London - Amsterdam - Dublin

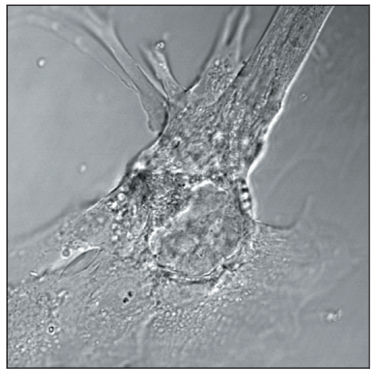
THE CONCEPT

Integral to life and to love, the heart is both a vital bodily organ and the seat of human emotion. Beating more than two and a half billion times in an average lifetime, this quadripartite muscle maintains a physical and metaphorical circulation necessary to the individual and to society. 'He has a heart of gold', 'my heart was in my mouth', 'I'm heartbroken': the way we speak about the heart tells a lot about how we feel about each other. The heart's importance as a physical organ is reflected in the way we use it as a metaphor for human emotion and interaction. The heart's health as a physical organ is also indicative of human development: cardio-vascular disease is most prevalent in wealthy societies. Throughout the history of art, the heart has been represented and evoked to express key human concerns. From William Hogarth's Sigismunda Mourning over the Heart of Guiscardo (1759), John Millais' Hearts are Trumps (1872), through to Sean Scully's Heart of Darkness (1992) and Tracey Moffatt's Heart Attack (1994), the heart has occupied a central place in the history of art.

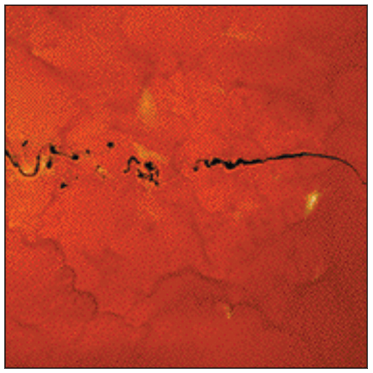
CARDIAC is a groundbreaking collaboration between molecular biology, painting and computer technology, exploring the physiological, aesthetic and social significance of the heart. It focuses initially on the individual cardiac muscle cell, the cardiomyocyte. This cell contracts spontaneously and individually. However, when grouped together under the control of the heart's pacemaker, each cardiomyocyte beats in tandem with its neighbour making circulation, and life, possible. Through the image, and the presence, of cardiomyocytes the exhibition investigates the aesthetic importance of these cells at a molecular level, then draws back to ask questions about how these cells operate at a social level, engendering social interaction and negotiating relationships between each person and the community in which they live. Our examination of the cardiomyocyte through the exhibition is an opportunity to explore the aesthetic implications of molecular science, and to question the ways in which biology underpins key areas of social interaction. CARDIAC explores the singular elements (cardiomyocytes) that keep each one of us alive, while examining how those elements have come to represent a complex web of cultural interaction that sustains community and communication.

CARDIAC is divided into

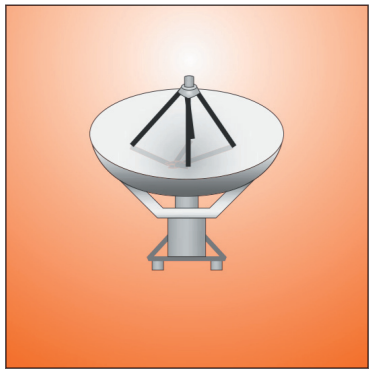
three elements



The projection of images of living cardiomyocytes (maintained in vitro) onto the gallery space. These atrial cardiac cells contract spontaneously in culture.

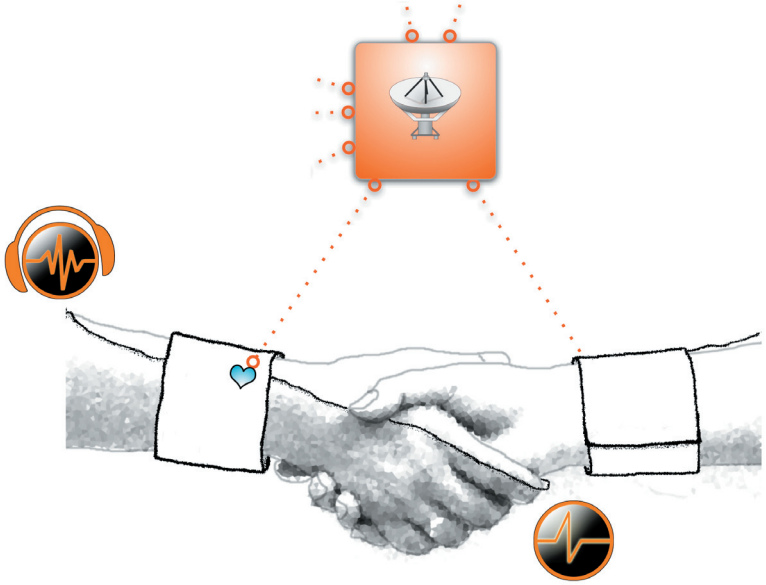


A series of large-scale paintings inspired by images of cardiomyocytes. These paintings will be complemented by small-scale drawings of cardiac cells. Certain paintings will be almost imperceptibly overlain by pulsating images of the cardiomyocytes, engendering a physical response from the viewer.



An interactive component that enables each visitor to the exhibition to experience the heartbeat of another visitor. Experiencing both one's own heartbeat and that of another questions our ideas of community: to what extent do we recognise the other next to us? How do we respond to the other? What is our responsibility for another?

In addition, Cardiac investigates the possibility that all of the audience's heartbeats may be synchronized.



Each of the three elements of the exhibition are interdependent on the others, enabling the viewer to experience a heartbeat on an aesthetic, biological, emotional, intellectual and political level. The exhibition will be supported by a series of workshops that explore the scientific, social and aesthetic implications of the work; and by a catalogue of essays and images.

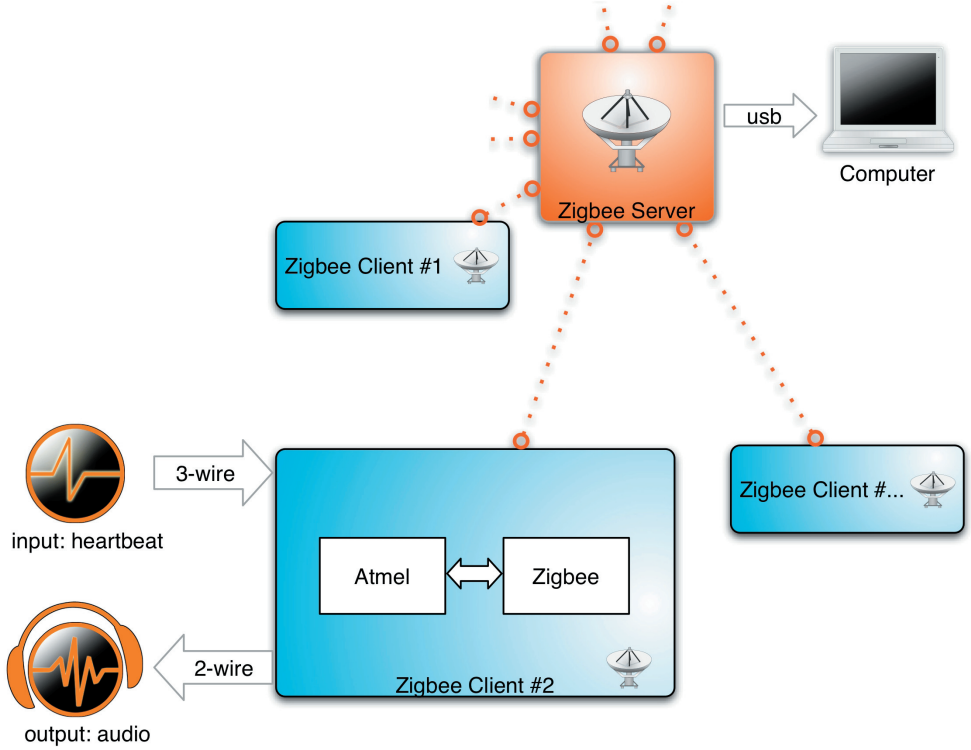
TECHNOLOGY

Multiple clients

and one server enable the project's interactivity. All clients (the wristbands) continuously communicate with the server. Wristbands receive analogue heartbeat signals, convert these to digital and report a person's heartbeat in BPM (beats per minute) to the server. The server calculates the average BPM and returns this value to all clients. Accordingly, each client calculates a 'personal average' BPM, ranging between the global average and a client's actual BPM. The 'personal average' heartbeat is relayed as audio output to the headset. Over time, the 'personal average' will converge towards the global average.

The biofeedback idea: each person is unaware that the heartbeat they are listening to is not their own, but an average. As a result, we may see a gradual shift of the individual heartbeat towards the average value, thus the heartbeats of each group of observers may become synchronous (unconsciously). All heartbeats are equal when all clients have equal BPMs. All heartbeats are synchronized when all clients have reached a 'collective equilibrium' in BPM phase dynamics.

Using biofeedback, project CARDIAC investigates the potential to synchronize heartbeats



Input: heartbeat
Infrared (IR) sensors measure blood flow (changes during a heartbeat). These measurements are enhanced to a usable analogue signal.

Heartbeats ▸ Zigbee Client
Analogue heartbeats are converted to digital using the Analogue Digital Converter (ADC) on the Atmel (Microcontroller). The result is a heartbeat rate in BPM. The client receives this BPM from the Atmel.

Zigbee Client ▸ Zigbee Server
All wireless communication uses the Zigbee protocol (2.4 GHz). A client passes BPMs to the server.

Zigbee Server/Computer
The server calculates the average BPM over all clients. The connected computer displays BPMs: the global average and actual BPMs from a (random) selection of clients.

Zigbee Server ▸ Zigbee Client
The server returns the average BPM to all clients. Each client then calculates a 'personal average' BPM.

Zigbee Client ▸ audio output
8-bit connection for soundoutput

Output: audio
A Digital Analogue Converter (DAC) with an external audio enhancer enables the resulting audio of a heartbeat at a given BPM.

CREDITS

Concept

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Derval Tubridy, BA MPhil PhD (IRE) (right) was born in Ireland and studied in Dublin, Paris and Atlanta before moving to London in 1998. She lectures at Goldsmiths College and keeps a studio in southeast London. Primarily an abstract painter, Tubridy works with resin and alkyd gloss paints, establishing her own vocabulary of texture and interruption through colour and form. By a process of addition and manipulation Tubridy explores the relationship between surface and depth, creating a dynamic interplay between elements.

Sandra Austin, BA PhD (IRE) (middle) is a cardiovascular research scientist at the Conway Institute, UCD, Dublin. Her current interests include the regulation of gene expression in the heart, and the protection of cardiac function during chemotherapy. She is also Artistic Director of ComedySportz Ireland, artistic co-ordinator for the Irish Humour Foundation's Clown Doctors programme, and has brought two U.S. theatre productions to Ireland for the Dublin Fringe Festival.

Daan Archer, MSc (NL, UK) was born in Capetown, South-Africa, moved to The Netherlands at an early age and has completed a Master in artificial intelligence/ cognitive psychology/neuroscience with an initial year in philosophy. Currently employed as a proteomics/systems biology scientist at the Conway Institute, UCD, Dublin. Previously employed as an IT-lecturer and international coordinator at the Hogeschool van Amsterdam (=Polytechnic University) and as a researcher at the Perceptual Dynamics Laboratory at the RIKEN Institute of Physical and Chemical Research in Tokyo, Japan. Co-founder of the FreshDeuce Foundation, which applies and integrates innovative technologies, science, art and design.

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