

Jack Dangermond Explains the Need for GeoDesign

“We Need More Geographic Thinking in the Way We Make Decisions”

During the ESRI European User Conference in Vilnius, Lithuania, Jack Dangermond sat down for an interview with GeoInformatics. Topics of interest were GeoDesign, volunteered geographical information, the need for creating more geo-awareness, open data sharing policies and ESRI's new software technology to facilitate this. Also, Mr. Dangermond shared his opinion on new ways of collecting geographical data as opposed to more traditional ways: “the use of crowd sourcing techniques for certain kinds of data collection will be a very exciting chapter in the history of geography”.

By Eric van Rees



Question: Gov2.o Summit Washington. How do you see your role as company in data exchange for governmental organizations? How can these organizations create a common organizational picture? And what is the role of your company in that?

Jack Dangermond: In the U.S. there's a new initiative to make all governmental data available to the public via the Internet. The federal government has established a new government portal called Data.gov and is requiring or requesting that agencies make all of their data (not just geospatial) available for download by citizens and other organizations. This is being promoted as the next step in open government and open democracy. There are also those who feel that this data will provide greater citizen transparency and possibly new business or research opportunities for the scientific community. I am personally interested in what this trend toward open data sharing means for the GIS community.

While data sharing has always been a key for success in GIS (i.e., clearing-houses, portals, etc.), it hasn't resulted in a framework where people can combine data easily. I am advocating that agencies make their data available as services, not simply as downloads. People could consume these services or easily mash them up with other services. That's starting to happen. There are a variety of vendors that provide that technology.

The average citizen can't do anything with downloaded data unless they acquire or write some software. If we're going to build an infrastructure like an SDI or INSPIRE, we have to move from the notion of data access to the notion of putting that data into a form of services.

In answer to your second question 'How is ESRI involved in that?' we have GIS server technology that serves maps and map services, and I think there's probably 50,000 of those servers out there being used now, so I'm simply encouraging users to begin to make those services available more publicly. People can then mash them up and build an infrastructure based on searching for services, integrating services, or building applications with those services and ultimately building app-stores that are application suites that bring those services together for various public applications. And to make that work, you need to have RESTful services, they need to be standards based, you need to have open and free API's that can adjust those and mash them up -- all of which is available in our technology.

That seems to me one step further than INSPIRE, because that doesn't include any services.

JD: While I think the vision of making the data available via an Internet portal is interesting, it doesn't result in a geospatial infrastructure that easily leverages national investments in geospatial data. To do that we need a series of geospatial Web services.

In the U.S., the Federal Geographic Data Committee has spent the last 17 years discussing and working on the so-called NSDI. In some ways this resembles work ongoing under INSPIRE. During that time period they have defined coordinated data responsibilities among agencies, created data interoperability standards, and promoted geoportals (metadata catalogues of data and services). Today, geodata.gov, our national portal, has over 100,000 registrations of spatial data and services that are available for browsing and use. These efforts, while important, have not resulted in an integrated system. While it allows us to download data freely and use it on our own systems or in various ways, and while valuable, it leaves much to be desired. Making all government data available (not just with geospatial data but with all data) doesn't get us to an open standards-based framework that allows people to easily integrate and combine data sets. That requires considering the Web as a platform and implementing a network of higher interoperable distributed services that provide a backbone for Web applications. By "serving" data from a local, state or national government agency, there will emerge a whole new class of applications that fuse (mashup) these services. What I imagine is a geospa-

tial "app" store similar to Apple's store for the iPhone, where people will build and share or sell applications. These applications will be related to defense fields, emergency management, logistics and transportation, land use planning, citizen empowerment, etc. People will be able to get these apps and use them immediately on top of that services infrastructure. For me, that's where I think the next big step is. To make it happen, organizations will need to understand the value of this shared infrastructure and open up with shared services. That doesn't mean 'just give the data away,' it means provide services with the data (e.g., maps, spatial analysis) and applications that incorporate map knowledge. These services will be served into an environment that can be easily and dynamically programmed to support applications.

The second question is also related to your keynote presentation at the ESRI European User Conference where you spoke about new connections between governments and citizens, governments and other governments. I'm interested how you see the role of citizens, will they be contributing geodata?

JD: Yes, UGC or "user generated content," sometimes called volunteered geographical information (VGI) will increasingly become a part of GIS systems. Yesterday afternoon there was a presentation by an NGO here in Lithuania who set up a GIS server that allows citizens to register environmental issues, like abandoned cars, waste dumping, illegal forest cutting, etc. Basically, any citizen can come to the Web site and describe an environmental issue. That point data is taken by the NGO, verified, and sent to the regulatory agencies that do something about it. That kind of citizen information is an alerting system that causes the government to respond.

Here in Europe you have 112 systems. In the US we call them 311 systems and many of our city's citizens inform the cities about potholes in the street or a broken tree or whatever their complaint is, and the government gets that information and responds to it.

That's one kind of UGC that I see, specially built around municipal systems. Another type involves support for citizen science, where people are recording things like bird observations by putting dots on a map describing the observations. This organizes citizens to participate in a workflow cycle of measuring, analyzing, visualizing, and making their data immediately available to others on the Web. The vision here is that millions of people on the planet can begin to become remote sensing devices, observing things and putting that information on to a web map.

Currently, the consumer mapping sites are experimenting with this kind of data collection. The problem is that it's not generally structured in such a way that it can be made useful. There's no ontology or data model organizing the observations that are being put in.

ESRI has been developing a software solution and workflow for the ArcGIS 10 release that supports exactly this kind of application. Basically, a GIS organization will be able to set up a server for Web editing of observational data into a geodatabases. The geodatabase can be set up with a science-based ontology and data model so that people making observations put them directly into a database with a scientific framework.

One of the most successful examples of citizen impact on geospatial data is an effort in the UK called Open Street Map. They allow anyone to calibrate street map measurements using multiple input formats (i.e., sketching, air photos) or uploading existing street data sets. This effort resulted very quickly in a global street map. While it isn't as accurate and doesn't carry many of the attributes of the street map vendors, it's quite extraordinary.

One of the main reasons why it's been so successful is that they thought through the data model on a server so that when people entered data they weren't just sketching unstructured information. The authors of the project organized how they wanted people to enter their data and built a system to do that. We have basically copied that model in ArcGIS Server 10 with the vision that users in many settings (governments, NGOs, private companies,

etc.) will want to set up those open UGC services to get citizen or volunteered input from various sources. I see this changing the science of geography by creating standard ways to get a new type of geodata input into GIS. Crowd sourcing techniques for collecting broad based geographic measurements will be a complimentary set of data to the traditional authoritative source data collection. There's some debate as to how this data will be fused and used, but I'm sure that will be figured out over time. The use of crowd sourcing techniques for certain kinds of data collection will be a very exciting chapter in the history of geography. While not replacing traditional methods, it will introduce new ideas that need to be properly reviewed and integrated into GISs.

What is the legal basis of the mutations of 'volunteers'?

JD: This crowd sourcing/UGC data collection is not just happening with geospatial information, it's happening in all information that people are being exposed to. The technique of the social media environment for news, for example, are replacing or at least augmenting traditional authoritative sources and techniques. People are starting to make judgments about truth based on how many stars a particular data source has. This is becoming a method for determining the quality of the data set, and that is very scary to traditional measurement and science people. But it shouldn't be. These are simply new methods. It's going to be a new source of information that we have to learn how to deal with, and it will have legal and governance implications, such as who owns that data and who has the rights to use it. So it's a new world. My sense is that traditional high quality data sources from authoritative organizations will have strong metadata and will continue to typically be trusted more. It's a very exciting time for the geospatial measurement field, and what's enabling this is the technology of the Web. Will there just be one player like Google that ultimately owns all of the data? What are their legal rights to the government data? If an agency puts its data into such a proprietary system, will they continue to own it? There's considerable controversy emerging on these subjects. My own view is that there will be many thousands of servers around the world that will serve information openly in a networked environment of on premise and hosted environments.

The third question is about raising geo-awareness. ESRI is very active in education throughout the world. And even if the economy is bad, there are still a lot of jobs in GIS, how can this gap be filled, how will it be filled and how do you foresee the future in raising and creating geo-awareness?

JD: Today the GIS market is very strong and growing. It continues to grow even in difficult economic times. I use ESRI's software sales as an indication that our field is and will continue to prosper and do better and better. I think the reason for this is that geographic and locational information continues to be very valuable to people and organizations. It helps them make better decisions and communicate more effectively. We're seeing some businesses, for example, that continue to expand. They see GIS as a strategic way to save money. Product delivery and transportation companies are using GIS to save money and make their organizations more efficient. Some organizations like cities are using GIS to cut their greenhouse gas emissions by doing GIS-based routing of their delivery and garbage disposal trucks as well as inspection vehicles. They're cutting up to 20% of their greenhouse gas emissions. These examples and dozens like them show that even in troubled economic times GIS is continuing to deliver value. In fact, business efficiency is becoming an even greater reason to buy it. This growth is also because more management and decision makers are more aware of the value. So there is a lot of demand for GIS jobs even in a down economy. The second point I want to make is that the U.S. National Academy of Sciences looked into the value of spatial thinking and geography in education and the results were extraordinary. The study suggested that people who were introduced to spatial thinking at an

early age grow more extensively in other intellectual fields (i.e., math, science, and literature) as a result of this early introduction. I conclude for this that educators can basically use techniques like GIS to accelerate learning and intellectual development. This excites us, professionally.

Over the years, ESRI has invested extensively with partners like the National Geographic Society and the Association of American Geographers in development of K-12 educational materials. We have a team of people who do nothing but work with teachers and develop standards-based curricula. We feel this is both of interest and a core strategy of our organization. We do it because we think it does good, makes people more aware of their environment, increases their intellectual capabilities, and advances geographic thinking.

The third point that you're suggesting in your question is that there's a link between our investments in education and development of the professional workforce. That is also true. We see that by getting to kids at an early age and teaching them GIS tools, they are more likely to seek higher education and emerge a richer and stronger professional. It is our belief that there is a need for that kind of professional right now. Our experience working with kids in secondary school is that they fully comprehend the fundamental concepts of GIS (i.e., measurement, spatial analysis, and visualization), and can successfully apply these concepts to projects that make a difference at an early age. We like to promote the idea that students be given the opportunity to carry out GIS projects. This involves "project-based learning" where kids go out and observe a problem, measure it, analyze it, come to a solution, and they get credit for it. That sort of science-based methodology for problem solving can be accomplished at very young ages, and the earlier that you learn that process, the more effective you become as a professional. You become more motivated, more interested, and more capable of applying science in your work. We support this idea a lot. I'm not sure that there's a rational reason why ESRI does this other than "we like it." I think one of ESRI's core values and goals is ESRI is to create a more geospatially literate society, and I think that has benefits along the same lines of why ESRI exists at all.

Can you please tell me something about the GeoDesign Concept?

JD: My original field of study was landscape architecture and that is probably the mother profession of GeoDesign. GeoDesign is about integrating design with geographic and science-based information. In the early days of ESRI, I always expected that people would apply GIS to design-based problem solving and finding the best location for something. I have been a little disappointed that didn't happen as rapidly or as naturally as I thought it would. My motivation for emphasizing it in the last year has been in part to make people aware that there's a huge opportunity to move in this direction to make a better world. I also found that there have been tools missing in GIS, so we've been developing new software capabilities that support the GeoDesign process. In January we will host the first GeoDesign Summit. It will bring people from both the GIS and design fields together and have them share their work and get a conversation going. I'm not totally sure what the outcome is going to be, but I'm hoping a new profession or direction will emerge. I think we need this kind of mixing at this point to bring these two fields together; people who design the world with people who design the future. Today, geography lives very well in its world and designers live very well in their world, but there's not this cross-mixing. I believe the outcome will be much enlightened ways to do development; ways that bring science into how we design things: cities, the environment, highways, everything that we do. Today we certainly see the need for this all the way from global warming to designing more livable and sustainable cities. We need more geographic thinking in the way we make decisions. GeoDesign is an attempt to try to do something about that.

Eric van Rees is editor in chief of GeoInformatics. For more information, have a look at www.esri.com