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UC Santa Barbara Geographer Charts the ‘Next-Generation Digital Earth'

The world has gotten smaller and more accessible since applications like Google Earth became mainstream, says UC Santa Barbara Professor of Geography Michael Goodchild. However, there is still a long way to go, and there are important steps to take to get there. His perspective, shared with many co-authors around the world, has been published in the Proceedings of the National Academy of Sciences in a paper titled, "Next-generation Digital Earth."

Based on former vice-president Al Gore's 1992 vision of a digital replica of Earth, the paper examines the world's progress to date, and its prospects for the future.

"The point of this paper is to say, ‘Well, how far did we get?'" said first author Goodchild, who specializes in geographic information systems (GIS). The answer? Since Google Earth –– the most popular publicly available program for spinning the digital globe –– not far enough.

Taken from Gore's vision, which is outlined in his 1992 book, "Earth in the Balance," and also taken from a Gore speech Goodchild helped to produce for the opening of the California Science Center in 1998, the development of the first iteration of a Digital Earth was rapid, as technology expanded to allow users to view the Earth in a way that had not been possible before. The results fascinated many, who took to maps made by Google and other digital globe-making services –– NASA's WorldWind and Microsoft's Bing Maps, for instance –– to visualize their worlds. Global

visualizations and modeling have been responsible for a variety of beneficial efforts, such as the tracking of major weather events and political uprisings, and finding lost people.

But the wider the technology spread, the more obvious certain issues became. For instance, different sources of data provided for these applications resulted in different maps, and different boundaries for the same regions.

"There's no such thing as a true map," said Goodchild, pointing out three versions of the boundaries of the Himalayas on Google Maps, in response to requests from the United States, China, and India. Differences in how the applications measure distance are magnified with each new location mapped. These are issues that could make information from digital globes unreliable, even contentious.

Goodchild sees the next generation of Digital Earth moving away from the top-down experience and giving way to the bottom-up perspective.

"I'm more keen on the next generation going local instead of global," he said. Things that happen to be important to those who live in the area should be part of the area's maps, according to Goodchild, though they may not be the standard political or topographic fare of the traditional globe. Temporal information –– traffic is an example already in use –– also proves to be useful and more relevant to users.

"There's more of a social perspective now, and less emphasis on permanent objects," he said.

However, to take the next steps effectively, the next generation of Digital Earth has to back away from the "exaggerated precision" of the current generation, allowing for uncertainty, and also for the various contexts and environments that a Digital Earth is able to access. Relationships and linkages between objects need to be developed and refined, and a way of archiving the sheer amounts of data must be developed, says the paper.

Additionally, according to the paper, collaboration between multiple infrastructures and open-source partnerships will be necessary for the next generation Digital Earth, as well as a code of ethics that will allow the technology to strike a balance between

universal access and universal protection.

"Privacy is less important to the younger generation," said Goodchild, pointing to things like Facebook and similar social media engines, "but we need the ability to opt-out or be invisible. It's getting increasingly difficult."

Despite the move away from ultra-high precision in mapping, however, there continues to be an overarching need for the next generation Digital Earth to be scientifically accurate, and it's the scientific community's job to ensure that accuracy, he said.

"It's the problem we have when major corporations produce scientific software," Goodchild said, citing Google Earth's inclination to satisfy 90 percent of its users. Scientists are part of the remaining 10 percent, he said.

"We ought to insist that scientific standards should be followed," said Goodchild. "Because if we don't, they won't."

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† Top image: Two versions of the boundaries of the Himalayas, as provided by Google Maps in response to queries from (B) China [Copyright GS(2011)6020 Google, Kingway, MapKing, Mapabc, TeleAtlas], and (C) India (Copyright Google, LeadDog Consulting, Mapabc, TeleAtlas)

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