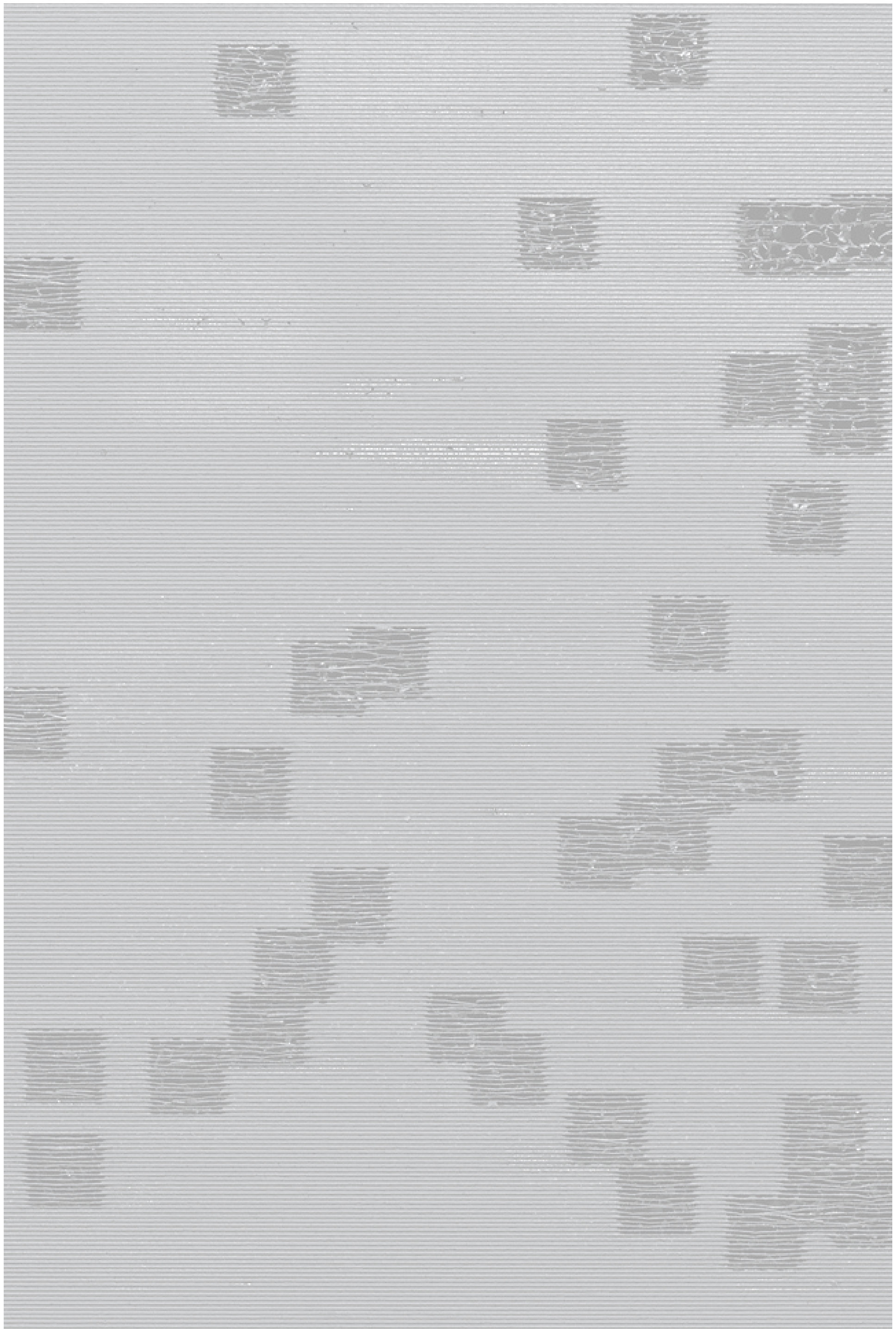


SITU ATED KNOW LEDGES

Scott Kildall

ISSUE 1

[The interview transcript has been lightly edited for clarity.]

Georgina Voss: Can we start with you talking about the history of your practice, and how you came to be at Pier 9?

Scott Kildall: So I have history of practices being a new media artist, and I've worked in video, in virtual spaces like Second Life, have created installations, sound sculptures, a real variety of types of form. But in 2012, I took a break for about 18 months and I took a job next door over at the Exploratorium. My job there was to work as a new media exhibit developer, to collaborate with scientists and investigators and researchers, and build exhibits for East Gallery, which is the gallery focused on living systems: biology, the ocean, things like that. Part of my work was to generate screen-based visualizations, and to work with some physical data visualizations as well. It was during that time that I started seeing the artistic possibility for physical data visualizations that worked less in more legible scientific realms, and more with experimental aesthetics and technology. And that idea began to ferment in my imagination. That 18-month period of time was deliberately when I went fallow, because I felt I was not really as focused as I'd like to be.

My fixed-term contract came up there and I decided not to pursue full-time employment at the Exploratorium. Simultaneously, there was an opportunity to work at Autodesk as an Artist-in-Residence with the machines over here, which was a perfect confluence of what I'd been wanting to do for a long time, which is to write software code, which is what I really enjoy doing; and working with sculptural physical forms, which I also find intriguing. It's only been recently that you have access to these incredibly large data-sets and access to these digital fabrication tools. So for me, that was what my proposal was about – working with those machines, and focusing on projects such as *Data Crystals*, which was an early project which focused on mapping data, and reorganizing it in an aesthetic form which created these non-predictive sculptures.

GV: After *Data Crystals* came *Water Works*. What was your starting point for that?

SK: A lot of the time what happens is that you have this wonderful brilliant idea about a project that you want to work on with data—and I've had so many ideas for data projects—and then you do the research and the data's just not applicable. The starting point is often thinking about what materials you have available, like what data do you have available to you. One of the conversations I had at the Exploratorium was with the Department of Public Works in San Francisco, who do all the engineering for the sewer system, and they were interested in producing sewer maps of San Francisco. That project never came to fruition at the Exploratorium, but I picked up that conversation with the *Water Works* projects, and that began a process of thinking about investigating the sewer system in San Francisco.

It was something I'd been interested in for many years because this is an amazing network of pipes and activities that you don't even think of for most of the time. And I'm one of those people who walks over to look at the different manhole covers and looks at the notation on them, and wonders about all these different aspects of how the city's been built. The sewer system's been around for over a century now, and has evolved slowly in this natural way where you don't just rip out the entire sewer system and put in a new one, you build on top of it, and it becomes an organism that has all these twists and turns, all this detail of how the city has developed and how the construction has developed, and how public policy has worked around that. So there's a fascinating conversation that happens in thinking about these sewer maps.

So the starting point of having that sewer data available to me was looking more generally at the water infrastructure of San Francisco. There are three different water systems in San Francisco, which is unique to just about any city that I've ever heard of. There's standard tap water that comes in from Hetch Hetchy, you get your drinking water, that's all the water that flows into your home. You have the sewer system, which is a combined sewer water and wastewater system, so it's one set of pipes. It's not unique at all in North America, but it is the only coastal city in North America to have a combined wastewater system and sewer water system. All the water in the rest of the pipes gets funneled out to wastewater treatment plants, one on the Pacific side, and one on the Bay side, where they get treated and disposed of, so it's a very clean system. It's also nearly entirely gravity-fed, which is very unusual.

San Francisco also has the auxiliary water supply system, AWSS, which is a totally unique system. It's an entire, separate set of pipes used only for firefighting. This is because, after the 1906 earthquake, the city was using the portable water mains to do all their firefighting, and the agencies and the politicians realized this was not sufficient because if you had a total infrastructure collapse you would need a separate system, a separate set of pipes. So it's a back-up system. There's a reservoir from the top of Twin Peaks that feeds that system, and there's also these underground water cisterns that exist that aren't connected via any pipes—they're just these giant tubs of water. There are about 170 of those; those are completely amazing and unique, and they're marked by these brick circles that you see in the street. Not every one is marked by a brick circle, but the brick circles always mark a cistern.

So once you notice those brick circles, you can't un-notice them. You'll ride your bike or walk around, and you'll see these little brick markers, especially in older parts of the city.

GV: So what did you do with the data, and what choice did you make in materializing it, around the aesthetics?

When I did the *Data Crystals* project, one of criticisms of it was that it wasn't as legible as people would like. I thought that was okay, because it was in a realm of experimenting with the formal properties of 3D printing and code. But I wanted to do more of a mapping project, that really fixed it in a certain space. With the *Water Works* project, I ended up producing three different maps: one of the sewer system, one of the underground water cisterns, and one of what I call the 'imaginary drinking hydrants', because the emergency drinking hydrants were taken offline after I went to press and got a lot of publicity, so.

So I wrote code that mapped these out in 3D space and created a set of 3D prints for each one. Each one is large-scale, 20 by 20 inches, and mounted on top of a laser-etched wood panel that shows a geolocated space. These maps don't look professional at all, like a data visualization, and they're not as slick as a GIS map. They definitely have the detail of an artistic hand in it.

GV: Were you using existing data sets? Certainly in some of the projects I've worked on, and in what we're doing in *Situated Systems*, we're thinking about the politics of a data set and what you have access to.

SK: So the politics of data sets are super-compelling. For the sewer system, I had access to a complete data set which I was to use only for the length of that project, and I had to destroy it afterwards, I had to scrub it from my hard drive. Because they don't want that data set to be public for various reasons. But because you can't really abstract any really specific information from my 3D print it's okay, and the data set's not published online.

The emergency hydrant drinking set was a data set that was somewhat available. There's a list of intersections. I had to write code that mapped this out in 3D-space, got the x-y, latitude-longitude, and elevations for each of those.

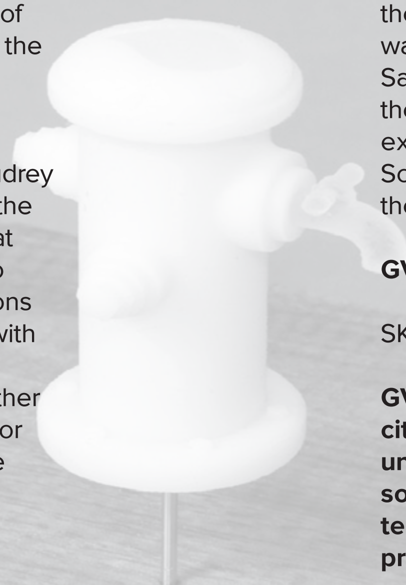
For the cisterns, that data set was not public, and there's no real good reason for it not to be public. Once again, you can see these manholes that are marked with these brick circles all over the city, so it's not like this is a hidden data set. Nor is there any security threat or reason for this to be private. But I did manage to find an online list of intersections through an old fire department manual from about 8 years ago, and got the intersection names off that, and generated code to give me an approximate location for all those. But that was just a rough guide.

GV: And so the cistern mapping project came after that, and that was more of a crowdsourced effort?

SK: So I generated the original cistern map from the list of intersections, the crude map. Then about a year later, as something I'd wanted to do for a long time, I organized a bike-mapping expedition to document, with photographs, the locations for each of these cisterns, and put them on top of the web map. There's no comprehensive web map of any of these cisterns, and so I thought, this is a good public service to do because people are interested in the story about the San Francisco cisterns. It's an amazing story about the history of San Francisco, because most of these were constructed in 1908, just after the 1906 earthquake. There was a huge bonds measure that passed because the citizens of San Francisco were completely terrified of another fire that would decimate the city, and the cisterns would save the city or portions of the city when the water mains collapsed.

So for the cistern mapping project, it was experimentation in crowd-sourced volunteer mapping. This was a completely new experiment for me, so I created a set of physical maps for people of intersections from the original set, and assigned people different regions. We got 18 bicycle riders together, and people travelled in pairs because it's more fun to bike with a friend than bike by yourself, and also there's a safety concern, that someone else can make sure you're not being run over by a car. I was at home, getting geolocations emailed to me of each of the cisterns, so we mapped the precise geolocations and took photographs of all the ones that we could find. And we couldn't find all of them, but we found a good chunk of them. Some of them from the original set were not on the map, some from the original set of intersections were not actually there, and so there's a conversation about this whole mapping process.

And we had a journalist in tow with us, a woman named Audrey Dilling, who worked at KALW and produced a show about the cisterns, and included this as the linchpin activity within that show. And since then I've gotten emails once a week or so asking about the project; people have been adding locations that weren't on the original map. It started a conversation with the general public about mapping. All these San Francisco residents are interested in this cistern story, because no other city has these 70,000 gallon vats of water underneath major intersections, like, that's just crazy that you have that inside the city.



GV: What is there specifically around water infrastructure mapping in San Francisco itself? There have been other infrastructure mapping projects in other cities—Ingrid [Burrington] has done a lot of mapping work around internet networks of New York, for example. What makes San Francisco interesting for thinking about these types of mapping projects?

SK: What makes San Francisco really interesting is that it has these three water systems that are unique—no other city has three water systems: one to fight fires, one to provide drinking water, one to provide a combined sewer system. The sewer system, because it's gravity-fed, has a very unique way of construction. Imagine a flat city like Chicago and having the sewer lines there—I'm sure that you have pumps all over the place, pumping stations that are pumping the water in different places. The sewer system actually maps out the topography of San Francisco in kind of this amazing interesting way. So the sewer map, when you look at it, you can see the hills of San Francisco, you can see the development of the city, you can see these underground lines that are all the way down Kearny Street, for example. There's this huge pipeway of sewage flowing down there. So if you're living on top of Kearny Street and there's a huge rupture then, look out, it's going to be stinky.

GV: And I was living there for the first two weeks I was here.

SK: Could you smell it?

GV: I couldn't figure it out. It's that thing, when you move to a new city and you don't know what you're experiencing here: is this unusual or is it just something I'm not familiar with? Also: there's something really challenging about materializing complex systems, these things which are not meant to be cognitively comprehensible. Did you find that some things, like the topographies, were emergent? Did you make decisions about bringing certain elements to the fore?

SK: For the *Water Works* project, I constrained myself to 3D printing. When you're doing a mapping project, it's important to have structural constraints, to think about the form. Is this going to be a photographic essay? Is it going to exist entirely on the web? (which a lot of people have done) Will it be on paper? (which plenty of people have done) Is it going to be a 3D-printed map? I tried to come up with those material constraints early on.

But a 3D print, unless it's painted, is going to look like a 3D print. With the 3D printers we have here, and the types we were using, I have only a limited palette of colors available. By mixing the two I can do two different colors, ranging from more of a translucent to a white color, and a black color to a white color. I can do grayscales, which is more relevant for sewage as not black or white; the cisterns, for example, are white. There are very limiting constraints in terms of the materials. So the physical structure becomes the form that's more important. So generating that structure entirely by code was where the magic happened, because the material process was fairly predictive, as long it didn't print and fail.

With the *Water Works* project, what was important to me was—especially with the sewer map, the sewer map had 30,000 manholes, and 30,000 pipes connected to it—so there was a lot of data coming through it. With the cisterns, there's about 170 cisterns. With the fire hydrants, I think the number is 67. And so the hydrants and the cisterns were a little bit more predictable— 170 is a number you can get your head around. But 30,000 is just a crazy number.

I also found holes in the data set that were reflected in the structure, because data is not clean, ever.

What was compelling, though, was that no one had ever seen this whole sewer map in a 3D space, and certainly not printed out.

What I printed out was a 1 foot by 1 foot section—printing out the whole section would have been prohibitive. When I show it to people, they immediately get it. They look right into the nodes and they can see these different sizes of manholes. Every single manhole has a volume associated with it. You can see the bigger chunks and access points, you can see these whole parts of San Francisco weaving through there. You can also see holes in the data set, where flows will happen to a lower point, and then there's no way for that lower point to then go to a higher point, there's no pumping station. It's just a hole in the data set.

GV: A previous project I'd worked on [*Familiars*, 2015, with Wesley Goatley] had similar elements—when we had a gap in the data we were clear that, it didn't mean that a plane had vanished from the air entirely, it just meant we didn't have data on that plane anymore. Being able to visualize, materialize, what data you have is useful for demonstrating the slippages of data, not the system itself.

SK: And the data has a lot of gaps and holes in it. One of the other projects I'm working on with the SETI organization is with a scientist named Peter Jenniskens, who does work on meteorites and meteor data collection, so he's provided me with data sets of meteorite impacts at specific locations. So, for example, I have a data set of 670 meteorites that were geolocated after an asteroid entered the Earth's atmosphere and fragmented and shattered and threw meteorites all over a 30 km range in the sand. He worked with about 100 students at the University of Khartoum to weigh them and geolocate each one. It's this amazing data set, this super-rich scientific set, but also for aesthetic purposes you have these three aspects: the x-y, the longitude-latitude, and the size of the meteor. Some are these tiny fragments which are smaller than your fingernail, to something which is quite large, that you have to struggle to pick up.

With that data set, it's my charge to think about the material expression of how it's going to look. This is not going to be a 3D print—it doesn't seem appropriate to me to have a 3D-printed meteorite. This is something where you have impact data, with a form that comes in at an oblique angle, where it usually tears up the surface. So I'm thinking about ways to gouge a surface with the waterjet cutter, ways to do this that will take some sort of material, yet to be determined, and create the fissures and gaps in it that give it that sort of feeling of an impact, but also give it an aesthetic appeal that folks who are not scientists, or not very knowledgeable about meteorites, can get drawn into that conversation. The research is fascinating, but to explain that to people in words requires several layers of conversation and interest, but with an aesthetic approach, then it begins to get into this conversation of what art can do for science.

GV: That's an interesting point about which audience you're developing work for. A lot of the conversations I've had about the place of artists in scientific institutions focus on how their work can shine a light on what's going on in that institution itself. But you're talking here about how to bring that work out of the institution, to a different audience.

SK: Yes. Bringing artwork to multiple audiences is the challenge of a lot of today's artists. I want to, of course, bring this into galleries, where people who are artists or art aficionados who come into this space look at it through a traditional lens of material, of formal constraints, of thinking about what artists can do with technology-based art, new media art. But also bringing it back to SETI, with these well-known scientists, to show that art has a role in a science-based institution, of showing the information in a way that's aesthetically appealing, that draws people in, in a way that a scientific paper or a podcast simply cannot do—they don't have that function. And showing this similar approach between art and science—where science is looking at experiments and curiosity and iteration to get results, and artwork is looking at curiosity and experimentation and, oftentimes, iteration, in my experience, to get to a result. Finally, just bringing the work to not-art or not-science audiences who can appreciate it.

I've wanted to move away from screen-based data visualizations because they can look very similar. There's a rich conversation with data visualizations, but a lot of them are using the same toolsets, D3 and JavaScript, and everyone's constrained to the screen and the mouse, to your relationship with your laptop. Creating these in material forms mandate a presence in reality, so if you look at these material forms, you're moving around the object and using your perceptive capabilities in a way that's a time-honored traditional way of looking at things. It's only very recently that we've had maps online and we think this is the norm, but this has not been the norm for millennia. We've had maps on stone or paper or other objects that have taken different aesthetic forms over the years. We think our countries are color-coded differently, like somehow the United States is green and Canada is red and these are all…they're not reflecting reality.

GV: That brings us back to the politics of the tools that we use here. Have you found that your own practice has changed with the tools that we have here? How do we stay mindful of the affordances that they offer us?

SK: There's an interplay with the hard edge of the tool and the artist's hand that I think is where I like to experiment. I recently worked on a project called *Bad Data* where I worked with datasets that were 'bad' in some political, cultural, scientific sense of the word, and began to think about how we use the machines here to give us more analog-looking results. I worked with etching and the waterjet in such a way that I would etch through the top layer of the material, and then let the water ricochet through the bottom layer but not pierce through it, so that the ricocheting produced unpredictable effects and gaps and fissures in the data itself, non-predictive effects. Whereas if I just cut the datasets out of a piece of aluminum, I could replicate the same look with every single piece of aluminum, predictably. So machines like the waterjet or the CNC machines or the lasercutter are designed for replicating something exactly, so that your first sheet of wood looks exactly like your second sheet, looks exactly like your third sheet. Working with non-predictive materials is what's starting to interest me. So with the meteorite data, my next experiment will be to project the data onto a surface, and then redigitize what I've drawn, and then do the cutting. So I'm putting my hand back into the work, 'cause when a meteorite hits the ground, it's not just a circle, it's an uneven shape. If you draw a rock, it's not going to be an exact circle, it'll be something that has these odd jaggedy lines.

> It's funny—this idea of what tools are 'intended' to do is really propagated by how people use the tools. This is one of the things about 3D printing that is still a very active conversation.

When 3D printers first came out and became more mainstream—and this is only a few years ago—you'd have people who were 3D printing Yoda heads and reusing the basic materials that are out there. Certainly at Autodesk Pier 9, when you invite artists into the fray, they're not going to do that type of artwork—that's not even considered real artwork. They're going to use the 3D printer in ways that were not intended by the makers of the machine or by industry, they're going to do stuff which is kind of wacky and weird. Some of the work that I've seen produced here ranges from data sets to wearables to joinery to sculptural recreation. There's so much amazing work done by artists here repurposing the machines.

So lasercutters, waterjets, all the CNC machines—there are intended uses for the machines, but there's no one that says that you can't use the toolpath of a milling machine to etch patterns that reflect data, or that somehow become inscribed, part of the piece.

Usually, when you think about the machine, you're trying to minimize the inscription of the tool, but if you somehow embrace the inscription of the tool, you'll see what was not intended, but is a totally legitimate use of that machine. And that then becomes part of the conversation about what the machine can do.

REFERENCE LINKS

Donna Haraway - Situated Knowledges
http://www.staff.amu.edu.pl/~ewa/Haraway,%20Situated%20Knowledges.pdf
Scott Kildall -
Water Works: http://kildall.com/project/water-works/
Bad Data: http://kildall.com/project/bad-data/
Data Crystals: http://kildall.com/project/data-crystals/
Ingrid Burrington - *Networks of New York*
http://www.mhpbooks.com/books/networks-of-new-york/
Georgina Voss and Wesley Goatley - *Familiars*
http://www.wesleygoatley.com/familiars/

Interview conducted on March 10, 2016

Scott Kildall is cross-disciplinary artist who writes algorithms that transform various datasets into 3D sculptures and installations. The resulting artworks often invite public participation through direct interaction.

His work has been exhibited internationally at venues including the New York Hall of Science, Transmediale, the Venice Biennale, the Vancouver Art Gallery and the San Jose Museum of Art.

He has received fellowships, awards and residencies from organizations including the Impakt Works, Autodesk, Recology San Francisco, Turbulence.org, Eyebeam Art + Technology Center, Kala Art Institute and The Banff Centre for the Arts.

He resides in San Francisco and is currently an artist-in-residence with the SETI Institute.

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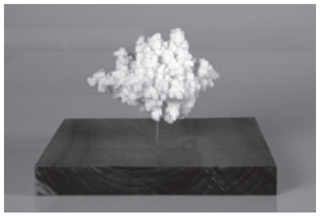
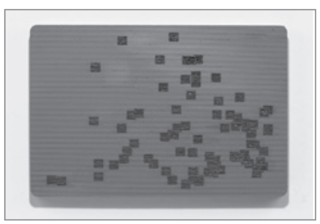
Georgina Voss, a *Situated Systems* team member, is an anthropologist of technology and innovation systems, working at the intersection of design, futures, and policy. She is a co-founder of design and research co-operative Strange Telemetry, and teaches at Goldsmiths, University of London.

pages 3-4: *Water Works*



pages 9-10: *Data Crystals*

pages 5-6: *Water Works*



back cover: *Bad Data*

pages 7-8: *Water Works*

IMAGES

courtesy of Scott Kildall

Situated Knowledges is part of *Situated Systems*, an experimental, collaborative, site-specific research project which explores military and industrial infrastructure in San Francisco and the Bay Area, investigating how this history has shaped the technology culture of the region and its outputs. This zine series collects interviews with people conducted as part of this project. *Situated Systems* is the inaugural project of the Experimental Research Lab at the Autodesk Pier 9 facility, from February through June 2016. The title of this series comes from Donna Haraway's 1988 essay, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," in which she writes, "Situated knowledges are about communities, not isolated individuals."
http://situated.systems twitter: @situatedsystem