

Landscape Design with Tangible GIS

Helena Mitsova shows the combination of a real-world digital elevation model with a flexible, laboratory-scale 3D model, indoor laser scanner, and projectors into a tangible geospatial modeling system at the 2010 GeoDesign Summit.

<http://video.esri.com/watch/53/landscape-design-with-tangible-gis>

Video Transcription

00:01 I will start my presentation with a little readout.

00:06 And just to give you some feel of what the tangible GIS is all about.

00:13 And you can see there a three-dimensional scale model which is flexible...

00:19 ...and which is linked to geographic information system and which runs a simulation.

00:25 And in that simulation we had water flowing through the drought.

00:29 So we can take a piece of the drought out, rerun the simulation...

00:33 ...and see what the consequences of changing that topography would be.

00:38 Then we can decide that we will put a small check dam into the landscape.

00:43 And now we want to see what will be the consequences of this new design.

00:47 And you can see at the very beginning it actually works.

00:51 It slows down the water flow.

00:53 But at some point the water just gets all over the, all over check dam.

00:59 So with this design, what we are creating here is three-dimensional interface to our simulations and to the geographic information system...

01:11 ...that allows us to change the topography, to change the landscape, and see what the consequences would be.

01:19 So now I will switch to my presentation, and let's see.

01:27 So, and let's look at what it is all about.

01:30 So we have already seen here sketches, sketching in two-dimensional space on two-dimensional touch table.

01:40 But can we do this with 3D?

01:42 Because our designs are really three-dimensional designs.

01:45 So how do we do this in 3D?

01:50 So the original idea actually came from MIT Media Lab and Sensible City Laboratory...

01:56 ...where they came up with this concept of illuminating clay where you have a three-dimensional, flexible surface...

02:03 ...that you can change, you can scan it, you can compute the analysis and then project the results over the surface.

02:11 So what we have done at NC State, we have taken this concept and we have hooked it to geographic information system...

02:19 ...which opened many, many more possibilities for working with the system.

02:24 So what we have here is the system, it has three-dimensional laser scanner.

02:30 That's how you get the data into the GIS.

02:33 It has projectors.

02:35 That's how you project the data from the GIS onto the three-dimensional model.

02:42 So what we can do, we can modify the model, then import it into GIS.

02:46 We compute the DEM, run the simulation, and project the results.

02:51 So you can generate, very quickly, many different scenarios.

02:56 For example, we can add buildings, we can dig in the ponds, add dams, add roads, we can change the land surface processes.

03:05 You can use different materials, put it onto the, on the surface to change the roughness, for example, of the surface.

03:14 And then what can you do with it?

03:16 Once you have your design, you can really explore various aspects of your design.

03:22 Everything that is available in your GIS, all of those analyses, you can do with your new design.

03:30 So you can compute simple analysis, such as slope and aspect.

03:33 You can look at what kind of impact your buildings will have on viewshed or line of sight.

03:39 You can look at flow accumulation, runoff.

03:42 That's what I have shown in the video.

03:45 You can look at soil erosion and deposition.

03:47 You can compute solar energy potential for different designs, different configurations of landscape.

03:54 So let's look at our little case study.

03:58 This is real topography, this is digital elevation model from LIDAR data.

04:04 And you can see what kind of problems we have in that small watershed.

04:07 We have sediment pollution, we have flooding.

04:10 That was the drought that was flooding, which I have shown in the first simulation.

04:17 So here is among the many, many things that you can do.

04:21 You can add the buildings so you can start asking the questions.

04:25 What will happen with runoff if I put the buildings there?

04:29 So the model is, you put on the buildings, the model is scanned...

04:33 ...you can compute the difference between the old and the new model...

04:37 ...and you can assign different parameters to these buildings.

04:41 So for example, here what we do in this part, we generate 100 percent of the rainfall, turns into runoff from the buildings.

04:52 And everywhere else, only 10 percent of the rainfall turns into water flow.

04:57 And that way, we can actually estimate how much are these buildings contributing to the overall runoff or amount of water here.

05:07 Then we can rerun the scenario where we have 100 percent turning into runoff everywhere.

05:13 So you can see the consequences of changing these.

05:17 Or you can explore. What if I put green, green roof onto these buildings?

05:22 What will be the consequence?

05:23 And again, you are doing it by interacting with this three-dimensional environment and using the standard GIS tools.

05:32 And the real fun that we have with this environment is people coming in and wanting to see it, want to see the demo.

05:40 So one thing that I always ask them to do, you do your own design.

05:45 So this is, so now I have a really nice gallery of incredible creative approaches that different people with different backgrounds...

05:54 ...come in and try to design this landscape and try to explore different things.

06:00 And they can look around the lab and pick up different materials, for example, to change the, to change the surface properties.

06:10 For example, here the, here one of the visitors put the CD-ROM on the, on the, on the

landscape, and he just tried to, wanted to see...

06:24 ...whether the laser scanner will work the same way as airborne laser scanner works, so you don't get any response from very shiny surfaces.

06:33 So we created a lagoon out of it.

06:36 So there are many, many different approaches.

06:39 I had one architect that used just the, just little pieces of paper, putting there for the buildings.

06:48 So all kinds of things that people really start getting creative.

06:52 And you can have not just one person working with it, but you can have two or three people playing around with it.

06:58 And it's really, really simple to generate, to generate these different scenarios.

07:07 So we have seen already that.

07:09 And we are using this environment for many things.

07:12 It's really a multipurpose environment.

07:15 We learn how to scan and how to work with the point clouds, because that's the laser scanner.

07:22 But we also test algorithms for analysis and simulations.

07:26 So you can see, for example, here we put the, a very, very rough surface.

07:34 And you can see we can test whether our models can actually handle something like this.

07:40 And then, of course, the main purpose is to explore and demonstrate spatial impacts of landscape change...

07:47 ...which you can generate very easily within this three-dimensional environment.

07:52 That's it.

07:54 Thank you.