

Researchers reveal inconsistent borders in online maps

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Google and Bing maps of some countries show users different borders based on where the users live. It's how governments claim sovereignty over disputed borders. Researchers led by Northeastern's Christo Wilson have developed a computerized system to reveal the manipulations: It crawls online maps continuously, tracking and recording every border shift over time. Image by YoungHee Jang/Northeastern University

We all look at the world subjectively, from our own point of view. Mapmakers, we assume, do the opposite: They portray the world objectively, as it actually is.

Not so, according to new [research](#) led by Northeastern's Christo Wilson, assistant professor in the College of Computer and Information Science.

Reports that Google and Bing "personalize" their maps—that is, change disputed borders at the behest of governments, showing [users](#) in different countries different international boundaries—have been making the rounds for several years. But now, for the first time, Wilson and his colleagues have developed a computerized system, called MapWatch, that continuously crawls the small, square images, or "tiles," that make up online maps, monitoring and cataloging every one of those changes.

"We don't have just a snapshot in time," says Wilson, who recently presented the research at the 25th International World Wide Web Conference. "We're always watching—we're recording and archiving all of the online tiles and seeing how they evolve as we move into the future."

MapWatch, the researchers write, is "a kind of Wayback Machine for the world."

Tracking border conflicts

The researchers' vigilance has revealed personalizations never before identified and provided robust evidence for those anecdotally reported.

After nine months of crawling every tile on Google and Bing maps from the perspective of every country in the world, the team reported six distinct cases of [border](#) personalization and one case where the borders

essentially changed in front of their eyes, during their tracking. Among them were borders between India and China, between Crimea and Russia, and in the South China Sea.

Consider those last two. Wilson and his colleagues showed that users of Google Maps in Russia see Crimea solidly within Russia's borders. However, users in the Ukraine see no such border, indicating that Crimea remains part of the Ukraine. Adding to the shape-shifting, users of Google Maps anywhere else in the world see a dashed border, signaling that control of Crimea is in dispute.

Similarly, Google Maps in China display a dashed border in the South China Sea, marking the waters as Chinese territory. Yet users in the rest of the world see no border at all. Bing Maps, on the other hand, forgo the border both in China and around the world, regardless of users' locations.

"We consider maps to be sort of sacred—they're a picture of our reality," says Wilson. "But in fact they're not; they're quite fungible."

Motives and meaning

Why do the online cartographers agree to personalize their maps? Wilson doesn't know for sure, as the process goes on behind closed doors. But he can speculate. Powerful countries such as India, China, and Russia, he says, might threaten to ban the sites and services of the companies that provide them if they don't comply with personalization demands, removing significant sources of revenue.

The lack of transparency raises questions about the mapmakers, too. "The China case is particularly interesting because Google is banned there," says Wilson. "So why would Google Maps personalize the South China Sea when the site doesn't have any users in China? Conversely,

Bing, which is available in China, does not personalize the South China Sea for the users there or anywhere."

The researchers hope that MapWatch, which can catch and report changes quickly, will help to open those doors. "A billion people use these online [map](#) services, but they don't know the truth of what they're seeing or why they're seeing it," says Wilson. "We want to help uncover the 'who' and the 'why' behind these changes because maps determine how we conceptualize the world, and people should know how corporations and governments are attempting to shape our perceptions."

More information: MapWatch: Detecting and Monitoring International Border Personalization on Online Maps. [DOI: 10.1145/2872427.2883016](#)

Provided by Northeastern University

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