Cybernetic Bacteria 2.0

The Interface of Biodigital Communication

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Introduction

Cybernetic Bacteria 2.0 is an interactive installation which makes explicit the sublime correlations between human digital communication and bacterial chemical communication. The project was a collaboration between a visual artist (Anna Dumitriu), a microbiologist (Dr Simon Park), a philosopher (Dr Blay Whitby), an interactive media artist (Tom Keene) and an artificial life programmer (Lorenzo Grespan) and was commissioned by The Science Gallery in Dublin as part of their exhibition "Infectious".

> The scientist, unconcerned with the ethical implications of his experiment and also unaware of the artists intentions, didn't anticipate that the fusion of the Earth's global bacterial communications network, with that of human origin would lead to the evolution of a novel and chimeric life form. Tainted carbon fused with doped silicon. Dublin became the epicentre of a new epidemic, and the origin of a new kind of contagion able to subvert both biology and technology. What followed was inevitable. What else would a creature with access to: humanities entire knowledge; the genetic toolbox that drives evolution; the sophistication of the pathogen; and intimate awareness of our vulnerabilities do. (Park, 2009)

Description of the Artwork

The artwork combines raw network traffic taking place live around the gallery (including web traffic, mobile technology and Bluetooth), a time-lapse film of bacterial communication occurring (involving two strains of genetically modified (GM) bacteria which will indicate, by changing colour or glowing, the communication taking place) and (generated from those sources) a new Cellular Automata artificial life form.
As a member of the audience approaches the installation a device "sniffs" the ubiquitous computing technology they are carrying, which is continually sending out signals such as the IP addresses of wireless devices, the names of Bluetooth devices and so on. In fact people are usually very shocked when the names of devices (often their own names in the case of mobile phones) are displayed in the installation (projected on to the wall). But the malevolent looking device, with its flashing electroluminescent wires and the hacked and soldered mobile phone which appears to have been assimilated into it, is not revealing anything secret, instead it is making explicit all the data we are (usually) unknowingly broadcasting to the those around us.

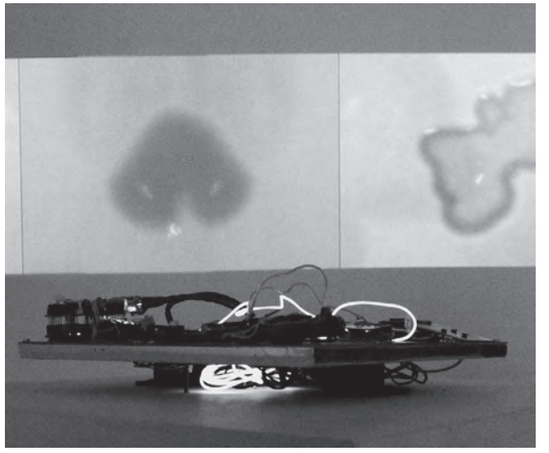

Fig. 1: Cybernetic Bacteria 2.0 installation view Photo: Anna Dumitriu

On a wall a video projection of bacterial communication taking place is displayed. The quorum sensing abilities of bacteria work in a similar way to nodes in the Internet, with a bacterium flagging up a message that says, in effect, "I'm here" to surrounding bacteria, like an organic form of "packet data". Due to regulations surrounding the use of genetically modified organisms it is not possible to easily show the live bacteria communicating in the gallery space as a "Category 2" laboratory would need to be specially built, however this is something that the project group are now looking into, as the experience of watching live bacteria "speaking" is very different to watching a film of it.

For Cybernetic Bacteria 2.0 a purple bacterium called *Chromobacterium violaceum* was used. This bacterium emits and detects a chemical signal. When a population hits a critical density, the concentration of the chemical signal reaches a threshold, which the bacterium is able to detect responding by turning on production of the purple pigment. The white coloured, genetically modified form *Chromobacterium violaceum* CV026 was also used to detect chemical signals and responded by producing a purple pigment also but it cannot produce the chemical signal itself. The other bacterium used was *Serratia marcescens*; it is also able to send out signals but cannot com-

Fig. 2+3: Cybernetic Bacteria 2.0 installation view Photo: Anna Dumitriu

municate to the CV026. Colonies of this bacterium are a striking red colour due to the production of the pigment prodigiosin.

The data from the process of bacterial communication was modelled and combined with the "airborne" digital data being "sniffed" by the hacked device. Both elements were used to generate new rules for creating cellular automata. The presence of new pixels affects the global behaviour of the game: as in the original Game Of Life, and echoes the behaviour of the bacteria: each pixel stays on or is turned on if and only if two or three neighbouring pixels are also on. Furthermore, white pixels become, purple if they have a purple neighbour. Red pixels do not affect other pixels colour, but only their on/off state (Dumitriu and Whitby, 2009).

Conclusion and Future Developments

As the biological and the digital are becoming merged and new approaches in synthetic biology are blurring the boundaries between artificial and organic life this work seems timely. New advances in bacterial communication research offer infection control solutions that could replace current antibiotics as we become able to chemically strike bacteria "deaf" by blocking their communication receptors (Bassler, 2010). The artistic investigations will continue and it is hoped that ways to display live bacterial communication in gallery spaces will be found.

References

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