

Data as an Art Material

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Good evening! Firstly I would like to say Happy Birthday to Visualizer and thank MedialabPrado for inviting me to take part.

Artist at Translating Nature

Lead of the Data as Culture art programme at
Open Data Institute, with Hannah Redler

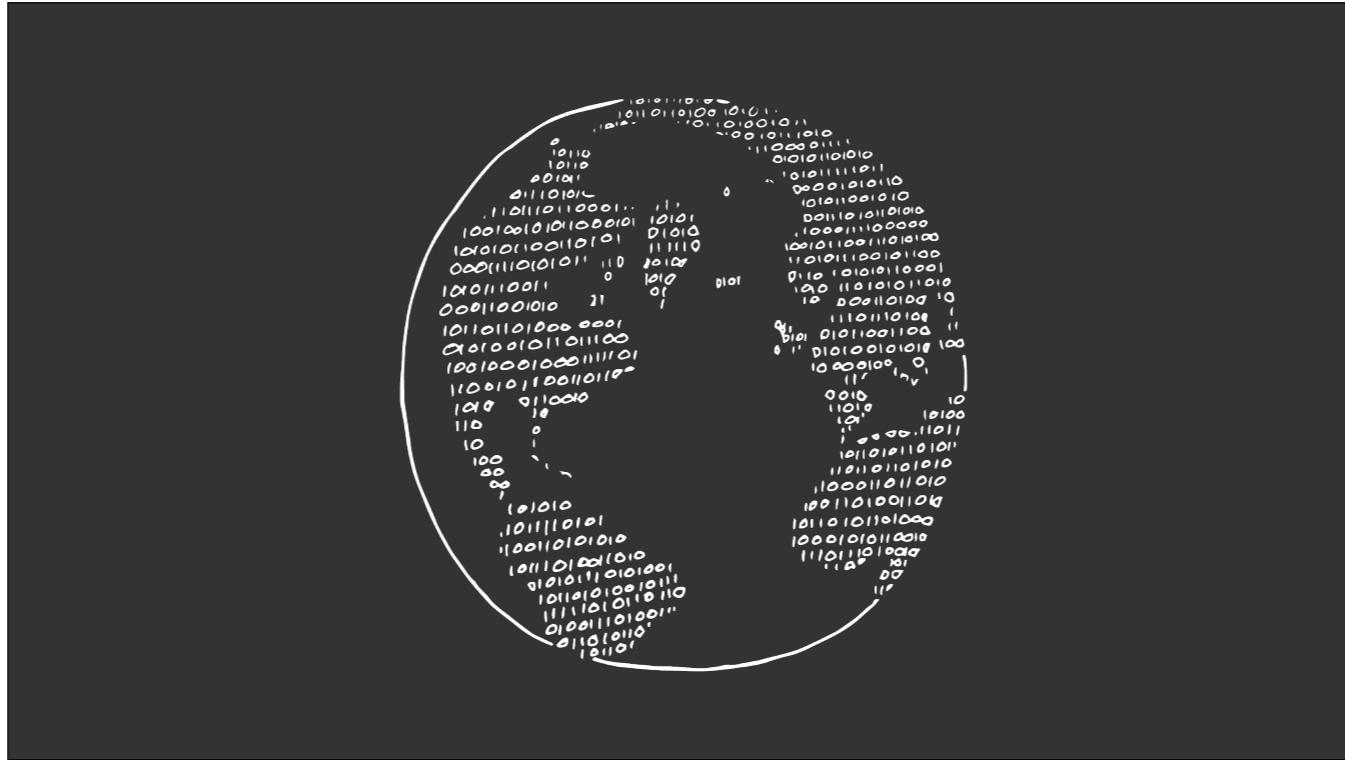
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I've just submitted my doctoral thesis on a Study of Data as an Art Material so now I'm ready to undo all my studies and learn new things here. Currently I run the Data as Culture art programme at the Open Data Institute - an organisation founded by Tim Berners-Lee and Nigel Shadbolt. The art programme commissions and exhibits artists working with data and networked systems.

I'm an artist, I've been working with data for over 20 years - my first job was archiving data to CD-ROMs (a huge 650MB). It was there that I realised how important data was becoming when one of my clients broke down in tears because his SyQuest cartridge (which were like giant floppy disks that held 644MB of data) had corrupted and his clients data was gone. When you are 21 years old and a grown man is crying in your office it makes an impact.

An an artist I started making art with data in 1997 when started tracking fish to generate abstract music.... I'll talk more about this later.



I'm fascinated by how we measure and quantify everything, getting access to macro and micro perspectives on familiar and unfamiliar systems. Data is pervasive, usually hidden, and its power often misunderstood, and as artists I believe we can interrogate it as we would any other subject or material, creating works that probe, provoke, enlighten, and awe.

I see data as not just a part of a process, but as a core material, a legitimate material through which to reflect and affect our lives. It is at the heart of many contemporary cultures, and is integral to governance, economics, social accord (and discord), and generation of, and access to, the arts. And of course, it has very much become a political tool.

It is apparent that as we instrument ourselves and the world through sensors and mass-measurement, and as data becomes part of a critical infrastructure, it is vital that we fully comprehend the languages, symbols and codes we are using to describe and decipher it, that includes the algorithms and the supporting ecosystems around it. As Aldous Huxley (author of *Brave New World*) has written, "when we invent new things we invent a language to describe it" - to understand it better and to explore it deeper. Data art, and data visualisation, are both part of this evolving language.



Data is an Art Material

Data is a catch all word for materials which have multiple properties: it's format, distribution, scale, origin, license, type, delivery — these characteristics of data are all significant when used in a creative works.

For example:

If the work uses real-time data from a living source, what are the consequences of the death of the source? And in this case, what does it suggest if the data transfer fails?

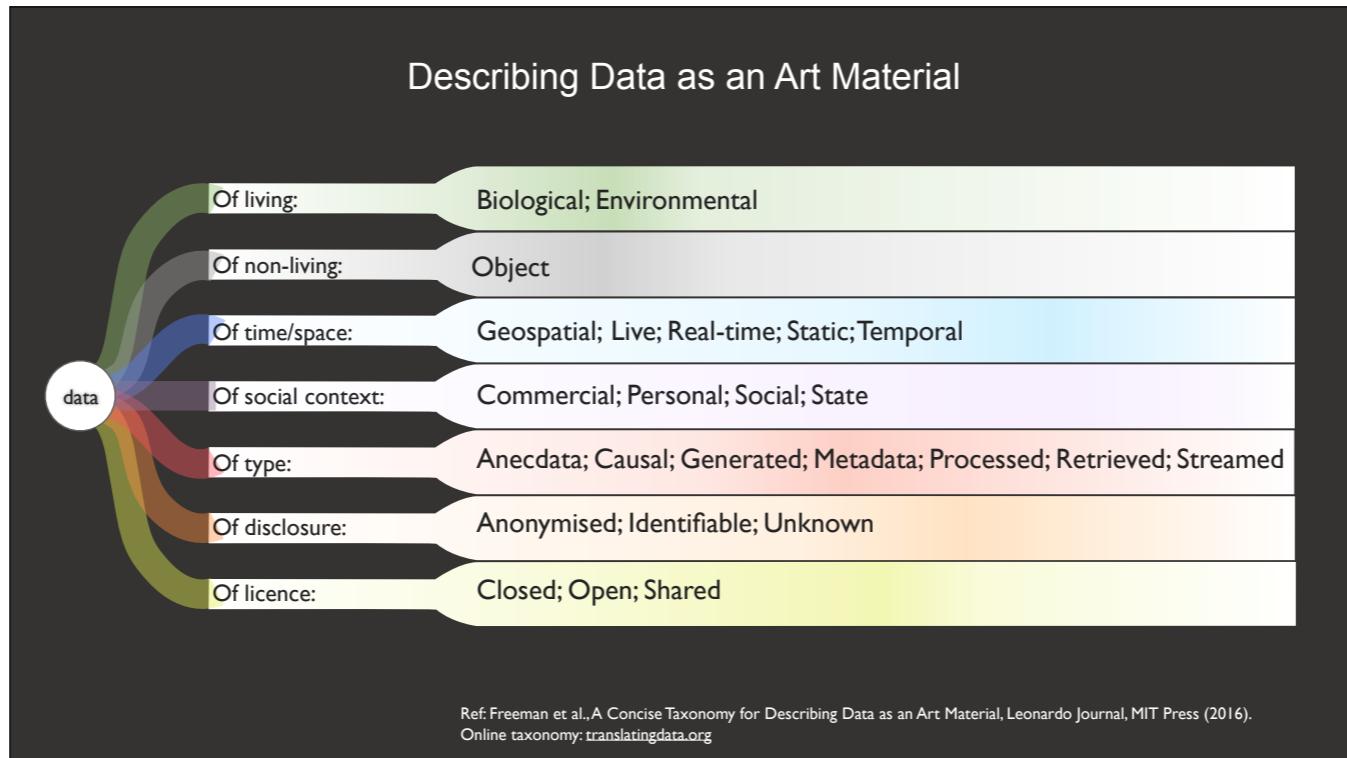
If the data is anecdotal, or fabricated, is that made obvious? Does it need to be?

Do preconceived ideas of data as evidence (real or not) reinforce the artist's ability to manipulate?

Does the intimacy of the work increase if the data is personal, or does it heighten discomfort?

Is the temporal aspect of the work true to the data, or is the artist playing with time?

These questions are of great importance to the ways in which we create with data.



So one of the things I'm interested in is how we describe these properties of data in ways that help us critique data art and data vis, and help us remember that data is not one thing.

To understand a material thoroughly it helps us to know which words to use to describe it, I've noticed many data artworks and visualizations are not clear about the data type even if the source is referenced.

Data Art - a definition

Translations of digital data to create cognitive, physical, and/or sublime artworks.
(Freeman, 2016)

Data Visualisation - a definition

“The use of computer-based, interactive, visual representations of data to amplify cognition.”
(Card et al., 1999)

I want to differentiate Data Art from Data Viz. Now this is an on-going debate, but it's important to make a distinction so I'm hopping in. Data visualisation is judged and critiqued on readability, clarity, functionality of design. A good data visualisation should present an objective view of the data, with no ambiguity. It provides a literal representation of data analysis, which can move or inform us through design.

Data art, however, is more playful, it can suggest, provoke, falsify, reconfigure data into an artwork - a performance, a sculpture, a soundscape and more. Data art often draws from visualisation techniques, but doesn't need to be confined by the practical rules of literal legibility.

The definition of data art I'm proposing, is broad...

translation - as a subjective, personal communication technique, can be a lossy or additive technique

digital data - a differentiation from all general information

cognitive - to trigger a reaction, emotional or not, good or bad

physical - a real world stimulation, a touch, a sensory experience

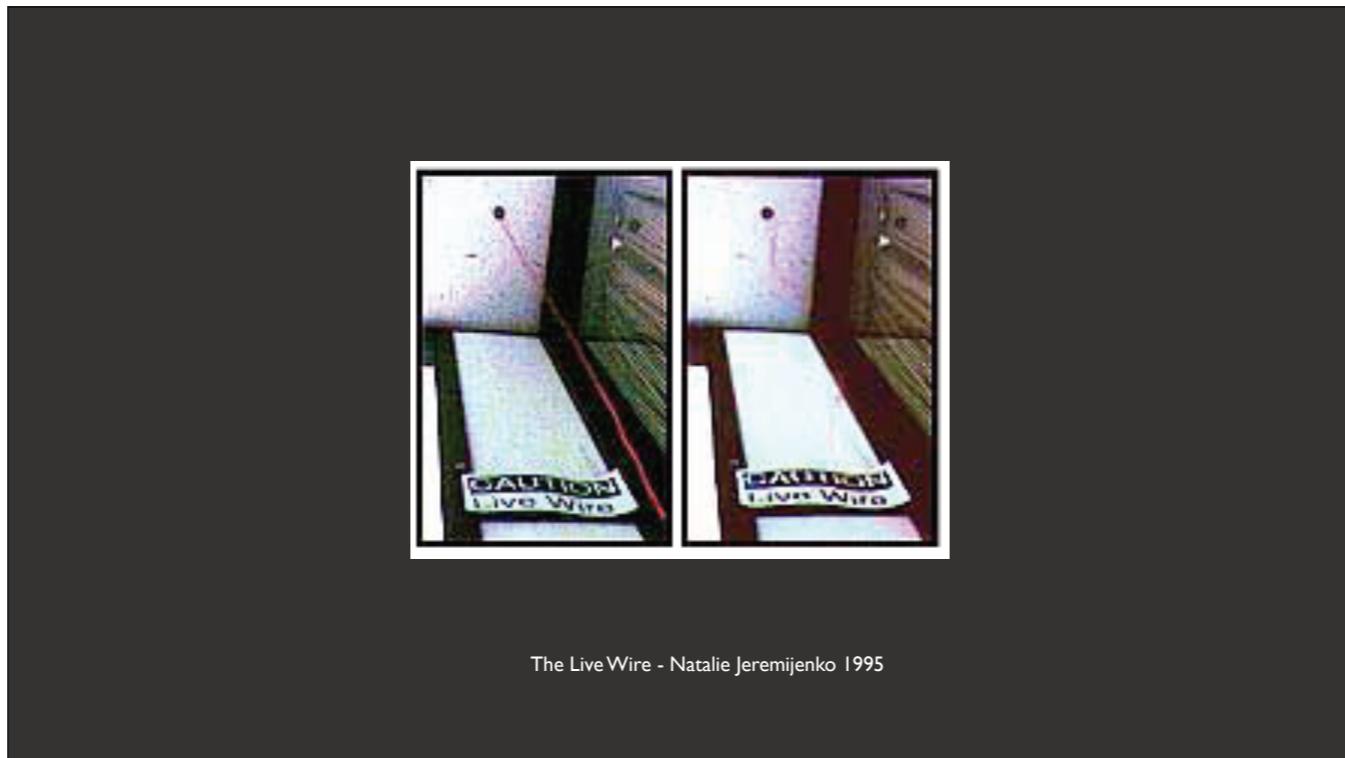
sublime - potential for awe and unreasonableness.

The reason I would like more distinction is that I feel we should try not to critique a data artwork through the lens of data visualisation is. Likewise assessing a data visualisation as an artwork also does not do it justice.

Manifestations of data in art

1. a method for spatial layout
2. text-based content
3. direct visual content (abstraction and mapping: light, colour, form, position)
4. synthesized into sound (sonification)
5. a sequencer for existing sound samples (compositional)
6. a method for gathering content (scraping, filtering, querying)
7. time-based controller
8. collected and dispersed
9. transformed into physical form(s)
10. translated into tactile (or haptic) experience
11. a manipulation or synthetic creation of olfactory or taste experiences
12. an algorithm
13. choreography for dance and movement of humans or machines
14. a way to generate more data
15. conceptual

There are many many ways that data can form an artwork.



The Live Wire - Natalie Jeremijenko 1995

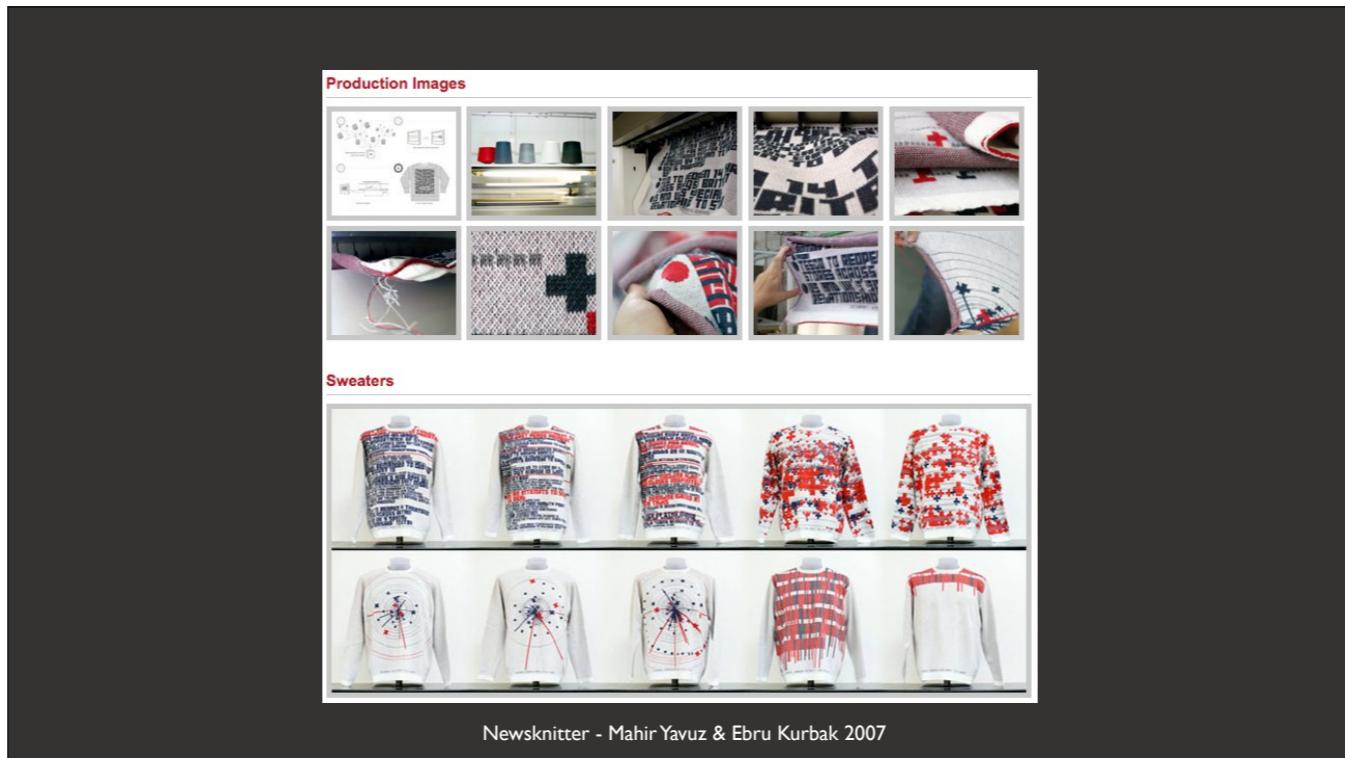
This is a very early example of data art. It is a terrible resolution image - I'm sorry. When digital cameras were terrible.

A simple yet effective artwork that relied on data as a core material, The Live Wire was developed by Natalie Jeremijenko whilst she was artist-in-residence at Xerox PARC. This is a foundational piece of data art. Jeremijenko describes the work as exhibiting "tacit information, rather than more of the precisely graphed, data fetishism of information rhetoric". "The Live Wire is a 3D, real-time network traffic indicator - material manifestation of cyberspace. Plugging into a local area network, the 2 metre long string hanging from the ceiling wiggles proportionally to the amount of traffic on the net. With each data package it convulses and sets up standing waves." Almost 20 years ago it cleverly predates our current obsession with data measurement.



Invisible Airs - YoHa 2011

In 2011, YoHa, assisted by Stephen Fortune, attempted to read the 20,000 comma-separated lines of the apparently open Bristol City Council expenditure database. **Concluding that power revealed itself through multiple layers of boredom**, they decided that the best way to reveal the relations contained within the databases to the people affected by it would be to construct four contraptions. They developed the Expenditure Filled Spud Gun; Open Data Book Stabber; Older People Pneumatic Brusher; and Public Expenditure Riding Machine. Any expense over £500 caused the contraptions to rise, stab, shoot and brush in a series of seemingly meaningless actions.



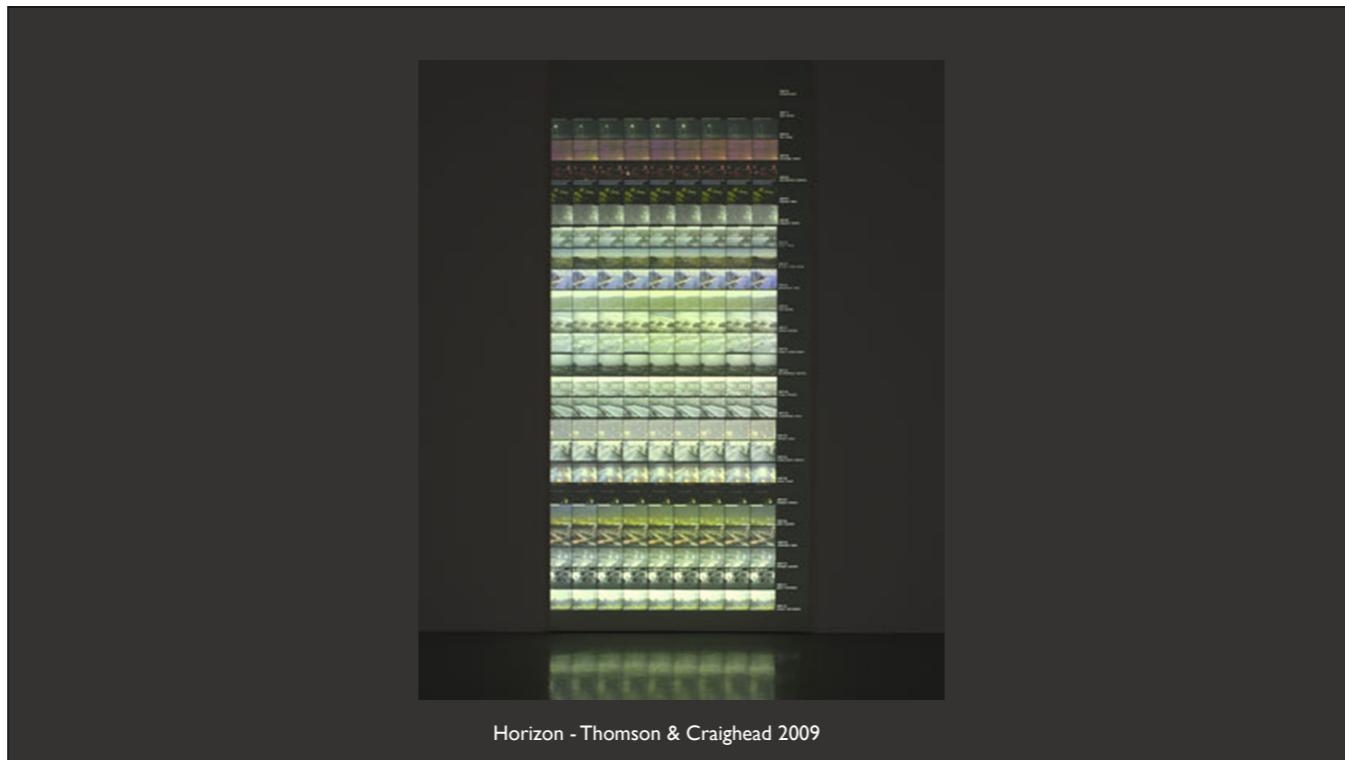
“News Knitter converts information gathered from the daily political news into clothing. Live news feed from the Internet that is broadcasted within 24 hours or a particular period is analyzed, filtered and converted into a unique visual pattern for a knitted sweater. The system consists of two different types of software: whereas one receives the content from live global or local Turkish news feeds, the other converts it into visual patterns, and a fully computerized flat knitting machine produces the final output. Due to the dynamic nature of live data streams, the system generates patterns with unpredictable visuality - an alternative medium to visualize large scale data.”

Mahit Yavuz and Ebru Kurbak, 2007



The Skor Codex - La Société Anonyme 2012

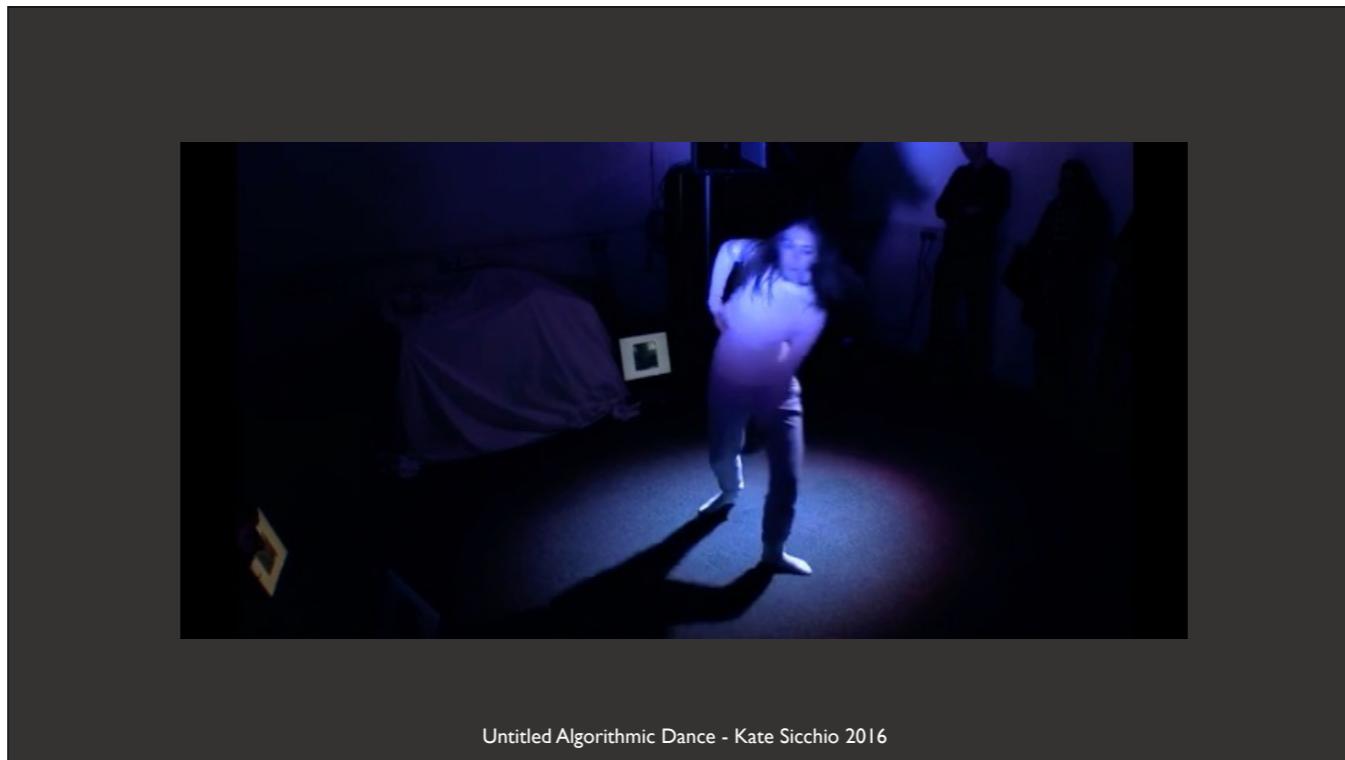
The SKOR Codex is one of eight identical perfect-bound acid-free paper books, produced to last over 1000 years. The books which are to be dispersed geographically around the world, contain raw data generated by audio, video and image files from the SKOR art centre which was closed due to Dutch funding cuts. The data in this work is displayed in its raw format, removed from its digital origins and printed as binary information on the page. It is impossible to interpret the data without re-digitising it and using a decoding algorithm to re-construct its original meaning, graphic depictions of decoding methods are included at the front of the book for future generations to unravel.



Horizon - Thomson & Craighead 2009

Horizon is a ‘narrative clock’ made out of images accessed in real-time from webcams in every time-zone around the world. The piece stems from the artists’ interest in the increasing amounts of ‘virtual’ information layered over ‘lived’ experience. The result is a constantly updating array of images that read like a series of movie storyboards, but also as an idiosyncratic global electronic sundial.

Thomson and Craighead, 2009

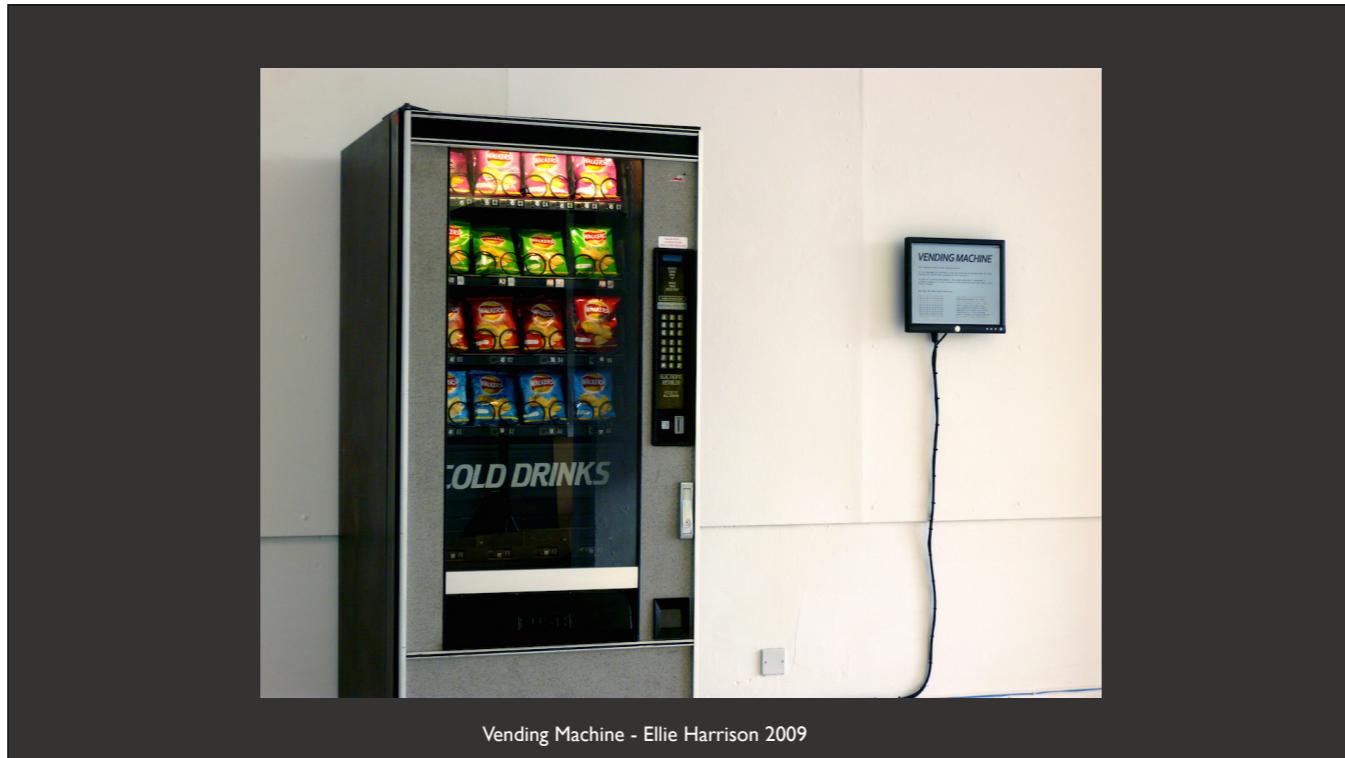


Untitled Algorithmic Dance - Kate Sicchio 2016

In Untitled Algorithmic Dance Kate Sicchio explores how data can be performed by a dancer, via a live coding performance. Sicchio worked with t-Distributed Stochastic Neighbor Embedding (t-SNE) --- a machine learning technique for dimensionality reduction, often used to visualise high-dimensional datasets. The artist states:

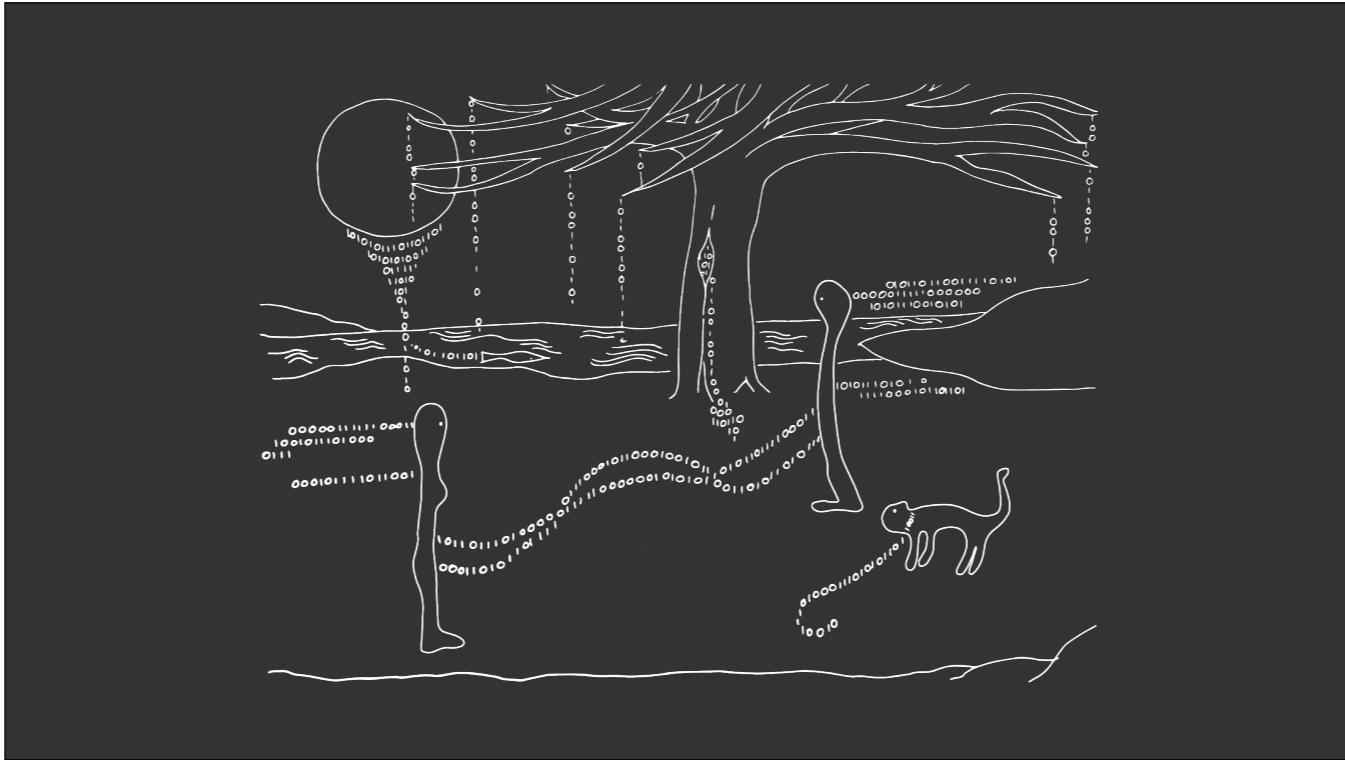
“Within this dance, images of bodies in motion are feed into the algorithm, producing new possibilities for live performance and the creation of new choreographic scores.”

In the performance, the dancer receives choreographical instructions in real-time by a series of changing images presented as the data is processed. The data in the work is used as a relatively unpredictable actor in the performance, placing it between the human choreographer of the work (Sicchio) and the dancer.



Vending Machine - Ellie Harrison 2009

Vending Machine is a snack dispensing machine from the 1970s that has had its payment and dispensing mechanisms hacked. In place of placing money in the slot to retrieve crisps, the machine 'listens' to RSS data feeds from the BBC news website, and dispenses packets of crisps when pre-defined search terms are matched. The data is close to real-time, it is text-based information which is a summary of the news written by BBC reporters. The news headline data is displayed on a screen mounted next to the machine, and the articles which trigger a snack to be dispensed are highlighted. If the data feed stops (due to lack of Internet connection, or BBC website fail), Vending Machine becomes an inactive museum piece.

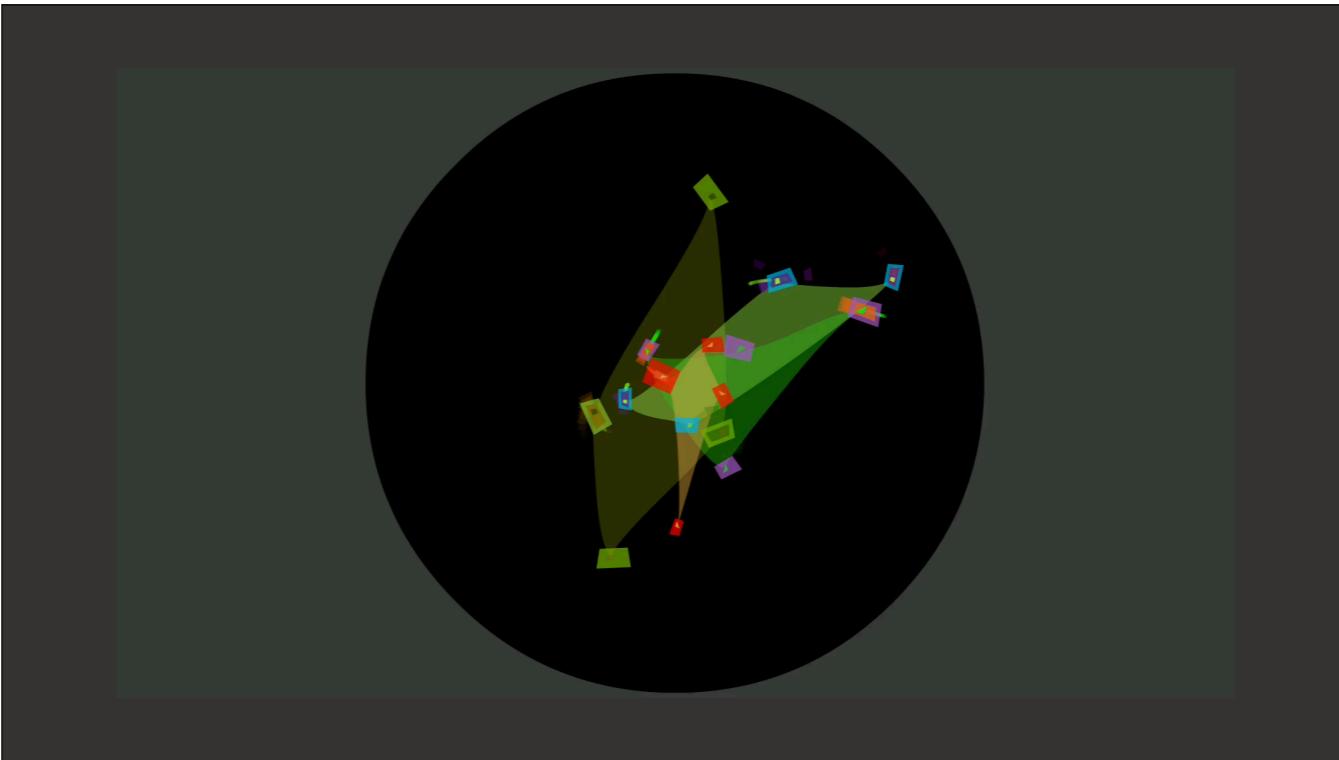


In my own work I am interested in how nature has become data, and how we connect to the natural world through the interface of technology. Often for me this involves the collection of data in the first instance, and the exploration of the processes needed to capture the world. I usually, not intentionally, end up working on long-term projects, from 6 months to 2 or more years which involve the entire data process from the point of collection. I like to be a part of the entire system.

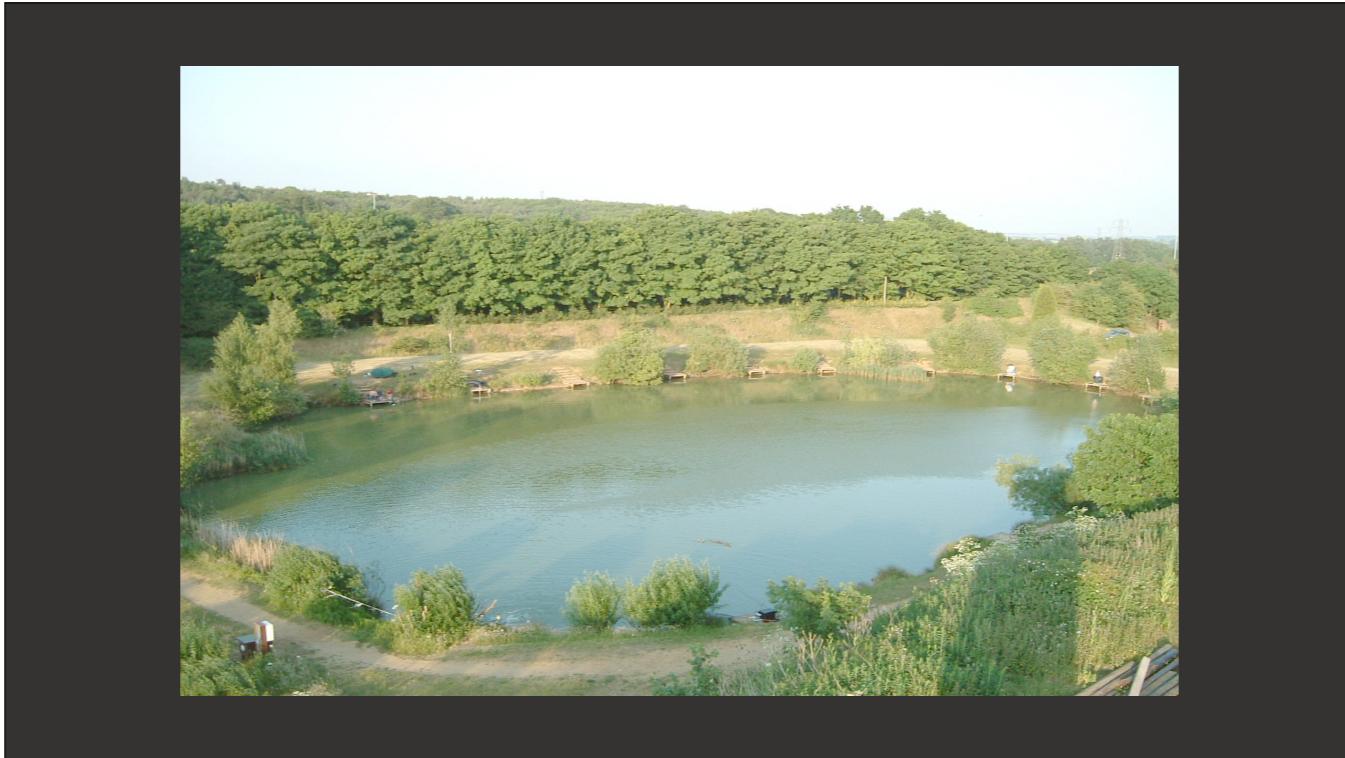


The Lake
(2005)

So as I mentioned earlier, my first data art foray was tracking fish. That led to a larger work called The Lake which used real-time data from fish tagged in a lake in a rural area in the UK (about one hour north of London in the UK).



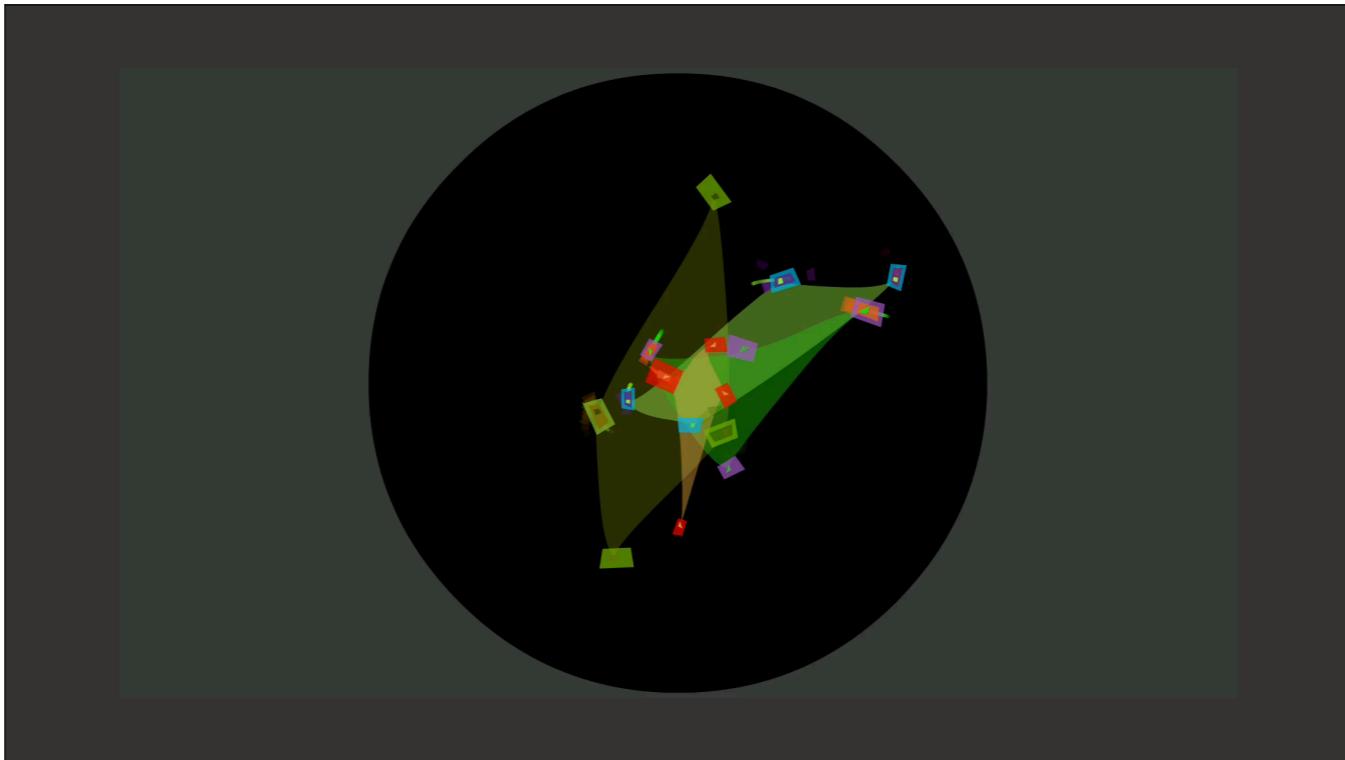
It is an exploration into the idea of whether the rhythmic movement of fish can create music. I created it as a kind of memorial to my dad – it helped me connect with two of his passions – fishing and technology. The abstract animation is accompanied by a sound scape, made up of over 150 environmental sound samples recorded from the land and the water on site, that is wholly generated by the fish in real-time.



The Lake where the fish were tagged, their natural environment. The platforms around the edge are where the fisherman sit. They catch and release the fish – for sport – they are not fish to eat.



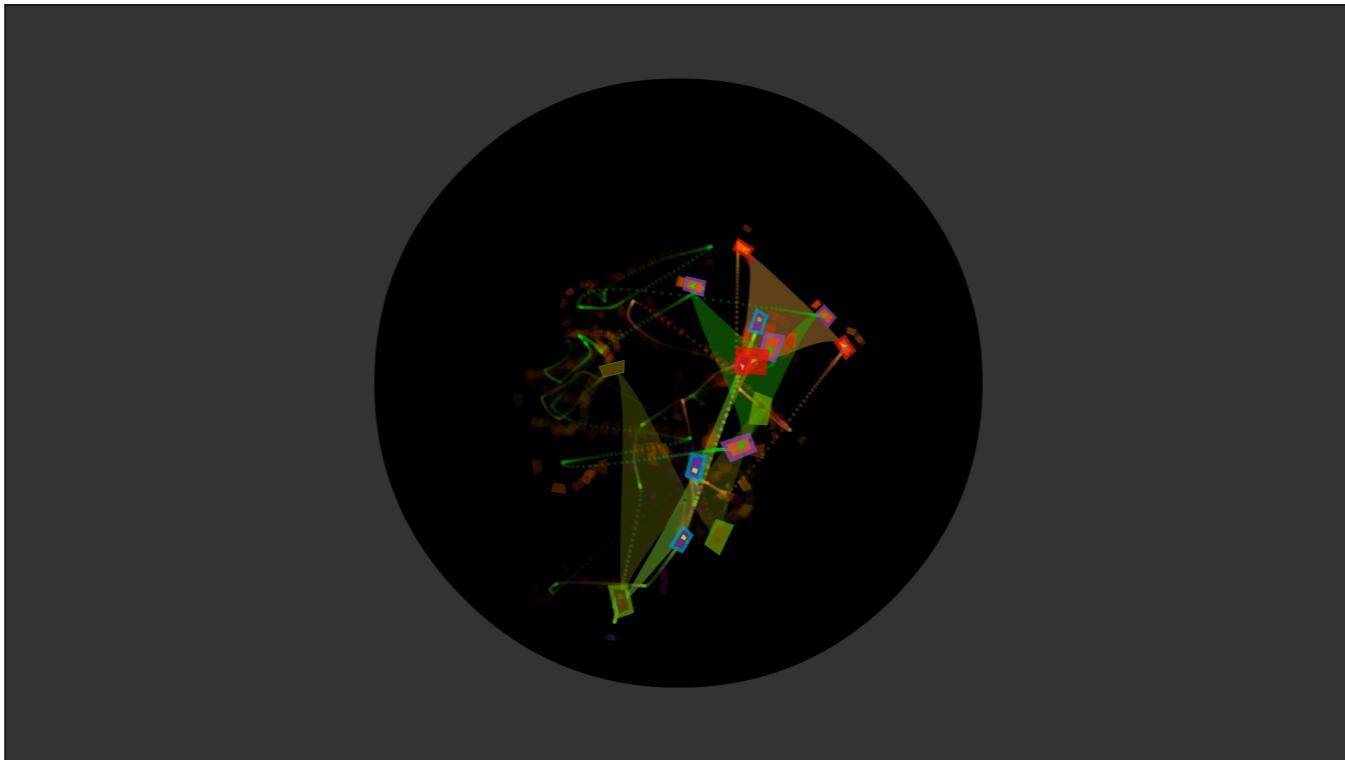
16 fish from 4 different species were tagged with bioacoustics transmitters. The signal from these transmitters was picked up by an underwater array of hydrophones (underwater microphones) that triangulated the data and gave X / Y coordinates of each fish.
The fish were tagged under an anaesthetic – a solution of benzocaine which makes the fish fall sideways in the water and allows around 60 seconds for minor surgery to take place before they are placed back in a tank and revived ready to go back into the lake.
Of course we knew how well they were doing because we could track them. It raised interesting questions about the utilisation of live animals in an artwork – we worked with a fisheries consultant who used the data for research purposes.



The fish coordinates were analysed so we could find out which fish was grouped with other fish of the same species, which were 'popular' and 'unpopular'. The large sail like shapes show the area covered by each species, so we can see if they are shoaling / sticking together. The data was real-time and locations mapped fairly accurately, and many aesthetic decisions were subjective.



The animation was shown in a 9 meter tall tower which visitors entered. Inside the animation was suspended above your head and the sound fell down from above giving a very resonant and immersive experience - like being in a digital lake. The platform outside the tower connected the edge of the lake where the fish were to the artwork.



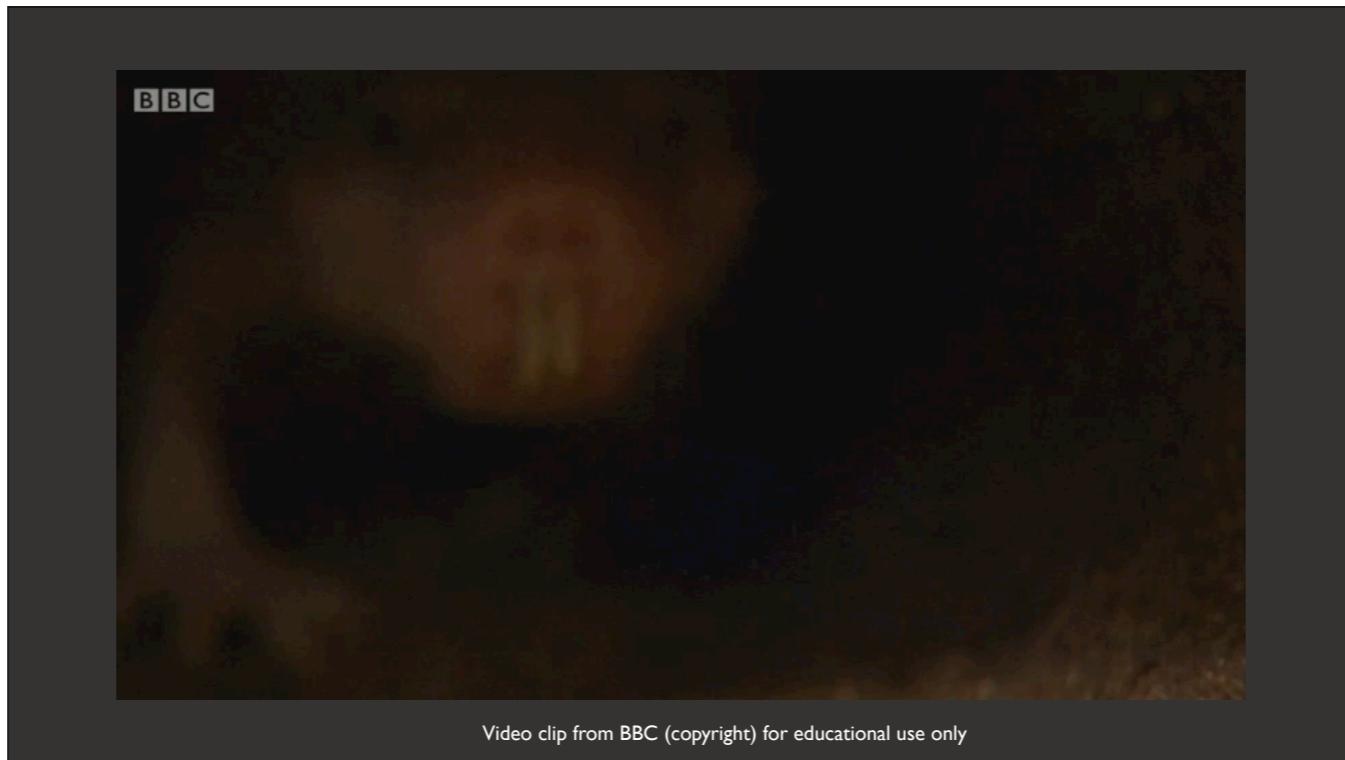
I was really pleased with how it appealed to the anglers who fished in the lake. They were mainly retired, older generation and for them it was the first time they had seen digital art. They warmed to it and within a week or so they would visit every morning before they chose a fishing spot - as if the work was a tool to locate fish, despite it being 16 out of 2-3000 fish. Reaching an audience unfamiliar with the arts, especially digital art, and placing artwork in the natural environment instead of bringing nature into the gallery was very important to me.

Rodent Activity Transmission systems

(2016)

<http://rat.systems>

This is my current project. An exploration of real-time, live, biological data - using data as 'evidence' through design work and as an art material through animation and sculpture .



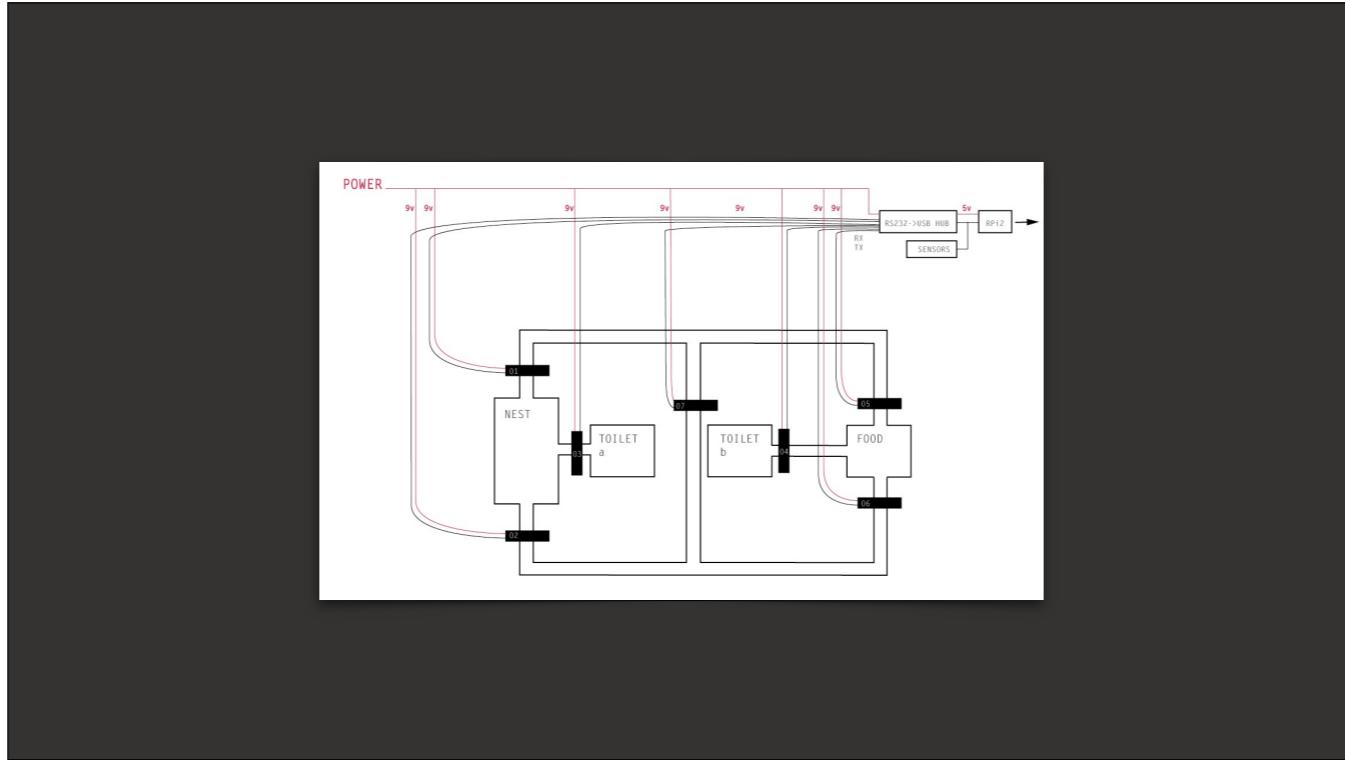
Video clip from BBC (copyright) for educational use only

These are naked mole-rats. They are amazing creatures and of much interest for genetic study. They have extreme longevity (up to 30 years, 10 times longer than any other mammal this size) they can run back and forth equally well
high resistance to pain
adapted to underground environments (high CO₂, low oxygen) 18 mins without oxygen.
independently moving teeth (chopsticks!)
cancer resistance
eusocial – breeding queen and psychological dominance assertion
[They are potential survivors of the impending apocalypse, and we should gene splice with them as soon as possible.]

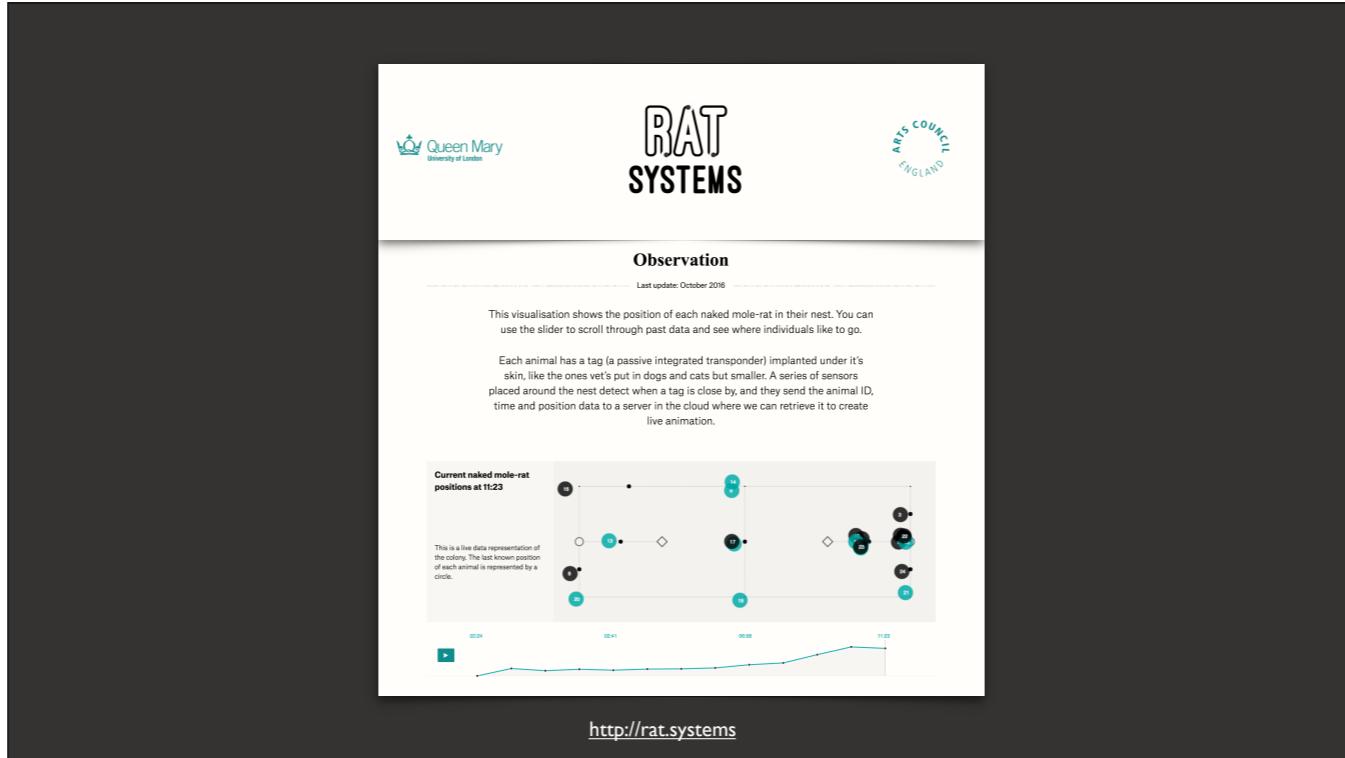


As with The Lake I am working with real-time biological data, and trying to understand what it means to experience life through data translations.

This is the artificial burrow the sensors are set up in. It is one of about ten in the room which is kept at 30 degrees centigrade. It's a bit like working in Madrid without air conditioning.



This is the system diagram for the sensor set-up – we can use the RFID system to monitor all the movement of the animals between zones (food, sleep, toilet, corridor). We also collect environmental data – temp, humidity, light and sound. Inadvertently putting a surveillance system in the lab, as we know when the light goes on and off when the feeding occurs (and some days it doesn't)

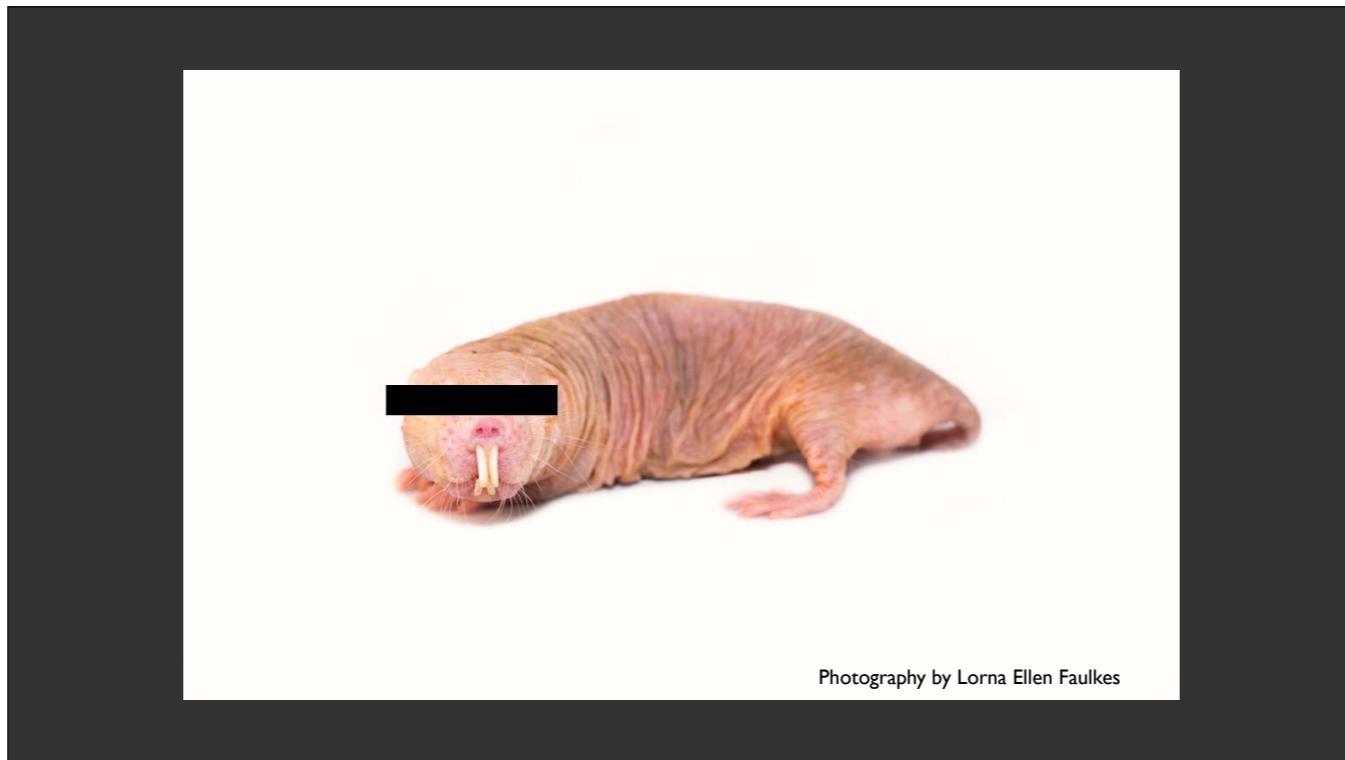


First we used the data in a straight way as a visualisation – this depicts where the animals are in the nest in real-time. It is a tool to convey information. There are additional visualisations about the animal behaviours on the website (rat.systems). This is more scientific aspect of the project.



Colony Omega Redacted Portraits
(2016)

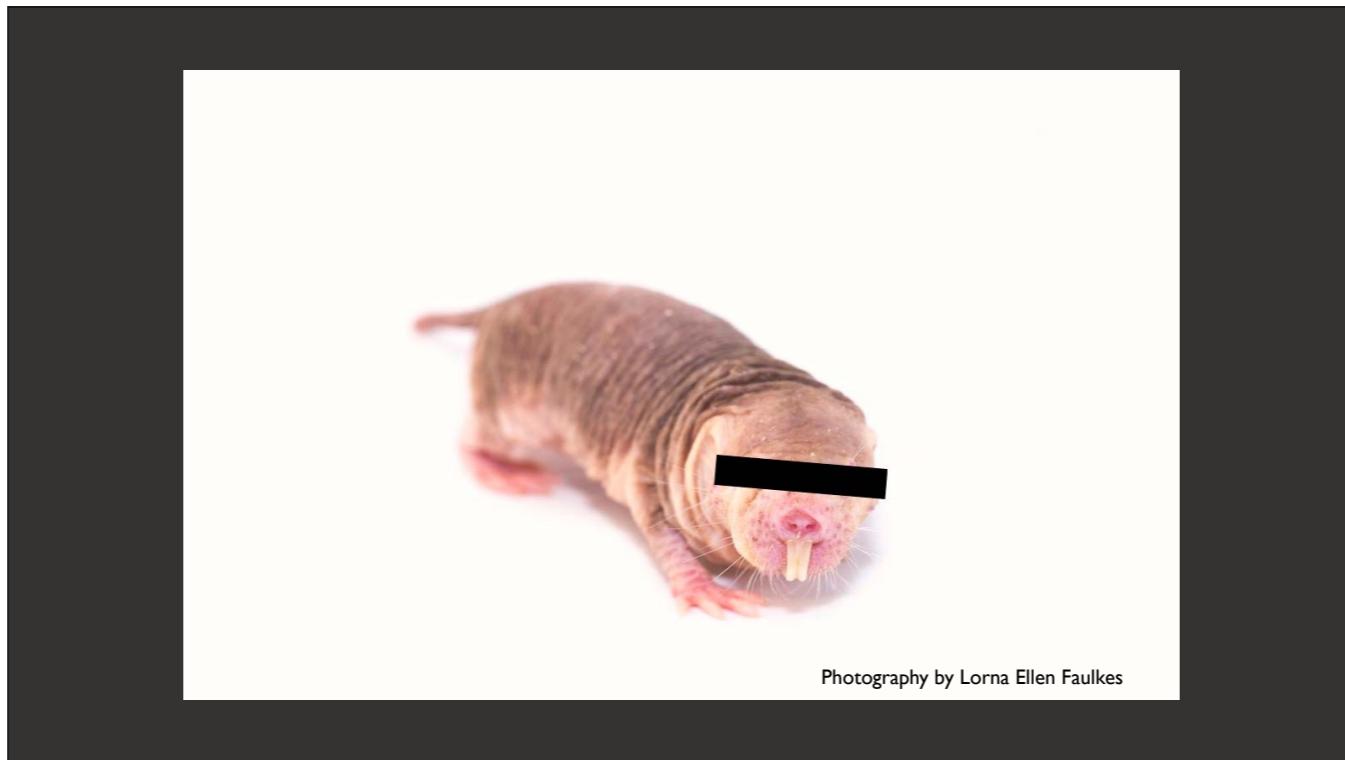
I also wanted to take photographs of the colony, to bring the project to life and help people see the personalities behind the data.



These redacted portraits highlight whether data privacy be restricted to humans?

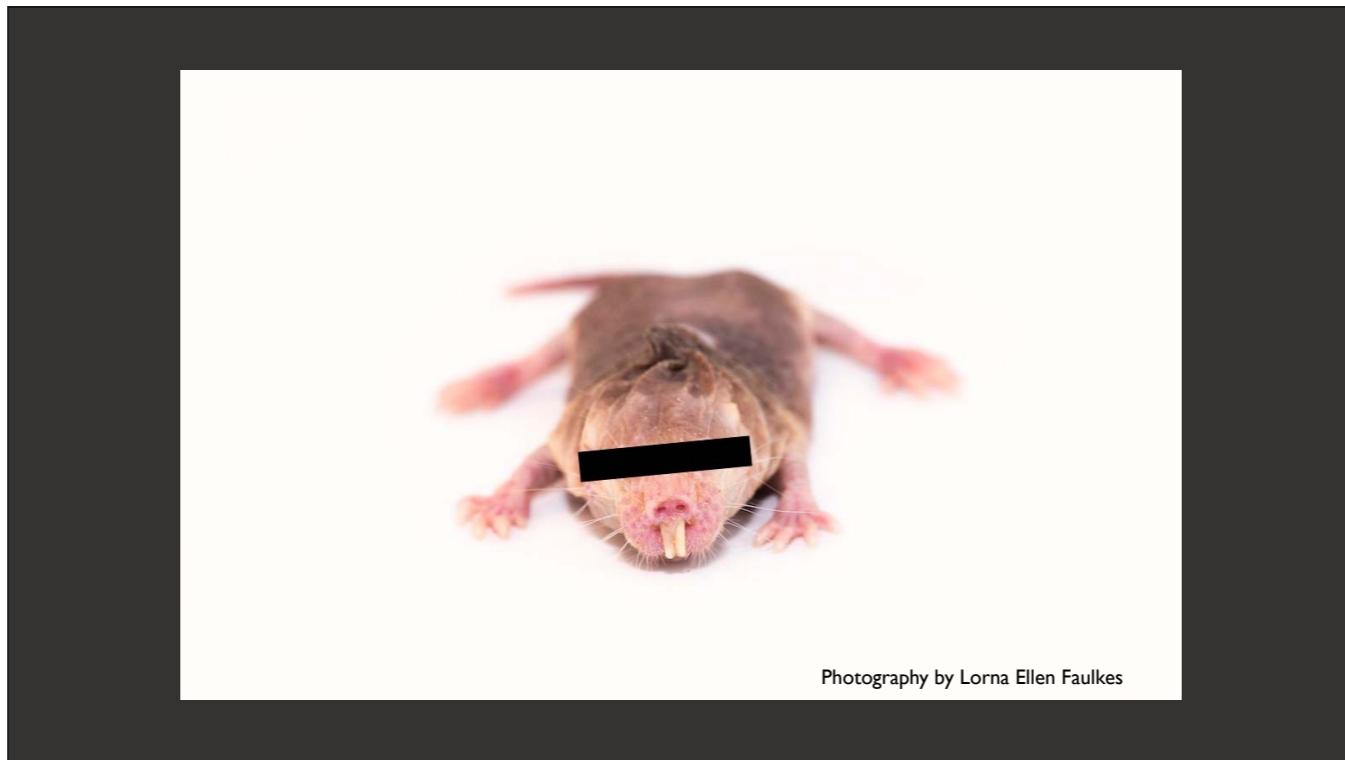
This artistic act shows the individuality of each of the naked mole-rats.

And refers to wider serious concerns. Poachers are said to be using metadata from tourist's photographs on safari, or even academic papers, to locate and kill endangered animals.



Photography by Lorna Ellen Faulkes

(on safari always turn your geolocation tagging off if posting images to social networks)

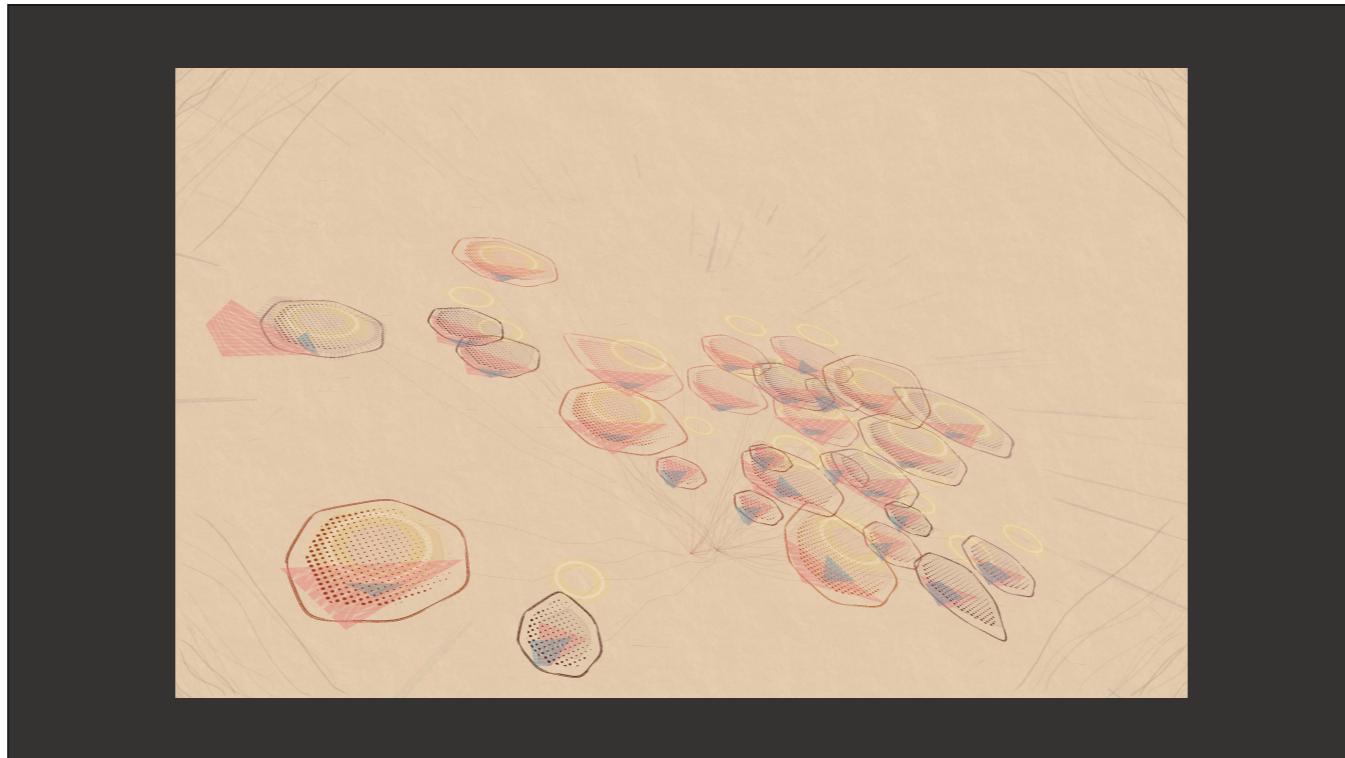


Respecting an animal's right to privacy may become akin to respecting their right to life.
This is a more conceptual use of data in the work.



A Selfless Society
(2016)

The data is also used to create a web-based artwork - similar in format to The Lake. It uses data as a dynamic in a real-time 3D animation/



A Selfless Society is a real-time abstract animation and sound scape of forms whose shape and behaviour are influenced by the activity patterns of the naked mole-rat colony. I'm interested in the cooperative lifestyle of the colony – As a whole they have the strongest chance of success, while lone individuals have little chance of survival.

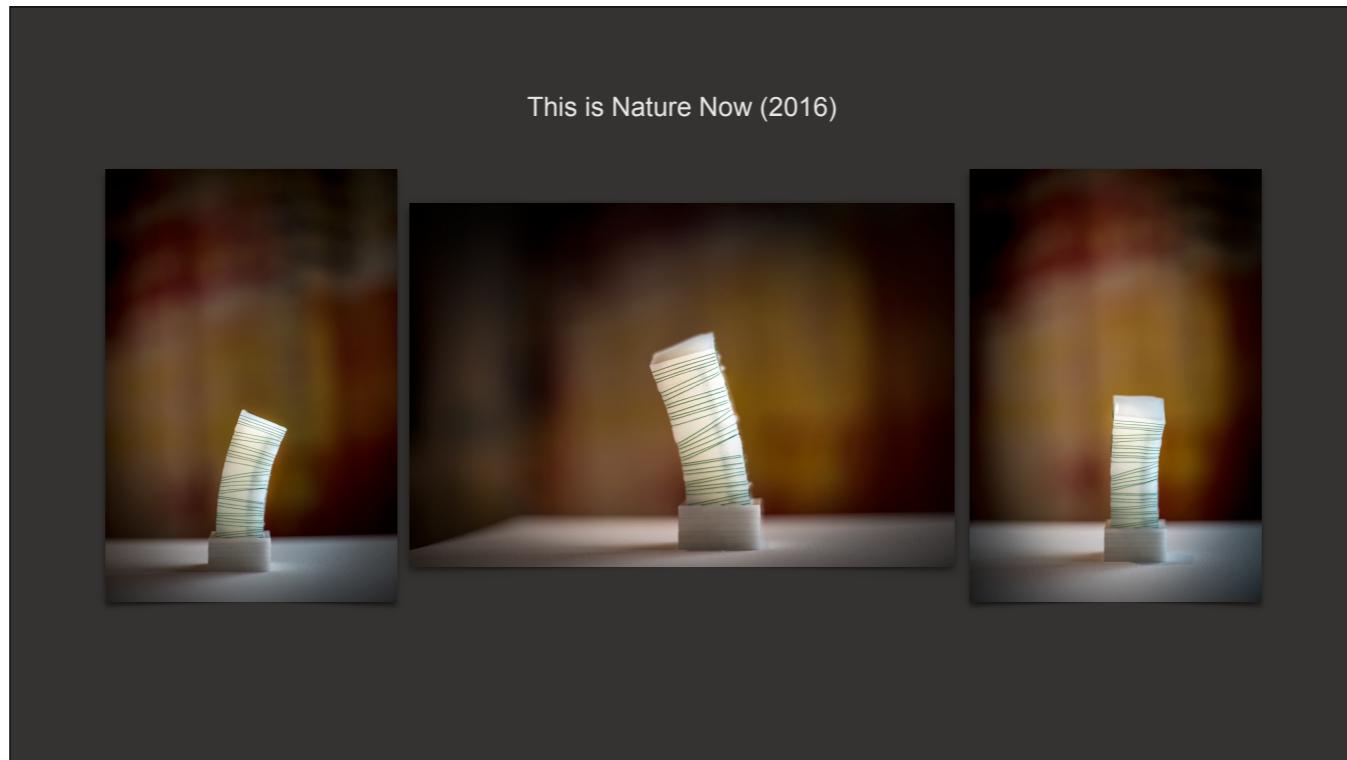
Naked mole-rats are 'eusocial' like bees, only the queen breeds. What would happen human society were restructured in this way? Would non-breeding females be considered selfish or selfless? How would political, economic and other systems be re-routed to serve the interests of the whole? What would become of the individual?

The work doesn't provide information as is expected from data, it provides an essence of the animals and an experience. It shows the life in the data – if the animals all die, so does the artwork.



This is Nature Now
(2016)

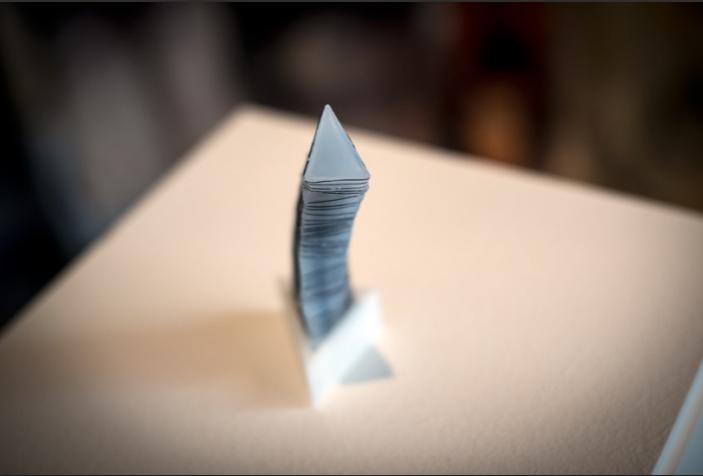
This is Nature Now represents the live data from the mole-rats through physical movements of an artificial material. It explores what I am calling a body language of objects.



The work asks us to reflect on how technologies mediate our experience of the natural world, and how we now encounter nature through physical objects using smart programmable materials.

This object is square with graphic markings to distance the object from looking like an organism. The concept is to elicit the appearance of life through movement not form.

This is Nature Now (2016)



The triangular form represented the queen data from the naked mole-rat colony.

This is Nature Now (2016)



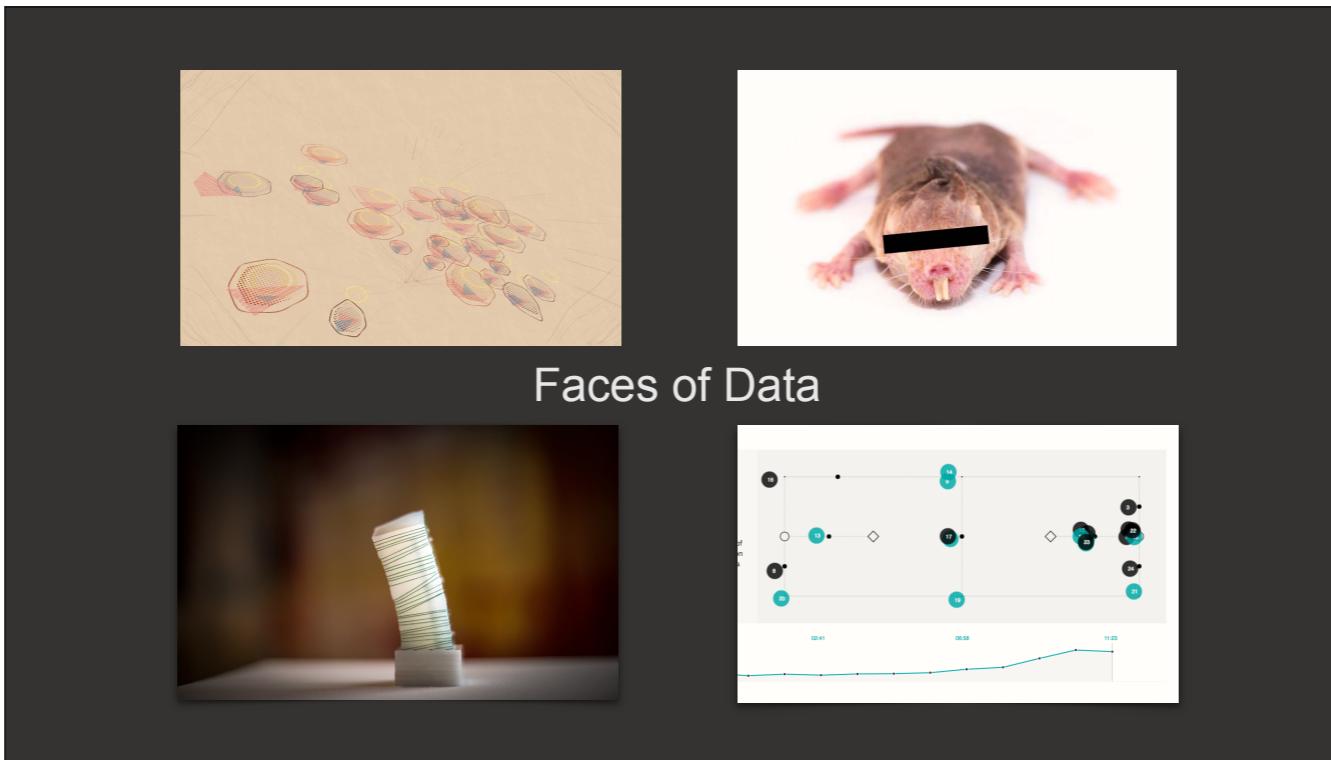
This is Nature Now (2016)

This is Nature Now

The three objects used data from the queen, and aggregated data from the females and the males to determine their motion.

The work was exhibited in 2016 at Somerset House, London as part of an exhibition called a Naked Mole-Rat Eutopia

The mapping – data to movement choreography – is at the heart of this work. It is still in development to explore whether living things be represented through data? If so, what are the traits a non-biological physical object requires to convey a sense of life?



Data has become powerful. As I mentioned earlier - there are many points in the data flow where human intervention and decision making occurs. Data is not pure like water from a spring that flows naturally, data is contrived.

We can see from the different ways of using data as a material in art that it has many faces.

Subjectivity and bias in the data flow

1. Why are we collecting?
2. What are we collecting?
3. How will we collect?
4. How will we store?
5. How do we protect and maintain?
6. What licensing will we apply?
7. How do we enable access?
8. With what techniques do we analyse?
9. How do we translate the results?
10. How do we communicate the results?
11. How do we receive the results?
12. How do we read the results?
13. What actions do we take?

Where's the bias? algorithms., task setter agendas, governments, personal in-- bias, data sample bias,

For The Lake, the collection of data was a key part of the process, and I learned a lot making the project. It highlighted that there are many points in the process that decisions must be made. I chose (and caught!) the fish we tagged, I designed the analysis and the representation of them. It was a very creative and subjective process. The data is not telling the truth here. It is providing an experience.

These decisions in the data flow are made by people not by machines. We must remember that data is not an automated process it is initiated and guided by humans, and those decisions can be biased and discriminatory.



“ Until we acknowledge and recognise
[the] power of inclusion and exclusion,
and develop some visual language for it,
we must acknowledge data visualization as
one more powerful and flawed tool of oppression.”

Catherine D'Ignazio, <https://civic.mit.edu/feminist-data-visualization>, 2015

Haraway's quote, highlighted by Catherine D'Ignazio in her article Feminist Data Visualization, reminds us to step back and consider the power we, and the data being visualised, might wield, and to question why we are collecting and visualising it. D'Ignazio talks of the issues around privilege and the dangers of representing information through generalised data.



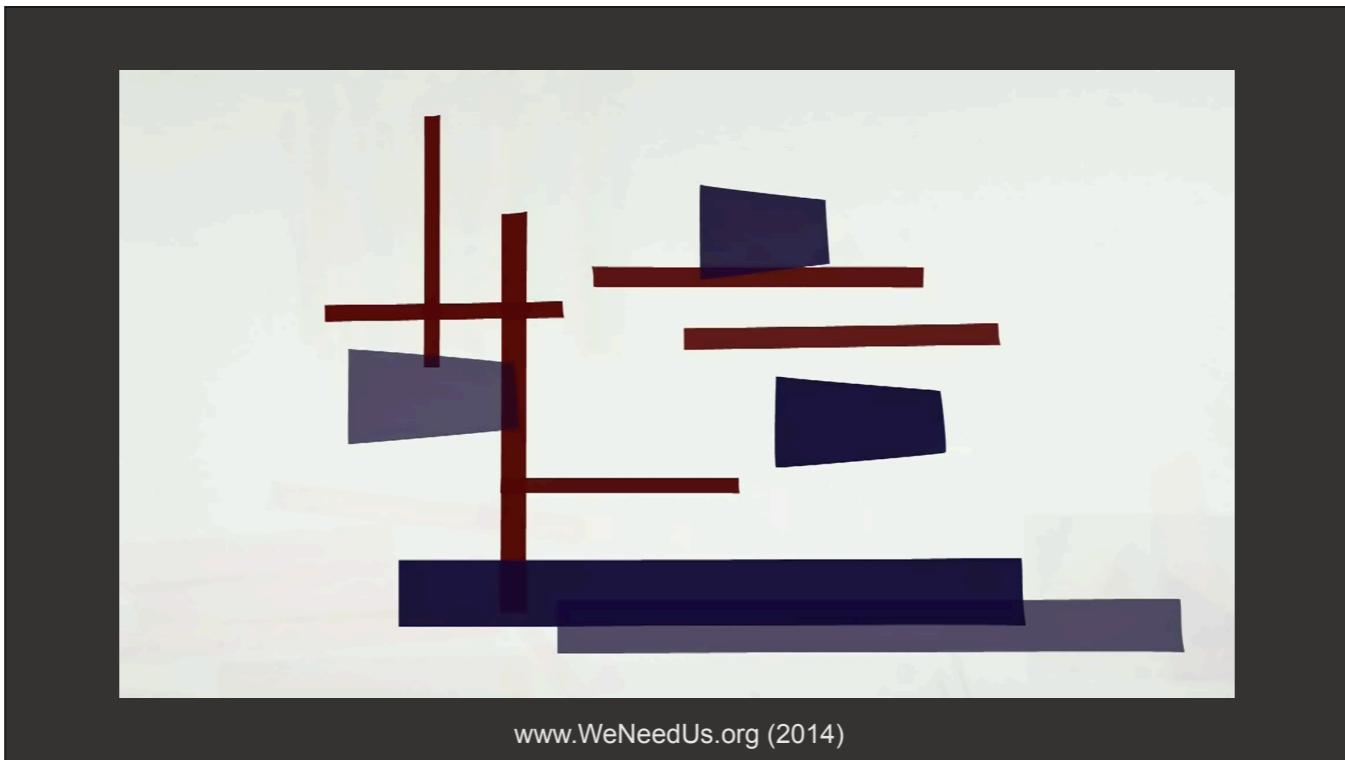
We Need Us
(2014)

I want to leave you by showing you one more piece of work. Its focus is away from the dark side of data and on the human in the machine, and how we still need 'us' in the deluge of data.



We Need Us uses real-time data from a citizen science website called the Zooniverse. The Zooniverse has over one million people classifying data for scientists – and they do this altruistically.

It is a wonderful example of how people come together – as a kind of Social Machine – to help scientists in astronomy, history and wildlife studies. The work is an abstract representation of the energy of the people's altruism.



www.WeNeedUs.org (2014)

Each composition is inspired by the project providing the data – this one is about detecting bats,

@misslake

translatingnature.org

rat.systems

culture.theodi.org



Thank you for listening.

I encourage you to visit the website for my work - Translating Nature and RATsystems, plus the Open Data Institute's archive of data art.