

# The What and Why of GeoDesign

Tom Fisher, Dean, College of Design, University of Minnesota, introduces GeoDesign and discusses the types of problems GeoDesign can help solve at the 2010 GeoDesign Summit.

<http://video.esri.com/watch/50/the-what-and-why-of-geodesign>

---

## Video Transcription

**00:01** Well, it's really wonderful to be here.

**00:03** I was in the planning meetings of this summit, and...and it's really Jack's vision and a lot of hard work of people like Diana...

**00:11** ...and Juan Carlos and Mike Goodchild and many others who have made this possible.

**00:15** So it's an honor to be here.

**00:18** As Jack said, I think that we are at the beginning of what I see as a new field, what many of us see as a new field.

**00:25** And I think that questions and conversations we have in the next few days will really help us define what it is exactly.

**00:32** Thought I would start by giving you my sense of what it is.

**00:35** And then also, since I'm coming from the design side, not the GIS side...

**00:39** ...I thought I would also convey to you some of the issues that we're concerned about in the design community...

**00:44** ...that we think GeoDesign can really help with and...

**00:48** ...and help define, perhaps, research agendas for this new field.

**00:53** As Jack said, GeoDesign is sort of the coming together of geography, the study of the earth and distribution of life on it...

**01:02** ...the geospatial technologies, which look at spatial software and the analytics related to that...

**01:09** ...coming together with design, which as the computer scientist Herb Simon defines it...

**01:14** ...is the transformation of existing conditions into preferred ones.

**01:18** So one of the things that the design community is often interested in is not just making things look attractive...

**01:24** ...which tends to be the popular impression of what designers do...

**01:28** ...but actually make things work in the world and improve that function.

**01:32** And as I think you'll see in a moment...

**01:34** ...I want to make an argument that the design community hasn't been doing necessarily a very good job related to that...

**01:39** ...particularly when it gets to issues of sustainability and social justice.

**01:43** GeoDesign, I think, brings together two fields, both of have spatial thinking at their core.

**01:50** Spatial thinking, spatial analysis, the spatial allocation of information and resources, human activities; we share that.

**01:58** That is something that binds us together.

**02:01** To me, what's also interesting about GeoDesign is it has a powerful temporal side to it...

**02:06** ...which is that geography is a social science that looks at the way the world is and the way the world was.

**02:17** Design is a field that looks at the way the world could be.

**02:21** So GeoDesign is bringing together temporally two fields, one of which looks at the world from the past up to the present...

**02:27** ...the other one looks sort of from the present out to the future.

**02:30** And therein lies, I think, its capacity to enable us to address problems that we haven't been very good at addressing up to now.

**02:41** So, for example, as a social science, geography/geospatial thinking is analytical, it's empirical, and it's inductive.

**02:51** In contrast, design is a field that is prospective, looking out ahead; it's imaginative, and it's abductive...

**03:02** ...a word that you'll hear a little bit more about in this conference, which is a way of thinking...

**03:07** ...actually, it's an idea as old as our thinking about induction and deduction...

**03:12** ...which is about making lateral connections among seemingly disparate and disconnected things, finding new connections.

**03:19** In some ways, I think GeoDesign itself is a kind of creative bringing together of two fields...

**03:24** ...which have been kept separate and are now coming together.

**03:28** But I think, since I'm not a GIS scientist, I thought that it might be most useful in my comments to talk about...

**03:35** ...what are some of the problems we see from the design community that GeoDesign can help with.

**03:41** And I think I would start by saying that, from the design community's perspective, a lot of what we have been designing in the world...

**03:50** ...our cities, our human settlements, our buildings, our landscapes...

**03:53** ...have been designed without a lot of information about the consequences of our actions...

**03:58** ...the consequences of what we're doing on other species, on distant populations, on future generations.

**04:06** So as a community, the design community's focused very much on the immediate needs of clients and communities in the present.

**04:13** And yet we've been having an enormous impact on the planet way beyond what we have data to understand.

**04:21** And as GeoDesign can bring data to bear on those design decisions, it will profoundly change the way we live and the way we inhabit the planet.

**04:33** And so I think that from that I would like to make the argument...

**04:38** ...that because we've been designing the world without this data-rich knowledge of consequences...

**04:45** ...we've created a situation in which we have made ourselves, as a species, rather vulnerable on the planet...

**04:52** ...which to me gives a kind of urgency to GeoDesign. This is not something we have a lot of time to develop.

**04:59** If we don't develop these tools and start enacting them, we ourselves are going to be increasingly threatened.

**05:05** And this gets to my first point, which is an idea that Thomas Freedman and others...

**05:10** ...such as the faculty member at University of Washington, David Barash, have made...

**05:14** ...which is to make the argument that we have basically created an enormous Ponzi scheme with the planet.

**05:20** That humans have developed a scheme over the last several hundred years in which we suck resources...

**05:28** ...and exploit labor around the planet in order to maintain ourselves.

**05:33** And as we know, from Madoff, Ponzi schemes cannot be sustained.

**05:39** They eventually run off the planet, as this diagram shows.

**05:43** And that's exactly what's happened. We are now off the planet.

**05:47** It takes more than one earth to sustain ourselves at our current population and levels of consumption...

**05:53** ...let alone the exponential growth that we are in.

**05:57** Now, for...as objectionable of what Madoff did, he really will, I think, be historically recognized for doing two things.

**06:06** He helped us realize that if you make the Ponzi scheme big enough, two things happen.

**06:11** One, it is something that it becomes very difficult to see, and it also is something that we want to deny is occurring.

**06:24** We have so much invested in the world as it is that we don't want to recognize that, in fact, we can't sustain it.

**06:32** So one of the ways in which the design community thinks about Ponzi schemes...

**06:38** ...is what an engineer would call a fracture-critical system.

**06:42** And to give you a sense of what that is, this is a photo of the I-35W bridge in Minneapolis...

**06:47** ...which was a fracture-critical bridge structure.

**06:50** And fracture-critical systems are such that they've taken all of the redundancy out of the system.

**06:55** They've become so efficient that if any one part fails, the entire structure collapse catastrophically.

**07:03** And I want to make the argument that that is a metaphor for the world we have designed for ourselves...

**07:11** ...that this is not an isolated experience. In fact, this is the infrastructure upon which we are now living.

**07:17** And that's why we have to take these issues seriously.

**07:20** Had engineers had a strain gauge on the gusset plate on this bridge that cracked...

**07:26** ...they would've seen a curve very much like this, which is that, as stresses increase in a fracture-critical system...

**07:33** ...they at the very end increase exponentially just prior to failure.

**07:38** And so one of the things we have to start watching for are these exponential increases of stress on systems...

**07:45** ...because that is where the next failures are going to occur, the next catastrophic collapses.

**07:51** And so let me go through some of them...

**07:53** ...because I think that this is where you begin to define what the research agenda for GeoDesign could be.

**08:00** One of them is the exponential increase in extinctions going on on the planet.

**08:06** As many of you know, biologists like, such as E. O. Wilson, have talked about us being in the midst of the sixth extinction...

**08:13** ...where two-thirds of all bird, mammal, butterfly, and plant species are expected to be extinct by the end of this century.

**08:21** This is a profound phenomenon that we are in the midst of. And much of this has to do with the fact that we have...

**08:30** ...and here's some graphing of the kind of exponential decline in the health of species around the planet...

**08:39** ...including diagrams such as this, which show, for example, global fisheries totally collapsing by 2050.

**08:48** And this has a lot to do with the way we have spatially inhabited our planet, that much of this has to do with polluting...

**08:55** ...fragmenting the landscape, and introducing invasive species across it.

**09:03** So the way in which we have been designing our landscapes has directly related to the collapse of a number of these ecosystems.

**09:12** And GeoDesign, I think, has the great potential to help us understand this phenomenon...

**09:18** ...and make design decisions that work counter to it, that, in fact, preserve habitat, connect habitat...

**09:27** ...preserve the resources that other species need in order for them to survive and, with their survival, for us to survive.

**09:35** Another obvious exponential increase has been carbon accumulation in the atmosphere...

**09:41** ...which has been triggering global climate change.

**09:45** And it...and here too, much of the greenhouse gas emission from humans comes from human settlements, from buildings...

**09:52** ...from transportation systems, from the geographical spread in which we now live which has contributed to this problem...

**10:02** ...and, over the last many hundred thousands of years...

**10:06** ...are clearly out of sync with any kind of cyclical rise and fall of carbon in the atmosphere.

**10:15** And so here too, I think GeoDesign has great potential to enable us to begin to make design decisions...

**10:23** ...that are zero carbon in production, that use renewable technologies...

**10:30** ...and that begin to turn the tide on something that, if we don't...

**10:34** ...will be incredibly disruptive to our food supplies, our water supplies, and to much of what we depend on.

**10:44** There are, though, fracture-critical threats to us which go beyond the environment.

**10:49** And this too is something that I think GeoDesign can very much help with.

**10:54** For example, we designed a fracture-critical finance system...

**11:00** ...where we designed financial products such that we increased debt on our financial system...

**11:07** ...to the point where a few investment banks go down...

**11:10** ...and they bring the entire global financial community down with it.

**11:13** It's a classic kind of catastrophic collapse of a fracture-critical system as a result of poorly designed financial products.

**11:22** And there was a spatial component to this, which is that the banks did...literally did not know where the debt lies.

**11:29** They...many of them still don't know who's holding what debt.

**11:32** So we...it's a case of designing products that are so poorly designed, they're toxic even to the people who designed them.

**11:40** They brought down the very banks that invented them.

**11:43** And they still don't know where the toxins lie and...

**11:47** So here too, I think GeoDesign can actually help us understand the flows of money...

**11:53** ...the flows of resources spatially across the planet, and help us understand...

**11:57** ...when we're putting ourselves in positions of threat, such as the ones we have encountered.

**12:02** And also, of course, one of the key factors in this collapse has been, as this diagram shows...

**12:09** ...the exponential increase in housing prices in which we are now in the process of collapsing back down.

**12:16** Much of this has, as well, to do with the ways in which we have designed our own housing developments in this country...

**12:24** ...which is that, in the name of efficiency, we thought that this is the way in which people want to live and should live.

**12:30** It's quick to build, it's easy to sell.

**12:33** But as it turns out, these sort of developments are incredibly fracture critical.

**12:38** In other words, if enough houses foreclose in communities like this...

**12:42** ...they bring all of the prices of all the other houses that are nearly identical down to the same point.

**12:47** And as a result, you have large percentages of the American population whose mortgages our

now underwater...

**12:54** ...where the prices have collapsed, they're paying more on their mortgage than their house is now worth.

**12:58** And it has direct relationship to the ways in which we designed monoculture-like housing developments after World War II...

**13:06** ...that lacked any kind of economic resilience as well as environmental resilience.

**13:14** And so part of this is, you know, How can GeoDesign help us design communities that are more socioeconomically diverse...

**13:22** ...more architecturally diverse, more environmentally diverse...

**13:25** ...that in fact enable us to withstand the potential collapses such as we're encountering?

**13:36** As well as understanding how zoning and other public policies have contributed to this.

**13:42** And I can go on. Our electrical grid system is fracture critical; we know that it is quite vulnerable to brownouts, blackouts.

**13:52** There are six transmission stations in the country, any one of which were attacked by terrorists could bring large sectors of the economic...

**14:00** ...of the electrical grid in this country down.

**14:03** We have a fracture-critical transportation system, highly dependent on oil.

**14:09** And here again, I think one of the ways in which GeoDesign can help us understand are the impacts of some of these issues...

**14:18** ...such as what does it mean to have...to be at or near peak oil?

**14:23** And how do we begin to design multimodal forms of transportation...

**14:28** ...rethinking even the need to move so many people around, so many goods around.

**14:33** Are there other fuel sources and other settlement patterns that make us less vulnerable to the exponential increase in price...

**14:43** ...as well as the exponential decrease in the availability of inexpensive oil that we are right at the...in the midst of.

**14:52** And...and begin to learn...

**14:54** Actually one of the things about this research is you begin to find that some of the answers to these are actually old answers...

**15:00** ...things that we used to know how to do and that we have forgotten.

**15:05** As Bill McKibben says, "We live in this age of information and great forgetfulness."

**15:09** We've forgotten a lot of what we used to know and what we used to do.

**15:13** And so, to me, one of the interesting outcomes of some of this research may be in the process of rediscovering.

**15:20** And a couple areas that I think are also really affecting all of us, one of which is the...

**15:29** ...the fact we have a fracture-critical food system.

**15:31** We are now dependent on four plants for a large percentage of our calories.

**15:35** Disease in any one of those plants could bring famine around the world.

**15:42** We also are in the midst, as many of us know, of kind of exponentially increasing shortage of water...

**15:51** ...and where demand is far outstripping our reserves.

**15:55** Again, here are research areas where GeoDesign can not only assess the problem...

**16:00** ...but help us understand how we design and locate and allocate resources; locate people...

**16:07** ...think about human settlements in ways that can overcome the highly efficient, highly interconnected...

**16:16** ...and highly fracture-critical systems that we've been putting in place over the last 50, 60 years particularly...

**16:26** ...although some of this goes back several hundreds of years.

**16:30** And begin to use some of the geospatial technologies that we have that go back as far as Ian McHarg, and others...

**16:37** ...to begin to reexamine what land we use for what.

**16:41** And the work that's been going on in sustainable sites, and others, are great starting points for that research.

**16:47** But I think the most worrisome exponential increase of all is this one, which is world population.

**16:55** And in a way, you could argue that this is behind all the other stresses that we're seeing on the planet...

**17:00** ...which is the idea that it took humans all of human history to get to two billion people...

**17:06** ...and in a hundred years, from 1950 to 2050, we'll go from two billion to nine billion people.

**17:12** We are a completely out-of-control species. We are the weed species on the planet.

**17:17** And we are the major invasive species.

**17:20** And so I think that coming to terms with the fact that we are the problem...it is us...and what do we do about this.

**17:27** Because the worrisome thing about this is when you talk to ecologists...

**17:32** ...when they see an increase like this of any species in an ecosystem...

**17:37** ...there's only, almost...almost invariably one result. The species collapses.

**17:41** And we don't want that to happen, obviously, that...

**17:44** But the urgency of this, that this is not just something that we have to think about as an incremental change...

**17:51** ...this is a ticking time bomb, and it is...it is all of us.

**17:55** And it is not something that will just happen in Africa or Asia.

**17:59** One pandemic disease, carried through our transportation system, will immediately affect all of us...

**18:06** ...and is probably one of the greatest threats to an exponential increase in our numbers such as this.

**18:13** So how does, then, GeoDesign help with that?

**18:19** I think one of the things about it is that it can begin to help us understand how we will allocate ourselves in cities...

**18:28** ...how we will think about human settlements in ways that are more resilient...

**18:34** ...and come to grips with the fact that if we are going to sustain our population on the planet...

**18:40** ...we have to have a fundamentally different relationship with the natural world...

**18:45** ...or that we will ourselves be one of the species that's part of the sixth extinction.

**18:51** And these are issues that none of us like to face up to, we don't like to talk about.

**18:57** They are, though, the core issues that are driving a lot of the design community.

**19:01** And it's one reason why the design community is so eager to work with the GIS community on developing these tools.

**19:09** We have got to begin to make decisions about how we allocate ourselves and how we allocate resources...

**19:14** ...in ways that address these threats that really are in front of all of us.

**19:22** One of the things we can learn about, with all of this, is the way in which ecosystems collapse.

**19:29** Some of you may know the work of Buzz Hollings at Florida...

**19:32** ...and the work he's done with others on panarchy and the Resilience Institute.

**19:37** A lot of their work has shown that as ecosystems collapse...

**19:41** ...largely because there is a increasing efficiency, particularly of a few species in the

ecosystem...

**19:49** ...there's an increasing connectiveness within the ecosystem...

**19:53** ...but all redundancy and resilience from the ecosystem has been removed.

**19:59** And so an ecosystem collapse is an adaptive cycle, as Hollings and others would argue, back to resiliency.

**20:07** But it brings two other pieces to it. It brings a change in the way in which the ecosystem is efficient...

**20:16** ...and it actually decreases the interconnectedness of them.

**20:20** And so those are some, I would argue, design principles...

**20:23** ...that we have to actually start to think about as we think about our inhabitation of the planet.

**20:31** Here is a adaptive cycle from that work on panarchy...

**20:36** ...which sort of shows how ecologists have seen how ecosystems rise and fall...

**20:44** ...and I think one of the questions for us is to sort of question the idea that...

**20:49** ...we often assume is that we are on some endlessly increasing line of progress.

**20:55** That in fact, as a human ecosystem, we in fact may be in the midst of an adaptive cycle very much like this...

**21:01** ...that all other species go through, plant and animal.

**21:04** And that...how do we begin to address the fact that we may be on that upper curve of...

**21:11** ...about to sort of reestablish resiliency as one of the key variables and key values that we need to pursue.

**21:22** And I think GeoDesign plays a key role in this transition by making global data available to us...

**21:28** ...helping us see consequences, not only locally but globally in our design decisions...

**21:34** ...providing the design community real-time data so that we can make data-rich decisions...

**21:41** ...are all aspects of this new field that will be vitally important.

**21:47** I think also the idea of GeoDesign empowering ordinary people. As Jack was saying, we live in this age of mobile technology.

**21:56** How can we bring this information not only to the hands of experts...

**22:00** ...but in the hands of everybody so that as we make day-to-day decisions...

**22:04** ...Do I drive to get that quart of milk, or do I walk? Do I, you know, water my lawn, or do I let it go native?

**22:13** I mean, there are just myriad decisions that GeoDesign empowered people can begin to change their behavior...

**22:22** ...at a level that will be, I think, fundamental to our ability to begin to deal with some of the fracture-critical threats that we face.

**22:33** And I think that...let me just end here, because I would love to hear some of your thoughts about some of this...

**22:42** ...with some work that has been coming out of the ecology community.

**22:49** This is a diagram that Jeffrey West from the Santa Fe Institute has been developing...

**22:56** He's a geophysicist; you may know some of his work on sort of scaling.

**23:04** He's been finding sort of universal scaling laws that apply across plant and animal communities.

**23:08** He's also starting to look at urban settlements, human settlements, in terms of these scaling techniques.

**23:14** One of the interesting discoveries he's made is that there's a constant relationship...

**23:19** ...between the mass and metabolism of all plants and animals on the planet...

**23:24** ...with one exception, which is humans.

**23:26** Via technology, we now have the metabolism, or the energy absorption needs, of a blue whale.

**23:34** So one way to think about the stresses that are on the planet is that we now live on a planet...

**23:41** ...with six and a half billion blue whales, which is us.

**23:42** We are driving other species off the planet...

**23:45** ...and we ourselves are threatened because the planet may not be big enough for that many blue whales.

**23:50** So one of the interesting design challenges which GeoDesign can help us with...

**23:54** ...is how do we bring our mass-metabolism ratio back into alignment with what it used to be?

**24:01** I mean, humans lived on this planet for thousands and thousands of years within the mass-metabolism ratio of all other species.

**24:10** It's only been in the last few hundred years that we are way out of line.

**24:15** And so we need to redesign the world and redesign our daily lives in ways that we stop absorbing so much energy...

**24:23** ...and run all the other species, or so many other species, off the planet and potentially ourselves with it.

**24:29** But this is another diagram that Jeffrey West's group has developed, which is looking...

**24:36** He too is concerned about these exponential increases, these curves that we are on...

**24:41** ...on water, on food, on energy, on carbon accumulation, on population. We are on so many of them.

**24:49** And that's the sort of diagram shown by number 1.

**24:52** He argues that what we need to prevent catastrophic collapse, such as what would happen with number 2, is innovation.

**25:02** And so innovation is the series of sort of sculpted increases here...

**25:07** ...which are that through innovation we can sort of rethink the way in which we inhabit the planet...

**25:17** ...we can rethink the use of resources, and prolong our ability to sustain ourselves on a planet such as the one we're on.

**25:28** I think, to me, and these kinds of points, number 3, number 6, are these sort of moments of innovation...

**25:37** ...where there's a profound paradigm shift in the way in which we occupy the planet.

**25:42** I think GeoDesign is one of them. I think it actually has that potential...

**25:46** ...that it can be one of these tools that through the proper use of it, we can...

**25:52** ...begin to reestablish a different relationship with our settlement patterns, with our relationship to nature...

**25:58** ...and prolong our ability to sustain so many billions of people on this planet.

**26:04** So GeoDesign, its time has come, I think, and it's none too soon. So thank you.