

Visualizing Complex Systems

On day one of the 2010 GeoDesign Summit, Kim Tanzer, Dean, School of Architecture, University of Virginia, explains the role of the National Academy of Environmental Design in advancing evidence-based design research.

<http://video.esri.com/watch/104/visualizing-complex-systems>

Video Transcription

00:01 Well, thank you for the invitation to join you today.

00:03 Like Tom Fisher, I come from the design side of the equation, rather than the GIS side of the equation, and so I look forward to meeting...

00:11 ...and talking with many of you over the next few days to learn more about what you do.

00:16 In my previous role at the University of Florida, I had some opportunities to work with GIS in some capacities.

00:22 And I want to single out Paul Zwick who has taught my design classes GIS, and Iris Patten with whom I worked on a project last spring...

00:31 ...which involved GIS mapping.

00:32 So I am enough to be dan...I know enough to be dangerous, I think, maybe just enough.

00:37 What I'm going to talk to you about today is a bit about how design use...how design can build on GIS information, and then...

00:47 ... the second portion of my talk will focus on the creation of a National Academy of Environmental Design, which as we described...

00:55 ...here includes and incorporates the important role of evidenced-based design research in addressing the problems that our...

01:04 ...our globe faces and that Tom spoke about so well earlier this morning.

01:11 I want to remind you all that visualization is something that human beings have been doing for a very, very long time, and a fairly recently example...

01:19 ...of this from Leonardo, who in these cases was studying floods on the Po River and proposed flood-control methods, about 500 years ago.

01:28 We...if we had historians with us, we would find many examples of historical evidence of visualization as being an important part of studying...

01:39 ...the problem that then became solved in various ways, and one might argue that the way we've been visualizing things in our cultures for the ...

01:47 ...last few hundred years has led to some of the challenges that we find today.

01:52 So, at the end of my talk, when I talk about visualization and creating meaning through design-based representations, images, I would argue that...

02:01 ...that's not sort of eye candy, but that's a really central part of how we understand the world...

02:06 ...and that's what many of you do for day-to-day living.

02:11 I'm going to talk about two projects first, both done by colleagues who I'm working with at the University of Virginia, just to give you a sense...

02:19 ...of how a designer thinks about using GIS, and then talk about the National Academy.

02:24 The first is the project, Albemarle. Albemarle is the county that the University of Virginia is situated in, and this is a project that's...

02:32 ...intended to communicate the results of ongoing research to the public and to local stakeholders.

02:39 It is a Web site that was created by my colleague Lucia Phinney, and as you can see at the bottom of this, she utilized a GIS platform...

02:49 ...to create a basis for this Web site.

02:52 So, the Web site itself is not interactive, but the way it was created was interactive, and I'm just going to go quickly through a few of the pages in this Web site.

03:08 So you can see in the Web site she has used the McHargian, some of the kind of general McHargian systems that...

03:16 ...can be highlighted to pull out critical features that members of the public would understand, such as the forest cover...

03:27 ...the soil setter in Albemarle County, and the urban coverage.

03:32 So here you see Charlottesville and another small town, Crozier.

03:38 She has identified the different subbasins as you can see here, and the quality of streams in those subbasins.

03:46 How impaired they are and, I don't know where she got this information, but presumably she was working between GIS...

03:53 ...and other resources that were available at the county level.

03:58 She identified in a very diagrammatic way the way that the infrastructure works now, where water comes from, and where...where wastewater flows.

04:11 And again, on the Web site, all of these are active sites, and the current water supply infrastructure, and the proposed 2055 infrastructure.

04:24 She built this site so that members of the local community could understand how their water

worked, where it came from...

04:30 ...where it was going, and how they could improve its quality.

04:33 And, so one of the uses of GIS, and I...I personally I think it's a very elegant and simple way to understand a local watershed...

04:43 ...that will be useful for members of the local community, as they make the deci...make the decisions that need to be made.

04:49 So it doesn't obviously have the complexity, nearly the complexity that GIS has, but it is something that we...we hope...

04:57 ...she hopes, will be user friendly.

05:00 A second example is the Palisades project.

05:03 This is creating beautiful evidence to facilitate research in cooperation...

05:08 ...with governmental agencies, foundations, other institutions, and organizations.

05:13 The portion in italics is part of the mission statement of, as was the last case, for the National Academy of Environmental Design.

05:21 And these projects obviously were not done under the umbrella of the National Academy of Environmental Design...

05:27 ...but I've selected them to indicate the kind of work that I hope that all of us can do together, to advocate for a more sustainable world.

05:36 And I wanted to also give a...give re..., make reference to the man who created the term "beautiful evidence," who you may or may not be aware of...

05:47 ...Edward Tufte, who's trained as a statistician and graphic designer; he worked at Yale for years and he's very good...

05:54 ...and has really made the later part of his career into the creation of evidence that is beautiful and also accurate.

06:03 And I think that that's where this discipline that you all are co-creating must come together; it must do both.

06:10 So the Palisades project was...is still ongoing.

06:16 The key...the principals are Guy Nordenson and Catherine Seavitt, and Adam Yarinsky at Princeton University...

06:24 ...And Guy and Catherine are currently also at the University of Virginia for this year.

06:29 Their project looks at the Palisades Bay, which includes Lower Manhattan, a portion of New Jersey, and a portion of the other side.

06:38 Sorry, I'm from New Jersey, so whatever that other side...

06:43 And, it was done initially with support from the American Institute of Architects.

06:50 Several years ago, they won the Latrobe Prize, which is a \$100,000 research prize, and so this project in its first phase, and I've grabbed...

07:00 ...about six or eight snapped pages from a 200-page booklet that they've produced, so I'm not by any means doing justice to this, but this...

07:09 ...has been disseminated through AIA channels.

07:11 They're currently working with the Museum of Modern Art in New York and they just cosponsored a six-week charette...

07:18 ...invited charette in New York City, where teams were selected to work based on their research that they'd done.

07:24 The project has been mentioned in the New York Times and in other places, as well.

07:28 So, I selected this both because it's built on a GIS platform, or at least the analysis phase was, and because they have been very...

07:37 ...strategic about reaching out and building support through the AIA sponsorship with the Museum of Modern Art, which has a...

07:45 ...a constituency that is at...at a certain level, interested in sustainability, but this I think will drive the point much more deeply...

07:53 ...into the consciousness of their membership and others.

07:56 And as you might be able to guess, it's about hurricanes and how they might hit New York City.

08:04 I'm not going to go through this, but early on, well, relatively early on, they talk about using GIS to build the analysis model.

08:12 I have...I happen to have this whole PDF on my jump drive, so if any of you would like it, I'd be happy to share it with you...

08:19 ...so you can evaluate the credibility of it, because you probably can do that much more thoroughly than I can.

08:27 So, but some of these maps should look familiar; this...so this is land cover, this is Manhattan, this is New Jersey...

08:34 ...lots of the shipping areas. this is that other part of New York, somewhere over there.

08:41 Land use, elevation data, and...and then its inverse, water.

08:49 Looking at slush, so, in a hurricane, and...and I'm also from Florida - now you know everything about me.

08:55 We care a lot about tidal surges when there are hurricanes, because even though they don't stay for very long, they can do huge damage.

09:02 Of course, that's part of the problem with Katrina; the other part was that the water didn't drain, of course.

09:09 But, slush you might also imagine could be a problem that would be similar to sea level rise, except that it doesn't drain out again.

09:18 So this is kind of the money shot.

09:20 Here we have a one-foot inunda...inundation, and this is a close-up, so this is Lower Manhattan, two feet, four feet,...

09:30 We go to a Category 2 hurricane, and then a Category 4 hurricane.

09:35 And you can see how much of Lower Manhattan and New Jersey is unin...are inundated with a Category 4 hurricane.

09:43 And, as you know, there's...there are many arguments made that the hurricanes, as other kinds of storms, will become more...

09:50 inten...intense with climate change.

09:52 What this does, I think, is more powerful than lots and lots of verbal testimony to Congress.

09:59 It helps you understand things like, even with a Cat. 2 hurricane, which is no big deal at all, that's, you know, you can look at...

10:07 ... the real estate value of that...that's all...those are ports, so the lost income and revenues and things like that, not to mention...

10:16 ... real estate problems in this part of Manhattan.

10:20 So, very simply, and with the tools you have, you could also make them go live and probably drag a mouse over something...

10:27 ...and figure out if this is out of service for four days, how much revenue is lost while the water's draining out, or over two months...

10:35 ...while you're fixing things after a storm.

10:39 So, that...that's sort of the analysis phase, and they went through a very thorough design process themselves, and this is just...

10:48 ...one snap where they look at you reutilizing the bay for local ferries, to a greater degree a local transportation, to...

10:56 ...a greater degree and incorporating these things that I think are intended to kind of kill the tidal surges, kind of artificial reefs.

11:05 And then they looked at ecosystems, habitats, and the creation of elements in the bay, and of course you can...with Photoshop and things...

11:14 ...like that you can very easily present to members of Congress or others an important proposal that may not be so easily visualizable, otherwise.

11:25 And Guy, I believe is a structural engineer; Catherine is a landscape architect, and architect by training...

11:32 ...and Adam is an architect by training.

11:36 So, those are just some examples of the important work that we need to be doing that incorporates GIS as a foundation...

11:44 ...and the work of very good, committed designers, to improving the physical world and the way human beings inhabit it.

11:52 I'm going to now switch gears and talk about the role of the National Academy of Environmental Design...

11:57 ...in advancing evidence-based design research.

12:01 First of all, there'll be, I'll briefly mention four things - who we are, what our mission and purpose is, our government...

12:08 ...structure and our research.

12:10 I want to begin by, and I'm happy to talk about this in more detail over lunch or whatever, but we, many of us, began the development of...

12:19 ...a National Academy of Environmental Design several years ago, as a companion to the National Academy of Sciences...

12:25 ...Engineering, and the Institute of Medicine, which are the key scientific academies that provide much of the scientific...

12:34 ...policy advice that governs the Congress of our country.

12:38 When I began look at...looking at these things, as many of you have, you recognize that...

12:42 ...none of the disciplines that we're in are very well represented in these disciplines.

12:47 In fact, when we met with the president of the National Academy of Engineering, we had a bit the same reaction as the...

12:54 ...NSF proposal, which is, what are you kidding?

12:57 What do you...what do you all have to contribute here?

13:00 And yet, as we all know, in between pure research and human behavior, is our disciplines.

13:07 And so, it's very important that if we can't be involved through these disciplines, we have a way with enough...

13:14 ...enough impact to make our case heard as well.

13:18 And that's why we've created the National Academy of Environmental Design.

13:23 We started with the disciplines listed on the right, which are, the...including interdisciplinary groups, and we reached out...

13:33 ...to them, created a steering committee, so that rather than all of us individually going to Congress, which of course we can still do...

13:41 ...or going to the NSF, or, you know, going to our provosts, or things like that, we can work together because...

13:49 ...we believe that we can be more effective, and we need each other, as we can see, in these kind of interdisciplinary groups.

13:56 We need the expertise that comes from the various people in this room.

14:00 So, we have now collected the major architectural organizations, construction, communications design, interior design...

14:10 ...landscape architecture, planning, and related disciplines, and...and formed a steering committee, which has now led to an...

14:21 ...organization that's a not-for-profit in Washington, D.C.

14:25 We have leadership from each of the disciplines on...on an executive council that includes Tom Fisher who spoke this morning and...

14:35 ...Fritz Steiner who will be speaking later today and the support of others of you in the room who I won't embarrass at this moment.

14:45 Our mission is to serve the public by promoting the flourishing of individual communities, and the natural world through...

14:51 ...the sustainable design and stewardship of human and natural environments.

14:58 And we have looked at four goals, two of which I identified earlier to facilitate research and cooperation with government...

15:07 ...agencies, foundations, and other institutions and organizations to communicate the results of ongoing research to the public...

15:14 ...and other stakeholders.

15:16 If we're just keeping it to ourselves, or going to our professional associations, we're not making an impact in the larger world...

15:22 ...at least, not very quickly.

15:26 And then also, and this is very important and what many of you were talking about this morning already...

15:30 ...to develop and maintain a multidisciplinary knowledge base on the complex interrelationship of individuals, communities...

15:37 ...and the planet.

15:38 GIS certainly isn't the only tool that will do that, but it's a very important and very powerful tool.

15:45 And then to foster scholarly cooperation and exchange, which is why I am so pleased to be have been...been invited today...

15:51 ...because certainly for me as an audience member, I'll be learning a lot from all of you.

15:57 As I mentioned, we have a council which has representatives at this point from all of the major design...

16:03 ...environmental design disciplines.

16:06 Officers, and that...that includes...as I mentioned, I serve as the president...

16:12 ...Tom Fisher, I hope some of these other names are representative as well.

16:22 And a research committee, which has been...is just being formed, Jim Wescott of...Wescott of MIT...

16:31 ...is the chair of the committee, and he is beginning to put together an agenda.

16:35 He is also a member of the National Research Council, which is the resource arm of the National Academies...

16:42 ...so we see him also as one of our sort of people in the room to remind folks in the...the academies, that what we're doing...

16:49 ...is important to what they're doing.

16:52 And we have begun to create a research map, we...and we've identified, mostly based on Web sites which are notoriously inaccurate...

17:02 ...and out of date.

17:03 But based on some of the organizations that are involved, various categories of work that we do in communities, human factors...

17:12 ...pedagogy, preservation materials, performance, construction, innovation, visualization, which as I said goes back to...

17:20 ...Leonardo, the economy, and the practice.

17:23 And you can see that although these may be incomplete, for instance, this is the organization that I used to be president of...

17:29 ...and that Tom Fisher is now president of, that the ACSA, Association of Collegiate Schools of Architecture...

17:35 ...focuses in some of these areas but less in others.

17:41 And then just sort of pulling apart, you know, taking the...the organizations out, I just would like to end with this slide to suggest that GIS,...

17:50 ...the tool that you all work with so well, and have such important ambitions for in the future, deals certainly with...

17:58 ...communities, with human factors, with the built environment, including preservation and contr...conservation...

18:05 ...perhaps with material science applications in certain ways, easily with risk and resilience, certainly with construction.

18:13 It is about visualization and communication in the most fundamental way.

18:18 Design economy, of course, is what it's often been used for in...in planning and real estate decision making...

18:24 ...and it is transforming the profession through its...through its very presence here with us.

18:30 So with that I'll conclude. Thank you for your time.

18:39 Yeah, I'm happy to answer questions if you have any.

18:44 Any questions?

19:01 [Audience question] Kim, I wondered if you could talk to us a little bit about how trends in parametric design at the level...

19:08 ...not at the regional scale but perhaps...but at smaller scales, from individual buildings up through urban design street.....

19:15 ...streetscapes, neighborhoods, and so on, how that...that trend toward parametric design within architecture is linked,

19:27 I have a feeling you may be able to do that better than I can, or someone else in the room, but I'll start...

19:31 ...and then maybe ask others to join in.

19:34 I think that as we develop tools that allow us to make decisions in real time and to make those interactive with other kinds...

19:44 ...of software, we should be able to nest these things.

19:47 So what I could imagine is that something that's being done at the scale of an individual building might be locked in...

19:53 ...somehow to something that's done in a GIS circumstance, or multiplied times a hundred for a retirement community, or...

20:01 ...something like that, so that they might work together better than they do now, in order to make smart decisions.

20:09 But, again, I suspect you...you have another answer in mind. Okay. Okay. I welcome...

20:14 [Inaudible audience question]

20:17 Yeah, yeah, well, and as I hope some of you know there are pretty powerful tools being developed at the scale of buildings...

20:25 ...that also contain information and so, when in fact the project that I worked on with Iris was looking at the Apalachicola basin,...

20:35 ...which starts north of Atlanta and drains into the Gulf of Mexico.

20:39 And, one of the problems that we found is that deci...it was zillions of local decisions in Atlanta that were impacting water quality...

20:46 ...in the Gulf of Mexico, and if you could use smart software in designing buildings in Atlanta, you could then, I mean, at least...

20:54 ...in theory, figure out how to change the water flow in the Gulf of Mexico, and those tools do exist, they're just not...

21:01 ...so far as I understand, connected yet.

21:06 Any other questions? Please raise your hand.

21:11 [Audience question] Evan Girvetz from the Nature Conservancy in the University of Washington.

21:15 I found it interesting that the National Academy of Environmental Design didn't have really any representation from colleges or the...

21:21 ...conservation community, environmental sciences.

21:24 I'm wondering, if there was a reason for that, is it too much along the lines of the National Academy of Sciences...

21:30 ...or if you guys are thinking about going in that direction?

21:33 This is a question, again, that Fritz and Tom could also answer, and we're happy to talk as much as you'd like during the course of...

21:39 ...the con...conference about this.

21:42 We wanted to start by making sure that we were being equitable to all disciplines, first of all, and that we were equitable between...

21:52 ...the practice or the professions and the academy.

21:55 And so we felt that by bringing in the major organizations, for instance, the AIA represents professionals...

22:02 ...the ACSA represents the academy and architecture.

22:05 This was a way to get some kind of a balance.

22:07 And...and on our council, for instance, the AIA, which has 68,000 members, has one seat, so does CELA...

22:14 ...the Council of Educators and Landscape Architecture, that has 40 member schools, something like that.

22:20 So, we wanted to, at...at the beginning, give everybody equal space.

22:26 We also felt that it was important that we begin with organizations because it gets peoples' attention initially, so that when we talk...

22:38 ...now when we talk to people in the NSF, and mention how many environmental design folks we represent, because it's so broad...

22:47 ...it makes more of an impression with them.

22:50 We're in the beginning process of doing two things that address your question.

22:55 One is, we're developing, right now we have only institutional members.

22:59 We're developing a kind of a...a supporting membership, which mem...which universities, or individual practices...

23:08 ...or not-for-profit organizations could join at some level, and that I hope will be a way for us to connect each others' knowledge...

23:16 ...because that's...that's one of the big problems that we have.

23:18 So, that's very close to coming online; we're already doing it for universities - we haven't reached out to nonprofits.

23:25 And the...the second thing is that the dean at Washington, Daniel Friedman, has brought to us, who's the incoming ACSA president...

23:34 ...has brought to us the idea of having a council of deans, because of course many of our universities are interdisciplinary...

23:42 ...and so that will provide another form of advice for the group as it moves forward.

23:47 We're just going as quickly as we can of course and we're getting there.