

Chapter 10

The Emergent City: 2004 – 2012

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Abstract

The Emergent City comprises visual artworks informed by critical analysis of city spaces. I am interested in the patterns we leave behind as well as real time networked events that can be re-imagined and sourced for information. Themes include the urban landscape, surveillance culture, privacy and alienation in the city. This chapter explores my work using connected city spaces, sensors and data visualisations of the city.

Introduction

I am an artist who exploits the changing dynamics of city life as a source for creativity. I have created meaningful artistic metaphors utilizing new technologies, and have integrated new media artworks into the public domain as part of my ongoing research into the visualization of city space. In essence, I research data as a medium for creativity, and show how meaningful experiences of our cities may result.

From a technological perspective I research sensors, motes, new display technologies and interactive architectures. This research includes investigations into concepts for the relationship of mobile computing within urban space and the built environment. There are three strands to my working process: collecting data, visualizing data, and then displaying this data.

My art is about the patterns and hidden values within systems and networks that can be disclosed through artistic practice. Interlocking environments and variables in these systems create other lenses and differences in given situations. The outputs from networked interfaces and online visualizations can be realized as real time dynamic artworks, as diverse as installations, and real objects made out of new display materials back in physical space.

I focus on the things that change, the flow, the data that describes our experience of the city as space. Data from all sides of systems that can be mediated by all, with varying visualizations communicated over the internet and represented on different display systems.

My work has covered experiments in these areas and traced a shift in practice from modernist approaches of asset gathering (linear construction) to arrangements of datasets in fixed lists or databases (interactivity) to new approaches of mining information across networks in real time: generative and real time systems, culling data from CCTV networks, and making visualizations of cities from wireless sensor networks.

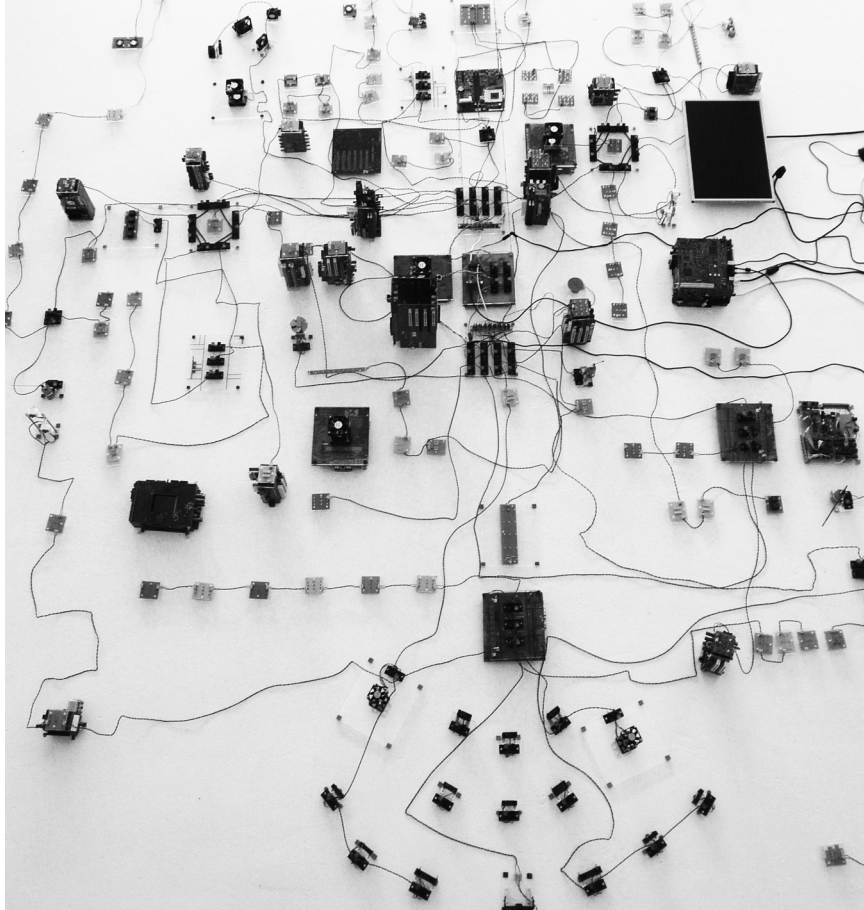


The Data Body. 2013. Software System of real time transport data.

Resulting artworks represent the real time conditions of the city. Works like *Sensity*, create real time interpretations of social spaces that inform the world (online), and hopefully create new meaningful experiences, allowing critical reflection on the real time city and the social political undercurrent embedded in the search for the real time city.



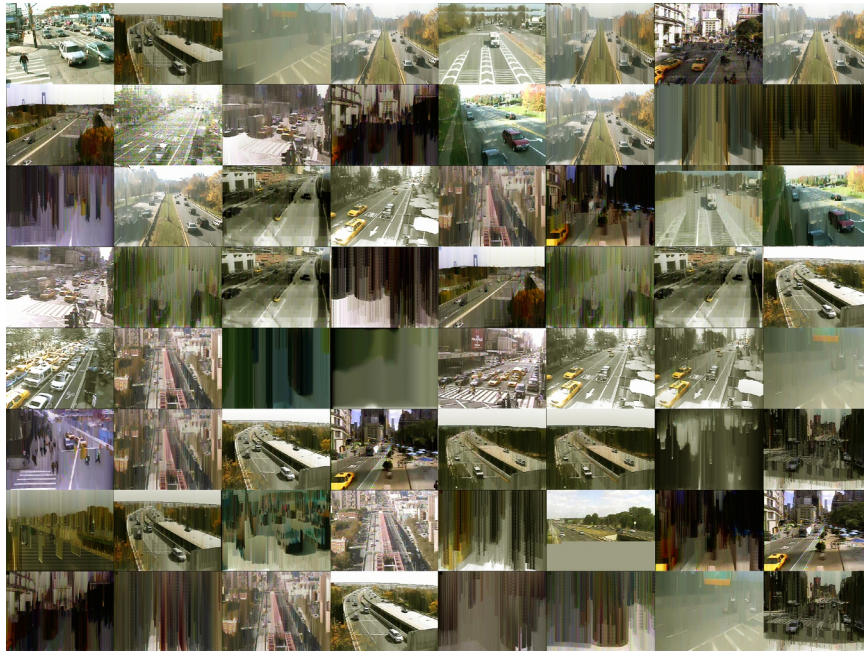
Urban Tapestry. 2005. Output from software system Urban Generation using live real time CCTV images. Artwork on Aluminium 2m by 2.2m.



Capacities. 2010. Installation using environmental sensors.

From Fixed Assets to open Systems and Media visualisations.

The newness of the internet is still a viable claim. The internet's ability to draw assets and data to create postmodern allegory allows all sorts of media visualisations. The internet presents myriad ways to create ephemeral art across networks using all sorts of data information and media. The internet provides gateways and access for all, the editing process, mash-ups; and authors as editors, as choice makers, and as decision makers. One can create these gateways oneself to allow others access ones information and data create organic, generative ever changing artworks and experiences which is what I do.



Meltdown. 2004. Unique C print on aluminum 120cm by 100cm.

The development of my work has shifted from asset gathering and media collection as artworks into a new studio space online. In earlier works I used video cameras and sound recorders to gather assets, or media to edit and make artworks that would be presented in various forms. These were mostly edited, and then used for distribution as editions or later online or displayed as output as art in an art gallery.

Even in earlier interactive pieces circa 1995 - 2002 I used assets and remixing, reworking these assets in a system, usually mouse controlled, all displaying some level of user control, and a generative visual aspect that is in these interactive works I was manipulating or allowing the user some control over my content, such as remixing this content.

This artwork has moved from fixed assets to interactive systems to open generative systems. In 2002 I started to develop less fixed systems that culled data and media from other sources. These mash-ups or interactive collage systems include *Subfusion*, *CCITYV*, etc. In these systems there are no fixed tangible lists of assets (i.e., they are not databases) they are drawn or harvested via software from (online) spaces.

I also moved away from real world studio practice to an online studio space for experimentation, output of ideas, and finished artworks. From artist as author to system as author; the question is who does the output being to?



Situations of Panic Noise. 1986. Video Still from Artitecture series. 120cm by 100cm.

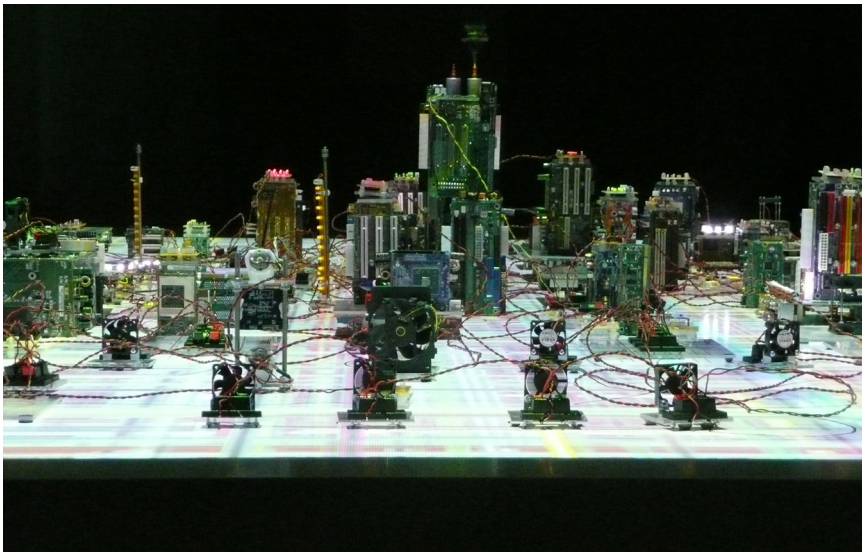
The City Of Data.

The Emergent City has become a body of work connected by a central theme. A city is a web of interconnected networks. In essence, the city fabric is a giant multi-user, multi-data sphere. The city is made up of traffic patterns, pedestrian patterns, bird flocking patterns. Patterns can be seen in the architecture, patterns in buildings, and patterns in the architectural fabric of the urban design network. All of these spheres can be represented by media, and therefore by data within the digital realm. And all of this data can be interpreted and mediated. It becomes a matter of choice. Collections of data can be stored to be retrieved later. The mobile data infrastructure becomes a data source so powerful, so interwoven, that its scale can only be imagined as metaphor. The size and scope of such an archive, of such rich mediated data experience can support many projects. As such, it can be interpreted via a variety of interfaces.

Cities offer the opportunity for unique types of data gathering experiences via a variety of sources. My objective has been to 'mediate' data into conceptual and cultural artifacts. With this perspective there are many unimagined threads of data

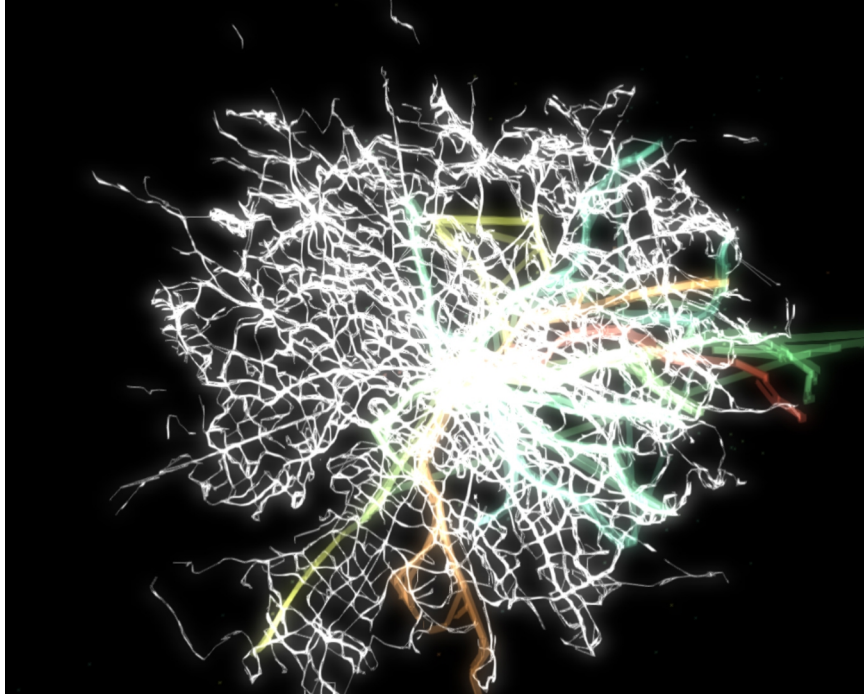
and connections that describe our world that can be explored through wireless mobile networks within which we can create artistic interpretations.

Various types of data can be re-imagined. This includes pollution data recorded via sensors in the street to create audio files. Weather and forecast data, acquired via weather station equipment, can be used to create ambient soundscapes and morphing visualisations as the wind shifts direction or the rain increases. Noise monitor levels, and noise maps, create a symphony of true urban sounds that can be used to make sound reactive sculptures.



The Emergent City. A Life from Complexity to The City of Bits. 2012.

Under this umbrella title of *The Emergent City* project I made a number of artworks, installations, sonifications and visualisations between 2004 and 2012 that have moved beyond the process of research, beyond what I term asset gathering, that are formed into software and installation prototypes.



Synchronicity. 2013. Software system using real time tube and bus data.

Parallel Realities

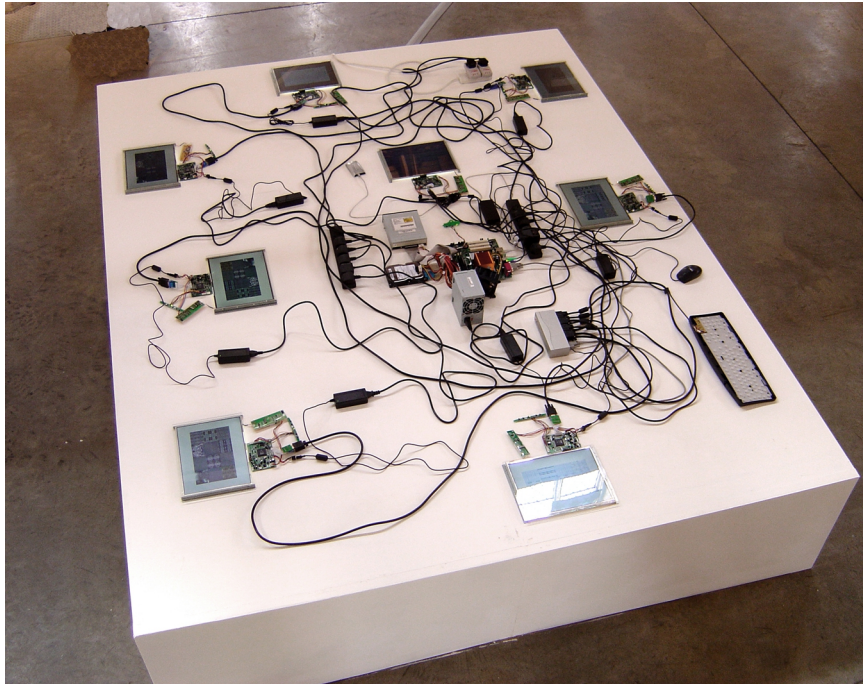
An example is the artwork *Urban Generation; trying to imagine the world from everyone else's perspective, all at once* (2002 – 2005). Multiple CCTV cameras are accessed randomly in real time to make this urban tapestry. What you see is an evolving, generative artwork. These images are taken from London, and they happen as you see them, in real time.¹

This online artwork represents many realities that exist in city space. The observed real time surveillance society is reworked into a series of grids. This presents London to a global online audience. The data that you see is protected by the data protection act. Here it is remixed into what you see, which is an online artwork that looks like a filmic experience, but it is not a film. It is a real time experience of the city from multiple perspectives I call a “parallel reality.”

The online version now runs as a series of twelve real time perspectives of the emergent city experience. This 'filmic system' is constantly evolving and will nev-

¹ The installation versions of this work can be presented in art galleries using projectors or plasma displays.

er be the same again, because the images are not recorded. Each screen is a live real time image from a camera in the city of London. The artwork seeks to explore the rhizomatic multinodal networked experience. *Urban Generation* draws on images across the networked city; the artwork creates a unique interpretation of a multi-point perspective that exists in time always in the present.



Urban Generation. 2005. Installation and software system using live real time CCTV images.

Data cities and control spaces

The city has millions of CCTV cameras. In essence, the city is the biggest TV station in existence. Millions of hours' worth of data are recorded every day by these cameras on city TV. One can take the sounds and images off live web streams and re-represent them thus creating new interpretations of the city in the process.

The city already has a recorded source of data, CCTV is everywhere. Using data from CCTV, you can bring the outside in. Selected feeds are collected from around the world in real time. These real time images are fed into a software system where a series of specialised channels rework these images. The channels are

always on, and always changing, a constant view of the world changing and evolving around the clock. This artwork uses specially created software and technology to randomly find images in real time from anywhere in the network, in this case anywhere in the world.

The increase of technology infrastructure in the daily existence of a city means that technology will be, more than ever, everywhere in our environment. Mobile data mining will be part of the fabric of the landscape. We will be carrying these data in pods, phones and ID cards. Everything is, or will be tracked: CCTV, car sensors, tracking inside our phones, ID card movement, and tracking in the guise of anti-terror activity.

The patterns we make, the forces we weave, are all being networked into retrievable data structures that can be re-imagined and sourced for information. These patterns all disclose new ways of seeing the world. The value of information will be a new currency as power changes. The central issue that will develop will be the privilege and access to these data sources. Uses of this information and data should allow rich new interpretations on the way our world is built, used, and designed.



Facade Norway, 2010. Live data visualisation connecting the city using sensors.

So we need to imagine the city at a different scale. The possibility is to extend our imagination and enable that perception of the city as a dynamic network. We

can now put systems in place that can re-employ our perception and thus create new understanding of how this behaviour unfolds. There are patterns, they are connected and the systems that evolve can be simulated and acted upon.

We can influence the process and the system and we can also create variables in this system that allows understanding of the bi-products of the system, the data and the resulting information.

The Art of Environmental Data.

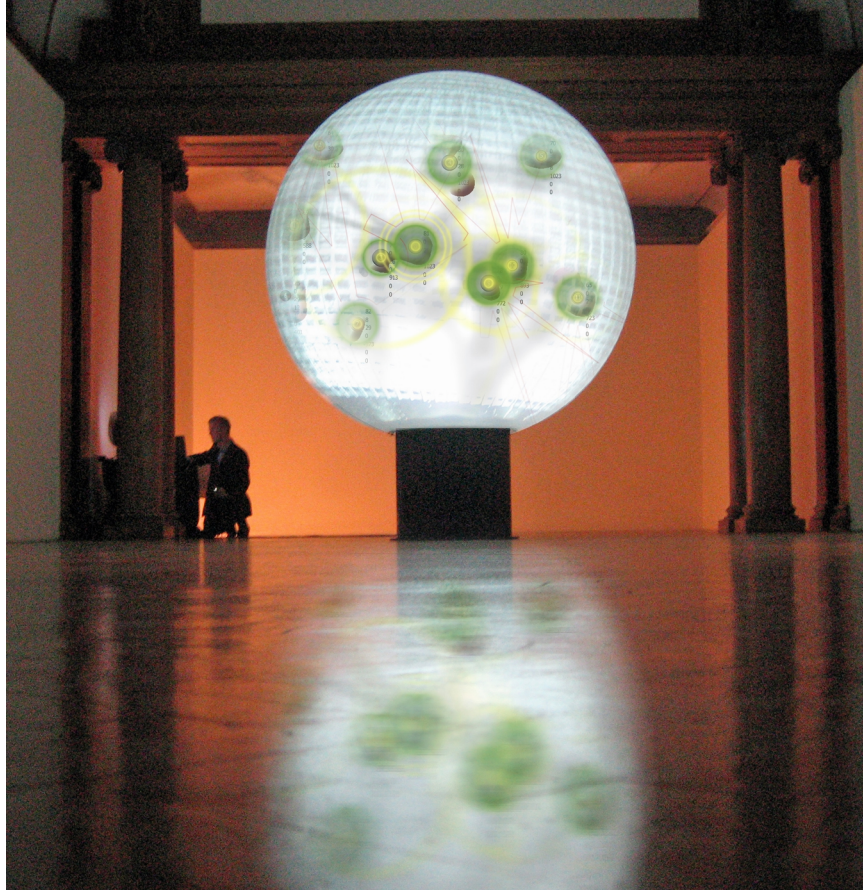
Visualisations and sonifications of the real time city.

In 2004 I started to layer the city with sensors for the *Sensity* projects. Dozens of sensors access the “environmental data” and make it public. I wanted to claim this space as a public domain; and to create a series of social sculptures affected in real time by the changes in the city.

The overall aim was to make smart networks that have data open to all, and not closed off spy surveillance oriented systems. These networks can be thought of as open social sculptures that inform the world and create new meaningful experiences.

Thousands of motes can be deployed across the city for gathering data in wireless sensor networks. Used in large numbers they communicate with one another via radio signals across the network. They can reconfigure themselves, so that the network stays stable. The data is funneled through a system to a point where it can then be interpreted.

The motes monitor the the environment for changes in temperature, sounds, light, position, acceleration, vibration, stress, weight, pressure, humidity, and GPS. Motes and sensor boards monitor the micro incidents of change in the city: the noise, traffic flows and people flows. The interactions of all this data are controlled via mixed up interfaces that can re-form and re-contextualize experiences in real time as social sculpture.



Sensity. 2006. Live data visualisation connecting the city using sensors.

The Control Space

Imagine walking out the door, and knowing every single action, movement, sound, micro movement, pulse, and thread of information is being tracked, monitored, stored, analysed, interpreted, and logged. The world we will live in seems to be a much bigger brother, than first realised.

It's the mother of big brother. It is now a world full of data that can help understand the fundamentals of our outside environment, and monitor the micro codes of our DNA. The world is now "surveilled" totally, but are we not liberated and empowered by data? When will the technology become more than gimmick and start to actually work for us? This is where these projects and artworks begin. In

addition, the artwork alludes to a more socially engaged practice, based on critical reflection of notions of privacy, surveillance space, and control space; speculating on the interactive city and meaning of real time space.

Towards The Emergent City 2006 -2012



London Sensity. 2004. Software System and live data visualisation.

The “Sensity” artworks were made from the data that is collected from urban environment locations. The networks of sensors collected data, is then published online. The sensors interpret the micro-data of the interactive city. The output from the sensors displays the "emotional" state of the city online, and the information is used to create installations and sculptural artifacts. I believe them to be in effect emergent social sculptures visualizing the “emotional state” of the city.²

Sensity is also a highly technical project that can output vast amounts of information about the fabric of our cities. By embedding the sensors in this way we can

² The sensor network can be moved from urban to rural setting and different types of visualization can be made depending on the environment.

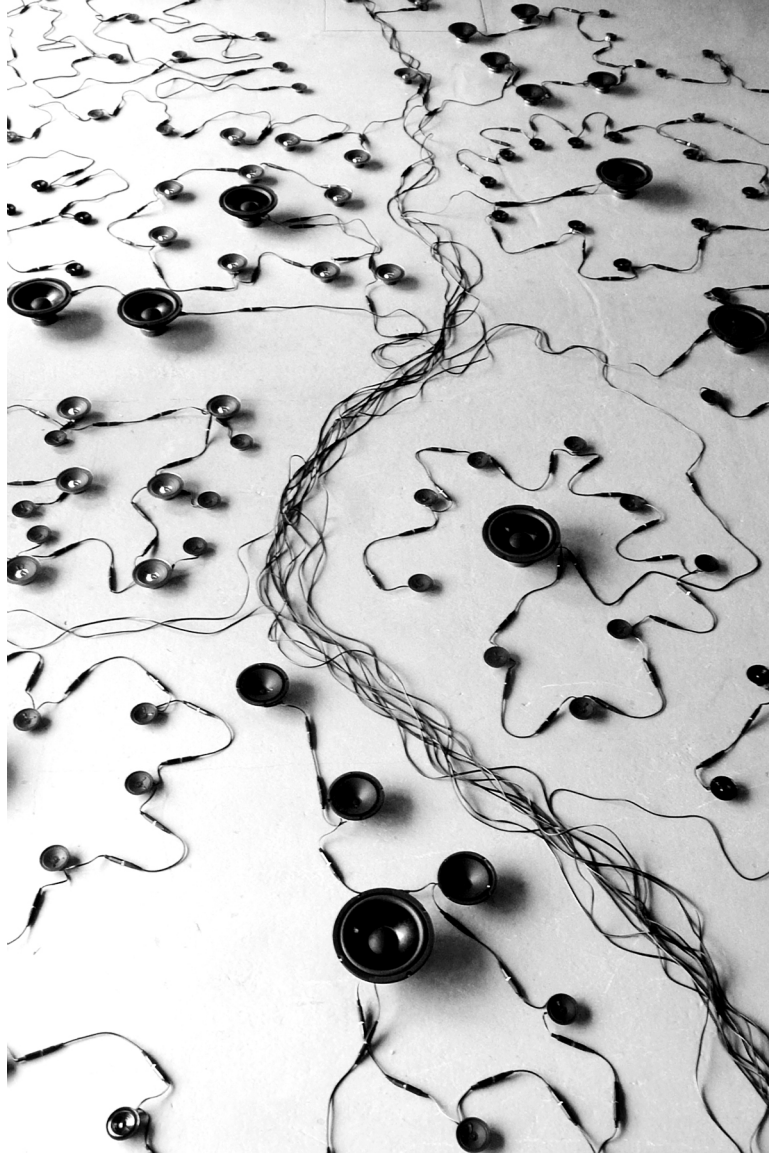
re-engage with the urban fabric and weave new artistic metaphors within city space. Custom made software enables these sensors to communicate with one another in a network over a proxy server in real time. The data is also available for others and can be used to create visualizations in the open source environment that is online. (see online xml streams).

Representations of these datasets allow unique understanding of the urban environment from this real time perspective. The interactions of all this data, controlled via interfaces that can re-form and re-contextualize experiences in real time. Sensity becomes a holistic city system. The sense city is a city of, accumulated incidents of love, abuse and death; the micro incidents of changes in the weather, the noise traffic flows and people flows.

Sensity leverages the real time data city and represents it online showing the life of the system and the emerging changing behaviours of the space.

The Data is the Medium.

In artworks such as *Sensity*, *Facade*, *House*, *Sonicity*, *Capacities*, *Body*, etc., I connect networks of real time information flows. The shared data space can overlap and there is a new space the space in between that only two nodes share. I has merged collected data from various cities and created an aestheticization of the shared city space.



Sonicity: Songs of Atoms Time and Space. 2010. Software System and installation; live data sonification.

Marcus Foth, states,³ “Alive with movement and excitement, cities transmit a rapid flow of exchange facilitated by a meshwork of infrastructure connections. In

³ Foth, Marcus. *Handbook of research on urban informatics: The practice and promise of the real-time city*. Information Science Reference, IGI Global, 2009.

this environment, the Internet has advanced to become the prime communication medium.”

I believe there is a new social space that exists between these independent networks. Future cities will be merged into real time connected up data cities. A connection of networks of real time information flows. The results created lead to mashed-up cities and real time performative city experiences.

These systems re-employ our perception creating new understanding of how this mixed city behaviour unfolds. There is an opportunity to influence this process and the system and we can also create variables into the networks that will allow greater understanding of the data and the resulting information. Data has become the medium of the age.



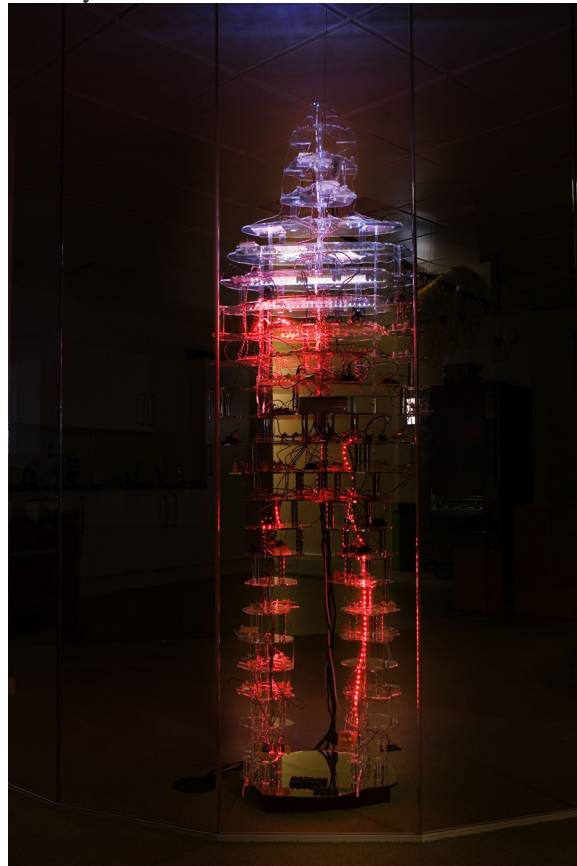
Data Data Data. 2010. Software System and live data visualisation connecting city space using sensors.

A City of Sculptures

In one of my experiments *Capacities* (2010) I made a new city of ‘sculptures’ re-presenting real time spaces and data environments. The work investigated the loop from the real to the virtual and back to the real space. This notion of playing or manipulating with a malleable form (data) is made possible as each stream, each node, each sensor, or even the entire network can be communicated with us-

ing XML online gateways.⁴⁵ The project was instigated by setting up its own wireless sensors networks across London to collect environmental data which was then published online in real time for an extended period of time. The output from the sensors display an interpretation of the real time city online, while that same information was evaluated and then re-visualized in the creation of numerous artworks, back in the public domain. The resulting artworks represent the real time conditions of the city.

The artistic aim was to create new meaningful experiences allowing critical reflection on the real time city and the social political undercurrent embedded in the search for the real time city. This allows for a greater community of interpreters and beneficiaries to see, and to come to their own understandings arising from this data about our socially-networked environment.



Body 01000010011011110110010001111001. 2013. Sculpture which responds to the emergent properties of the environment.

⁴ http://igor.gold.ac.uk/motes/mts310/motestatusxml_html.php

⁵ <http://igor.gold.ac.uk/motes/mts310/motestatus.php>

The Third Space. Future Avatar Cities

I proposed in a recent interview for The Internet of Things Council⁶ that future cities will be merged into real time connected up data cities. Not just one space, but a connection of networks and of real time information flows. The results created will lead to mashed-up cities and real time performative city experiences.

I am now interested in how this shared dataspace can overlap, creating a new space in between, which only two nodes share, a future avatar city. The aim here is to give tangible form to this new space, the space where the cities overlap, presenting an alternative urban virtual environment. In the prototype the audience sees the data and will be able to mix data from cities; they can even mix the data to make music with it. This novel approach allows a critical reflection on the real time city.

“The Third Space” speculates that social sensing might lead to a new social space, and eventually, to new business enterprises which can be exploited. What is possible is that significant breakthroughs in knowledge about the shared data experience can be achieved through user-based interfaces online, on mobiles, media facades and other platform (multi-distribution will spawn micro business.

In the last few years several systems have been deployed to monitor city environments. Mostly they exist as isolated networks. My plan is to ask them to link up. This takes a step towards the “City of Bits” that Bill Mitchell talks about.

Future cities will be merged into real time connected data cities. A connection of networks of real time information flows as demonstrated in trials for my earlier AHRC funded project (Sensity 2006 -09). The Third Space works impacts on how data flows overlap in live streams, demonstrating the possibilities for novel artistic experiences and technical outputs, including sonifications, visualizations, and sculptural objects.

“The Third Space” creates outputs that directly show how networks can be connected and data harvested for creative uses. In the last few years several cities have started to use motes sensors to create data spaces as test beds including Newcastle, and soon Santander. “The Third Space” also impacts on Connected Environments, Smart Places, Smart Cities, Wireless Sensor Networks.

By using the standardized XML data streams that were developed previously to make the data / city available in the public domain. The aim is to improve this availability and connect up multiple data spaces (cities) to show the impact on our experience of the city, and thus create an ecosystem prototype. The data environment becomes a virtual data map of the real events. What is demonstrated is that the collected data can be re-made reconstituted to be real again enabling physical objects to interpret the virtualised city data. The analogue is made digital and the digital can be re-formed into a variety of output devices.

One has to experiment with the technology and understand how to get under the bonnet, and then new outcomes will shed light on how data flows overlap in

⁶ <http://tinyurl.com/3trotzq>

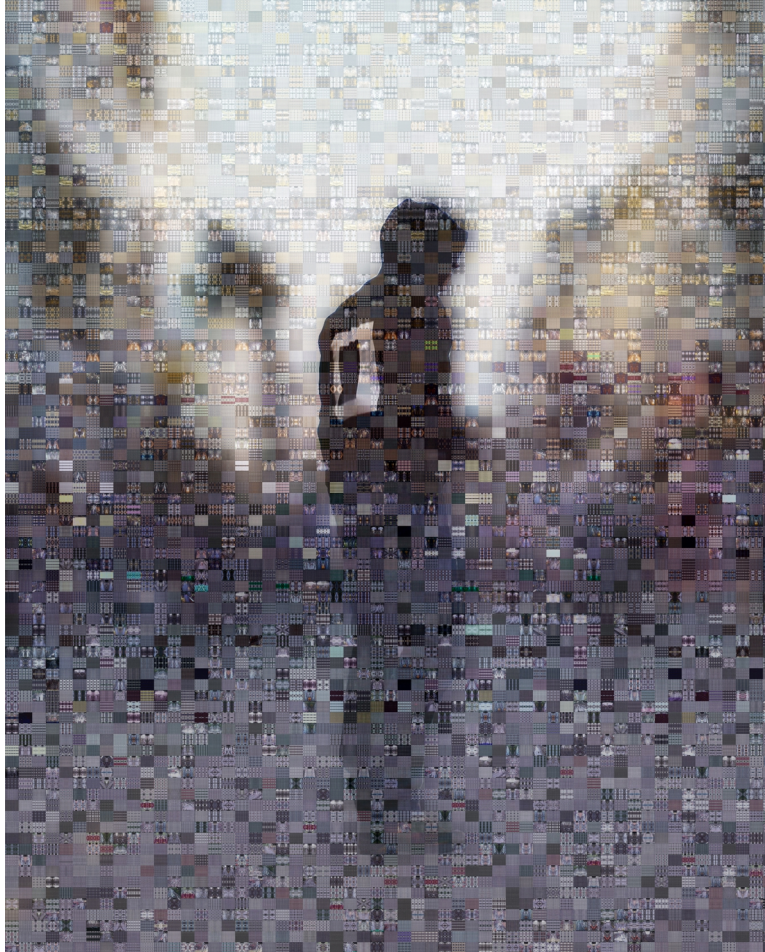
live streams demonstrating what are the possibilities for novel artistic experiences and outputs as well as new business models which will benefit from sonifications, visualizations, and sculptural objects; as well as apps, and feedback into other networks and integrated systems.

Problems inside the Emergent City

Can we use new technologies to imagine a world where we are liberated and empowered, where finally all of the technology becomes more than gimmick and starts to actually work for us or are these technologies going to control up, separate us, divide us, create more borders. Will the securitization of city space create digital borders that monitor our movement and charge us for our own micro movements inside the system? The conceptual ambition of the project is to answer this question.

The result will be used to test the main hypothesis which I believe to be a new social space that exists in between these independent networks. What happens when future cities are merged into real time connected data cities. The results created will lead mashed up cities and real time performative city experiences. For example how can we merge collected data from various real time cities to visualise this new space, the space where the cities overlap? This could allude to a new architectural and urban virtual space.

This might also allow for a greater community of interpreters and beneficiaries to see, and to come to their own understandings arising from this data about our socially-networked environment.



Self Portrait. Inside CCTV. 2009. Unique C print on aluminum, 200 by 220 cm.

Social Spaces

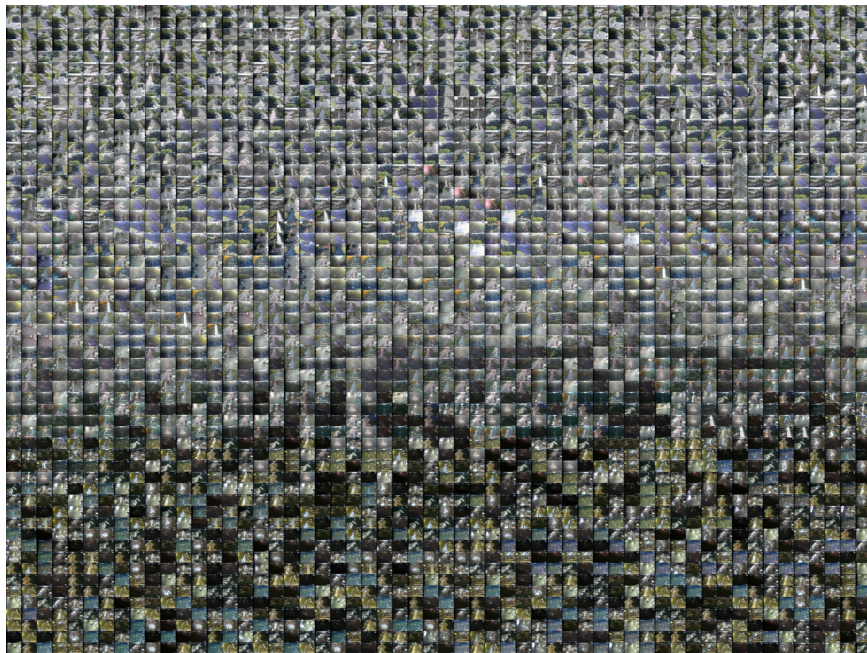
Underpinning this research are a whole series of potential problems about observation, surveillance, and the ethics of the control space. By researching current surveillance systems, tracking software, and pattern recognition software one can come to an understanding about the social and ethical implications of such technologies both in artworks as well as public domain space and to speculate where these technologies could lead us in the future. By building my own art systems

and tools using custom made software, I try to raise further questions about the ethics of the control space and surveillance space

Alongside this technology research I have focused on the aesthetic development of systems outputs by investigating different ways to represent the data and different ways to question the meaning of the system.

Cultural Contexts.

How we understand and value information is of great importance. It seems reasonable to suggest that visual metaphors might simplify our understanding of data in space. Adopting visual and poetic metaphors for gathered data enables a perspective which I call a “parallel reality”, a multi-point perspective. I want to make his artwork eternally current. It will allow a real time multiple perspective of an identified space.



Parallel Reality. Madrid 2006. Output from online software system using real time CCTV images. Artwork on Aluminum 120cm by 100cm.

The art of gathering environmental data.

Selected projects and artworks I has made since 2004 that demonstrate the art of gathering environmental data. These works came into being because of a Nesta Dreamtime award and AHRC creative fellowship grant. Most of these artworks where made between 2004 – 2012.

The Emergent City. A Life From Complexity to The City of Bits.

http://stanza.co.uk/emergentcity_show/index.html

The artwork captures the changes over time in the environment (city) and represents the changing life and complexity of space as an emergent artwork. The artwork explores new ways of thinking about life, emergence and interaction within public space. The project uses environmental monitoring technologies and security based technologies, to question audiences' experiences of real time events and create visualizations of life as it unfolds.

Body 01000010011011110110010001111001

<http://stanza.co.uk/body/index.html>

Body is a sculpture which responds to the emergent properties of the environment in South London where the artist's wireless sensor network is situated. It represents the changing life and complexity of urban space as a dynamic, kinetic artwork.

Sensity

<http://www.stanza.co.uk/sensity/index.html>

Sensity artworks are made from the data that is collected across the urban and environment infrastructure. The sensors interpret the micro-data of the interactive city. The output from the sensors display the "emotional" state of the city online in real time and the information is also used to create offline installations and sculptural artworks.

Datacities

<http://www.soundcities.com/data.php>

These datamaps show live environmental data from a 40 motes wireless sensor network that can be deployed anywhere. They monitor light, temperature, humidity, noise.

Intelligent Sheep: Baa Ram Ewe...to your clan be true.

<http://www.stanza.co.uk/sheep/index.html>

This is an interactive sound performance and concert. This artwork uses local environmental data collected using ad hoc wireless networked devices for environmental monitoring, which are attached to the sheep. In this case the dozen sheep collect and send data about the environment, and respond to the space as a collective as they move about.

Faith

<http://www.stanza.co.uk/ingodwetrust/index.html>

Faith is an artwork made using data harvested from sensors scattered over the cathedral. The sensors respond to changes in the environment they are located in this case Liverpool Cathedral. The data is turned into a sound stream, this sound stream represents Gods presence and you can listen to this sounds, the sound of God.

House

<http://www.stanza.co.uk/house/index.html>

House is a dynamic public sculpture viewable over the internet. House describes the space, a real Victorian terraced house, in this case, that the artist lives in. House is a live embodiment of change and renewal. In “House”, the private interior has been made public. Sensor data unfolds and discloses the inherent properties of the space, creating an online artwork.

Tree

<http://www.stanza.co.uk/tree/index.html>

A tree that makes music and sings a song about the environment. The first version of *Tree* used 40 networked multi sensors. The sensors are hidden all over a tree, broadcasting sensor data (light, temperature, humidity, noise, and GPS location). The data is translated to music. The results produce a singing networked tree which can be heard in the park.

A world of new possibilities.

<http://www.stanza.co.uk/possibilities/index.html>

The landscape becomes virtual, dynamic, and encoded. The artwork discloses the underlying data that we see that is changing all the time in front of us.

Gallery

<http://www.stanza.co.uk/gallery/index.html>

The gallery becomes the artwork formed by the emergent real time data in the space. The gallery laid bare as a work of art. *Gallery* proposes that the data is art. The art is a real time flow of the things around us that allow our senses to invoke understanding. The gallery space becomes the art described by the shifts in light, temperature and noises in the space over time.

data data data

<http://www.stanza.co.uk/data/index.html>

data data data is a live real time data visualisation made using sensors which are scattered over the building. The sensors respond to changes in gallery space ie the environment of the building. The changing data is turned into this visual event and projected outside across the city, in this case Liverpool. This artwork is networked, its real time, and its takes data from a wireless sensor network that is placed in the real space.

Façade

<http://www.stanza.co.uk/facade/index.html>

The façade is a live dynamic interface, an artwork that changes its behaviour as a result of the changing condition in the environment. This works by sensing the city and the environment to make art. The results become representations of the real time spaces and environment of Trondheim in Norway. The output from the sensors display the real time environmental and emotional state of the city online in real time and the information will be used on the façade and online interface to control it.

Capacities

<http://www.stanza.co.uk/capacities/index.html>

In *Capacities* the whole gallery space becomes one large artwork made from real time city information and data. The aesthetic and feel of the space looks like an electronic city. The city is made of units, grids, repetition, building blocks. In the gallery city called 'Capacities' the leads, the wires, and cables are incorporated into the artwork to look like a city map. *Capacities* looks "designed" like a piece of urban design, a city surveyed and controlled. The whole space becomes a map to wander through.

Sonicity

<http://www.stanza.co.uk/sonicity/index.html>

This artwork is a responsive installation, a sonification of the real space and environment. The sounds you hear are the sounds of the changing environment, ie the changes of noise, light, temperature of the space is turned into a real time sound stream using dozens of wireless sensors presented as an installation on 170 speakers. My system monitors the space (the building) and the environment (the city) and captures live real time data (light , temperature, noise, humidity, position) to create an ambient sonification, an acoustic responsive environment, literally the sound of the micro incidents of change that occur over time.