Alex May, Flow State (2018).

From Petri Dish to Big Data

Alex May

As we begin to understand the human condition in terms of a `multi organism', we need to ask more about the interactions that sustain life between the multiple living bodies involved. These are relationships that generate data, sustain information exchange, and build a shared heritage. In this interview, Alex May explores how his work as a creative technologist can open up a very human engagement with the human condition.

Computer interaction techniques can be a powerful way to refract living processes into different informational streams, so bringing them `to life' in a different way. With works such as `Sequence' and `The Human Super Organism', how are these techniques changing the nature of our interactions with bacterial life?

In both 'Sequence' and 'The Human Super Organism', the interactive element encourages visitors to explore, in an engaging and educational way, aspects of the complex relationship we as humans have with our bacterial ecosystem; in this way, they bring new knowledge from cutting edge research and bioinformatic techniques out of the lab and into the gallery.

'Sequence' is a work that offers a VR-based experience to visitors, leading them through the physical processes and healthcare implications of whole genome sequencing. Its starting point was work by the artist Anna Dumitriu on *Staphylococcus aureus* bacteria that she has been culturing from her own body since 2010. From 2014 to 2015, Anna worked in collaboration with the Royal Sussex County Hospital (Brighton, UK) and the 'Modernising

Medical Microbiology' project (led by the University of Oxford, UK) to undertake DNA sample extraction and preparation, load and operate the whole genome sequencing machine, and process the raw data generated using bioinformatics software to arrive at a DNA sequence for the bacterial samples. To create the piece 'Sequence', we took the raw and processed data from the sequencing process and developed a VR environment around it using my bespoke software, Fugio. The VR setting allows the visitor to fly through the extracted and reconstructed data, letting them come face- to-face with the 'big data' of a single ring-shaped bacterial genome (2.4 million DNA base pairs). The project was supported by Arts Council England, the Royal College of Pathologists, and Oxford University's Knowledge Exchange seed fund, and it was premiered at the Victoria & Albert Museum as part of the London Digital Design Weekend in 2015.

The 'Human Super Organism' is an interactive digital installation that reveals the abundance and diversity of our commensal bacterial ecosystem . Similar to 'Sequence', which relied on cultivating bacteria from our own bodies, Anna Dumitriu and I cultured our own skin flora onto homemade agar plates and filmed them in a custom camera enclosure. The method we developed to do this involved making high-resolution time-lapse videos, which were then cut up to capture individual bacterial cultures growing within sections of the agar plate; these were then used as the source imagery of the work. To interact with the work, visitors place their hands on a large projection screen – acting as a virtual petri dish – for a few seconds . On the screen, the silhouette of the visitors' hands appear filled with bacteria, these made from the cut-up video sections described, composited in real-time using Fugio, and then projection mapped onto the screen; once activated, the bacteria then go through a life cycle of growing and dying off. Commissioned by Eden Project with support from the Wellcome Trust, this work was based on previous projects commissioned by CineKid Festival (NL) and the Wellcome Collection.

Big data offers us the promise of previously unattainable levels of detail relating to life processes. Yet, in its abstraction and sheer quantity, it lacks the very *singular coherence* we attribute to life. Are you using arts practices around data visualisation to bring a sense of unity back into big data?

The scientific process of visualisation consists of preparing an optimised selection of information that is reliably reproducible across a particular type of source data sets. This is done in order to prepare the checked data for further study and classification by the human observer . Conversely, to work with even a single set of big data in its complete, raw form is an experiential proposition. One is faced with a scale of information that has no meaningful start or end point. The ring-shaped genome of the bacteria in 'Sequence' is a good example of this; the experience of approaching a Big Data set feels like standing under the stars of the Milky Way on a dark night. On a comparative physical scale, and in terms of temporal existence, we can truly sense the magnitude of that information. In looking beyond the organism into the genome, we must engage with abstractions and data that are hard to interpret or make sense of. There are further levels beyond that of chemistry, physics, and quantum mechanics that we cannot feel or smell either ; so the challenge is making some kind of meaningful link to what we understand in the everyday. The visualisations that we present in 'Sequence' and 'The Human Super Organism' were created as much with the intention of bringing the visitor face-to-face with an experience of the magnitude of such data as with confronting them with the meaning that might possibly be derived from that data.

Part of that 'new meaning' is a reappraisal of what it means to see ourselves as individual human beings versus a part of a wider system of organisms and relationships. For example, bacteria, historically speaking, have been understood as separate from us, as something either 'good' or 'bad'. However, through the public dissemination of science, we are all now learning just how deeply integrated our physical and psychological existence is

with these minute life-forms; this is quite a switch from our dominant human-centric world-view. Artworks like 'The Human Super Organism' aim to introduce people to aspects of these discoveries. The work encourages people to learn to accept the fact that we are literally covered, inside and out, with commensal bacteria. In this way, our artworks are more than just an engagement with the products of scientific enquiry and big data; they open up a unique enquiry for each individual that interacts with the works as they explore questions about what it means to be human in a world of 'super organisms' that have shared heritage, engage in symbiotic relationships, and so on.

Artworks based on living materials can engage us directly with life's generative and unpredictable nature. Can digital techniques (such as projection mapping) bring the simulation and re-presentation of living processes into the same kind of close proximity that a `living encounter' can offer?

The line between what is digital and what is not continues to evolve, with advances in the fields of visual and audio technologies (over other senses like touch, smell, and taste) best known and more publicly available. This interests me in relation to the presentation of 'living systems' in that whilst we can present some kind of simulation (such as in 'Super Organism', where visitors press themselves against a projection screen that looks like a giant petri dish, and they see colonies of bacteria grow in the shape of their body), it is the physical interaction and involvement that makes the experience work. There is a visceral and experiential moment where you are forced to be in your body, feeling it pressed against a physical object before you stand back to visually evaluate the results. This extension into just one additional sense (touch) brings an important extra interactive dimension to the experience of the work and the living matter represented in it. It is the innate ability of digital technology to i) respond to such

inputs in a non-trivial way; ii) respond in real-time to the nuance of the physicality of the participants; and iii) present a narrative and guide the participant through it without being didactic that holds the promise of a wholly immersive experience – one that does n ot need to address all senses unless it is enriching to do so.

In my experience of researching artworks based on lab works, there is a rich palette of aromas that vary from room to room based on what processes and life-forms are being worked with. They are not always pleasant, but they are part of living systems and so capture another way for us to understand or interact with them. Scientists are rarely aware of these aromas (having become desensitised to them through repeated exposure over many years), but for a first-time visitor, they can knock you back. While I am not suggesting that artworks that lack an olfactory or somatic component are less able to convey a meaningful experience or message, these other sensory experiences remind me of how living things inhabit a richer spectrum than that generally encountered through interactive artworks dominated by a visual sensory component. To explore this field further, we are currently working on a new interactive robot with a 'nose' – one that can smell specific compounds in the environment and physically react to them.

There seems to be an interesting parallel between the endless, shifting grounds of scientific knowledge and the fleeting nature of digital practices. Is there a need to preserve the digital works and immersive environments of our age if we are to understand in the future how we got there?

It is an exciting time to be working with creative technologies because they give me the tools I need to integrate with a wide range of developments in a countless number of fields. It can also provide a 'common tongue' when talking to scientists and bioinformaticians, where applied knowledge of certain algorithms and techniques is relevant for many areas of scientific

research. (For example, the F ast Fourier transform, or FFT, that translates signals between the time and frequency domains, is something I use a lot for real-time musical analysis, but it is also something commonly used in the sciences). On more than one occasion, I have been able to hold much more in-depth discussions with scientists after telling them about the technologies I use every day as part of my art practice.

There are some interesting differences, perhaps, in how new tools are superseded in different fields. As better tools are developed, and valid information comes to light through their use, we can, generally speaking, safely leave old tools behind. Scientific researchers would hardly ever choose to use antiquated technology, particularly if there was a better solution available to them at that time. There is, however, an experiential quality in the digital realm that has proven itself desirable to preserve. For example, the 'MAME' project has developed a computer program that emulates old arcade machines, making thousands of old arcade games playable once more (many of which are still fun to play and elicit a joyful, deep reminiscence). I am very much of the opinion that those who create digital artworks should pay some thought to the proposition of preservation so that, in the future, people can fully experience an artist's original vision of their work, rather than just reading documentation about it. The preservation of digital artworks is something that I have spent the past fifteen years thinking about and working on. It is a complex area, and, above all, it requires a good grasp on which technologies provide the possibilities for preservation and which do not.

Developing this further, what are some of the key current technological and cultural shifts in the use of digital practices that enable preservation of digital works or introduce difficulties into preservation activities?

We are seeing a shift of technological control back towards centralised servers and services; originally an issue of physical necessity (computers of

any power were large and expensive), this has now become a necessity by dint of how many people use computers daily around the world. Companies like Apple and Microsoft, who spent years offering more desktop features and power, recognise the vast majority of their consumer/office market want to do relatively few things (web browsing, email, photos, etc .) and so do not need powerful computers. By stripping out lesser-used features and shifting others online, these companies have fewer user-support issues or software bugs (potentially) to worry about; and if they break some digital artworks and frustrate a few artists here and there, who cares? While a large number of computer users were once technically savvy enthusiasts and early adopting creatives, they now represent a small part of the market; powerful computing devices have become ubiquitous facilitators in all of our working and social lives. But at the same time, we have seen the growth of platforms such as Arduino and Raspberry Pi. While not entirely open source, these self-contained computers are cheap to make, cheap to replace, and powerful enough to run open-source operating systems. Although they are not always suitable for projects that require vast amounts of raw computing and graphics power (where clustering or other innovative solutions will be needed), these qualities – durability, mass production, and open design – do make them a good choice for developing and preserving works.

Seen from another perspective, however, creating new work on closed platforms affords certain advantages, such as being able to use tools not yet available in open-source form; this may be vital when artistically responding to contemporary developments and conversations around digital concerns (although one must accept that such works are built on shifting ground with no guarantee of longevity or support). Along these lines, I consider emulation (and the ability to be emulated) a key property of technology primed for preservation activities. Operating systems such as Linux (and its many variants) offer the most promise due to their open-source policies. Windows has traditionally been a good next choice as it is relatively simple

to run under VirtualBox, Bootcamp, and other emulation layers, although the direction in which Microsoft is taking Windows (more towards a managed system) may require a re-evaluation of whether it remains fit for this purpose. Apple's macOS (a much loved operating system) is much harder to emulate (although possible using Hackintosh systems) and actively fights any attempt to run it on unsupported hardware (i.e., those not made by Apple). It is telling, and inconvenient, that the most closed system is a product of the first company to be worth over one trillion dollars.

Much of your work is made possible through funding and support from UK university researchers. You are currently working on a commission for the Francis Crick Institute in London. How do these connections reflect the changing landscape of our engagement with scientific knowledge and those who can shape in it?

Working with the Francis Crick Institute has been a fascinating exploration into the boundaries and crossovers between different levels of public/private space. There is a proactive desire to bring the public into the building to meet scientists, learn about the work they do, and find a platform for discussing their concerns with the kinds of issues scientists at the Crick are working on. The scientists I had the pleasure of working with on the project have been very open and relaxed about being involved with the production of an artwork. They recognise that the piece is not an exercise in science education, but rather an opportunity to reveal research processes and visualise information that the public would not normally be able to witness, i.e., creating an aesthetic exploration of scientific work where anyone from the public can ask questions about what they are seeing and why what they are seeing behaves like it does – the kind of questions that are posed by scientists every day.

From my experiences of developing that work for the Crick Institute, I feel that there is a real opportunity to build on the potential for connecting across disciplines and creating new flows of information between fields. Basically, I think that we need to focus more on the commonality of our humanity and our innate shared curiosity . It would not open all doors for new partnerships, but the better able projects are to cross disciplinary boundaries, the more we will benefit from the rich insights and experiences they can offer. This is true both in terms of knowledge created and in how those exposed to (or involved in) such work will think about their practice or methods in the longer term. In this way, we will see a more seamless use of creativity, and a wider range of opportunities for working together, opening up.

There is, as such, a growing recognition that artists can bring unique and unexpected insights into this 'common curiosity' that drives humanity to strive, to explore, and to learn . How these partnerships can be best supported is an evolving question. My personal preference is for artists to work with institutions on long-term art projects, not as part of a scheme that tries to instrumentalise them for the purpose of generating new innovations. Of course, innovation may happen as a by-product of the work the artists are undertaking (or the environment in which he or she is operating), but the principle purpose of such collaborations should be for the artist to create the best possible art. However, for that to happen, all doors must be open for an artist's curiosity, and there must be ample time for new work to be conducted and sufficient support given to them.

Author Biography

Alex May is a British digital artist working with a range of media, including code, video mapping, performance, interactive installations, VR, photogrammetry, algorithmic photography, and robotics. His work concerns the human condition in a hyper-connected, software mediated, politically and environmentally unstable world. Alex has exhibited internationally, including at the Tate Modern and the Wellcome Collection (UK), Ars Electronica (AT), LABoral (ES), the Museum of Contemporary Art in Caracas, the Science Gallery in Dublin, and at university institutes in the US and Canada. He has artwork in the permanent collections of the Francis Crick Institute and Eden Project (UK). Alex is currently a Visiting Research Fellow and Artist-in-Residence with the Computer Science Department of the University of Hertfordshire, UK, and a sessional lecturer on the Digital Media Arts MA at the University of Brighton, UK. More on Alex's work can be found at https://www.alexmayarts.co.uk/