The ART and SCIENCE of Visualisation

by Brigitta Zics

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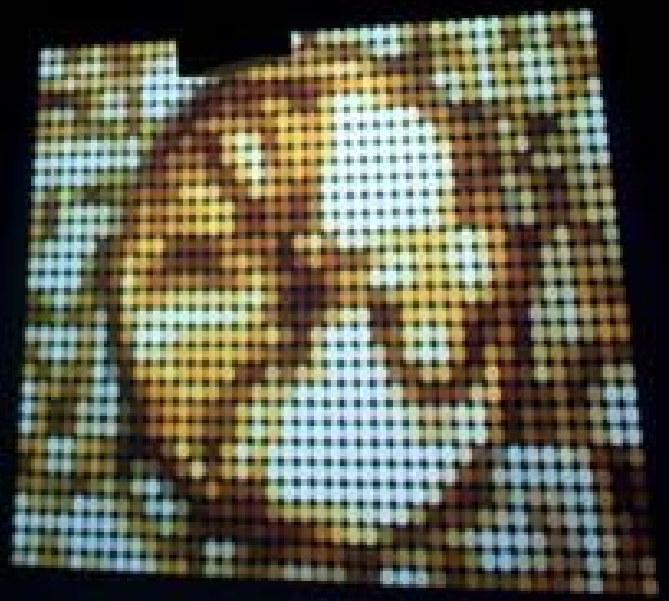
Newcastle University UK



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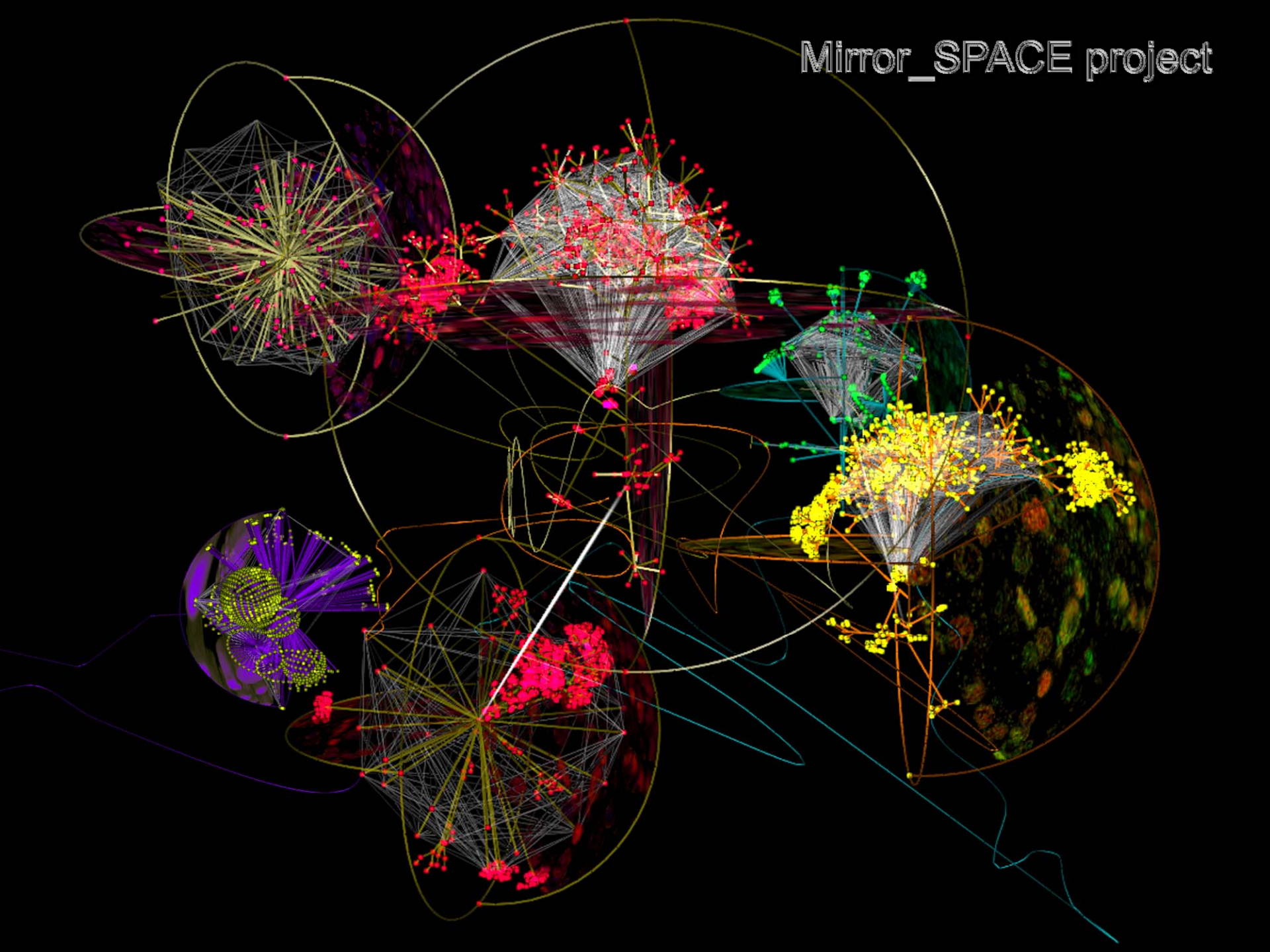
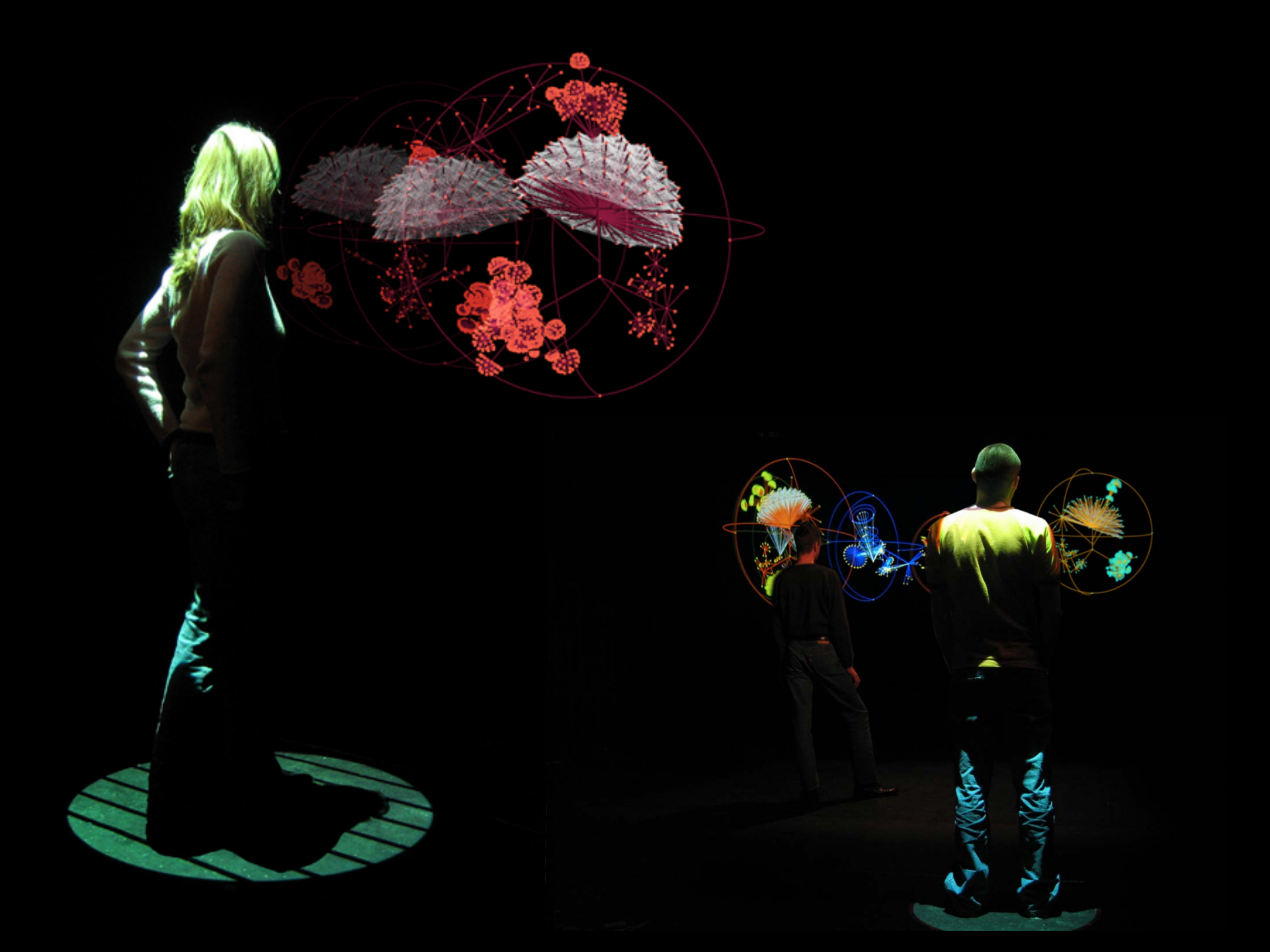
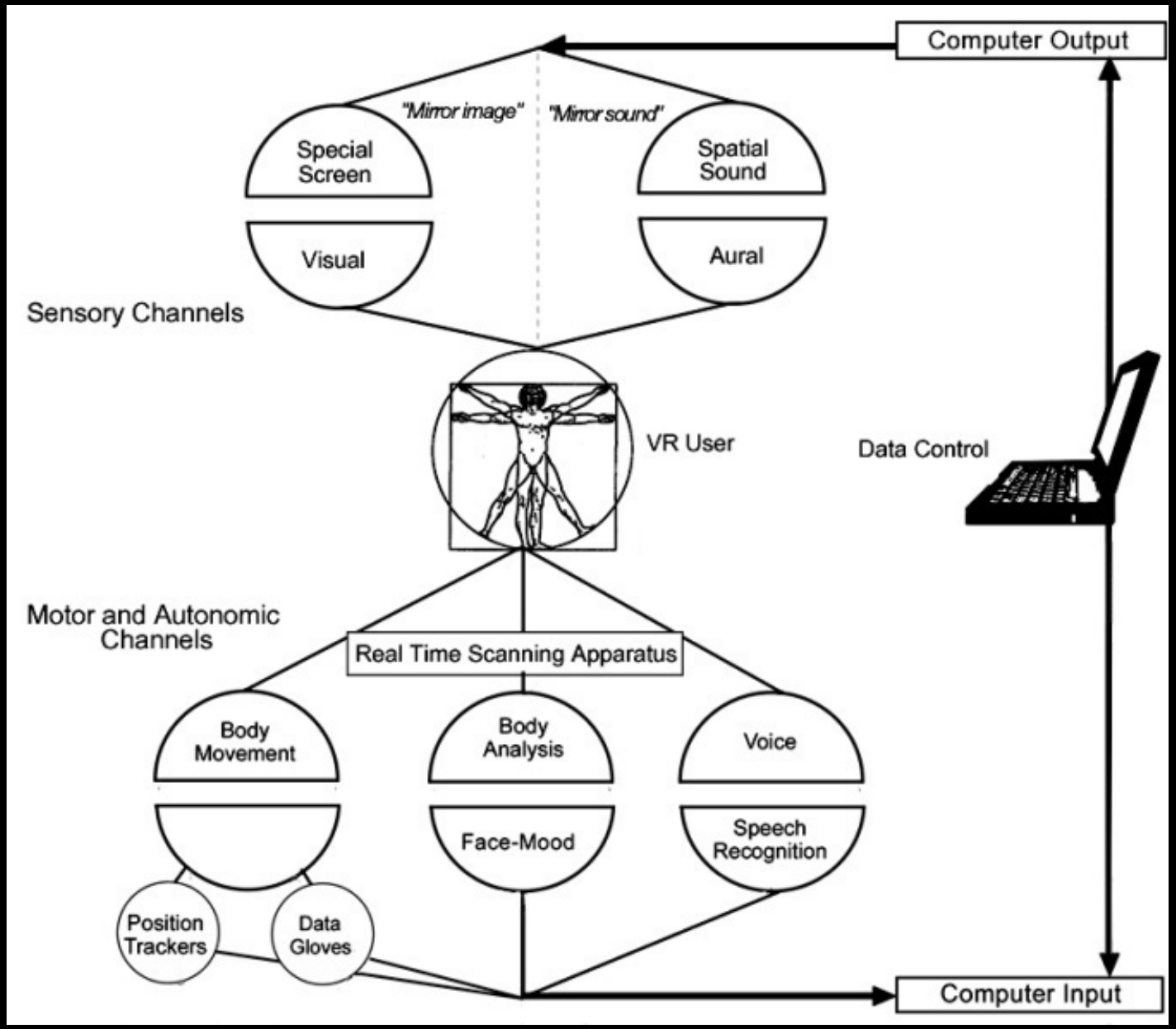
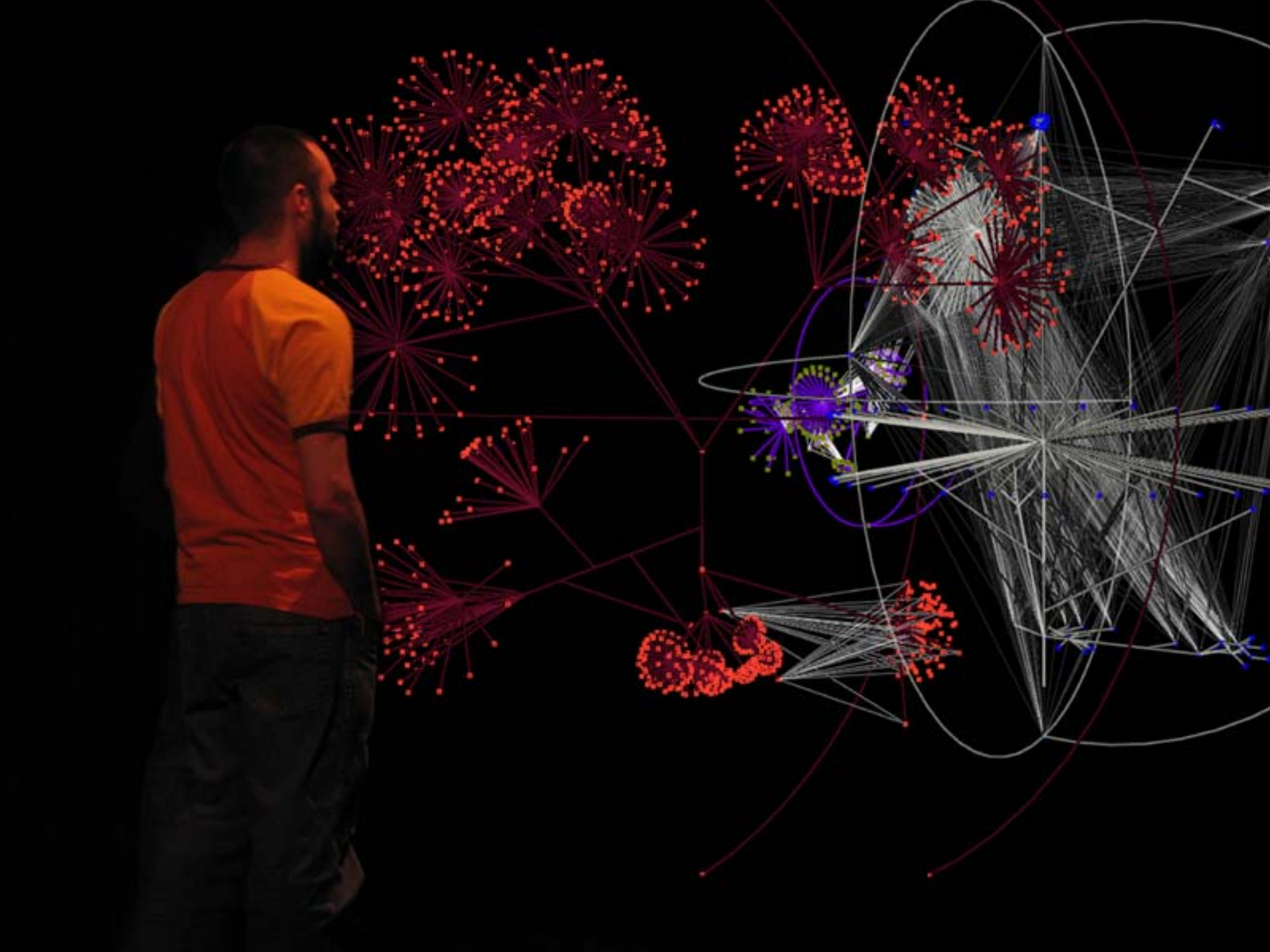
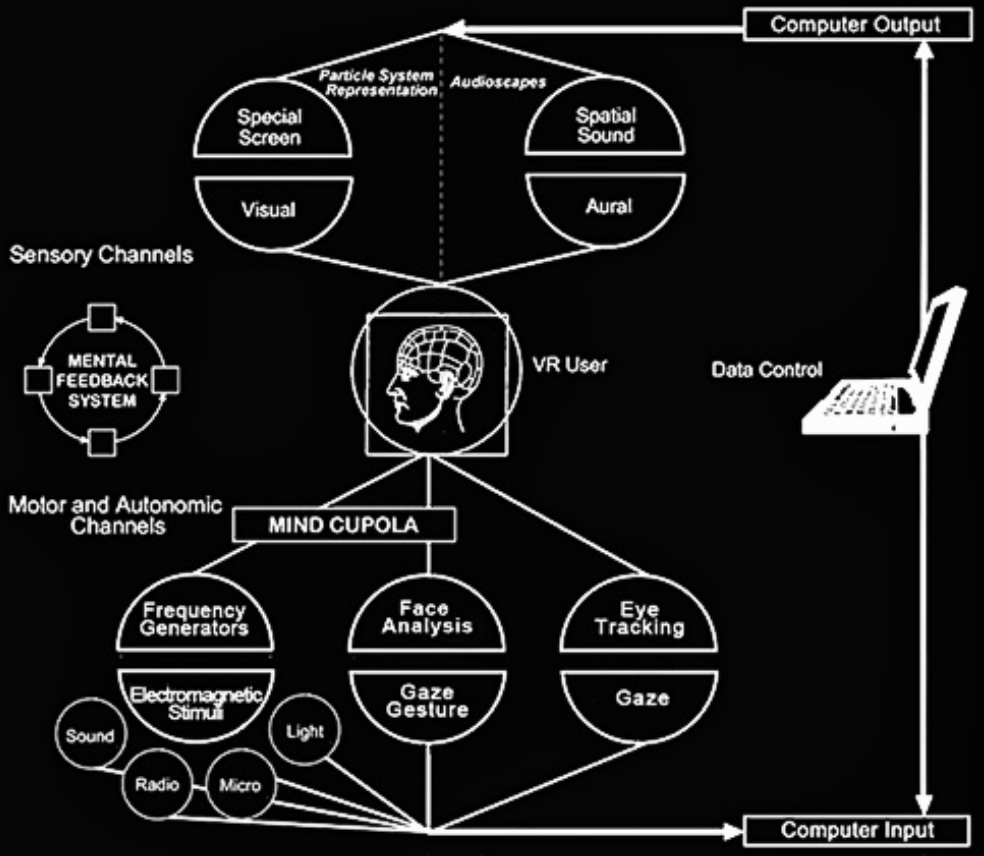

Mirror_SPACE project

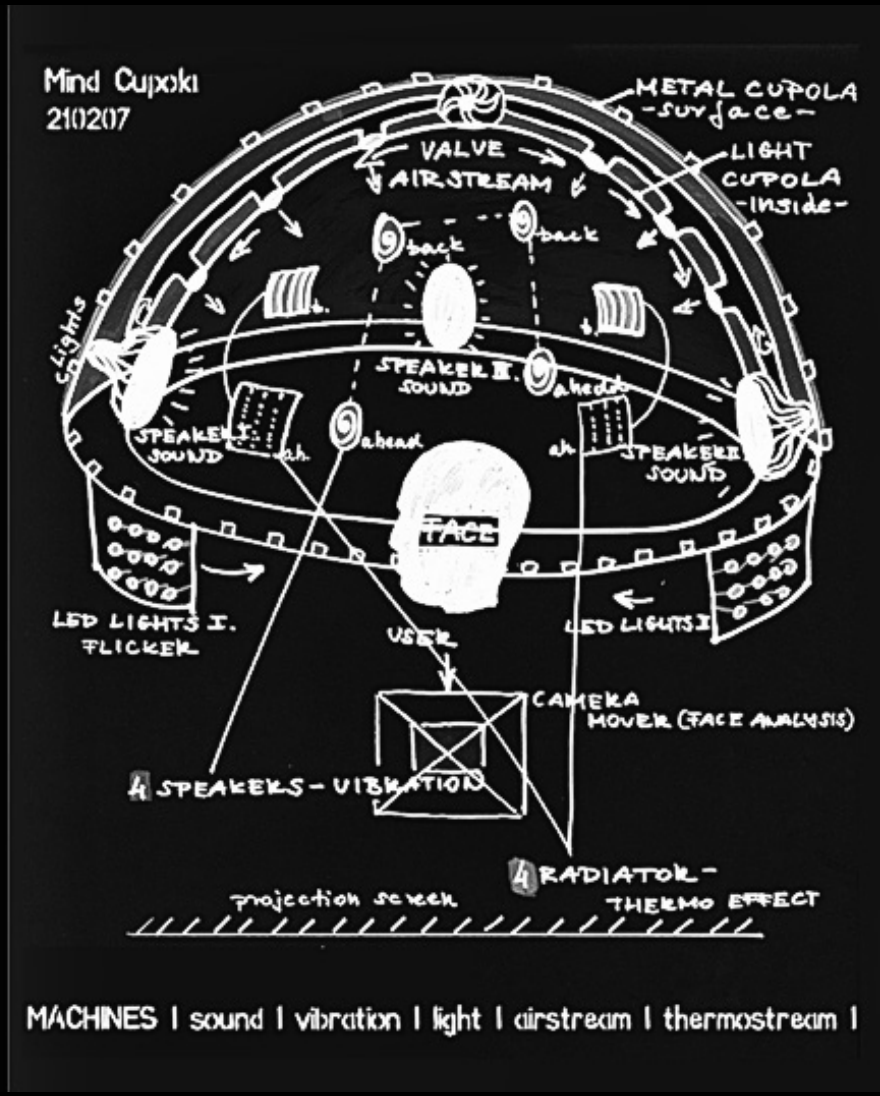



Computer Output
"Mirror image"
"Mirror sound"
Special Screen
Spatial Sound
Visual
Aural
Sensory Channels
VR User
Data Control
Motor and Autonomic Channels
Real Time Scanning Apparatus
Body Movement
Body Analysis
Voice
Face-Mood
Speech Recognition
Position Trackers
Data Gloves
Computer Input

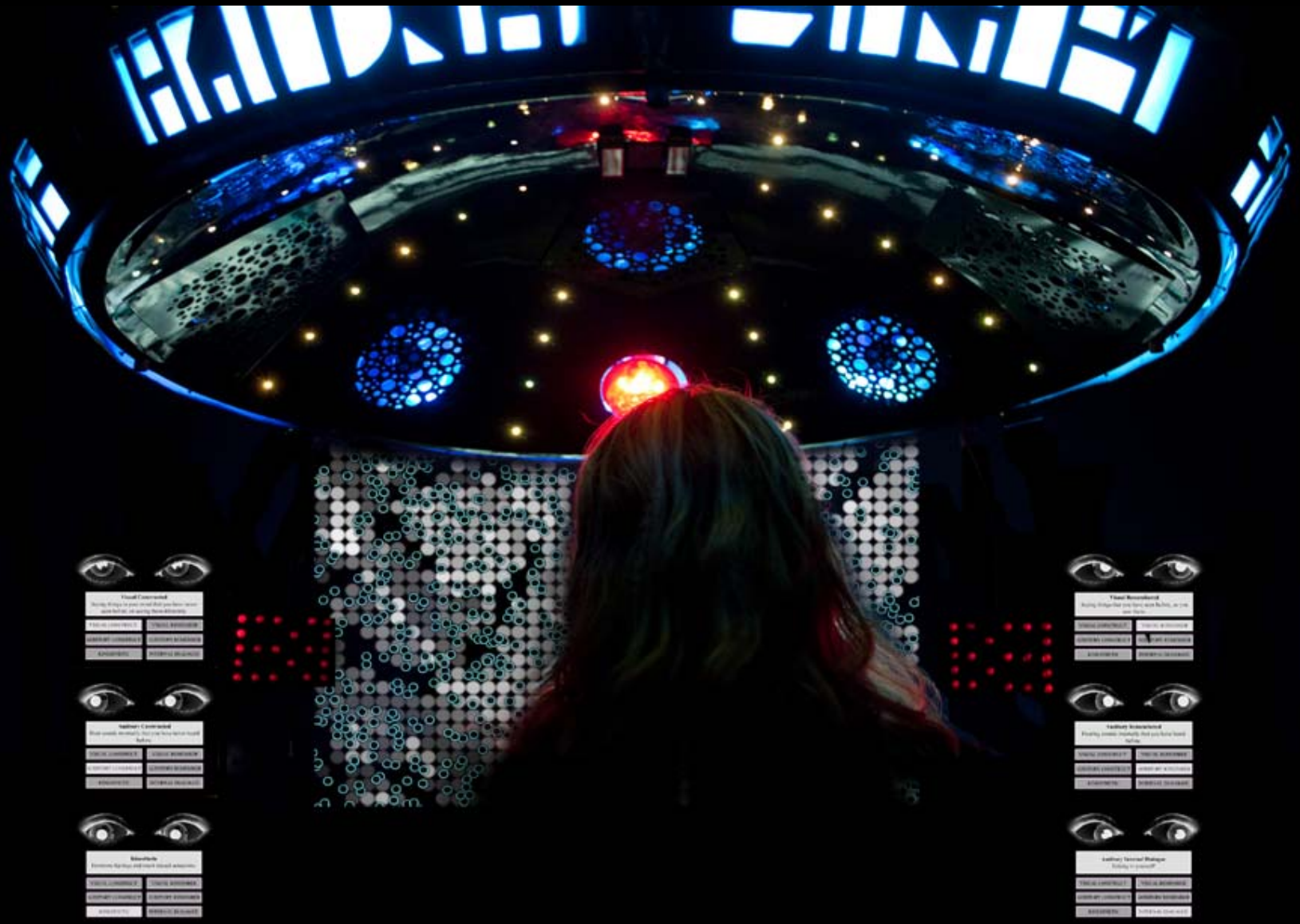


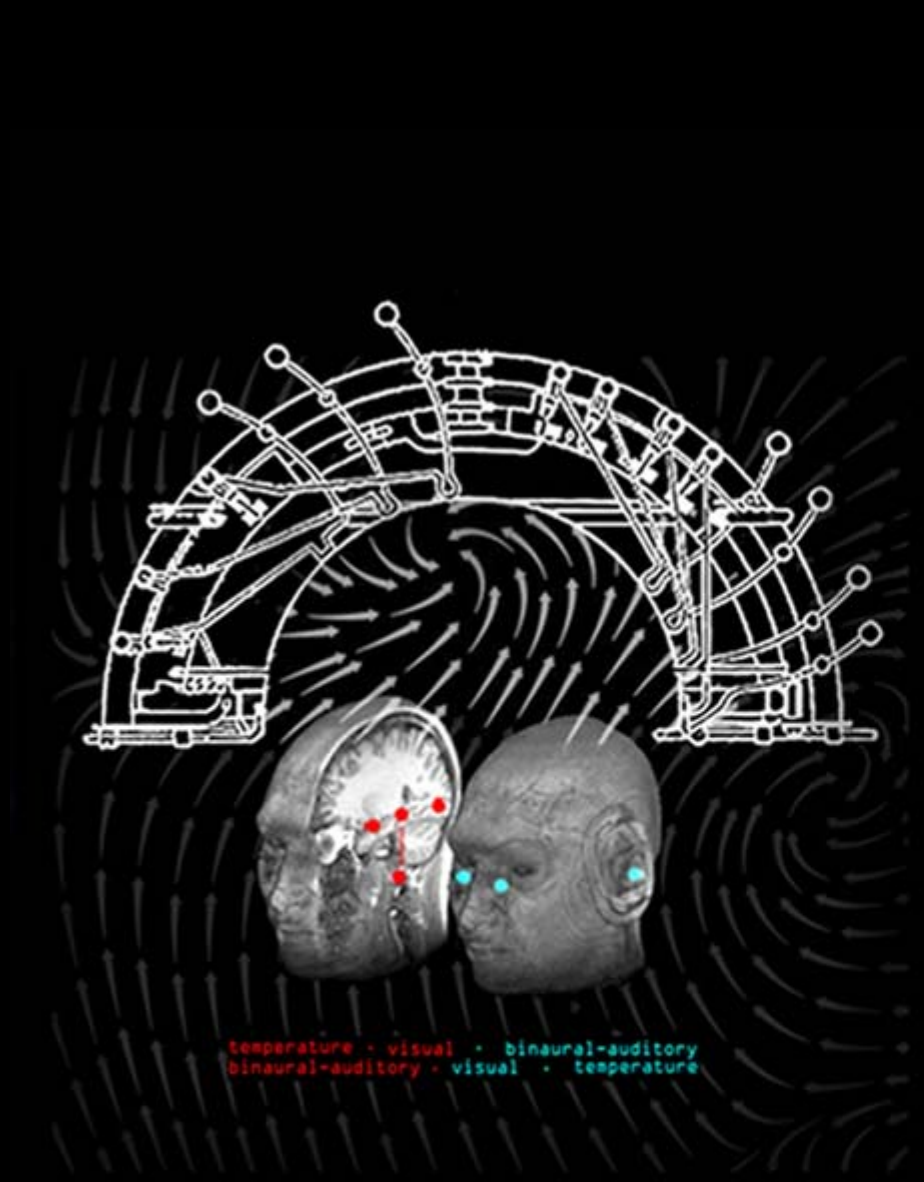
Affective Visualisation In Mind Cupola


Computer Output
Particle System Representation
Audioscapes
Special Screen
Spatial Sound
Visual
Aural
Sensory Channels
MENTAL FEEDBACK SYSTEM
VR User
Data Control
Motor and Autonomic Channels
MIND CUPOLA
Frequency Generators
Face Analysis
Eye Tracking
Electromagnetic Stimuli
Gaze Gesture
Gaze
Sound
Light
Radio
Micro
Computer Input


Mind Cupola
210207
METAL CUPOLA -surface-
VALVE
AIRSTREAM
LIGHT CUPOLA -inside-
back
back
Lights
SPEAKER II. SOUND
SPEAKER I. SOUND
ahead
ah
SPEAKER III. SOUND
FACE
LED LIGHTS I. FLICKER
USER
LED LIGHTS II
CAMERA HOVER (FACE ANALYSIS)
4 SPEAKERS - VIBRATION
4 RADIATOR - THERMO EFFECT
projection screen
MACHINES | sound | vibration | light | airstream | thermostream |

Visual Display Responding to Eye Movements




temperature · visual · binaural-auditory
binaural-auditory · visual · temperature

fovea vision
2 degrees at the centre of the visual field;
responsible for the sharp detailed sight
parafoveal vision
2-10 degrees off centre;
responsible for low resolution compressed information
peripheral field
>10 degrees off centre

The Anatomy of the Eye

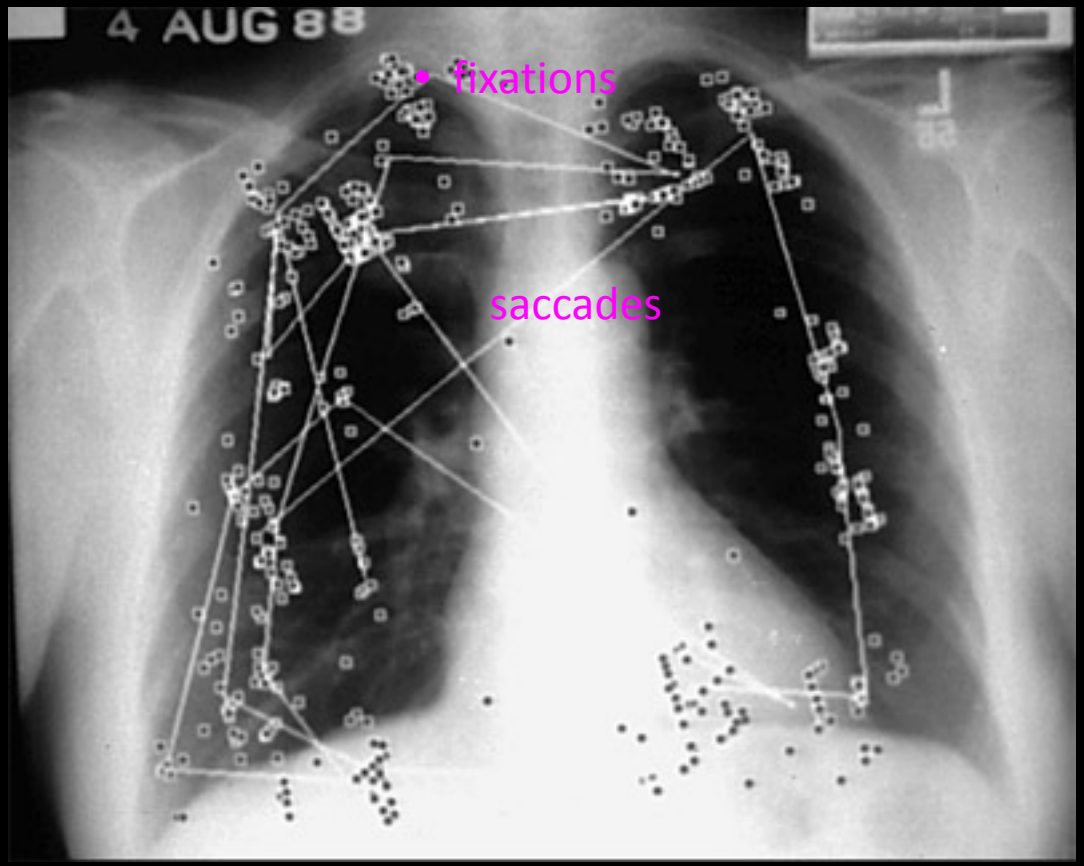
Since the visual field cannot be processed from one single fixation, rapid eye movements are necessary to bring the retinal image of an object of interest to lie on the fovea .

VOLUNTARY

- fixation
- smooth pursuits
- saccades

INVOLUNTARY

- micro-saccades
- blink



Expert judges review scan patterns of an Xray

Eye Movement Research and Aesthetics

Relationship between the viewer's eye movement and viewing act of art

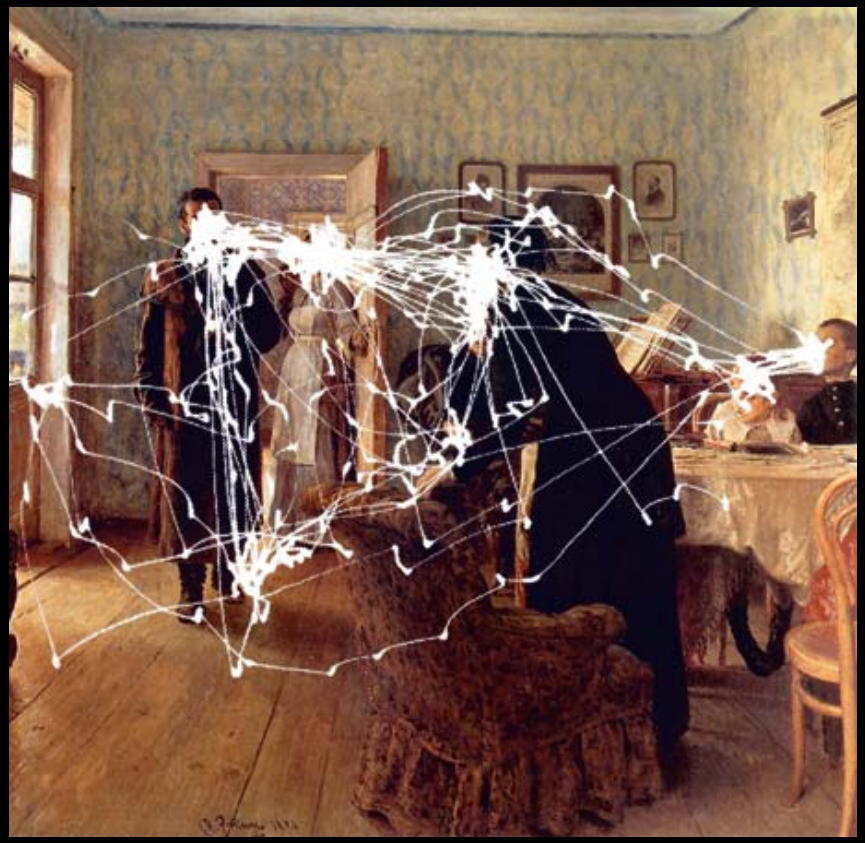
…methods often reduce the viewer's act to a mechanistic agency

ScanPath

static image of the viewer's eye movement which is recorded and visualised as sequence of fixations and saccades

Yarbus' Scanpath Research

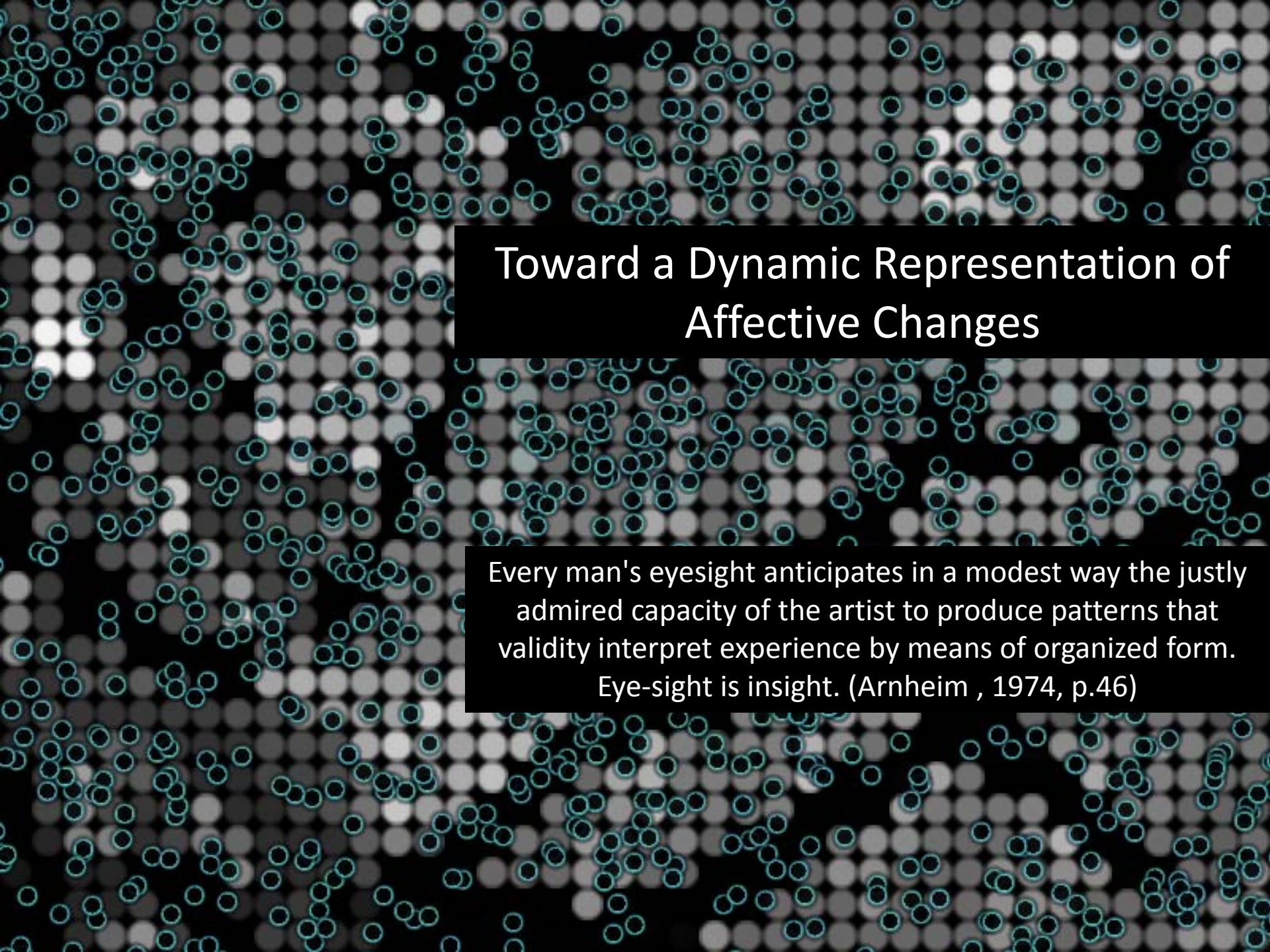
composition that guides the viewer's eye on a pleasing path of visual elements of the scene



When observer asked to 'give the ages of the people' (see on the left) , their gaze where focused only on people whereas if they were asked to simply look at the picture ,many more fixation occurred also in different areas (see on the right). The two images are an updated version of Yarbus' original images (Yarbus 1967, p.174) that now showing the image and scanpath in an overlap (Archibald, 2008)

The Affective Eye

Discrete Emotional States ← → Dynamic Capacity of the Embodied Eye



Toward a Dynamic Representation of Affective Changes

Every man's eyesight anticipates in a modest way the justly admired capacity of the artist to produce patterns that validity interpret experience by means of organized form. Eye-sight is insight. (Arnheim , 1974, p.46)

Affective Interaction – Feedback Mechanism

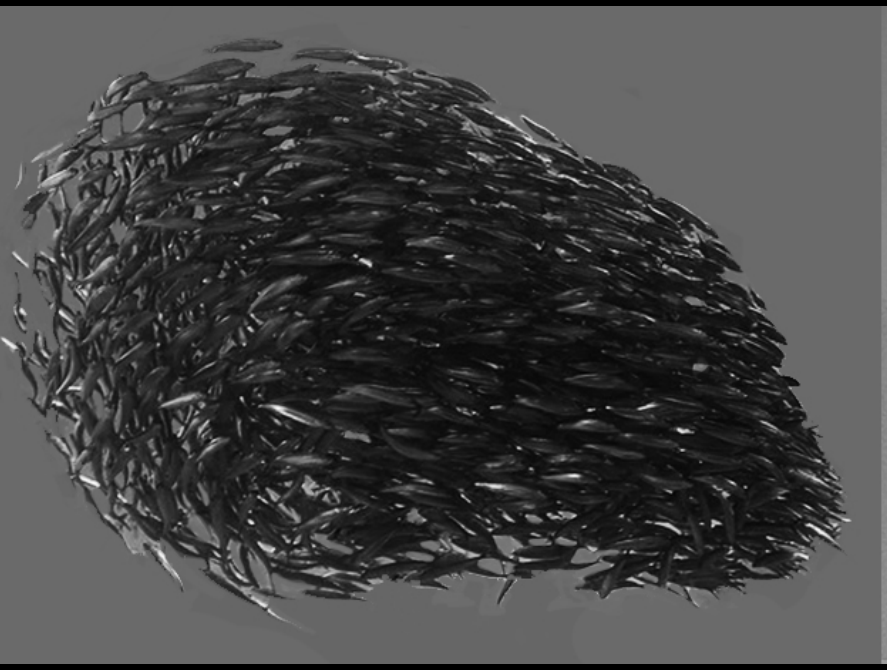
- Dynamic changes in the patter of the swarm reflect affective changes in the user – visual application of collective consciousness

- Swarm might follow or avoid the focus of the eye, which can be described as ‘predator’ or ‘guider’ behaviours.
  →covert attention

- Task-driven interaction are when the user is asked to guide a swarm/ Smooth pursuit eye movements

- The particle system produces messages as affective texts or recognisable shapes with affective meaning

Swarm Intelligence: An Aesthetic Enquiry



This intelligent behaviour can be described as a form of ‘swarm intelligence,’ (Beni and Wang 1989) designed to visualise the natural phenomena of fish shoals, bird flocks and swarms of insects.

Swarm Intelligence: An Aesthetic Enquiry

The particular patterns appointed to the changes in the user's evaluated affective states.

fish shoal patterns is appointed to low engagement level

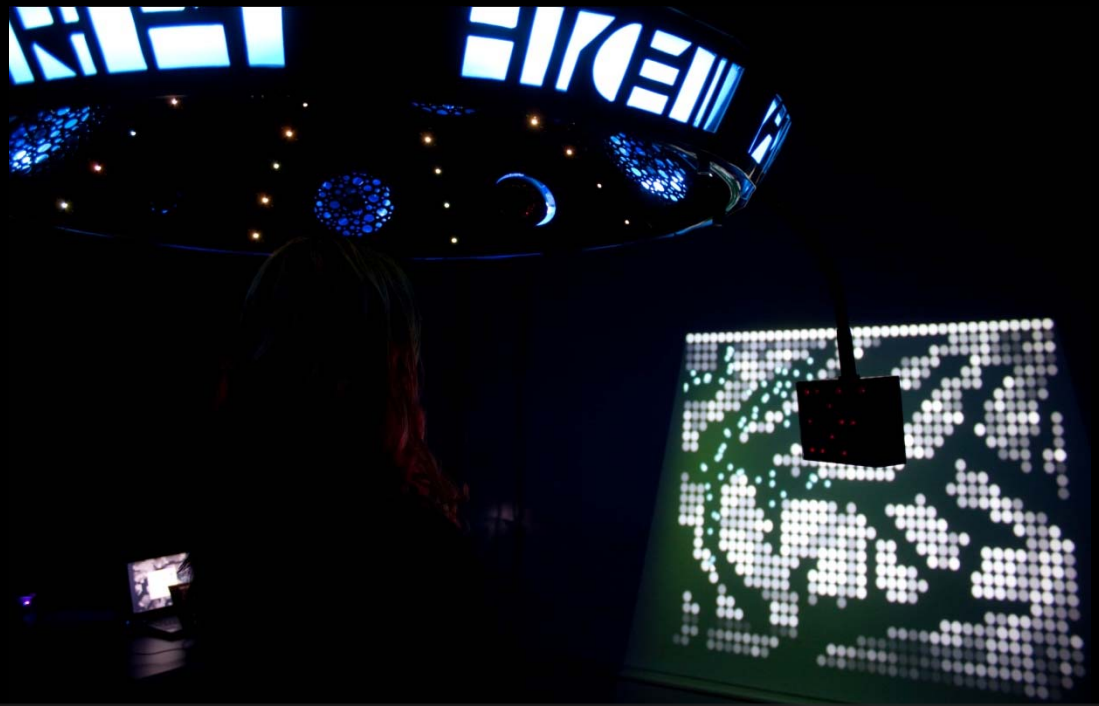
bird flocks to optimal performance and

insect swarm behaviour to erratic engagement level.

Large Display controlled by Eye Tracking

Eye Tracking Adjustment and Calibration

Affective Modeling of the User



aesthetic exploitation of the feedback mechanism between technological effect and affective human responds

The affective modelling of the user is based on three characteristics:

- aesthetic engagement with the screen (level of engagement), task driven interaction
- (as level of attention, engagement, performance) user's affective responses over time
- Involuntary responses as eyelid movements (blink rate, blink closure duration)

TraceNorth