The technology to make common objects clickable, like hyperlinked words on a Web site, is available today in the form of 2-D barcodes. These digital tags look like empty crossword puzzles. Users create them online, print them out, and paste them around the city. Then anyone with a phonecam can "click" on them. A program on the phone decodes the pattern and redirects the curious pedestrian to a Web page. One project, called Smartpox, is using these barcodes to build online communities that center around, for example, scavenger hunts and restaurant reviews. Members slap a barcode on a given establishment, and in-the-know passersby can get the dirt on its crême anglaise. At Semapedia.com, you can drop in any Wikipedia URL to instantly generate a 2-D barcode pointing to the corresponding entry.

A career in cartography used to be the prerogative of well-funded adventurers — men like Rennell or Lewis and Clark — with full government backup. Even after the advent of commercial satellite and aerial photography, the ability to make maps remained largely in the hands of specialists. Now, suddenly, mapmaking power is within the grasp of a 12-year-old. In the past two years, map providers like Google, Microsoft, and Yahoo have created tools that let anyone with an Internet connection layer their own geographic obsessions on top of ever-more-detailed road maps and satellite images. A host of collaborative annotation projects have appeared — not to mention tens of thousands of personal map mashups — that plot text, links, data, and even sounds onto every available blank space on the digital globe. It's become a sprawling, networked atlas — a "geoweb" that's expanding so quickly its outer edges are impossible to pin down.

There are the narrowly focused maps, like hidden mountain-biking trails, local restaurant favorites, and annotated travel guides. Then there are the more elaborate efforts, all of which "give people the power to create their own ground truth," says Mike Liebhold, a senior researcher specializing in geospatial technology at Silicon Valley's Institute for the Future. When a large fire broke out in Georgia in April, a resident quickly built a regularly updated map showing the burn areas. In Indonesia, for which Google still has no underlying road map, someone is tracing routes over satellite photos to create his own. The US Holocaust Memorial Museum recently released an annotated layer in Google Earth that displays the Darfur genocide in horrifying geographic detail, showing burned villages and linking to photos and videos.

Whether it's citizens appearing at local zoning-board meetings with elaborate Google Earth presentations or the Air Force using the app to reach victims during Hurricane Katrina, the new mapmaking is about much more than spotting your house in a satellite photo. "This is about individuals as local observers, creating their own map data," says Michael Goodchild, a professor of geography at UC Santa Barbara. "It's 6 billion pairs of eyes."

**The idea of providing digital maps** for the masses is not new. Xerox Parc launched its first online mapping application a year before Netscape produced its first browser in the early '90s, and online driving directions of varying reliability have been ubiquitous for nearly a decade. Google released the first version of Google Maps in January 2005, followed by the more intricate 3-D world of Google Earth five months later. (Those two applications — along with Google Maps for Mobile, which calls up maps and local search results on mobile devices — are overlapping views of the same underlying data.)

At first, the data all flowed one way, from the mapper to the user. But Paul Rademacher, a DreamWorks Animation programmer, changed that when he invented the map mashup. In the fall of 2004 he was looking for an apartment in the Bay Area. Driving the streets with a pile of craigslist ads and pages of maps balanced on his lap, he thought, "Wouldn't it be better to have one map with all the listings on it?" When Google released the first version of Google Maps a couple of months later, Rademacher took a close look at the source code, written in JavaScript.

## The New World

### Traffic Tracker

When a gasoline tanker crash destroyed a freeway overpass near San Francisco this spring, Seattle-based Inrix knew right away that something big had gone down. The company scooped the news choppers because its Smart Dust Network, analyzing data from more than 625,000 commercial vehicles and 13,000 road sensors, saw the chaos unfold. Currently, coverage is limited. But in the future, personal GPS systems will likely know the location of each stitch of gridlock, thanks to communication with every other vehicle on the road.

Eight weeks later, he had a demo that linked craigslist housing ads to pins he'd added to a Google map. One Thursday night, he posted a link to the demo on craigslist, and by the next day thousands of people had already taken it for a spin. "I had no idea how big it would be," he says. "I just wanted to write something that was useful."

Rademacher's HousingMaps was an even bigger hit inside Google. The company hired him and opened up the Google Maps code so anyone could work with it. Microsoft and Yahoo followed suit, and before long the Web was awash in map mashups.

"Someday, there will be the Paul Rademacher statue in front of the Googleplex," says Greg Sterling, an analyst at Sterling Market Intelligence. Today, the number of mashed-up Google Maps exceeds 50,000. (Google Maps itself is now the second-most-trafficked mapping site, after MapQuest.) Practically overnight, new companies were formed to meet the demand for Web sites and software tools to help people create and distribute their maps. Platial features thousands of user-generated maps of favorite bookstores, bar crawls, and road trips. Panoramio lets users peg their personal photos to Google maps, and it has already logged more than a million pics.

This April, Google launched its own mashup software, My Maps, which allows users to personalize their Google maps by attaching images, text, and video. They can either save them privately or publish them for strangers to find. My Maps wasn't revolutionary: Microsoft added a similar feature to Live Search Maps back in 2005, and Yahoo-owned Flickr allows users to geo-tag photos. The difference was that Google also announced plans to add another dimension to the mapping universe by making the entire geoweb — not just Google Maps — searchable. "We are approaching it as a problem that's not unlike page rank and the Web," Hanke says. "Now that you've got a lot of stuff out there, it will become important to sift the wheat from the chaff."

**Building 45 can be found in Google Earth** just southeast of the company's main campus. (Employees put a 3-D rendering of the building at the proper coordinates. Look for the bland box with blue siding and a pyramid-topped column over the entrance.) When I visited the real thing, there was nothing to signal that this was the headquarters of a cartographic revolution except a few plastic globes and the occasional map pinned to a cubical wall. But make no mistake: On the second floor, Hanke, 40, and his engineers are laying the groundwork for just that. In Mountain View and at companion offices in New York, Bangalore, Hyderabad, São Paulo, Sydney, and Zurich, they take terabytes of raw satellite imagery, aerial photography, and road map data that Google buys from commercial providers, stitch them together, then send them back out as the base maps for Google Earth and Google Maps.

Hanke grew up in Cross Plains, Texas, a town of just over 1,000 people, about 120 miles southwest of Fort Worth. Google Earth's satellite view of Cross Plains reveals a compact grid of two dozen streets surrounded by open farmland. "There was a blinking red light and a Dairy Queen and a few stores downtown," Hanke recalls. "Like a lot of other kids, I wanted to see what else was out there." After college, he spent four years working in Washington, DC, and in Burma on what he will describe only as "foreign policy type of stuff" for the US government before eventually joining a video game startup.

In 2001, Hanke cofounded a company named Keyhole. Inspired in part by the Neal Stephenson novel *Snow Crash* — the protagonist uses a software program called Earth, created by the "Central Intelligence Corporation" and containing "a perfectly detailed rendition of Planet Earth" — Hanke and a collection of programmers used their game design experience to create an online 3-D globe by streaming in commercial satellite images stored on the Keyhole servers. They called it Earth Viewer.

In 2003, echoing the *Snow Crash* plot, Hanke signed a deal with the government venture arm In-Q-Tel (partially funded by the CIA) that put Earth Viewer in the hands of the National Geospatial-Intelligence Agency, the department that handles maps and satellite imagery for US military and intelligence units, and which remains one of Google Earth's largest customers. "At the time, what was on the globe was fairly lo-res, widely available commercial imagery," says Gregg Black, director of the agency's eGeoint Management Office. "But immediately we said, 'Wow, this is going to be powerful.'" Black loved how easy it was to use. "We could do these mashups and expose existing legacy data sources" — intelligence data overlaid on the latest hi-res satellite imagery — "in a matter of hours, rather than weeks, months, or years."

Among civilians, Earth Viewer became a cult hit. People delighted in tilting the planet in all directions and zooming down to their homes. Particularly popular was a feature allowing users to mark and save locations. The original idea, Hanke says, "was that if I wanted to meet you at the Stanford game, I would be able to find a spot outside the stadium." But enthusiasts began finding and marking oddities like planes in mid flight and blurred-out military installations. To take advantage of the phenomenon, the company created a descriptive language called keyhole markup language, or KML, which lets anyone annotate maps, not only with their own place markers but also with lines, icons, and three-dimensional shapes. Users could save their annotations as KML files, which anyone could then open as a layer in Earth Viewer.

In 2004, not long after Sergey Brin downloaded a copy of Earth Viewer and interrupted a Google meeting to "fly" to the house of each executive in the room, the company bought Keyhole for an undisclosed amount, renamed it Google Earth, and moved Hanke's team into Building 45.

## The New World

### **Pinpointed Photography**

Organizing vacation pics would be so much easier if you could remember exactly where you took each one. The Ricoh 500SE can help: This 8-megapixel digicam comes with a built-in GPS receiver that notes longitude and latitude in the file every time you fire up the shutter. (Programs like Google Maps can decode them.) Not ready to drop \$1,100? Try a lower-tech workaround: Follow your photos with snapshots of the readout from a cheap GPS unit and type in the coordinates later as tags on Flickr. As GPS becomes more of a must-have feature, you'll see this kind of kung fu embedded in all your gadgets. Imagine checking your computer to see exactly where you left your glasses.

**Since Google relaunched the software** in June 2005, the stand-alone Google Earth program has been downloaded more than 250 million times. The program's seamless zoom-in feature has become ubiquitous on television news shows. And there are dedicated sites — such as Google Sightseeing and Virtual Globetrotting — built for scouring and saving odd and interesting finds from not only Google Earth but also competing 3-D globes like NASA's World Wind and Microsoft's Live Search Maps. Scientists, students, and government agencies use Google Earth layers to display their data to the public — the migration of a tagged whale shark in the Atlantic, say, or the latest earthquake activity in the Hayward fault zone. Google provides extras, like photographs from *National Geographic* and restaurant reviews from Yelp. Or you can turn on third-party layers that monitor commercial US planes in flight or that mark the world's best surf spots, complete with webcam video. "It's always been the case that maps have value because they show one

subset of data and hide the rest," says David Weinberger, author of *Everything Is Miscellaneous*, a new book about the value of disorder in the information age. Given the infinite data that can be layered into Google Earth, however, we can now "include everything, then sort and draw the maps on the fly."

In the midst of all this cacophony, Google is discovering that a smart, effective search engine is once again the key. Google Earth and Google Maps have long had search boxes, but you couldn't find much. Typing in "pizza New York," for example, brought up links to sites that Google itself had generated, usually by buying up Yellow Pages listings or crawling the Web for pizza mentions that had New York addresses.

But with the launch of My Maps, Google is anchoring its new search strategy to KML. The company is indexing *all* KML files on the Web — it has cataloged several million so far — and is working with the Open Geospatial Consortium to make KML the standard. "Right now, Google Maps is mostly about searching for businesses," says Jessica Lee, a Google product manager. "But what we don't have is the sort of niche, long-tail content. We don't know where all the endangered species or the pandas in China live, or where the best places to go bird-watching are. By providing the tools, we can let other people create it."

The underlying digital imagery, meanwhile, is constantly reflecting more of the real world. In late May, Google announced Street View, an ambitious project that incorporates street-level photography into Google Maps for the San Francisco Bay Area, New York, Las Vegas, Denver, and Miami. (Microsoft's mapping products already contained street-level photographs for a few cities.) It's not hard to imagine a cell phone that pinpoints your location and then shows you a digital version of the city block in front of you, just as you see it, but annotated with all of the geoweb's information you need to find nearby a store, office, or restaurant. In essence, as Mike Liebholt at the Institute for the Future puts it, "you'll be able to click on the real world."

The New World

### Going Off the Grid

For smartcard-carrying citizens of the 21st century, leaving home without an RFID-safe wallet is the equivalent of wearing a T-shirt with your Social Security number silk-screened on it. That's why, about a year ago, Difrwear began offering billfolds with a built-in mesh Faraday cage to block RFID scanners. (Think of it as a tinfoil hat for your bank account.) In a completely wired world, radio-proof accessories, buildings, and even entire neighborhoods will serve as disconnected oases, the only ways to go offline.

**Online maps** are clearly no longer just useful toys for finding your way to the stadium. During Hurricane Katrina, the Air Force used Google Earth to map out hundreds of rooftop rescues in New Orleans. Later, though, a user noticed that some of Google's satellite images of the city had been replaced with ones that predated Katrina. After reading press reports, congressman Brad Miller (D-North Carolina) wrote to CEO Eric Schmidt complaining that the company "appears to be doing the victims of Hurricane Katrina a great injustice by airbrushing history." Google quickly replaced the images — which it said had been added automatically because their resolution was higher — with post-storm satellite photos.

"It was a surprise," says Chikai Ohazama, a Keyhole founder who now manages Google's constant updating of satellite and road map data. The incident, he says, "has definitely given me an appreciation that the database has become so much a part of people's lives."

And part of people's politics. Countries like Morocco and Bahrain have tried to block Google Earth, only to have residents smuggle in PDF files of the data. The BBC recently reported that Iraqi residents have been using the software to plot escape routes that avoid insurgent hot spots. And Hanke's team was accused of censorship when it swapped in alternate imagery of Basra after Britain said insurgents were using Google Earth to target its soldiers.

Censorship is only one part of a broader issue: Who controls the maps we use, and how much can we trust them? "Mapping has always been a tool of dominance," says Michael Goodchild, the UC Santa Barbara geographer. "There is no such thing as an objective map." It's no coincidence, he says, that the last golden age of mapmaking was the colonial era, when cartographers were dispatched to catalog western Europe's conquests around the world. James Rennell's maps weren't just an effort to understand India; they were a means to show, as he once said, "the advantages

that may be derived from our territorial acquisitions."

Today the power still lies in the hands of the map makers. The only difference is that we're all mapmakers now, which means geography has entered the complex free-for-all of the information age, where ever-more-sophisticated technology is better able to reflect the world's rich, chaotic complexity. "Once you express location in human terms, you get multiple places with the same name, or political issues over where boundaries are, or local differences," says David Weinberger. "As soon as you leave the latitude/ longitude substrate, you get lost in the ambiguous jumble of meaning. It's as close to Babel as we get."

*Contributing editor Evan Ratliff ([www.atavistic.org](http://www.atavistic.org)) wrote about the search for killer viruses in issue 15.05.*