

A Sensor Commons

Global DIY environmental monitoring activities.

Lame Intro: How many of you are interested in...

Basic soldering

Designing your own
circuits

Applied physics

Ballooning & drones

Map-making

Home energy usage
monitoring

Weather data

Environmental
monitoring: air quality,
radiation, ...

Statistics

Data visualisation

Massive databases of
volunteered geographic
information: tagged, geo-
referenced time series
data

How about doing all of it?

Together with other
great people?

For the benefit of humankind?

The Setup

- **Reduced funding** for many universities, research institutes, national weather services (US, UK, others)
- **A staggering amount of environmental catastrophes** at our doorsteps. Fukushima, BP oil spill, etc.
- ...and **not all of these are monitored** in a sufficiently public manner. A growing ability by **private citizens to make their own hardware**
- You have a keen interest to establish facts.
- Be assured: You can help.

Fukushima

- Big reactor failures in early 2011
- Official monitoring stations stopped reporting at times
- Public uncertainty about the degree of radiation levels
- Individuals started making their own measurements
- Started teaching others

Out of this several
community groups
formed

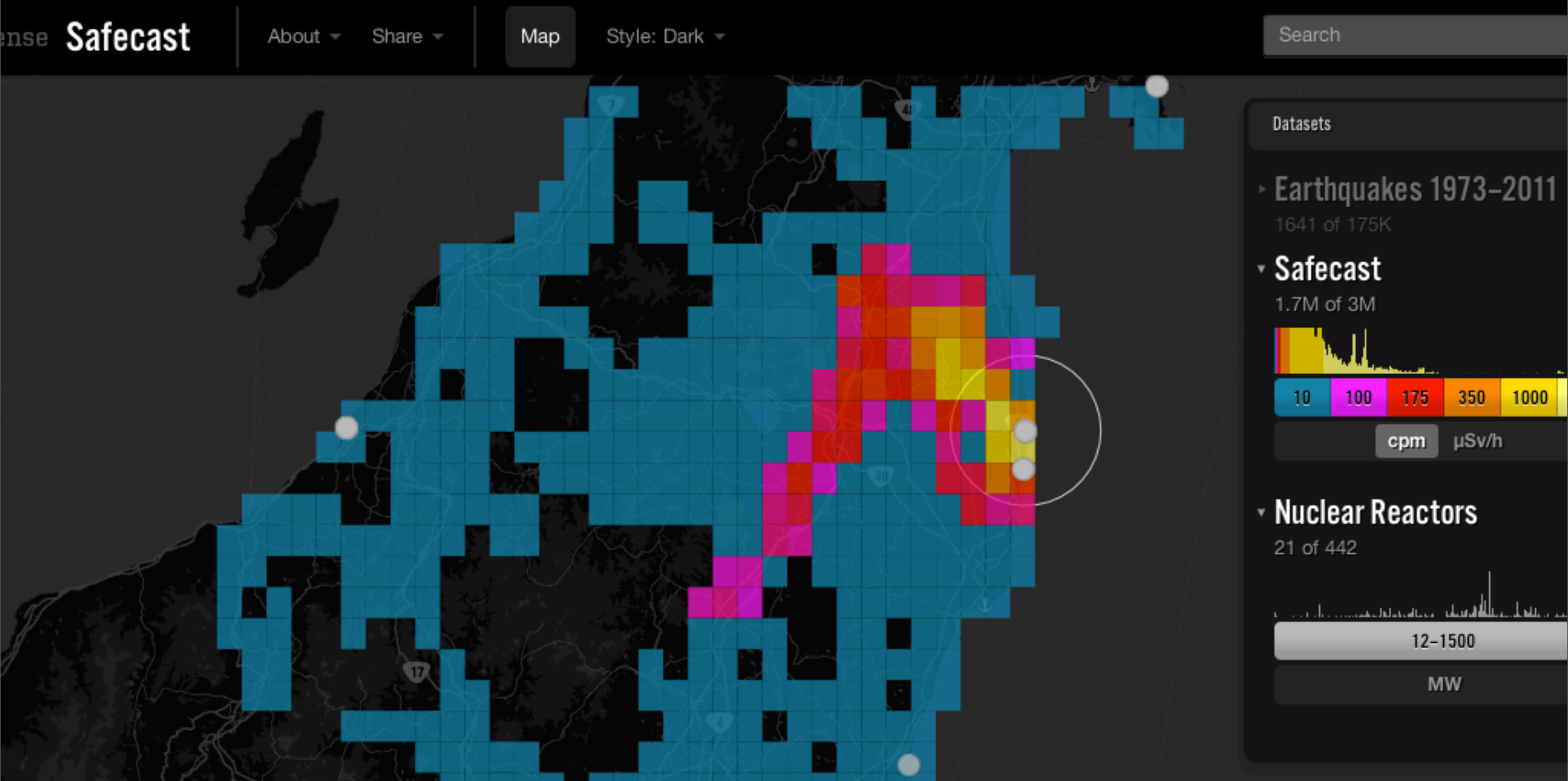
Marian Steinbach: free-form and inclusive.

Much activity
on Pachube
(now Cosm.)
Geigermap.

A number of other groups...



Safecast: clear structure, thorough quality control



BP Oil Spill

Large oil spill in the Gulf of Mexico in 2010

Oil continued to leak for three more months

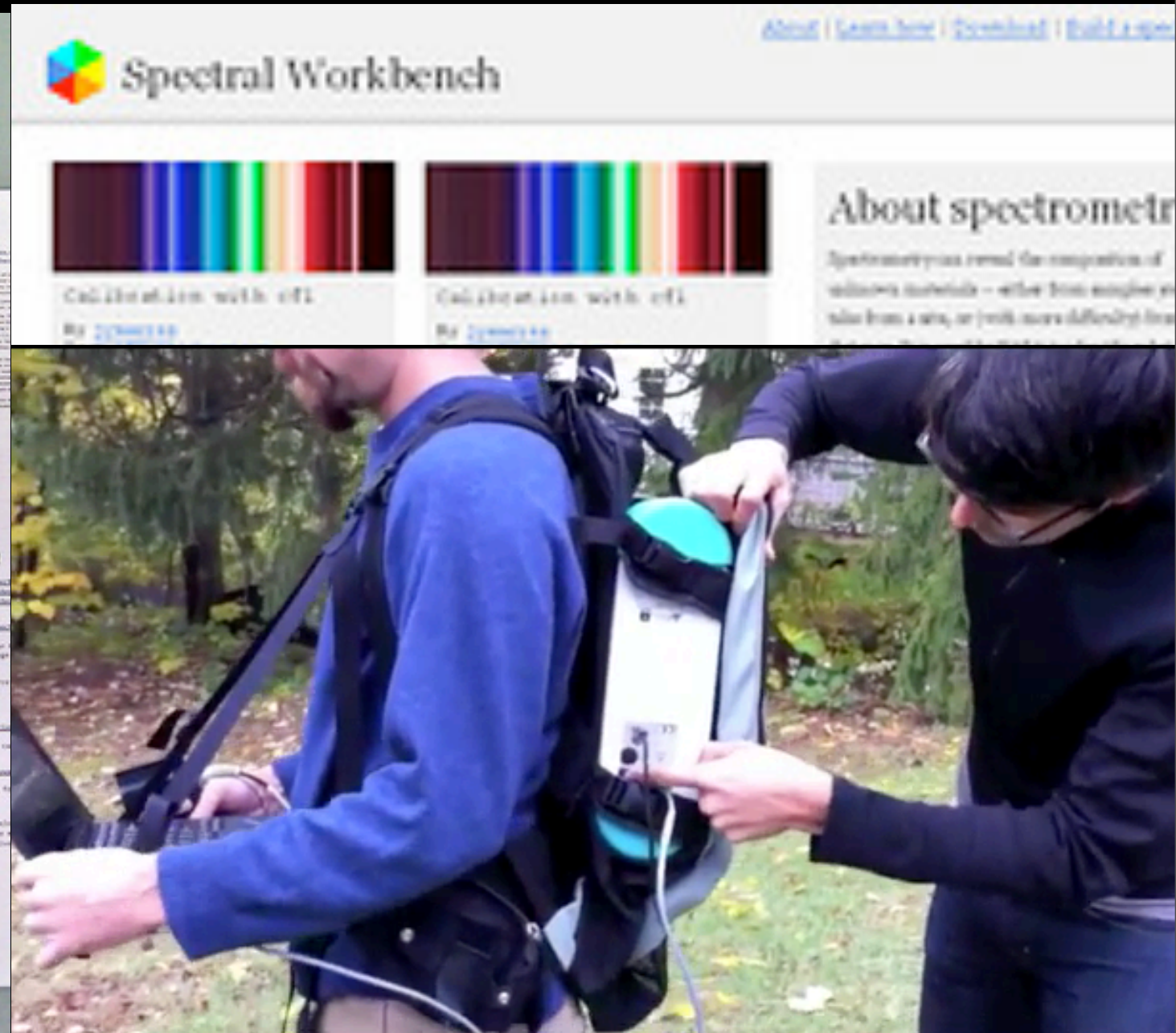
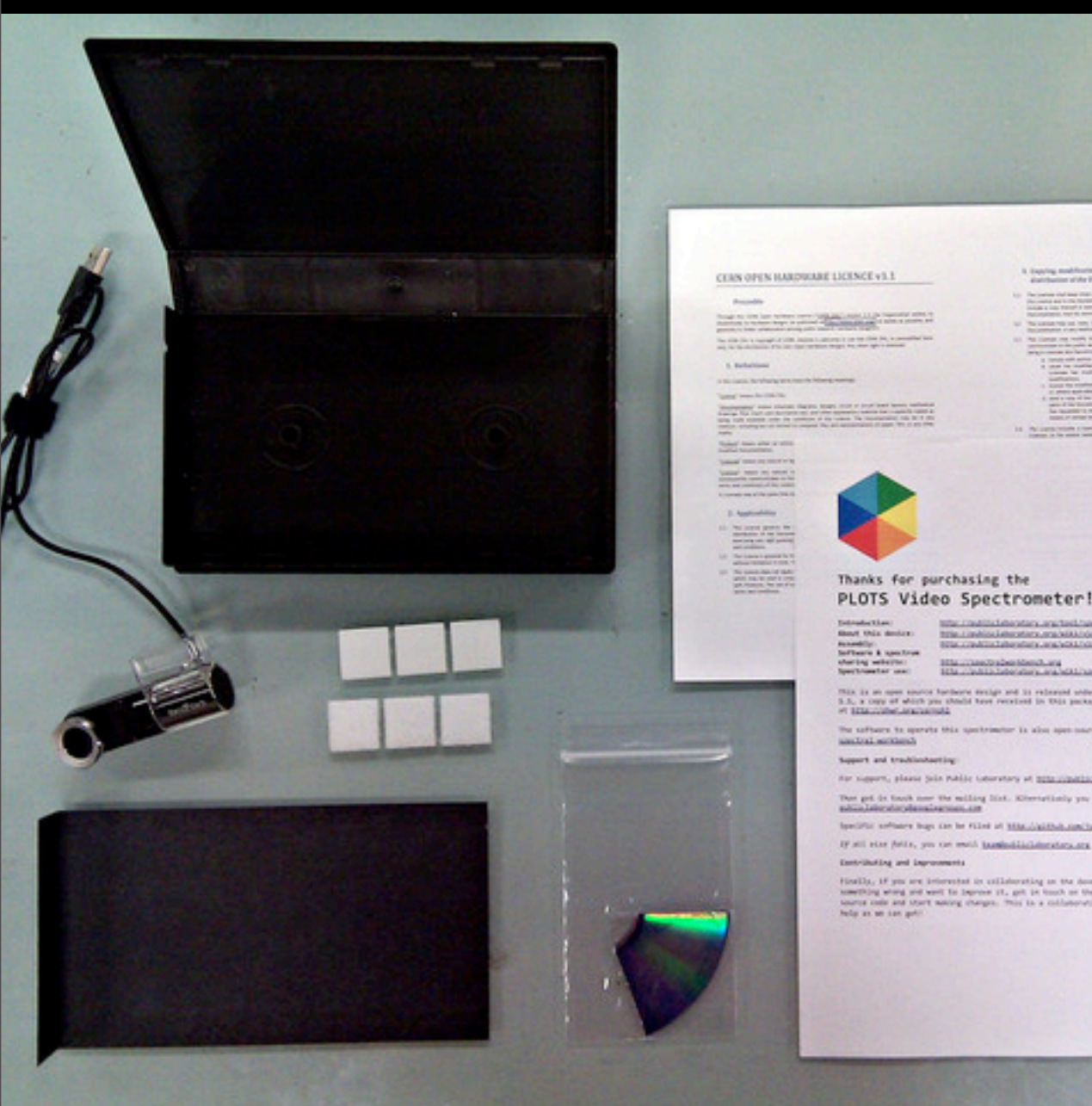
Little official reporting on the environmental impact

Community group Public Lab starts monitoring instead:

Balloon mapping



DIY Spectrometry

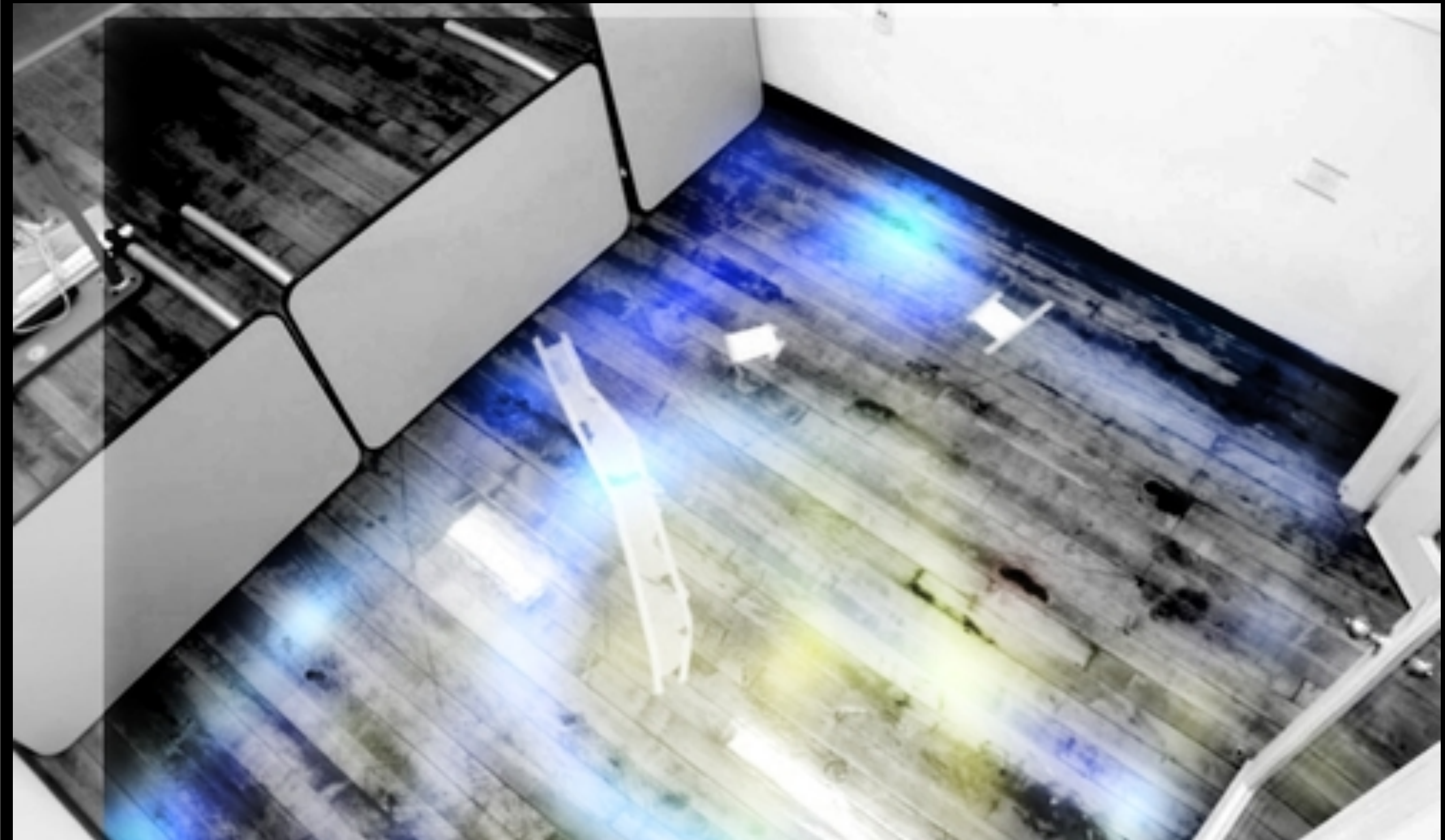


... to identify unknown materials

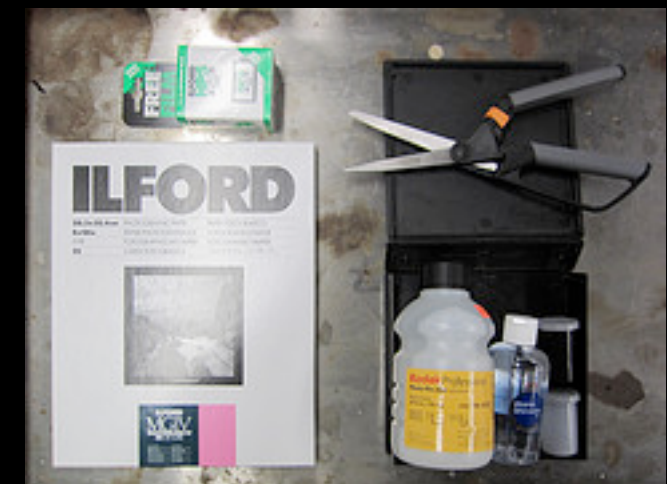
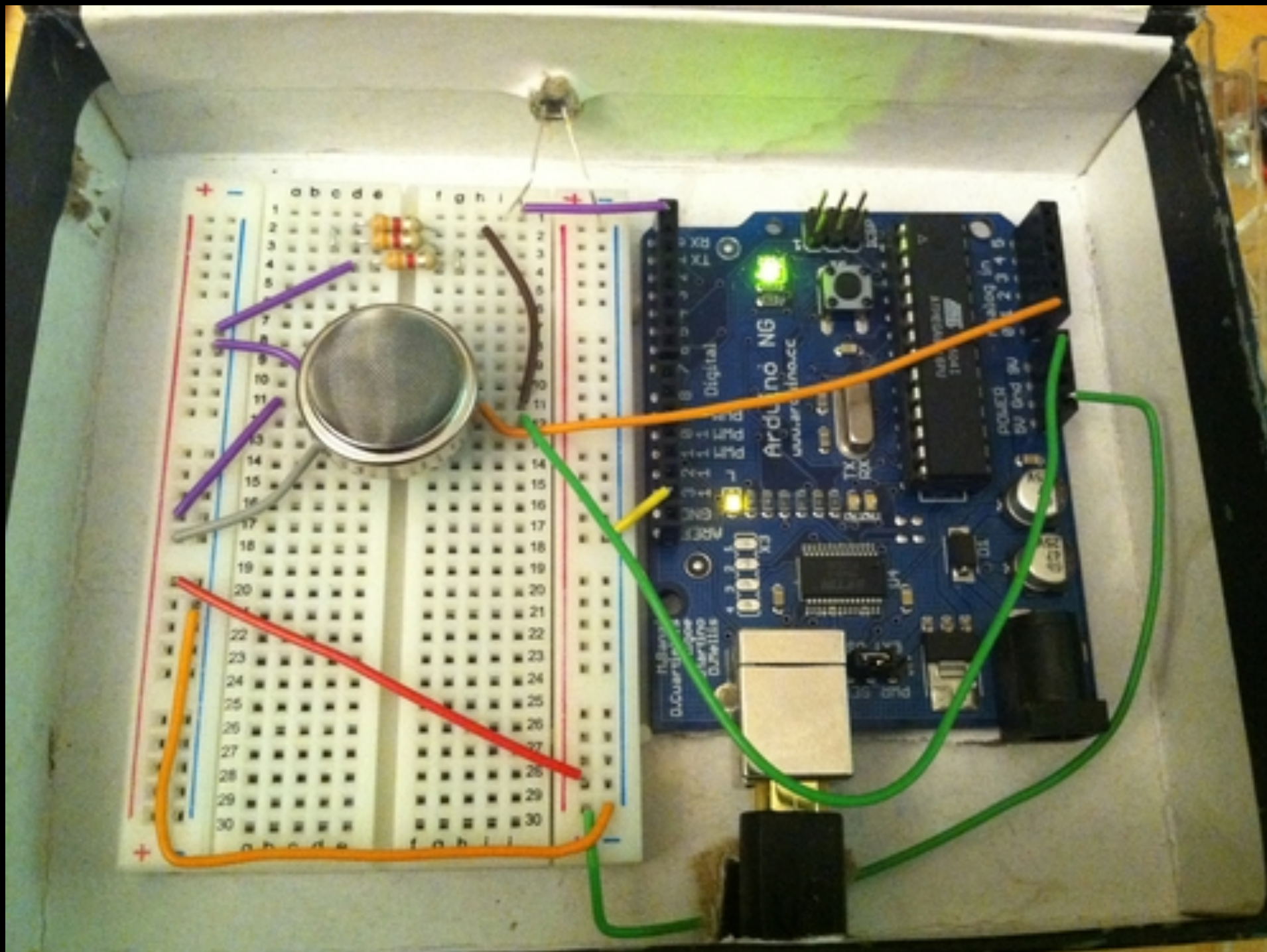
Many other community
activities.

But we are geeks. We
don't need the threat
of human extinction so
we can play with things.

Indoor Air Quality Mapping



Hydrogen Sulfide Sensing



How to make your own

Both of these tools are currently in the early stages of development and can be found at the links below. There are two different tracks, one using a sensor with an arduino board and the other utilizing photographic paper and a developer.

[Framing the Problem](#)

Basic Information on Hydrogen Sulfide

[Hydrogen Sulfide Monitoring in Gas Patch: Background](#)

[Hydrogen Sulfide: Information on the Gas](#)

[Conversion from \$\mu\text{g}/\text{m}^3\$ to ppm hydrogen sulfide](#)

Arduino and Industrial H₂S Sensor

[Prototype H₂S Sensor](#)

[Temperature and Humidity Sensors to Correct H₂S](#)

[Arduino + Figaro Hydrogen Sulfide Sensor](#)

[Arduino Patch for Detecting Hydrogen Sulfide](#)

[Hydrogen Sulfide Detection for Fart Detector](#)

Photographic Paper for H₂S Sensing

[Hydrogen Sulfide Testing with Black and White Film](#)

[Hydrogen Sulfide Dosimeter](#)

[Hydrogen Sulfide Tarnishing Silver](#)

[Controlled Testing with B&W Film Hydrogen Sulfide Detectors](#)

[MSDS sheet for Kodak Photo Flo](#)

Air Quality Egg

- Community project to monitor air quality
- Designing their own hardware
- International network of contributors
- Kickstarter campaign aimed for \$40k, received > \$100k
- First-gen devices shipping in a few weeks (days?)
- 800 sensors: a lot. But: not enough for comprehensive coverage.

And many more. Lots
of new community
activity.

The nature of such community projects

- Science perspective: VGI, Citizen Science, Participative GIS, ...
- Many of these models make a distinction between degrees of participation
 - aka "The Scientists" and "The Participants"
- The reality is: Scientists are just people.
- And: a lot of people can do pretty amazing things.

In the olden days, such science was always done by "the people".

We are returning to this model.

With a big qualitative difference:

Thanks to the Internet we
can easily collaborate.

The Air Quality Egg has contributors all over the world.

Many of them specialists: engineers, scientists, software developers, ...

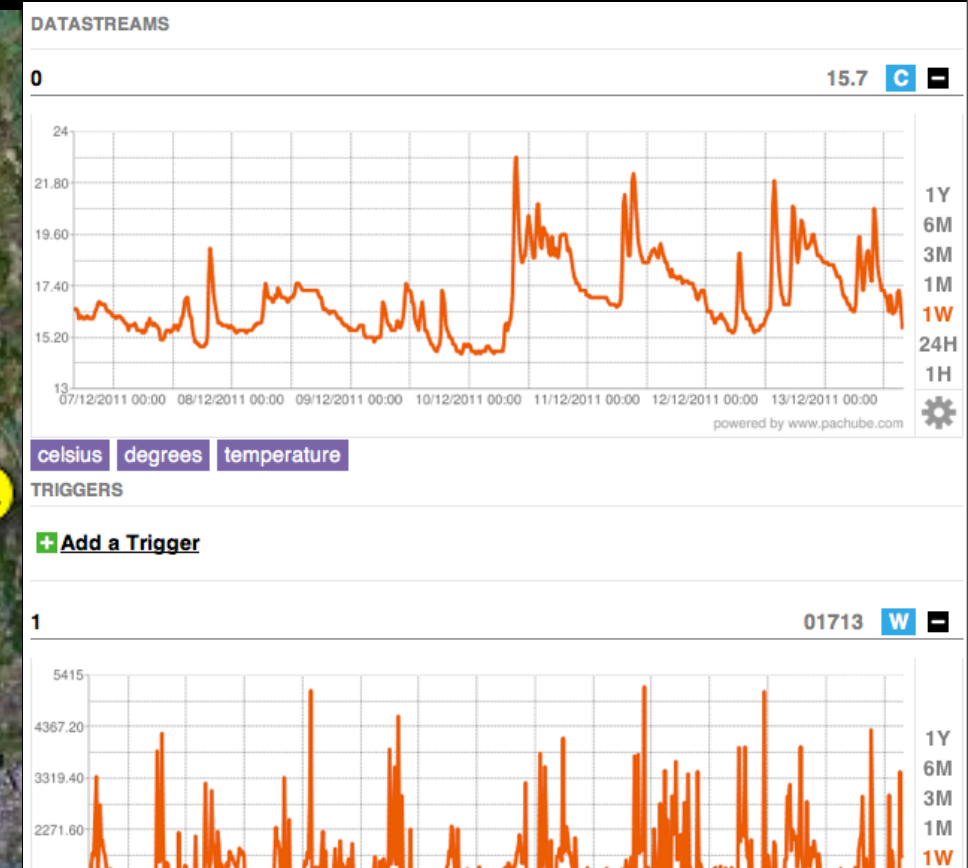
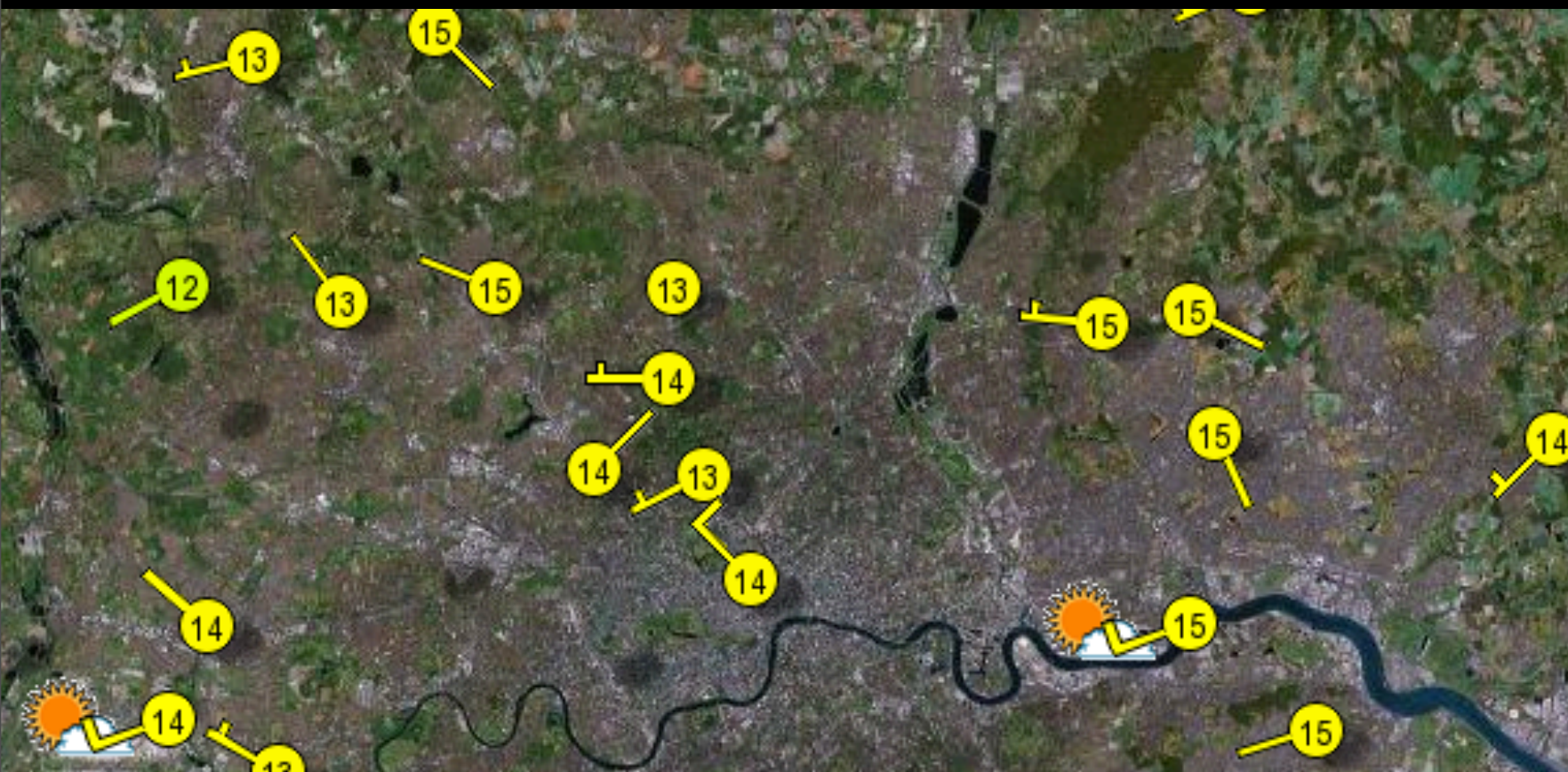
The Internet allows
Participation at massive
scales.

Cosm: many thousands of users and an
archive of 70,000 sensor data feeds.

So let's gather some
data.

What can we do with it?


Data visualisations?



Can we build a public weather service?

Oh wait, it exists.






The Weather Underground.

 **Milton Keynes, United Kingdom** ☆ 🏠 Lat: 52.0° N Lon: 0.7° W Ele

Rapid Fire Updates™ ☐ ON Updated 2 min 50 sec ago [Get Free Weather](#)

⚠️ **Tropical Weather:** [Hurricane Kirk](#) (North Atlantic) [Tropical Storm Leslie](#) (North Atlantic) [Hurricane Ileana](#) (East Pac)

Milton Keynes Weather at a Glance

Weather Station - report	Elevation				
Milton Keynes	68 m	Station Select			
Now	Temperature	Wind(km/h)	Sunrise / Set	Moon	
 Partly Cloudy	18 °C Feels Like 18.1 °C	 4	 6:13 AM  7:51 PM	 Full More Astronomy	
Tonight	Tomorrow	Tomorrow Night	Sunday	Monday	
				Tuesday	



What else can we do?

- Can we build a home energy use monitor that models national usage at postcode resolution?
- How large can such projects become?
- Can we cover the globe?

How can I set up my own community project?

Little shared knowledge exists.

Some practitioners share their experiences online.

Many pitfalls. Just to
mention a few:

Accurate sensing is actually really hard.

- Often good devices are too expensive.
 - This may change over time...
- What to measure? "Air Quality" can mean very different things.
- Sensor setup is just as important as the device itself.
 - This is why "professionals" snub DIY projects.

Can we find a middle
ground?

A solid but simple theoretical
foundation, then open
participation?

There are no good
manuals for DIY sensing.

Pls write one.

Design Patterns for
DIY sensor projects?

There is no strong public
culture of DIY sensor
monitoring.

Not a lot of people know how to do it
well.

But there's lots of interest now.

Let's build the culture.