# MASS BODY INDEX: BIO-OS, A BIOLOGICAL OPERATING SYSTEM

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Mass Body Index describes an ongoing project being developed by i-DAT called Bio-OS, a Biological Operating System. Bio-OS builds on the i-DAT's 'Operating Systems' (www.op-sy.com) [1] to develop open tools for gathering data from environments (buildings and landscapes) and organisms (crowds and bodies) to dynamically manifest 'data' as experience in order to enhance perspectives on a complex world.



*Figure 1. Bio-OS Data Lab, 2011, i-DAT. CC BY-SA.*



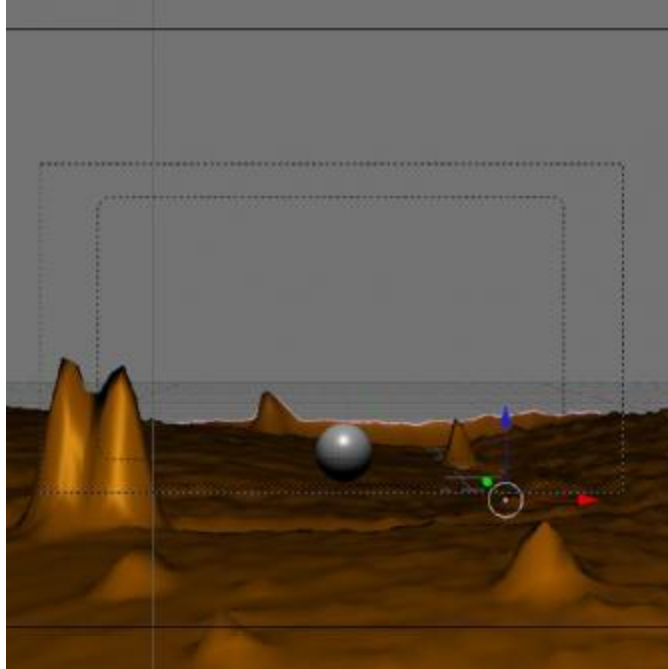*Figure 2. Human Internal Landscape, Ultrasound Pornography, 1988, Phillips, M., CC BY-SA.*

*Figure 3. Human Geography, 2011, i-DAT, Atomic Force Microscopy Data in Blender Game Engine. CC BY-SA.*

## Isotonic Aids Recovery

In many ways, apart from the trauma of general bodily ownership or being owned by a body, 'Bio-OS' [2] was inspired by a longstanding collaboration with the Artist Donald Rodney. As much as it was a continuation of i-DAT's Operating Systems mission, Bio-OS built on the production of collaborative projects such as 'Visceral Canker,' [3] 'Psalms' [4] and 'Autoicon.' [5] Donald's death, in 1998, followed the a long slow degenerative disease of the Darwinian curse Sickle Cell Anaemia which caused his regular incarceration in hospitals and various medical technological apparatus. Donald's work political work was entwined with the attributes of this genetic decease, providing a rich palette of medical paraphernalia that became incorporated into his work, blurring the edges between a personal, racial and political heritage.

'*Visceral Canker*' (1990), now in the Tate collection, was a work that literally incorporated the artist's bloodline. Like many of his works, *Visceral Canker* contained elements of his own body, such as skin and scars. '*Psalms*' (1997), an autonomous wheelchair attempts to articulate the presence or lack of presence of the body. And '*Donald Rodney Autoicon*' (2000), a collaborative project Rodney was working on at the time of his death. The intention was to integrate his 'body' of medical data with an 'expert system' synthesised from interviews, and a rule based montage machine that would allow Autoicon to carry on generating works of art.

From the remnants of Donald's body, whether it was the politics of a bloodline, the space of an empty wheel chair that defined his absence or the attempt of Autoicon to continue the body of creative work, it was clear that the physical body is more than the material of flesh and blood. The body was defined by an absence, an event, a trace, a measurement and it was essentially perfomative and time based. It is this temporal fragmented entity that Bio-OS engages with.

The Mass Body index attempts to define a collaborative body that is neither ill nor super fit, but an aggregation. Whilst Bio-OS positions itself within the field of information visualisation/literacy, the generation and collection of bodily information through the use of instruments overlaps coherently with the history and contemporary fascination of body hacking. However, a preoccupation here is often with the body as object for adornment rather than an engagement with bodily process. Where the body hack converges with the performative it is often in framed within the constraints of choreography. Bio-OS builds on a previous engagement with these frames and constraints.

Previous collaborative projects attempted to capture the body in the form of a Corporeal Archive. The idea of the a corporeal archive emerged as a real time archival process that attempted to capture, articulate and disseminate 'unstable' 'difficult' or 'live' body-based media (particularly forms of dance, theatre, and performance art) through software and conceptual tools. The prototype '*Liquid Reader*' (*Liquid Reader™ v1.1*) [6] explored the reciprocal relationship between 'live' performance and its dissemination through other media, how ephemeral, body-based practices can be captured, analysed, shared and communicated. Here the temporality of the body was the focus of attention. Its spatiality was of importance but its transitions as a flow through time, a trace to be captured and communicated, became the important ingredient in understanding the dynamics, mechanics and physics of the physical body.

A historic fascination with the body, its mutability and its relationship to technology runs deep through the modernist machine aesthetic. The trauma of triage in World War One left more than surgical scars on returning troops. Like perspective and social order the nature of the body had suffered a significant rupture. No longer was the marble edifice of David enough to satisfy, the white exterior had fragmented into a car crash of flesh and bone popped inside out by munitions. The contemporary body freely melts into the technology that surrounds it as distinctions between body and instrument dissolve. The symbiosis evident/required in the cyborg is one of meat and metal, a Léger painting manifest, not one of soul and intelligence or intuition and logic.

As our instruments evolve from an isolated artefact, through physical and social networks into an all-pervading system or process, the nature of our relationship with them will inevitably change. There is now a sophisticated symbiosis between our instruments, and us, what happens to that relationship when the instruments we manufacture become ubiquitous and decentralised from hospitals and medical institutions. Imaging systems and digital instruments have revolutionised our relationship with the inside of our bodies creating a new pornography. This pornography is played out nightly on our TV screens, from House to CSI, or witnessed in the transformative marketing campaigns of soft drink manufactures. What reimagining of the body took place when a drink for sick old people became a drink for the super fit young people?

## The Body - not, and, or, if…then, if and only if - ill/well

i-DAT is developing a range of technologies and software under its core program, 'Operating Systems' (op-sy.com). The current Operating Systems are:

- Arch-OS: [architectural operating system] An 'Operating System' for contemporary architecture (Arch-OS, 'software for buildings').
- S-OS: [social operating system] - The S-OS project strand provides an Operating System for social life.
- Eco-OS: [ecological operating system] - Eco-OS collects data from an environment through a mesh network of environmental sensors called ecoids.

- Dome-OS: Dome-OS is based around i-DAT's immersive vision theatre (Full Dome). A transdisciplinary instrument for scientific and artistic production of immersive environments and the manifestation of material, immaterial and imaginary worlds.

The intention of Bio-OS is to make the data generated by human biology tangible and readily available to the public, artists, engineers and scientists. The Operating Systems project explores data as an abstract and invisible material that generates a dynamic mirror image of our biological, ecological and social activities. The Operating Systems project proposes a range of tools and initiatives that have the potential to enhance our ability to perceive and orchestrate this mirror world.

Bio-OS builds on this open technical framework to offer the opportunity to collect and manifest biological data. Dynamic visual and sonic experiences derived from human movement are being tailored to enhance public understanding of the collective, mass biology. In this context Bio-OS and its distribution and engagement mechanisms provide an open tool for public engagement with a domain that is primarily owned by medical, scientific fields.

Bio-OS provides accessible tools (through 'hacks', wearable devices, phone Apps and domestic and public health technologies and social media tools) that are being deployed in daily life for monitoring health and activity. Data collected from these tools feed dynamic databases that facilitate a shared understanding of the mass body index through visualisations and sonifications – a data body culture of health.

The Bio-OS project is supported by the Arts Council England and was delivered through a series of 'Collaborative Data Lab's,' [7] in order to design and share 'instruments' or 'provocative prototypes' topically described as the 'Internet of Things', in this case the human body becomes a networked and shared 'thing'.

Bio-OS generates a rich mix of quantitative and qualitative data. Collectively these processes establish an open participatory 'techno-ethnography' - mechanisms for evaluating engagement and participation. It is the body as a temporal event and the trigger for a whole series of interactions that underpins Bio-OS as a platform. Here the body is seen within the context of numerous external frameworks and social cultural and economic systems. For instance, embracing the preoccupation of the Banking system where processes are based around key stages in the life of a body, birth, marriage, divorce and death (not necessarily in that order). Or the body on a more short-term basis, as the source of sewerage or food consumption around which provoke massive engineering, financial and ecological problems. As such, the body acts as an active node in a dynamic network, linking resources, technologies and social processes.

## Human Geography

As a Mass Body Index Bio-OS intends to pervade these human manufactured structures by being part of the material of our shared understanding of our bodies and the collective body. Bernard Stiegler articulates the emergence of this new embedded technological landscape as a "global mnemotechnical system." [8] With such mnemotechnical system in place, information never leaves the world. It just keeps accumulating, simultaneously more explicit, more available, and more persistent than anything we have experienced. In this context Bio-OS strives to contribute to an emergent definition of interaction design strategies for spimes, sentient objects, blogjects or whatever they are going to be called. Bio-OS instruments become more then just biological probes, they emerge as cultural probes, permanently embedded in the body as part of the physical nature of the 'thing' and part of the physical digital ecosystem.

Figure 3. *Human Geography*, 2011, i-DAT, Atomic Force Microscopy Data in Blender Game Engine. CC BY-SA.

The body operates as conduits for exchange for ideas, knowledge and the passing of physical objects. The body is also a node on more problematic network, such as supply chains for food, traffic and amenities. Bio-OS explores the temporality of the body and the latency of the network of bodies and the impact on the environment. Bio-OS engages with the body and the 'things' that cluster around it through a process of participatory design of 'provocative prototypes' that will elicit real time data.

As such it is easy to see how the body becomes institutionalised. How the needs of servicing the organism, feeding, relieving and fixing it become instrumentalised and systematised. A de-humanisation or a re-humanisation? The shift from the body as the focus to the institution that builds up around it is a process of bureaucratic aggregation. Measuring and instrumenting a single body is intimate, a whole hospital of bodies is institutional. Bio-OS is pragmatically engaging with the implantation of instruments into these institutions in order to recover the 'lost' or aggregated body. Most notably through the inclusion in the development team of the E-Health and Health Informatics research group and the deployment of Bio-OS prototypes within the National Health Service Derriford Hospital (Plymouth, UK). For instance, the application of sensors to beds not only provides location (the number of misplaced beds is quite shocking) but also context (urine and temperature sensors can inform on bodily activities and occupation – the number of misplaced patience is even more so).

Without an appreciation of context, interpreting streams of bio signal data is fraught with difficulty. Consider for example attempting to interpret the pulse rate of an individual who is running to catch a bus, without knowledge of what they are doing or why. Human behaviours and external influences interfere with biological signals and can result in misleading data and lead to erroneous inferences. Instrumentation and recognition technologies are not yet sophisticated enough to allow us to accurately distinguishing between different contexts. In order to reliably interpret bio signal data, our focus must shift from considering absolute values to the analysis of relative and somehow correlated values.

## Data Body

One such approach to relative values is the use of signal coherence. This concept is easily illustrated with the use of a simple example. During physical exertion, both heart rate (pulse) and breathing rate (respiration) increases. Conversely, during periods of rest both readings will fall. The rates will depend on numerous factors, some of which are accurately measurable, others somewhat less so. As such, these absolute bio signal values tell us little about the health, fitness and general well being of an individual. What is insightful however is the relationship, interdependence and importantly the divergence between these values. This 'coherence' provides a much more sophisticated mechanism for interpretation, inference and understanding. Differences in the rate of change (during both increasing and decreasing phases) provide us with an accurate and reliable appreciation of human physical condition. By considering these relative values we can cancel out and remove much of the noise and interference caused by factors such as external stimulus, exertion and conscious control.

Baselines are another value tool in the interpretation of bio data. We can compare an individual's bio signal patterns with a previously recorded baseline set in order to determine variation and deviation. Similarly, we can perform comparisons of collective community patterns with that of community baselines. By comparing like with like (i.e. a community with itself) we can gain insight into the impact of

short-term events (e.g. illness, bereavement, or other major life events) as well as revealing longer-term trends (caused by aging, diet, environment, exercise regimes etc). More provocatively, we can compare individuals or communities with idealized baselines - allowing comparison and even competition between them and the most fit or healthiest individuals and communities. This provides us with a unique insight into previously unexplored aspects of group and community health.

Bio-OS will engage in the sharing of the Mass Body Index using a similar paradigm to the recent Open Data governmental initiatives (for example in London and Manchester). These attempts by local and regional government to make their activities, achievements and deficiencies open and transparent have had the effect of revealing (anonymised) data regarding the attributes and behaviours of individual citizens and communities. Bio-OS harnesses the technological infrastructure developed for use with Open Data (namely Resource Description Frameworks, Triple Stores, SPARQL etc) yet with a grass roots, "bottom up" and voluntary ethos. Individuals and communities self-exposing there own Bio signal data in this fashion would result in a culture not unlike that which Sousveillance has achieved within the realms of audio visual data - an evolution of body instrumentation and institutions that smother it, and a further exposure of our most intimate parts.

**_References and Notes:_**

1. _Operating Systems' Web Site, http://www.op-sy.com/ (accessed June 6, 2012)._
2. _Bio-OS' Web Site, http://www.bio-os.org/ (accessed June 6, 2012)._
3. _Donald Rodney, "Viscieral Canker," Tate's official Web Site, http://www.tate.org.uk/servlet/ViewWork?cgroupid=999999961&workid=98078 (accessed June 6, 2012)._
4. _Donald Rodney, "AUTOICON," Iniva's official Web Site, http://www.iniva.org/autoicon/ (accessed June 6, 2012)._
5. _Guido Bugmnann, "An Autonomous Wheelchair at an Art Gallery," Plymouth University's Web Site, http://www.tech.plym.ac.uk/soc/staff/guidbugm/wheelchair/wheelc.htm (accessed June 6, 2012)._
6. _Liquid Reader v1.1, DVD Supplement is jointly developed by i-DAT/ Liquid Press, Performance Research e-Publications and DeMo. Liquid Reader v1.1 produced by the Liquid Press, an i-DAT (Institute of Digital Art & Technology) research project: "On the Page," in Performance Research 9, no.2 (2004)._
7. _The Bio-OS collaboration includes: Artshare - http://www.artshare.com.pt/ , Message – http://www.message-research.org/ , E-Health and Health Informatics, and School of Biomedical and Biological Sciences. i-DAT Artists commisions: Katy Connor, Simon Evans, Simon Johnson, Hannah Wood. Supported by Arts Council England._
8. _Adam Greenfield, Everyware: The Dawning Age of Ubiquitous Computing(Berkeley: New Riders Publishing, 2006), 128._