Boredomresearch, *White Cart Loom* (2016).

Imagining New Life Systems: Consistency Touched by Chaos Boredomresearch

To successfully simulate life is thought to hold untold promise for making a better future. A creeping unease, however, emerges that a simulation can only ever be incomplete. In this interview with the artist duo boredomresearch, we explore how our increasing confidence in modelling living systems is only matched by our inability to fully understand the consequences of such actions.

A central, recurring theme in your work is the matter of life's complexity, understood through its astounding diversity and shifting – but ongoing – coherence: life at the transition between predictable order and randomness. What is the appeal of such complexity?

The excitement of 'consistency touched by chaos' can be seen in the coherence which binds diversity. In psychology, the consistency principle describes a strong psychological need to remain consistent with prior acts and statements. This might also describe the point where new ideas create a dynamic tension between a need for familiarity and the possibility of change. In contrast to a myth, propagated by many historical narratives describing revolutions in art and science, the need for familiarity and the possibility of change both appear subject to a principle of consistency. Here, abrupt changes are resisted, even resented. It seems apt then that reward should be found in that which challenges our expectations without destroying them. Such a balance is mirrored in natural diversity with many

small differences providing a wealth of variation. For us, complexity is the pleasurable overlap of these opposing forces, where complicated interconnecting parts provide an intoxicating sensation of the familiar spiked with the extraordinary.

Our artwork 'White Cart Loom' (launched in November 2016) captures this perspective. It takes the form of an early 19th-century weaving loom, drawing inspiration from the Jacquard loom of 1804 (the first programmable machine). A length of fabric, as though in production, provides a surface for animated pearlescent forms to materialise from where a digital shuttle shoots back and forth. These life-like forms are inspired by an ancient teardrop motif of Persian origin, known in many parts of the world as the Paisley pattern after the name of the town in Scotland where textile production took place that incorporated the motif in their designs. The animated forms swimming across the fabric surface are inspired by the freshwater pearl mussel, *Margaritifera margaritifera*, now a critically endangered organism that was once prolific in the White Cart River which winds its way between Paisley's former textile factories. The artwork weaves a narrative combining current scientific and ecological data in a fight to save this rare organism, now locally extinct. To these ends, the 'White Cart Loom' uses computation to enable the creation of 7.3 billion unique life- like forms, one for each human alive on earth at the time of launch. Considering the affordances of contemporary technology, we essentially ask through this project: 'How should we value the unique and last representative of a living species'?

Your approach is not based on making interventions into life *per se* but, rather, to simulate it in a way that brings different forces and pressures to the surface, so opening them up to inquiry. What are some of the experimental and investigative techniques you have come to use?

Research funding ensures the enduring importance of an intervention-based approach to life, and it remains central to the scientific endeavour.

Researchers are expected to deliver world-changing powers for our benefit. All life is subject to this ingenuity. Recently, we were based in an artificial life lab at the Karl Franzens University of Graz, Austria, where we collaborated with scientists aiming to install the world's largest robot swarm in the highly polluted environment of the Venice Lagoon. With an interest in creating bio-inspired control systems for robots, the team consists predominantly of biologists who see swarm intelligence as a robust engineering paradigm. In science, simulation often helps illuminate a specific problem, and in the a-life lab in Graz, the honey bee has provided a good research model for understanding the value of distributed intelligence. We were shown an example of simulated agents equipped with artificial hormones; here, the simulation provided a basis to evaluate the enhanced seek-and-consume abilities of bio-inspired control systems.

Simulation is also significant for creative arts practitioners. For example, in the animation and special effects field, visual qualities like fluids, cloth, or even crowd behaviour are often synthesised in this way. We too use the term, at least casually, in relation to our own creative practice, though we also like to consider simulation as an expressive process. In science, simulation helps test ideas through the careful application of a focus that excludes unnecessary or irrelevant detail. This process of reduction is similar to that exploited by the artist, by which a particular idea or interest becomes central to a study. In contrast to science, however, the models we find interesting have expressive potential. Simulation extends notions of the mechanical to the aesthetic. Here, uniquely afforded creative gestures transcend an inadequate representation of reality to inform our understanding *and* experience of life: Considering the lab's simulation of ravenous, hormonally enabled robots, we are reminded of human patterns of consumption, patterns that are now widely understood as the predominant force shaping life on earth. In this context, our chosen role in the lab – ignoring robust engineering metaphors – was to consider both the fragility of the swarm and the importance of hormonal influence on negative emotions amongst swam members. In our opinion, these negative

forces should not be ignored in an attempt to understand swarm behaviour because they may play a crucial influence in how it copes with future scenarios less favourable than the current. More so, as our ability to intervene in system behaviours increases, our ability to evaluate the consequences of our own actions is exceeded.

A second core theme in your work concerns how the act of simulation – in rendering open to intervention the mechanism and substance of living systems – challenges the boundaries between disciplinary practices. Where has your work begun to open up such disciplinary conversations?

Photography introduced the icy indifference of a camera lens, indexically linking points in physical reality and the imagined universe of the image. Before that, the capture of the elusive essence of life (spiritual, biological, and physical) in visual form was the unique domain of the artist. Despite a highly developed appreciation of the artistic affordances of photography, concerns over the absence of human spirit in contemporary digital arts practice remain a prominent point of discussion. In the domain of computer graphics, a virtual camera captures a virtual world, which is rendered in visual form as the result of a simulation of light particles bouncing from surface to surface. This level of abstraction is more established in scientific fields. Here, models that are based on data collected from the real-world experiments, and subject to a form of disembodiment, furnish society with knowledge concerning the effects of possible, real-world interventions. Therefore, rigour in the scientific process requires that the integrity of a model is constantly challenged in relation to the measurable physical and biological universe it represents – in any case, it should not be influenced by the subjectivity of the author.

In our project titled 'AfterGlow' (2016), we collaborated with a mathematical modeller working in the field of epidemiology to create an artistic expression of an infection transmission scenario. Although the visual expression

that resulted was very different from that used to communicate scientific insight, the underlying model was similar to that which might form the basis of a scientific inquiry. It subsequently became clear to us that there was more in common between artistic and scientific practices than might at first have been apparent. Both artist and scientist employ technology to create powerful abstractions which intensify a particular area of interest. A valuable rendering is then created to share the significance of the underlying process with individuals who bring to bear their own experience and interpretation. In artistic fields, there is a greater acceptance of differences between interpretations, while, in science, a singularity of meaning is enforced by strict protocols which aim to ensure immutable translation. Individuals lacking the necessary key to unlock this value remain outside its field of influence. In our opinion, much science communication fails to recognise the value of art in providing polysemous expressions with which the growing disconnection between expert and lay person can be overcome.

In `White Cart Loom', you explore the variability of shell formation in the freshwater pearl mussel as refracted through different biological, social, cultural, computational, and economic lenses. In what way do you see this project – and others from your work – as reconfiguring the relationships we traditionally see between these different forms of activity?

The value of the freshwater pearl mussel has been recognised for centuries, primarily for the beauty of its unique pearls. Despite the ease by which pearls can be farmed and synthesised artificially, there remains a demand for them, encouraging illegal poaching of this critically endangered species. Filtering around 50 litres of water a day, scientists highlight the importance of mussels for maintaining water quality over their commercial exploitation. The teardrop shaped motif, central to the textile industry in the town of Paisley, gives visual form to a reverence for nature but one lost in translation. Imported from the Middle East, the pattern's exploitation contributed to

the local extinction of the previously abundant freshwater pearl mussel. The riches the design brought to Paisley are expressed in extravagant, now crumbling, architecture – a wealth long-since spent. The loss of natural diversity remains an enduring cost.

In our project 'White Cart Loom', we revisited the concept of the programmable loom (the cutting edge technology of Paisley's industrious past), so celebrating this first recognition of the creative significance of programmable technology. Although the loom's contemporaries favoured its capacity for wealth generation, the programmable loom allowed for the exploration of aesthetic variation through re-running programmed patterns with different colour schemes. It is this less-considered affordance that suggests, to us, a more important focus for human cultural innovation recognising the importance of diversity. Increasingly, computational technologies provide the tools to negotiate the complexity of ecological systems. This means we are now well placed to move beyond a reductive approach to, for example, food production or environmental management that favour standardised units of production and intervention. Where food crop monocultures have been maintained through chemical warfare, these can now be replaced by complex tapestries of interacting parts. Where environmental simplification and reduction has been valued because of its short-term benefits, such value is to be outweighed by the riches of investment in longer-term biological diversity – diversity that is itself reflected in the richness of global cultural diversity.

The way in which your practice folds together and reconfigures different influences in the study of life systems opens up new imagined (but previously inaccessible) possibilities. What are some of the decisions that lie behind this process of reconfiguration, and where have surprising outcomes emerged?

Surprise and process are the primary reason we choose programming as the medium of our work. Many think of computers as machines that follow

instructions, precisely and without error. While true, the nature of those instructions may incorporate complexity in such a way that our expectations are also challenged. Our preference is for something that is evocative of the richness we perceive in life. Vast creative spaces are revealed at reasonably low thresholds of complexity. The overwhelming diversity present in nature represents only a tiny slice from the space of possibilities. What of all the life living but undiscovered, lost but unrecorded, or even that yet to become? Many of the artworks we create share this quality in that most of their content will never actually be seen: Their rules allow for an enormous – often un-witnessed – diversity to be generated. Many creative decisions are made in steering this process through which we aim for maximum freedom in what is created, while maintaining artistic and functional integrity. Our reward is to experience the surprise of unexpected, emergent forms. The most surprising element, however, is how difficult it is to synthesise this freedom without catastrophic collapse. To us, this stands as a blunt reminder of the wider limitations in any attempt to manage the complexity of biological systems.

From one angle, a simulation of life processes is self-contained (indeed algorithmically deterministic) in a way that life fundamentally is not. From another angle, however, your works deeply embed such simulations into contemporary `living' contexts, behaviour, and activities (such as in galleries and museums); is this where life lies in your work?

Ignoring the celestial energy from the sun, life on earth is predominantly self-contained. The sum total of all the earth's constituent ecosystems is immeasurably more complex than any simulation of it. In creating a simulation or model, we may imitate an existing system or mechanic, but we also create something new – a new expression that is subject to its own rules and limitations. In effect, we create a new universe connected

to an outer, sun-like, energy source. Many of the works we create use algorithmic processes that, although deterministic, produce operations that are impossible to fully predict until they are computed. This, in our opinion, breathes life into the work allowing the viewer to enjoy the sensation of surprise as changes occur. Life is also an ongoing process of change to us; computation is the best medium to express this. In a scientific context, an urgent need for results applies a pressure to the modelling of systems, encouraging the use of computation to accelerate simulated time, enabling, for example, future system outcomes to be predicted in advance – often with a view to making a positive intervention. Currently, the use of abstract computational representations of natural systems is more common in science than art. Our concern is that this creates an uncomfortable power relationship, whereby the non-expert citizen has little basis from which to believe the insights of science, other than to accept their own ignorance. We would like to see algorithmic expressions of life become more common in a wider cultural context, such as in galleries and museums, to address this. Through our contribution to this debate (in the form of works such as 'White Cart Loom'), we hope to help form a common aesthetic understanding of these simulative processes, aiding a positive synergism whereby art, science, and society can move beyond a current state of discord in relation to our sustaining environment. Earth is, after all, a self-contained process that can only be run once.

Taking this further, how would you wish audiences to place themselves in relation to your works? Are they to be part of a didactic process, or is there a route by which they can feel themselves into the life of your works, a way of `becoming media'?

Scientific datasets can strike the uninitiated as being destitute of vision. As artists, we seek poignancy, not to overwhelm an audience with facts but to

make visible an undercurrent of essence that has significant societal implications. The vehicle of art can, at least, broaden an audience's reception of such data, formerly numbed by its deliberate, anti-emotive language, so provoking intrigue and emotional connection. For us, the distinct didactics of art present powerful tools to synthesise responses that are different from insights. In addition to a conceptual formation of meaning, favouring an immutable symbolic communication that fails to completely capture the extraordinary nature of life as experienced by the living, an artistic expression provides a missing visceral dimension. Science is currently the predominant paradigm through which technological creation brings into being the mechanical basis of our daily lives. Increasingly, the mechanical basis of life is understood and manipulated with a technological mindset formed in the industrial revolution, favouring standardised units of production like that seen in palm oil plantations. This and similar agricultural innovation continually erodes the habitat of our closest biological cousins (Borneo's Orangutan population, for example, has dropped by 150,000 in just 16 years). As a consequence, we have become a living expression of a disconnection between what we know and what we feel. Experiencing a world increasingly limited by the outdated ideals of mass production, discomfort is felt by many when the benign tasks of buying food forces them to either ignore, deny, or negotiate food chains that reek environmental destruction at a distance. For human culture to regain its integrity, we must both feel and understand the material basis of our world. In effect, how we want to feel about the world should inform the technological basis for our lives, not the other way around. Our artworks are a response to the mechanics of natural systems, their scientific understanding, and the wider concerns we face at the level of the everyday citizen trying to get the best from life.

Imagining new life systems requires an appreciation of different ways of knowing and conceiving; it also requires an understanding of where weaknesses lie in one's own grasp of the models through which we know and conceive reality. How did you get here, to boredomresearch?

A contradiction inherent in 'insight' is that it consumes the necessary ignorance from which we can conceive anew. To understand darkness, we must first turn off the light that obscures it, freeing ourselves from the constraints and limitations of what we feel we know. Although we can only think in the shadow of our mind, the rigour of research practice demands we expose the mechanics of thought through methodologies that bleach the bright colours of playful freedom. But play may be more important than we care to acknowledge. In engineering, there exists a theoretical ideal to remove all wasted motion from moving parts. This 'unnecessary' motion, often referred to as play, is in reality essential for movement. Without the freedom of play, the machine literally seizes. Although the mechanisms of research may be expected to steadily fill gaps in knowledge, replacing doubt with certainty, for us, is to become stuck in an unchanging world – to become bored. Disengaged with one's current environment, while maintaining an uncomfortable fidgety energy keen to act, boredomresearch aims to escape the limiting friction inflicted by the certainty of established academic structures. Boredom is a force providing insights liberated by imaginative freedom where the illusion of rigour gives way to what may, or may not, be possible. As new and imagined life systems become reality, we should remain mindful of the impossible ideals of systems without play and to the impossibility of exactitude. To achieve this, we must temper the actual with the imaginable; only then can we be sure to provide a better situation than the current.

As humanity invests a significant proportion of its creativity in the endeavour of resolving problems arising from rapid population growth, we bring to bear the sum total of our knowledge. This base of understanding has

predominantly been built in the image of deeply ingrained cultural beliefs, limited by unquestioned assumptions – healthy not sick, rich not poor, easy not hard, more not less. In the early 19th century, American philosopher Henry David Thoreau, famous for his reflections on simple living in nature, rejected the predominant cultural wisdom of developed society. Foreseeing that one has established the basis of their life 'When one has reduced a fact of the imagination to be a fact to his understanding ...', he explored the possibilities of life outside the constraints of developing technological innovation; these he perceived as encumbering the freedom of humankind. He pitched himself against nature's adversity to find life's true and essential needs. Unsatisfied with developing market forces and mechanisation, he recognised that 'man's labour would be depreciated ', leaving him 'no time to be anything but a machine '. In response, he sought a visceral experience of both the nourishing and antagonising forces of nature, from which he foresaw the methods and insights of ecology. In the present, as we make use of a recently gained mastery of living media, underpinned by all that we know we know, we should also consider the Confucian 'unknown unknowns' that can only be sensed by a free imagination. Subject to the darkness of our knowledge and the light of our creative freedom we should, at least, observe Thoreau's observation that 'The finest qualities of our nature, like the bloom on fruits, can be preserved only by the most delicate of handling '. In imagining new life systems, we must recognise that life is, and should remain, fragile.

Author Biographies

Boredomresearch is a collaboration between British artists Vicky Isley and Paul Smith. Through computational technologies and real-time animated environments, they ask questions of complex system behaviours, exploring their robustness, sensitivities, and vulnerabilities. Often working in collaboration with scientists, their work has explored the biological signatures of neural activity, the frontiers of disease modelling, and our cultural obsession with speed. Boredomresearch has worked in collections around the world including the British Council Collection and the Borusan Contemporary Art Collection. Recent international exhibitions include Artience, Daejeon (KR); ISEA, Manizales (CO); Data Aesthetics Exhibition, Amsterdam; Bio-Art, Seoul; and TRANSITIO MX_06 Electronic Arts & Video Festival, Mexico City. More information on Boredomresearch can be found at www.boredomresearch.net