

Isn't That Spatial

## **Exploring the World in 3D with Google Earth: Could it be that the world is finally discovering how useful geography really is?**

Joseph J. Kerski

Launched less than a year ago, in June 2005, Google Earth (GE) has already caused quite a stir not just within the geography education community, but also with the general public. After years of telling people about GIS for nearly 20 years, I now have people coming up to me and say, "I've been using Google Earth and now I finally understand what you have been saying about the power of GIS!" Does this mean that Google Earth is a GIS? What value could GE bring to the university or K-12 classroom? What is all the fuss about?

### **What is Google Earth?**

Google Earth streams satellite imagery, elevation data from the USGS-NASA Shuttle Radar Topography Mission, along with anything from transportation routes to hotels. GE requires two main components—a desktop software package that is only about 12 MB in size, and an Internet connection. Because GE streams data down to your desktop computer from the Internet, and because these data sets can be very large, a fast broadband connection to the Internet is absolutely essential. Using these two items in tandem, the geography educator and student can view most locations on the Earth's surface from any angle and from any distance. The tool simulates flying above the landscape and stopping at key points of interest that you specify. At any point, you can zoom, pan, or tilt the Earth view for a 3D perspective.

Depending on the area examined, you might be able to see individual trees, automobiles, and other information that you would expect while viewing 0.61-meter resolution Digital Globe QuickBird and other detailed imagery. In other areas, however, the resolution is only suitable for medium-resolution investigation, for example, of watersheds.

### **Three Versions**

The GE client is available in three different versions. Google Earth is free and runs on both the Mac and PC platforms. Download the free GE program client from <http://earth.google.com>. Google Earth Plus costs \$20, runs on a PC, and allows the user to add GPS coordinates to the 3D map. Garmin and Magellan GPS coordinates can be directly input via a cable, and output from other GPS receivers can be used if the data are saved via a .gpx or .loc file. Spreadsheets of 100 points (using the Plus version) or 2,500 points (using the Pro version) also can be imported and mapped. These spreadsheet locations can be street addresses or latitude and longitude.

Google Earth Pro costs \$400, runs on a PC, is faster, streams the highest resolution satellite images, allows for higher-resolution prints, and allows the user to add many types of data, including georeferenced data layers traditionally only viewable through GIS software. Pro allows you to purchase modules to make movies, print larger prints, import GIS data, and add data on shopping centers and vehicle counts. These are the kinds of data that are typically either unavailable or else difficult for the educator to obtain, yet are the types of data that can excite students to learn more about the Earth. The Google Earth "frequently asked questions" page provides details on minimum system requirements: <http://earth.google.com/faq.html>

User-acquired images can be added manually to the free version of GE, but the Pro version makes overlaying much easier. This is because Pro version can read the coordinates from image headers (or embedded information such as in GeoTIFF images).

### **Keyhole Markup Language**

When Google bought Keyhole in 2004, Google acquired the Keyhole Markup Language (KML), and a compressed version (KMZ), which define the data used and several aspects of the data user experience. Because KML is open source, it has been used to create Google Earth and Google Maps "mash ups" that combine the capabilities of Google Earth (or maps) with other applications.

The geography educator could start by downloading KML and KMZ files that others have written, loading them into GE, and explore. After investigating the syntax of the source KML files, some may want to start creating their own. Students could then use the instructor's generated files to go on a structured exploration of exactly what the instructor wanted them to examine, rather than just a random browse across the planet.

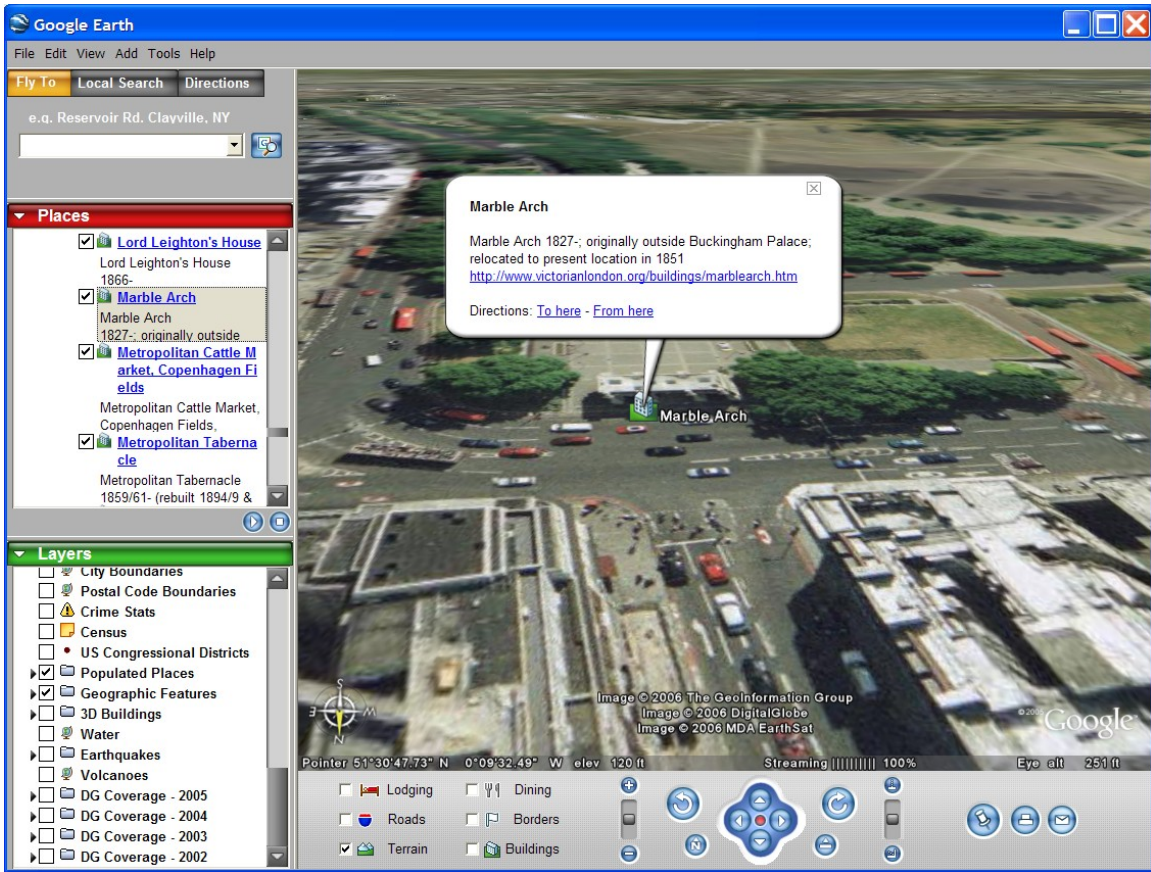
### **Mashups and Mapping Hacks**

The open-source nature of Google has led to thousands of "map mashups," Internet applications that combine the content from more than one source, one of which is usually a web-based mapping application. These include everything from crime locations to determining where the other side of the Earth is from any given spot. Increasingly, spatial data is being served on the web in formats that GE can easily read. One example is USGS earthquake data on:

<http://earthquake.usgs.gov/eqcenter/recenteqsww/catalogs/> Another example is USGS near-real time stream gage information on: <http://water.usgs.gov/waterwatch/kml.html>



A portion of the San Andreas Fault in California with earthquake data as recorded by the USGS and viewed in Google Earth.









Atlas of Victorian London, <http://www.victorianlondon.org/googleearth.htm>, including links to historical maps and photographs.

Map hacking is another development, in large part due to GE. Map hacking is not used here in the negative sense, but rather, referring to adapting and developing mapping software for one's own purposes. According to Jeremy Crampton, professor at Georgia State University, noted in a recent article in *GeoWorld*, there are already more than 250,000 members of the Google Earth bulletin board, with more than 4,500 joining every day. That's not total users, but rather, people who take the time to register.

GE is making them make people aware of the power of mapping, spawning legions of developers who are tagging data with location information and posting it online. It's being done mostly by amateurs who create services because they are useful. As Crampton notes, "Not all mashups use maps, but it's surprising how many do."

The downside is that this grassroots effort yields much duplication and content without documentation, or metadata. Numerous crime applications now exist, but they seem to be drawing from different sources, with much missing data, but no comprehensive site where an educator would know that he or she is examining **all** of the crime for a certain city over a certain period of time.

### **Educational Value**

GE is, at this point, primarily a visualization tool, although it is rapidly becoming a powerful tool for importing all sorts of spatial data and allowing the user to analyze it. It doesn't have the functionality of a GIS, but it does provide an excellent first step into geotechnologies. It could lead an educator and students to a future that would include the use of GPS and GIS tools. Because of its engaging nature and wealth of data, I believe that GE is one of the most important visualization tools that will emerge in our lifetimes. Its value simply cannot be ignored. GE can be used to investigate anything and enhance lessons about urban sprawl along interstate highways, the folds of an anticline, or the forms of a river delta. It can be used to investigate a site that students are traveling to on a field trip, the location of a news story, or the route of a historic or present-day explorer. The Pyramids of Giza, Mount Everest, and other real places can be examined with stunning detail. As with any technology, however, the benefits of GE will be multiplied hundredfold in the hands of a teacher who can use the tool for inquiry-driven, problem-based, exploratory learning.

### **Educational Initiative**

One of the most exciting recent developments is the Keyhole-Google Education Initiative, through which a faculty member or school administrator can a free license of Google Earth Pro for one year. Dennis Reinhardt is the point of contact for this agreement, and can be reached at [den@google.com](mailto:den@google.com).

### **For More Information**

GE and its applications are changing so rapidly that some of the information in this article may have changed by the time it is published. One excellent way to find out more about Google Earth and explore applications is to visit the GE blog, on: <http://www.gearthblog.com/> However, the best way to learn more about it is to download the program and start exploring! You'll be amazed at how powerful the tool is, how easy it is to use—and how many late nights you spend with it.