

# MAKING SENSE OF SPACE

<http://www.makingsenseofspace.com>

For more information please contact  
Gonzalo Garcia-Perate, [gonzalo@makingsenseofspace.com](mailto:gonzalo@makingsenseofspace.com)  
Duncan Wilson, [duncan.wilson@arup.com](mailto:duncan.wilson@arup.com)

Making Sense of Space a two-year, £1m TSB (DTI) funded project lead by Arup that explores the use of ambient technologies to understand the creative workplace through design scenarios. The outcome is a "toolkit" designed to help us understand workplace performance beyond economic contribution and post-occupancy evaluation. Project partners include Arup, BT, UAL, Brunel, Imperial College, AP Futures, Artificial Tourism, Maoworks and Spy.

The project correlates quantitative and qualitative data about the physical environment and the mood of the work force. Wireless sensor networks (WSN) capture tangible environmental factors such as light levels, heat levels, noise levels. These are then correlated to workforce reports on intangible factors such as perceptions of personal mood, and WSN data on how people use and move in the space.

## Overview

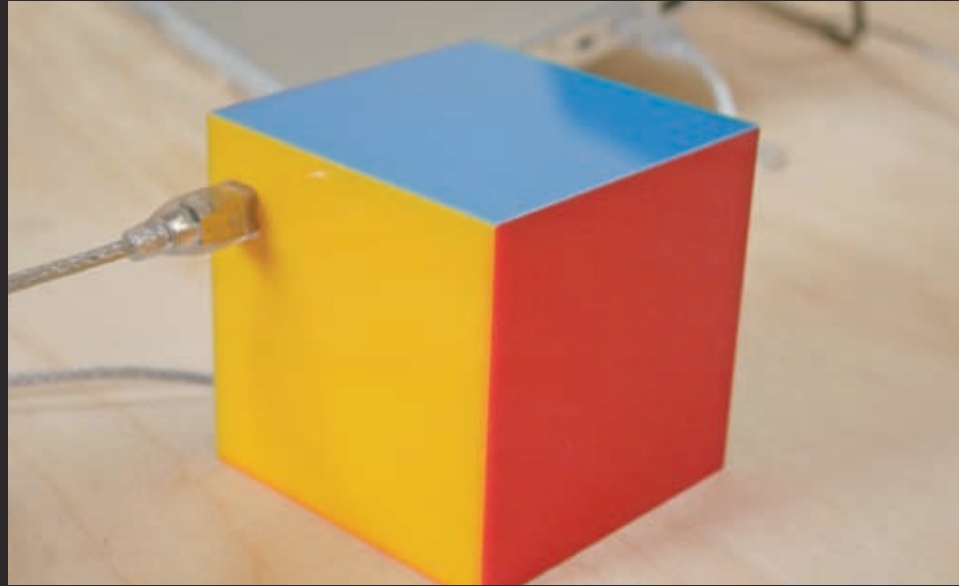
## input

A major aim of the project was to **record subjective impressions, feelings and experiences** of people in relation to the spaces they inhabit.

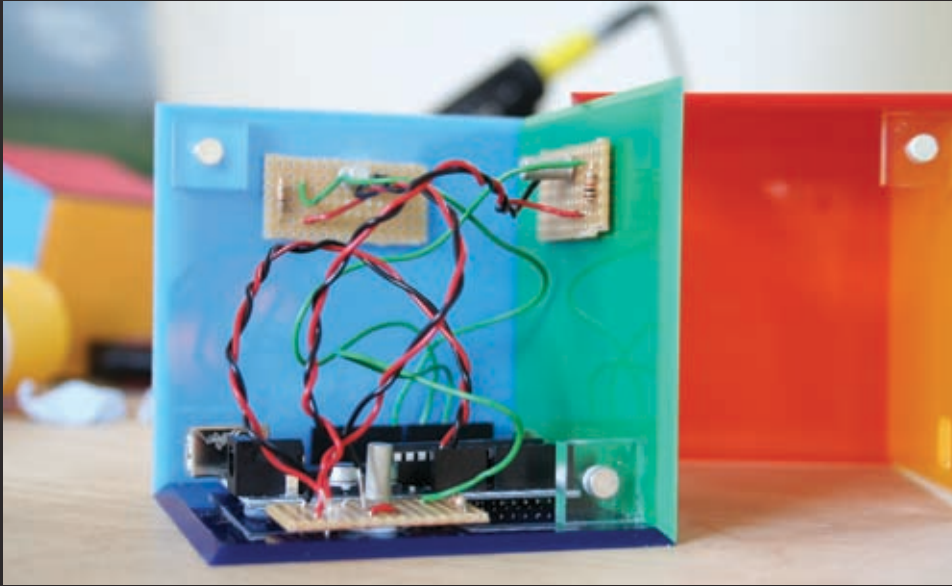
We created a set of objects that briefly shared people's desktops in their work environment. Through these objects, we could ask questions and get a deeper understanding how people felt about their workplace.

Through these objects we got a personal and subjective account on a range of factors, both environmental and social.

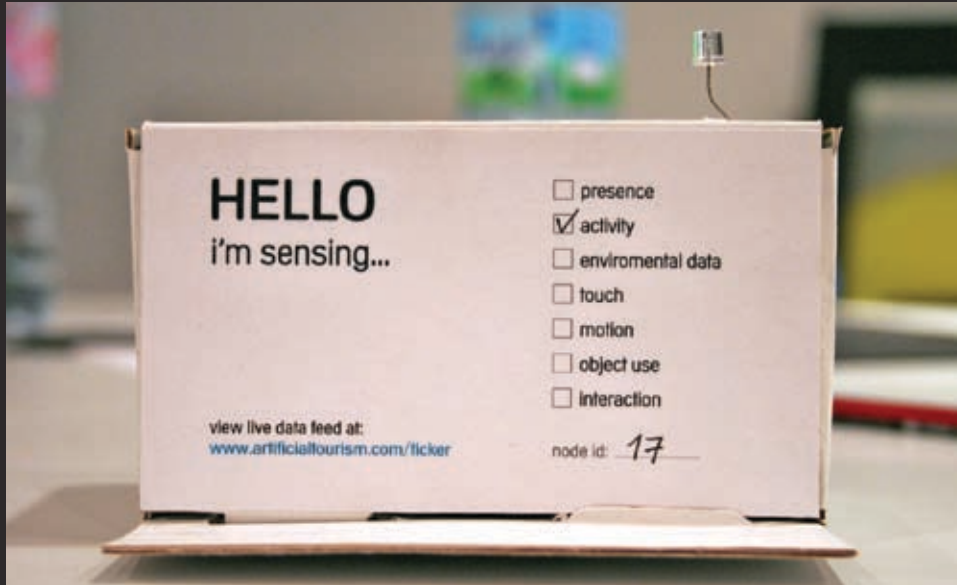
As well as monitor environmental and subjective data we attached sensors to tables, chairs, doorways, cupboards, etc. **to get an understanding of how the space was used.**



Cube lets users vote how they feel about a place.



Cube using three simple tilt switches.



Light sensors used to detect kitchen activity.



Accelerometers sensing fidgeting.



Touch sensors detecting presence.



Passive infrared sensors detecting presence.

## storage

**All data for the project was stored in a database and correlated spatially and temporally.** We then developed a **Building API** allowing a wide variety of applications to connect and query the building. The returned data can then potentially be presented as RSS feeds, as a mobile application or visualised.

The query interface allows us to retrieve data for a whole building, a particular section or floor or even an object within the building at any point in time. This query interface was implemented as a REST protocol over http, thus allowing anyone or anything with an internet connection to access the building's data. The data was then returned in either xml or csv format. Example Building API query format:

<http://server:port/location/timestamp/device/fields/format>

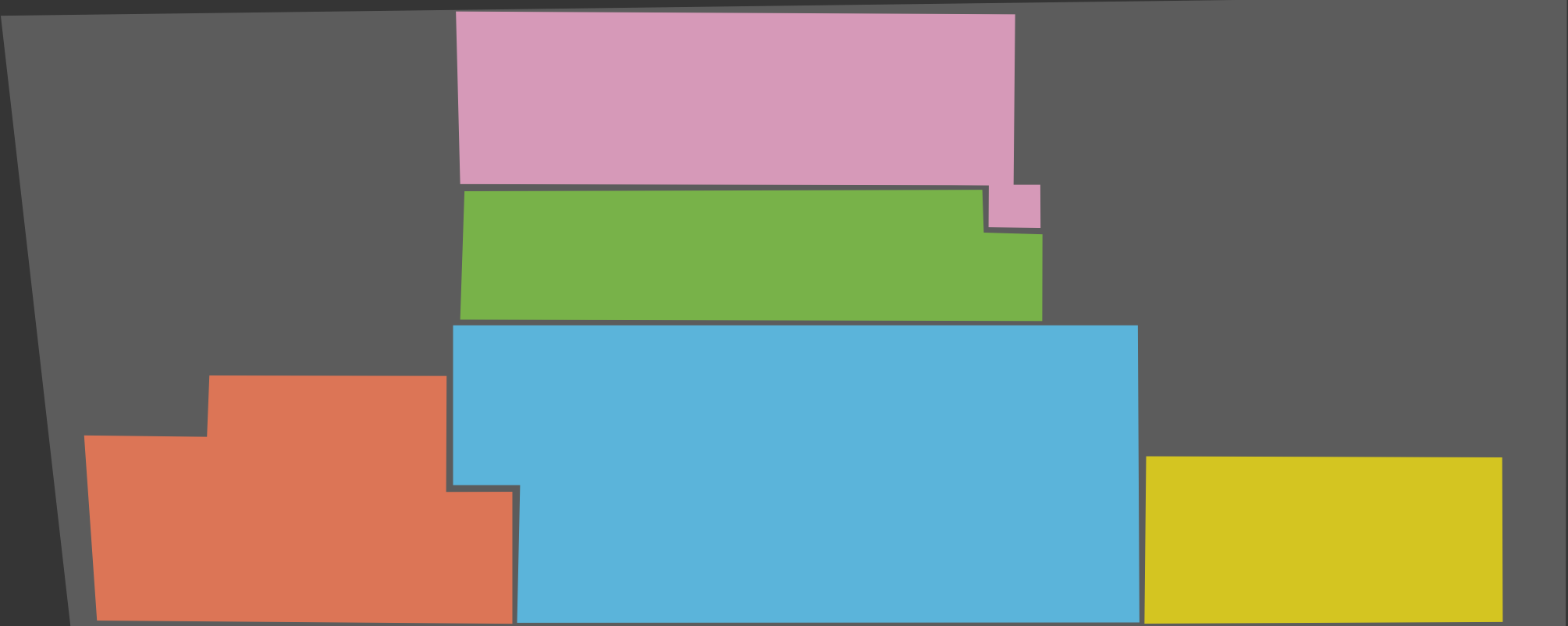
Building API query examples:

[http://195.195.65.13/20071001\\_04/1/0/xml](http://195.195.65.13/20071001_04/1/0/xml)

<http://195.195.65.13/entrance/20071001/xbow/temperature,light/xml>

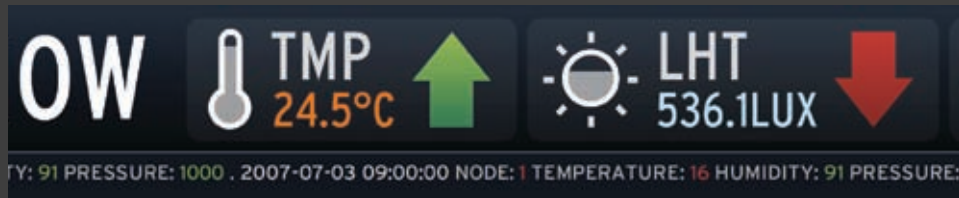
[http://195.195.65.13/ben\\_desk/last\\_2\\_hours/mood](http://195.195.65.13/ben_desk/last_2_hours/mood)

<http://195.195.65.13/studio/today>



Floor plan of Arup's 13 Fitzroy Street offices. The highlighted areas correspond with different locations for sensor network. These locations are then used by the building API and the query interface, allowing application to get data for a particular department or sub-area.

## output



Display showing latest temperature and light readings for a space



Display showing temperature and light averages for a day



Display showing temperature readings for a whole week



Display showing result from qualitative survey



Display showing energy consumption levels for the building



Display in interactive mode showing correlated readings in month view

We developed a visualisation system as a means to feedback both in real-time and over time on how the environment was changing. The project captured the world in digital form and the role of the visualisation was to transform that data into insights. Inhabitants could respond to the output of the visualisation affecting it in turn creating an open conversation with the space.

The design of our Building Dashboard took the form of a financial ticker. The display continuously scrolled through the different environments within the space, correlating qualitative and qualitative data. Other data flows like newsfeeds and live weather feeds were also incorporated.

