the triangle

space media arts

mare street

wifi meshbox

antenna

lansdowne drive

play area

1665 plague pits?

feral robots

cycle route

industrial estate

london fields rail station

bats

18th century highwaymen

picnicking

old sheep droving route

primary school

pub on the park

lido

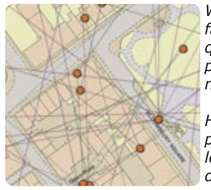
cricket played since 1802

houses demolished by WW2 bomb damage

richmond road

N

ROBOTIC FERAL PUBLIC AUTHORING



What environmental factors such as air quality, noise and light pollution affect our neighbourhoods?

How can we measure pollution in our own localities and make this data visible?

How can we make sense of this in the context of what we already know about the places we live, work and play in?

Robotic Feral Public Authoring links together two branches of research for community fun and action. Hobbyist robotics and public authoring both enable people to use emerging technologies in dynamic and exciting new ways. Brought together they open up whole vistas of possibilities for exploring our local environments with electronic sensors to detect all kinds of phenomena and map them using online tools.

Everyday Archaeology
Electronic sensors are now cheaply available for detecting a wide range of phenomena such as carbon monoxide, nitrogen dioxide, solvent vapours, electro-magnetic emissions (mobile phone masts, electricity generators etc), light and noise pollution. These can be combined with other cheap electronics (such as toy robots) that engage people in evidence collecting in a fun and tactile way.

Adding the sensor readings to online mapping tools, such as Urban Tapestries, suddenly brings the relationships between environment and home vividly to life. It enables people to feel they can learn about their environment and have the evidence to do something about it. By linking robot building and mapping workshops into traditional community events (village fetes and local festivals etc) a wide range of people can become involved in gathering and sharing knowledge about their environment.

Robotic Feral Public Authoring is part of Proboscis' Social Tapestries research programme, exploring social and cultural benefits of local mapping and knowledge sharing (public authoring). Proboscis was awarded funding from the EPSRC to host design engineer and technology artist, Natalie Jeremijenko as a Visiting Fellow in late 2004.

We set out to investigate how toy robots can be hacked together with environmental sensors to map pollution, and how this could be used by local communities. Natalie's previous projects reconfigured low cost toy robots into vehicles of social and cultural activism, exploring how robotics could break out of the academic lab and how sophisticated equipment could be acquired by the general public via products benefiting from the economies of scale of consumer manufacturers. Proboscis initiated a further collaboration with Birkbeck College's Computer Science department to design and build the new feral robot and the software needed to sense pollution, add GPS location data and feed this back our Urban Tapestries mapping platform.

LONDON FIELDS

London Fields is a popular local park in Hackney, East London. Bounded by Richmond Road to the north, not far from Mare St (Hackney's busiest road) its an important resource for local communities in a built up area. The park is used by local people for a variety of activities; as a space to play and socialise in (with two children's play areas), organised cricket and football matches, and many dog walkers. It is also a popular walking and cycle route. As part of a global city, London Fields and the area around it is constantly changing, adapting to accommodate the differing needs of the surrounding population. London Fields' origins (first recorded mention in 1540) and it's existence today are related to its use as Lammas land, an area for communal grazing. It was the last piece of common land for livestock on a drovers route from Essex to London Town before being herded off to 'Slaughter Street' off Brick Lane or East Smithfield.

Currently the intervention of property developers in the locality of London Fields is raising serious concerns about the gentrification of the area and the impact this will have on local communities. During the 19th century the Fields themselves were under threat and only just survived a number of attempts to change their use. In the 1860s agents for landlords began promoting the site for development, dismissing the Lammas rights as rarely used and pointing to the neglected state of the fields. The importance of London Fields location as large open space so close to the city was recognised, and thus development not allowed. London Fields became a public park in 1872.

Proboscis chose London Fields because of its strengths as a public space used by distinct and diverse communities. Collaborating with SPACE Media Arts (based on Mare Street) enabled us to create swift and trusted links into the area using SPACE's extensive local community networks.

COMMUNITY MAPPING WORKSHOP

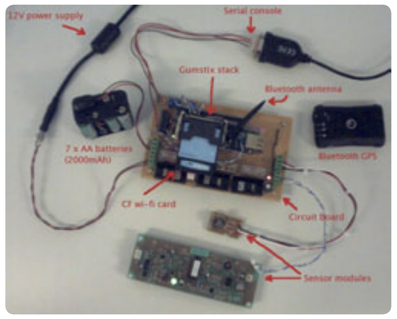
A group of 15 participants took part in a community pollution mapping exercise in London Fields in November 2005. In small groups, participants explored London Fields equipped with audio devices, digital cameras and Pollution Sensing eNotebooks to look for evidence of pollution. Information gathered was mapped on to a large aerial photograph of the area and became a starting point to explore wider concerns about pollution (both visible and non visible) and the potential use of technology by communities to detect it.

'In London we have the highest level of asthma in the world. There must be a reason for this. If people don't have the tools they can't make this jump... to enable them to visualise the pollution that they in part cause.'

'As soon as the word pollution is mentioned, one is made to feel like something is under threat or being destroyed.'

'If we encourage people to map pollution in their area they suddenly think their area is polluted.'

'Most people's homes are more polluted than the outside space we occupy, through chemicals in furniture, upholstery and construction materials such as MDF.'



CREATING THE ROBOTS

The first generation of feral robots was developed using the very low cost PIC microcontroller family which provides computing power roughly equivalent to that of a remote control. The requirement for location annotation and wireless and internet connectivity for the new version implied that an altogether new design was required. We also wanted to be able to support a more extensive collection of sensors, several of which required an extended period of warm-up. For this reason, we designed a new printed circuit board that provides appropriately regulated power to all components including the processor board, the data acquisition boards and the sensors; can be used to recharge the on-board battery pack; supports terminal access to the system console; and a mounting foundation for all the electronics.

The heart of the new design is the Gumstix small form factor system, measuring 80x20x6mm, which incorporates the Intel Xscale network processor and supports an embedded Linux distribution including a full implementation of the IP stack. Wireless networking is provided via an extension board and the Netgear MA701 CF card. This component also provides Ethernet and Bluetooth functionality. Location information is collected using any NMEA compatible Bluetooth GPS unit – in our prototype we used an OEM version of the Socket BT receiver. Finally, we used two Figaro chemical sensors, namely the AMS-2100 which measures air quality and the AMS-4161 which measures the number of carbon dioxide particles per million particles of air. Such sensor readings are converted to digital measurements via the Robostix data acquisition board which includes a 10-bit analogue to digital processor.

Two software applications were required: one to configure and maintain correct system operation (for example network discovery and connection to a network time server for timestamp synchronization) and a second application to poll the sensor boards, retrieve data and package it in an appropriate format for transmission to the UT server. Although this new version can connect to any accessible wireless LAN, a mesh network infrastructure provides maximum coverage and flexibility. In the London Fields outing we used a portable WiFi mesh node from Locustworld.

Would you want to know just how polluted your local park is?

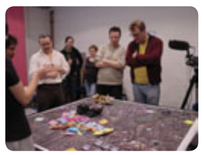
'Living close to London Fields I would like to be part of an experiment which maps pollution in London Fields inch by inch... we need to know where it is polluted and then we can start to put up signs and warn people'.

Or perhaps not:

'The more I think about it, the less I want to have any access to any data about air pollution in my locality, or information about this park. I don't have a garden, I have a kid, I'll always use it.'

'We have come to accept air pollution because we are culturally habituated to it... that's got to change and if this doesn't happen at a grass roots level with tools that we can handle ourselves governments will not shift because they are in with the big corporations.'

So is community pollution mapping about producing accurate scientific data? Or is it a tool to highlight concerns, to map knowledge and collect data to reinforce perceptions of an area?



How can activities like hobbyist robotics and public authoring help local communities come together to explore and act on the environmental evidence they collect?

INTEGRATING WITH URBAN TAPESTRIES

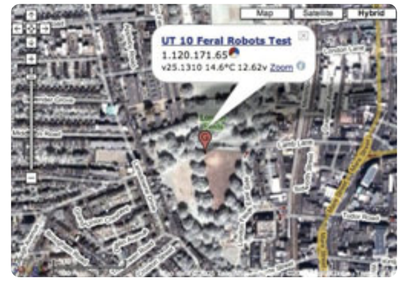
Collecting and processing the data sent from the Feral Robot required a series of extensions to the existing Urban Tapestries backend system to fit with the special needs of the robot client. A separate server component was designed and implemented that establishes connectionless communication with the robot. This accepts the robot's data packets which contain the robot's GPS position along with the corresponding value of each sensor measurement and the time this measurement was taken. After extracting the packet contents they are stored in the database, from where they become available for processing and visualisation.

SENSOR VISUALISATIONS

The initial visualisations of the feral robot sensor data were made by processing a static high quality aerial photo of the area in which the measurements were taken, and overlaying it with an extra transparent image layer. The sensor values and each reading's position were fetched from the database, associated with a colour from the visible spectrum, then drawn onto the image layer as a dot with diameter equal to the maximum GPS position deviation. This forms a dense coloured "cloud" over the subject area. Our next stage is to develop a dynamic mapping representation using Google Maps and associating the sensor data with other contextual knowledge.

SOME IDEAS ABOUT THE BENEFITS OF ROBOTIC FERAL PUBLIC AUTHORING

- To make invisible pollutants visible and tangibly highlight the effects of our reliance on the motor car
- To trigger a larger investigation into local pollution by public authorities
- That it is a worthwhile exercise in itself, bringing a community together and stimulating debate on local issues
- It could inspire other creative and artistic outcomes about local issues
- The act of mapping allows another layer of data to be mapped onto an area, building up a contextual snapshot



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RFPA Technical Documentation
http://socialtapestries.net/feralrobots/docs/
RFPA Software
http://socialtapestries.net/feralrobots/software/
Community Workshop Documentation
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Natalie Jeremijenko's Feral Robots
http://xdesign.ucsd.edu/feralrobots/

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Robotic Feral Public Authoring

SOCIAL TAPESTRIES

SOCIAL TAPESTRIES

Robotic Feral Public Authoring

Project Credits
Giles Lane – *Principal Investigator*
Natalie Jeremijenko – *Visiting Research Fellow*
Alice Angus, Camilla Brueton, Sarah Thelwall and Orlagh Woods – *Proboscis*

Project Partners
Dr George Roussos – *Birkbeck College Computer Science Department, University of London*
Gini Simpson – *SPACE Media Arts*
Dima Diall with Dimitri Airantzis – *Public Authoring Feral Robots design & construction*
George Papamarkos with Karen Martin, Dima Diall and Dikaios Papadogkonas – *software development & integration with Urban Tapestries*
Matt Karau – *Feral Robot design & construction (Dublin Ark version)*

Community Mapping Workshop
Participants – Arkem, Melissa Bliss, Colin Bloxham, Michael Calderbank, Heather Corcoran, Corinna Drossel, Jennifer Gabrys, Lewis Griffin, Kevin Harris, Siraj Izhar, Kevin Moore, Christian Nold, Rokeby, Paula Roush, Ben Scott. *Facilitators* – Alice Angus, Camilla Brueton, Giles Lane, Sarah Thelwall and Orlagh Woods.

Aerial Photo of London Fields provided courtesy of Getmapping.com

Design by Giles Lane & Camilla Brueton
Published by Proboscis March 2006
Funded by EPSRC (Cultural & Creativity Programme)

http://socialtapestries.net/feralrobots/

EPSRC Engineering and Physical Sciences Research Council