



Art-Eco-Science. Field Collaborations

Art-eco-science practitioner Keith Armstrong is committed to a hybrid practice. He collaborates in the field with ecological scientists recording biodiversity, species loss and extinction and creates works that play a role in redesigning social relations to natural systems. Currently working closely with aerial robots (aka drones or UAVs), Armstrong wants to understand how 'we' might better use drones, away from societal preoccupations with surveillance, privacy, AI and remote warfare, and our apparent drive to create bleak 'new natures'. In this conversation, Armstrong and sustainability scholar Tania Leimbach explore the potential of arts-science collaborations to radically transform attitudes, perceptions and modes of participation.

in-conversation: **Keith Armstrong and Tania Leimbach**

Keith Armstrong (with Luke Lickfold and Matt Davis)

Eremocene (Age of Loneliness), Ars Electronica Festival, 2017, Austria, Mixed media, 2017 © Keith Armstrong

Together, Keith Armstrong and Tania Leimbach explore insights generated through a sustained media-based collaborative arts-science practice led by artist Keith Armstrong and scientists working in the field of conservation biology and ecology. In this conversation we pay close attention to ideas and concerns emerging from Armstrong's new body of work that utilises drone technology in order to invert its associations with surveillance and warfare into something much more life-affirming, seeing these aerial robots as tools for transforming our sense of ourselves within interdependent planetary ecologies.

Tania Leimbach: With the realities of climate change, species extinction and environmental decline presenting as complex systemic problems, the capacity of creative artists for critical analysis, deep investigation and nonlinear insight are called into action. Contemporary theorists, such as the late Beatriz da Costa and Kavita Philip, suggest that the political challenges at the intersection of life, science, and art are best addressed through a combination of artistic intervention, critical theorising, and reflective practice.^[1] It seems a kind of fusing of activist practices with an effective and affective poetics is really needed; something that can shine a light on our deep cultural and environmental crisis. In your own practice, you explore tensions between the interests of (certain) humans and the interests of other-than-human life and the broader environment, informed by the philosophical idea 'ecosophy'. How has the notion of ecosophy influenced your critical thinking and creative interventions over the past two decades?

Keith Armstrong: My longstanding project as an experimental media artist has been to frame my work within the realm of political ecology, in the understanding that biological, economic, social and political factors are deeply entangled and co-dependent. I have then sought to understand what capacities my practice might have to affect perceptual and philosophical shifts in the public's imagination, an approach that I understand as necessary in modelling pathways towards sustaining futures. I have pursued this hybrid practice in many guises over the past two decades, with a particular focus on art & ecological science, and art & social science projects.

This began initially with framing the practices of *Ecosophy*, a series of ecologically oriented principles, or a form of personal practice, to which one adheres. I built a case in my doctorate (written 25 years ago), as a means for framing 'embodied media' installations; in essence, interactive spaces that were a big focus at that time in the electronic arts. Ecosophy is a word coined by Norwegian philosopher Arne Naess and subsequently developed by George Sessions in particular. Michael Heim describes how ecosophy is derived from the Greek words *oikos* and *sophia*, meaning 'wisdom of the dwelling'. Founder of 'deep ecology' Arne Naess described his own personal ecosophy, which he called 'Ecosophy-T', as being a form of self-realisation, born both out of his development of, and identification with the philosophical ideals of deep ecology and his evolving engagements with the world.^[2] He laid out a series of characteristics to which an ecosophical practitioner might subscribe while acknowledging that it is contextual, personal and therefore its definitions must always remain open and fluid. These included the respect for intrinsic value, the crucial importance of diversity, the need to decentre ourselves (resonating with the thinking of Timothy Morton and the broader

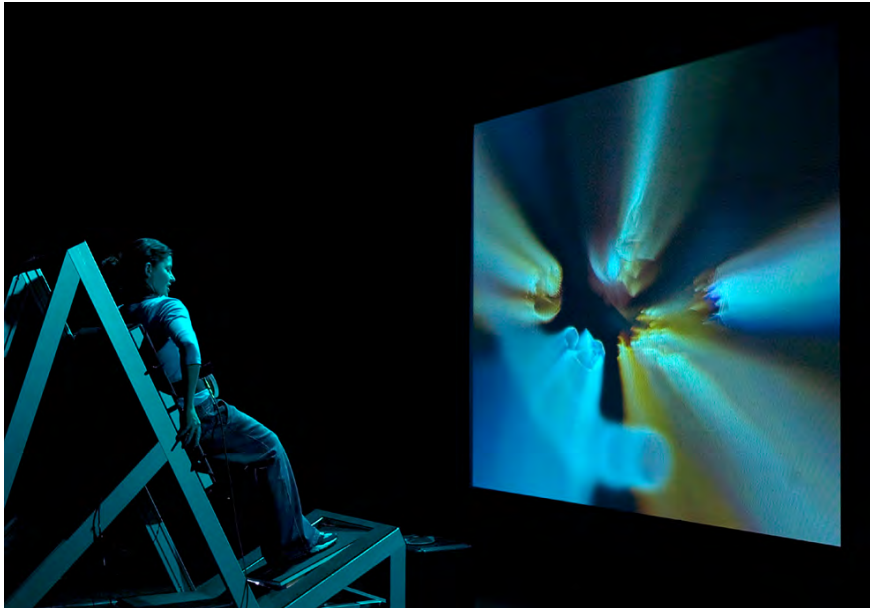
Object Oriented Ontology movement); all of which should be underpinned by radically redefined economic, technological, and ideological structures. Hence ecosophy was a form of political ecology that called upon its supporters to directly or indirectly attempt to implement necessary changes. This was my own call to action in the early 1980s.

Leimbach: Words such as environment, wilderness, wild, natural, organic and place have shifted in meaning over time. The cultural theorist Raymond Williams famously said that 'nature' is "perhaps the most complex word in the English language"; there is an "extraordinary amount of human history" embedded in this term.^[3] Today's artists and theorists typically eschew notions of the environment and nature as something 'out there', separate to the makings of culture in light of contemporary understandings of ecological systems, and the recognition that the environment cannot be disassociated from 'us'. However the art historian T.J. Demos notes that ecology has received relatively little systematic attention within art history; whilst its visibility and significance has grown dramatically in relation to the threats of climate change and environmental destruction. His recent book, *Decolonizing Nature: Contemporary Art and the Politics of Ecology*, explores the intersecting fields of art history, ecology, visual culture, geography, and environmental politics, presenting artists' widespread aesthetic and political engagement with environmental conditions and processes around the globe. Can you talk about the conceptual challenges you have faced in defining the 'environment' and by extension 'environmental art' and describe your efforts over time to develop work at the intersection of art, science, and ecology?

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Armstrong: Can I answer this by first saying that experimental artists have long worked with practices and methods drawn from other disciplines as the imperatives arise. Not unexpectedly the natural sciences have been of particular interest for those seeking to conserve and protect other than human worlds. Based upon the longstanding *ecocidal* nature of our capitalist systems of governance and commerce, our new epoch is now characterised by dangerous climate change as only one of numerous worsening indicators. Faced with such risks and challenges, on scales never before encountered, and with global responses clearly inadequate, many artists like myself have felt the need to transform their practices in ways that render them viable as modes of civic engagement. Choosing to locate my work within political ecologies stresses deep interpenetration of biological, economic, social and political factors, and assists my work to remain speculative and experimental in ways that better assist the public to imagine radical and alternative sustaining futures. I consider such an ecopolitical focus a much more activated space than say 'environmental art', which tends to get caught either exclusively in the biophysical, or within particular places or causes that centre upon perceived human needs. My interest lies in engaging systemic forces and currents, understanding the imperative to acknowledge enmeshing of culture, manufacture and biology. Examples such as *SymbioticA's Tissue Culture Project* come to mind here as something similarly on the front-foot of ecopolitics.

I also understand that the innately relational sensibility of ecology suggests the importance of working with other disciplinary practitioners committed towards similar goals, in ways that draw upon the strengths and differences of each approach. Not unexpect-



Keith Armstrong/ The Transmute Collective

The Body Shelf, 'Intimate Transactions' from the exhibition, *Media Art China*, National Gallery of China, Photo Document, 2008
© Keith Armstrong



Keith Armstrong with Roger Dean, Stuart Lawson and Darren Pack

Finitude, from the exhibition, *Information, Ecology & Wisdom*, 3rd Art and Science International Exhibition and Symposium, National Science Museum, Beijing, China, Mixed media, 2012 © Keith Armstrong

edly the ecological sciences have been of particular interest to me given their work is most often dedicated to conserving and protecting other than human worlds, and I see my practice not as one based upon 'solutions', but rather an interactive modality that encourages reflexive circling around complex questions, hinting at new ways to understand how things could and might be. The goals of this speculative practice can therefore be seen to complement, but not necessarily mimic, the tactics of mainstream environmental campaigners and activists, ensuring differently valuable contributions towards proposing or building radical and alternative models for sustaining futures.

Leimbach: Artists and scientists have historically worked together. Currently, we are in an interesting moment where collaborative activities occur in increasingly diverse contexts, facilitated by high-level funding support in several countries, and broader, more systematic investigations of knowledge structures. This suggests an increasing focus and interest upon the underlying conceptual similarities (as well as the differences) that the arts and sciences share, as well as a greater interest in understanding what emerges in the hybrid space between diverse practitioners. Cultural Geographer, Leah Gibbs suggests that arts-science collaboration have the potential to engage di-

verse publics and for new projects to 'do' a kind of social, cultural and political work. Certainly powerful alliances and allegiances appear possible through this process, when partners wonder together about shared politico-scientific challenges, working — if only briefly — beyond individual areas of specialisation and expertise, maybe not knowing initially what they are doing or where they are going. This is a critical potential for art-science interactions that Bruno Latour speaks to directly. Such dialogic collaborations can open up a rich space for discovery with the potential to render the pairing sensitive and sensible to unexpected kinds of phenomena, undetectable by the conventional instruments of science or art. These fusions, freed temporarily from conventional or habitual approaches seem to promise the possibility of renewed ways of thinking or seeing, about deeply entangled systems of cultures and natures; as Bruno Latour and Peter Weibel in *Making Things Public* suggest, perhaps they even offer the potential to imagine alternative modes of natural-cultural democratic assemblies.^[4] By working and re-working through these findings, it seems that some collaborators are trying to advance the radical creative, perceptual and philosophical shifts necessary for imagining alternative collective futures. What are your views on the strengths and limits of scientific knowledge systems and how does that inform your approach to collaboration as a practicing artist?

Armstrong: In my view, the collaboration can only be successful if creative practitioners develop a tenable position and purpose in propelling arts-science engagements, based upon their understanding of dominant trends in scientific epistemology, in order to take a meaningful and politicised position. The world is full of powerful technological invention, and yet something that so often gets forgotten in that rush for progress is that design goes on designing. The rolling implications of scientific discoveries when released into the world have very often had severe environmental consequences that were both undesirable and unintended. Regardless, many natural scientists and policymakers continue to insist that applying further technological solutions remains the best approach. The sociologists Richard York and Brett Clark note this concurs with the broadly Modernist project of favouring science and rationality, whilst minimising consideration of the powerful political and social drivers that propel environmental demise.^[5]

Collectively these observations have led me to adopt a position that I have come to understand as 'Eco-critical materialism' (or alternatively 'Eco-critical realism'). I see this epistemologically-located position as one that both stresses the crucial nature of the natural sciences in combating environmental decline, and yet remains skeptical of any science that refuses to acknowledge or act with regards to its innate societal embeddedness. Such a position is supportive of fundamental empirical, rational and realist approaches that allow us to comprehend both science and society, whilst refusing reductionisms that fails to understand how profoundly science and technology interact with, and are immersed within specific historical ecological and social relationships. It is within this space that I see the work of creative artists having real agency to affect critical reflection, given how our work has long sought to draw political heat upon the failings of each era.

I sat there with the ecologist in the heat of the afternoon watching her patiently pulling at the pellets, constructing lines of femurs, tibias, pelvis' and parts of skulls, all set in between clumps of fur and other fluid detritus, painstakingly assembling a numerical picture of what those birds of prey had consumed.

Leimbach: As you say, science has traditionally put the idea of objectivity at the heart of its practice, suggesting it can operate free of value judgements and thus can retain a political neutrality and claims of truth. However, scholars such as Haraway, Harding, Latour, and Woolgar have written widely about how social values actually both influence the types of questions being asked and then how that information is interpreted. Your alignment with an eco-critical materialist position also suggests a rejection of reductionism, concurrent with its intensive critique in recent decades. As a mode of scientific thinking, reductionism has long assumed that if complex structures are broken down into their constituent elements, and if the laws governing those elements can be discovered, then by extension the properties of the larger world can be grasped, such that the larger world becomes the sum of its many parts. In recent decades it has been shown how ecosystems are governed by emergent behaviours, ensuring that processes are in reality inseparable and that reductionism cannot provide successful explanations for levels of complexity that arise due to emergence and contingency within complex systems.

While many arts-science collaborations have occurred in laboratories (and there are numerous precedents for this kind of work), the wider located 'field' as a site for collaboration is a distinctly different context. Currently, we are seeing interdisciplinary efforts to engage in the 'field' discursively through new forms of 'worlding' and writing in the environmental humanities, but not so much arts-science collaboration in response to the field as a space for generating



Keith Armstrong

The artist/fieldworker releasing a boodie (burrowing bettong/*Bettongia lesueur*) after check, AWC Scotia Sanctuary, NSW, Australia, *Re-introduction Project*, Photo Document, 2012 © Keith Armstrong

new work. Your collaborative arts-science practice has long involved intensive periods of fieldwork, in collaboration with biological scientists and social scientists, turning these experiences into creative works. How do you engage with the scientific process in the field and in your work as an artist?

Armstrong: Renowned practitioner/arts-science curator Jill Scott speaks about field trips as powerful contexts for creating tacit knowledge and social interaction in a given spatial environment where explicit knowledge is prioritised. I began developing arts-science, creative incubators around ecological fieldwork in 2010 - which have since evolved to include a broad range of projects, that include: landscape-wide conservation (*Re-introduction Project*); flying fox rescue, care and conservation (*The Bat Human Project/Remnant Emergency Art-lab, Black Nectar and Uncanny Intimacy*); anti-uranium mine activism (*Stop Jabiluka!*); marine conservation and climate impacts (*Over Many Horizons*) and (*Eremocene*); and grassroots sustainability projects (*Re-Future/Seven Stage Futures*). Each project has been underpinned by an initial process of discovering what I could practically add to the process within a shared frame of interest. My approaches in the field have ranged from the ethnographic (e.g. joining teams as science assistant), to the more speculative (initiating experiments and modelling futuring processes).

In 2011, I decided to pursue a direct engagement with conservationists. This led to an arts-science residency called the *Re-Introduction Project* with the Australian Wildlife Conservancy (AWC), an important, independent, non-profit organisation dedicated to conserving threatened wildlife, and by extension the habitats in which they live. I was acutely aware that Australian policymakers have been unable to reverse the acceleration of mammal extinction, nor arrest the high proportion of surviving animals and plants (over 1,700 species) listed as threatened with extinction. AWC's progressive model for conservation involves acquiring high ecological value land of all biotypes whilst often entering into land management agreements with Indigenous owners, and then actively managing it based upon sound science; ensuring feral animal control, weed eradication and requisite fire management practices. They pursue these methods over their 4.6 million hectares of land, which represents the largest private conservation estate in Australia, specialising in the erection of fenced-in, feral-free areas where they can safely reintroduce endangered species to areas where they had been historically lost, a practice now also referred to as rewilding.

In 2012, supported by the *Synapse* art-science program of the Australian Network for Art and Technology, I engaged with a year long series of high-intensity field trips, at times when different properties were being annually surveyed for fauna. By volunteering practical services to the scientific teams as a survey assistant I experienced rich collaborations within tightly knit teams working together on intensive, remote survey activities. This accelerated my understanding of their techno-scientific processes and methods, and also the cultural specificities or avoidances of this work. My practical contributions to team activities involved processes of clearing pit and cage traps, measuring animals, re-setting, watching and listening for species, describing sightings, mending equipment, baiting traps, digging scientific installations, assisting designing experiments etc. Almost all of the results from this survey process were ultimately reduced to tables of numbers and graphs, in their effort to statistically determine species health and range.

Leimbach: I'm curious about your observations of these scientists and their lived experience as you understand it from having shared time while working in the field and on the frontline of extinction.

Armstrong: I have a brief anecdote that speaks to that... On a hot afternoon, after a pre-dawn mammal survey, the ecology crew were resting in the common room in the rising heat. Needing some air and a break from number crunching, trap fixing, and bait-ball making, I left to walk back to my tent. In the shade, next to an aging tool shed, I came across one of the field ecologists with a table full of tiny objects set out in neat lines. On closer inspection, I saw that these items, dotted with hair and bits of dry vegetation were miniature mammal bones. The ecologist informed me she was analysing owl pellet contents (regurgitated inedible materials) and entering data into another of the many favoured spreadsheets. Kalamurina Station was replete at that time with long-haired rats (*Rattus Villosissimus*), normally considered an endangered species in that area. The rats had multiplied massively in the boom times after a recent good 'wet' with predators like the owls in question being well fed, as their regurgitations demonstrated. I sat there with the ecologist in the heat of the afternoon

watching her patiently pulling at the pellets, constructing lines of femurs, tibias, pelvis' and parts of skulls, all set in between clumps of fur and other fluid detritus, painstakingly assembling a numerical picture of what those birds of prey had consumed. As she came to the end of her long task, she started to sweep the bones away into a box for disposal, to leave her only with a numerical record of the labour: a classic 'count' process like so many others we had done. As I recall, she didn't even choose to snap a photo since this was such routine.

All that time as she was counting, I couldn't help reflecting that there was something about the strange beauty and intrigue of these microscopic structural elements. Behind them are so many stories of struggles, extinctions, sustenance, structure, endings, and the human, anthropocentric contexts that had propelled much of this in each logically identified and carefully placed item. Could this really be the end of the investigation? Was that all? The only residue some inputs to a graph for future scientific reports? Somehow so many of those other dimensions of the picture had neatly escaped; fugitive narratives erased with the mere sweep of a hand. It struck me, albeit gently, as a powerful metaphor for the place where science chooses to stop, when in reality it was likely these backstories and such experiences that were so compelling to me, and that gave me the fire in the belly to continue to shape my supportive practice accordingly, in ways that might move others to support their work.

I felt compelled to request that I might use them; at least for some further visual experiments that day. Those experiments resulted in little more than some curious photos — collections of strange pearlescent sculptures, mounted upon a portable lighting box I had brought with me — eerie still lifes or memento mori... but the experience left me with a sense of our differences of perspective, outlook, and ways of investigating the ecological conundrum. These thoughts really stuck powerfully with me, and indeed have built over the years and compelled me to consider where arts and sciences, in the shared and urgent context of conservation and its sociopolitical roots, might extend upon each other's capacities and strengths. That clear delineation of what needed to be done, so clearly expressed by the ecologist's actions that day compelled me to imagine what I myself might then be able to 'do'.

Leimbach: An aspect of the work of the Environmental Humanities is to render the lived experience of non-human others. For example, the Extinction Studies Working Group produce vivid reflections across the biological and social world that engage with the lively agency of non-human others, bringing to light all kinds of biosocial relationships. Thom van Dooren writes poignantly about the critically endangered Asian Vulture that is dying in great numbers from organ failure caused by an anti-inflammatory painkiller, Diclofenac. The birds ingest the drug after feeding on cattle carcasses in India. This drug has been given to aging beasts of burden in recent years to prolong their lifespan and productivity. Once dead, these animals are eaten by the carrion as part of the workings of a large multi-species system; and the once abundant vulture is now critically endangered and will soon become extinct without intervention. This situation will cause a number of other problematic disruptions, not least the spread of disease caused by mountains of rotting flesh that would have otherwise been removed by the birds (the number of cattle used for farming in India is massive). Van Dooren's stated objective in writing is to engage and



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Keith Armstrong
Contents extracted by field ecologist from multiple regurgitated
owl pellets, AWC Kalamurina, Re-introduction Project, South Australia, Photo Document, 2012, © Keith Armstrong

118 antennae

119

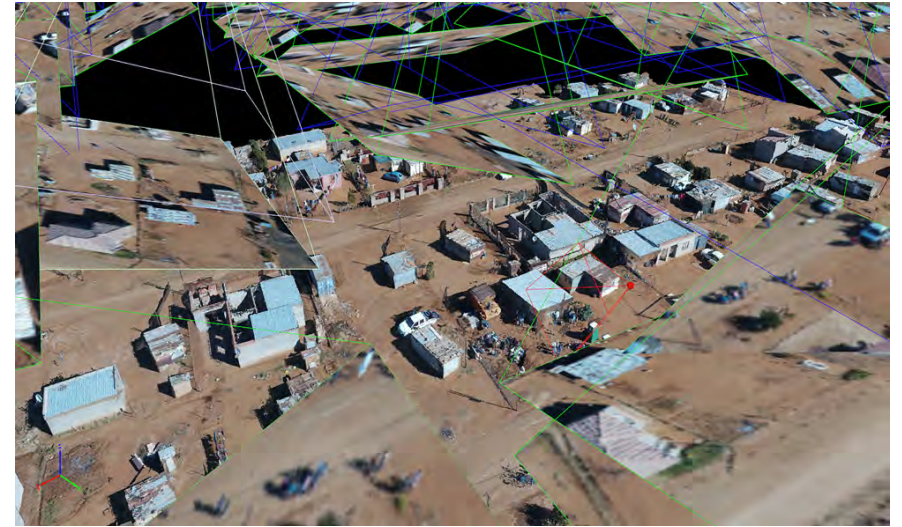


Keith Armstrong

Complete regurgitated owl pellet, AWC Kalamurina, South Australia, *Re-introduction Project*, Photo Document, 2012
© Keith Armstrong

empathise with the lived experience of a single creature in the hope to render it ethical and meaningful. He offers it as a counterpoint to the standard scientific representation of loss, for example, what you might find on a data spreadsheet on the IUCN red list. Dooren writes, “In contrast to these more conventional accounts of extinction, this essay takes up the pain of the individuals whose deaths constitute species extinctions; the individuals that are lost, or covered over, both in their deaths and in their suffering, by an exclusive focus on the management and conservation of a species”.^[6] In your creative practice, can you describe how you harness the potential to critically and/or emotionally engage audiences with the underlying challenges represented in scientific data sets of endangered species?

Armstrong: I am very aware that ecological data ‘read’ alone by the layperson, without direct experience, often makes limited impact on the senses, and can often fail to convey the multilayered complexity of ecologies under distress or reparation. However, the data clearly does tell a very extraordinary part of the ‘story’, and thus, used in concert with other media and sensory experiences may be part of the process of encouraging shifts towards public action that we need to subscribe to. Such processes of presenting multi-layered narratives within creatively focused public outcomes can offer quite different



Keith Armstrong

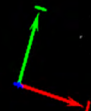
Regenerative (still), from the exhibition *Change Agent*, ISEA, Durban, South Africa, Rendered video still, 2018
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Today's newly minted robotic machines are capable of flying a range of sensors beyond the ubiquitous camera, offering up a whole range of new approaches to photo and video imaging of the environment, monitoring and acting from the air in ways not previously possible in larger, noisier, bulkier craft.
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modalities of thinking that can speak to broader cultural dilemmas. The goal must always be to enhance both cultural and biological diversity in ways that acknowledge and negotiate human psychology.

Leimbach: Questions of politics have become integral to both the concerns of creative practitioners and climate scientists. Cultural theorists, Jennifer Gabrys and Kathryn Yusoff suggest that arts-sciences discourse and practices must grapple with how to find the forms of intensive political engagement that climate change calls for, but in the process are returning not to a two-cultures debate, but instead to recognition of the multiple nature-cultures involved in these practices.^[7] Do you consider part of your creative process to involve visual re-working, visual analysis and artful communication of scientific findings around climate and related datasets, or is that anathema to your approach to arts-science collaboration?

Armstrong: There is often an ‘in-house’ hierarchy of arts-science project ‘worth’, that begins with art as communication, and culminates with the pinnacle — where the artist makes a creative contribution towards or even co-invents scientific knowledge. Whilst we are all curious about how far we may be able to push experimental practices in this arena, i.e. how much the methods of science and arts can be practically interchanged and re-worked, there is probably ample room for a ‘biodiverse’ set of approaches to the serious relational work that needs to be done (and in record time). I use that principle



Keith Armstrong

Regenerative (still), from the exhibition *Change Agent*, ISEA, Durban, South Africa, Rendered video still, 2018

© Keith Armstrong

of biodiversity — implicit in Naess' call for complexity — to say; yes, the holy grail is desirable, but let's also actively encourage all of the above as differently valid approaches.

Personally, I am less drawn to the data representational approach and more towards areas that the scientists I work with feel less comfortable operating within. This accords with the role of political ecology within my practice, and the need to collaborate towards a more activated and politicised science per se. Climate science is a good case in point because it draws from numerous disciplines — all in a hugely complex conversation — although perhaps not always with the general populace in tow. This takes us back to the value of working in the field, especially because the effects of climate change may not be primarily evident in a 'lab' for example, and are unevenly distributed across the world, at multiple scales. These were concerns raised in the collaborative project *Over Many Horizons (O|M|H)*, where our team of designers, artists, scientists, and philosophers sought to develop a transdisciplinary conversation around the complex problem of coral reef decline; an issue that the collaborating marine biologist passionately brought to us. His expressed fear, that I had heard before from other scientists, was that his reliable, solid, well-researched science seemed to have limited impact upon public opinion; however, he felt unable to resort to more emotive, immersive, political language/tactics that might risk reputational damage. By all spending time together in the field (in this case above and below Sydney Harbour where we snorkeled together on several occasions), we began to embody and qualify the impacts which his science had quantified - fragility, toughness, diversity, and danger — all in that one profoundly interconnected experience.

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The aim of that project was to design and build low-cost sustainable buildings and models for living with residents, scientists and international development organisations in South Africa's informal settlements, working with international development workers, architects, and sustainability scientists.
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Leimbach: The artist and cultural theorist James Bridle critiques misguided assumptions about technology as neutral, benign or the beneficent fix-all, stating: "We need to stop thinking about technology as a solution to all of our problems, but think of it as a guide to what those problems actually are, so we can start thinking about them properly and start to address them".^[8] From what you have said in regard to problematising the 'techno-fix', it seems that you share his perspective. Bridle's view that technology reveals to us our own flaws and as such provides real opportunity to deeply engage with problems, connects us here to an exploration of how 'we' might better use our aerial robots. You have suggested that the investigation of drones is a key cultural challenge of our age, brought to the fore by individuals currently co-inventing drone applications that could play critical roles in redesigning social relations to natural systems. For example, in 2018 a collection of essays were published by MIT exploring the 'good' drone "as an organising narrative not only for technological development but for political projects, governance practices, and social mobilization as it is imagined, legally constituted and deployed".^[9] In a sense this text is a manifesto for diverse applications of humanitarian, commercial, environmental and other civilian purposes; with the authors pointing out that drones have now thoroughly been co-opted by conservation science, agro-science and those working with anti-poaching and other animal and biota security concerns. Today's newly minted robotic machines are capable of flying a range of sensors beyond the ubiquitous camera, offering up a whole range of new approaches to photo and video imaging of the environment, monitoring and acting from the air in ways not previously possible in larger, noisier, bulkier craft.

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Ultimately the objective is to understand how this composite art form might be able to render something as seemingly familiar as an iconic landscape profoundly 'strange', allowing it to be experienced anew via 'sensual realms' that the artwork helps stimulate.
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In conservation biology, typical applications include land-use surveys, species monitoring, 3D modelling and thermal imaging useful for anti-poaching activities. What first drew you to UAVs and what are your current interests in drone technology?

Armstrong: During my time at the AWC working closely with scientists in the field, I was often engaged tracking animals fitted with radio transmitting collars on foot using handheld and vehicle mounted analog aerials and receivers, to accurately triangulate their position. I did this work extensively on North Head Conservation Park adjacent to Sydney Harbour to monitor the local protected populations of Bandicoots, and to a lesser extent at other sanctuaries, as a means for calculating the 'home range' and current position of released rare animals such as wolyies, boodies and bilbies. The radio signals and the animal radio collars had a range of technical limitations such as tracking noise, physical breakages and dead batteries. Furthermore, the large scale use of GPS collars to enact landscape-scale monitoring of moving animals was fiscally not feasible, and still in many cases is not. We often spoke of the power of aerial monitoring from planes or helicopters, in an era long before domestic drones were available. My interest was therefore strongly piqued by the cheaper drones that began to emerge on the horizon somewhat later.

Leimbach: Depictions and applications of UAVs have appeared widely in the arts, with some seeing the drone as emblematic of contemporary anxieties about surveillance, privacy, artificial intelligence, and remote warfare, whilst others celebrated what the newly accessible technology afforded. The first two decades of the 21st century often saw artists using the tools and strategies of tactical media — people like Peter Fend, Marko Peljhan, Bureau of Inverse Technology and Trevor Paglen — creating work that both revealed the growing capabilities of aerial technologies, but also using these capabilities to turn attention towards the manufacturers and users, and sometimes actively intervening within systems deemed to be problematic. Many artists continue to critique the use of drones and explore civilian activities and their integration into daily life, including James Bridle, Mariele Neudecker, and Liam Young. Exhibitions such as *Decolonised Sky*, curated in 2014 by Yael Messar and Gilad Reich expand the critique of spatial territory and the possibility of new visual strategies that can activate the political imagination. Returning to earlier comments you made about your central preoccupations and your commitment to a creative practice in support of living ecological systems and non-human others, I'm curious about how you engage with the use of aerial robots within your arts-science collaborations?

Armstrong: My drone experiments began three years ago as part of a project around regenerative futures called *Re-Future* based in South Africa. The aim of that project was to design and build low-cost sustainable buildings and models for living with residents, scientists and international development organisations in South Africa's informal settlements, working with international development workers, architects, and sustainability scientists. Working on the ground with local residents I then assisted them to re-image and re-present that work for new audiences to build understanding, support and critical mass around the work, including a presentation at a series of community festivals (*Seven Stage Futures*, 2017-18). The use of drones in this

project involved the flying of numerous 'missions' above these settlements and ultimately rendering out creatively manipulated 3D models of those locales (using the drone-based terrestrial mapping process called photogrammetry), further overlaying cultural information as part of the projects' remit to question what future sustainable, grass-roots suburbs based upon the local building designs might become.

This experimentation ultimately led to *Uncanny Valley* (2018–) which is currently emerging as a rich collaboration between biological, conservation and agricultural scientists, who together will seek to invent a 3D visual map-making process that exploits the inherent technical weaknesses of drone-based map making software processes. The visible exterior of our ecologically damaged planet is now almost entirely satellite-mapped, and available on demand via Google Earth. Armed with a domestic drone and some high-end scientific 'photogrammetry' software, any smaller part of the earth's skin can be 'captured' and presented as a 'fully-featured', user-navigable 3D model. However, getting that model to mathematically align with original forms means avoiding all sorts of technical pitfalls. The process can result in extraordinarily strange, yet highly evocative 3D imagery — whether of a riverine valley, waterfall or settlement — presenting a new way of envisaging these altered and re-presented landscapes. Much energy and time goes into avoiding these problems (e.g. the 'wrong' time of day, 'incorrect' flight paths, 'indistinct' or 'moving' objects, 'shutter blur' etc.). As one would expect there appears to be little, or maybe no significant investigation into how these errors might lead to the creation of more extraordinary 3D imagery than that close mimic of the landscape these 'scientifically accurate' packages promise. The aim is, therefore, to collaborate with these scientists to build towards an exhibitable VR artwork that enables users to wander within a series of these continuous 'uncanny landscapes'.

Much of our world has been rapidly warped beyond recognition during the Anthropocene. Overall, our attempts to re-badge our error-laden ways of living have failed the planet. Hanging doggedly on to failing systems has left us with little possibility to welcome in the unanticipated, or see and act anew to comprehend root causes. Artists have long been aware that the creative repurposing of mistakes can become powerful triggers for seeing things anew, suggesting possibilities beyond accurate or graphic representations of quantitative data sets. Curiously these early experiments in creating 'landscapes in error' I have found still possess the feel and form of something as immense and unknowable as a riverine valley, a towering waterfall or a village, but their strange bulbous glitchings, unfamiliar stretched shapings, missing or mysterious textures or apparent 'inside out views' confound description and possess a strangely uncanny power. Metaphorically, therefore, re-imaging disparate landscapes through this arts-science partnership offers new potential for seeking to re-image a 'world made strange' through the entwined capacities of science and media art. Ultimately the objective is to understand how this composite art form might be able to render something as seemingly familiar as an iconic landscape profoundly 'strange', allowing it to be experienced anew via 'sensual realms' that the artwork helps stimulate. Collectively this approach speaks to eco-philosopher Timothy Morton's rich idea of the "strange stranger"; something that we are unable to completely comprehend or label, given the more we think we know about it, the stranger it becomes.^[10] Joining together immense, strange landscapes via VR imagery I believe will also speak to Morton's concept of 'hyperobjects'; 'things' like landscapes of vast

scale that are far beyond normal human comprehension. Morton suggests if we wish to become sustainable humans, we must work to transform how we see & experience our world, rewiring our 'ecological awareness'. In all these ways I hope that *Uncanny Valley* will create unexpected, strange encounters, both with the artwork & its originating landscapes, as a tactic for de-centring & expanding ecological perception.

Leimbach: The environment (as 'we' generally understand and experience it), largely appears as local and tangible, however the interrelated issues of anthropogenic climate change are global and intangible. This means that in some locations, associated risks are contemporary and very real, while in others — perhaps most — such risks are remote in both time and space and thus only knowable through various representations. It seems that your new project speaks in certain ways to this strange warping of space and time, and the dislocation between the very local and the global. Certainly, the strange and sombre crisis of the biosphere is challenging longstanding accounts of the meaning of human agency and notions of responsibility. We are now very much confronted by the challenge of shifting ethical understandings — of ourselves, communities, social change, and world society — and of rethinking the terms of our relationships between culture, science, nature, technology and 'life itself'. In finishing then, how do you see arts-science projects utilising drone technology to actively transform attitudes, perceptions and modes of participation in relation to this bigger picture?

Armstrong: Obviously these are early steps into these new strange landscapes of aerial possibility; building along the way unexpected 'big picture' experiences that may ultimately make contributions towards the transformation of attitudes, perceptions and modes of participation. Whilst I anticipate a rich arts-science process in the making of these speculative worlds, and outcomes exceeding these preliminary sketches, if they fail to connect with other facets of this struggle then their limited agency is guaranteed. Furthermore, the weight of the problems that we face today refuse easy solutions and require a plethora of actions working in concert — in no small part because we have so often failed to understand the tenor of the landscapes within which those problems are situated. Our designed worlds — limited by their lack of meta-perspective — simply keep on designing, so often in ways quite opposite from those which we would have hoped for. Today we need to urgently re-harness all the creative tools and tactics at our disposal as we build our communities of concern, and ultimately our communities of change — in the search to liberate powerful and transformative ideas and ways of being.

Endnotes

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antennae

THE JOURNAL OF NATURE IN VISUAL CULTURE
SUMMER 2019



interface

antennae

THE JOURNAL OF NATURE IN VISUAL CULTURE
edited by Giovanni Aloï

Antennae (founded in 2006) is the international, peer reviewed, academic journal on the subject of nature in contemporary art. Its format and contents are inspired by the concepts of 'knowledge transfer' and 'widening participation'. Three times a year, the Journal brings academic knowledge within a broader arena, one including practitioners and a readership that may not regularly engage in academic discussion. Ultimately, *Antennae* encourages communication and crossovers of knowledge amongst artists, scientists, scholars, activists, curators, and students. In January 2009, the establishment of *Antennae's* Senior Academic Board, Advisory Board, and Network of Global Contributors has affirmed the journal as an indispensable research tool for the subject of environmental and nature studies. Contact the Editor in Chief at: antennaproject@gmail.com Visit our website for more info and past issues: www.antennae.org.uk

Front cover: Aki Inomata, *Think Evolution #1: Kiku-ishi (Ammanite)*, 2016-2017, photo: Koki Nagahama © Aki Inomata
Back cover: Laura Splan, *Recursive Expressions (Squint #2)*, 2017, archival pigment print on hot press cotton rag © Laura Splan
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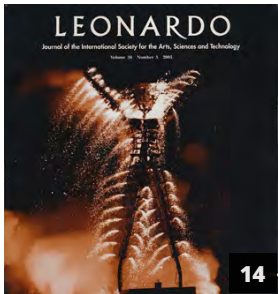
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A circular field of view showing a complex, multi-colored microscopic structure. The colors range from deep blue and purple to bright yellow and orange, with dark, irregular shapes scattered throughout. The texture appears granular and porous. The word "interface" is overlaid in white, lowercase, sans-serif font in the center of the image.

interface

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A Node within a Network of Networks: An Interview with Roger Malina

Interviewee: Roger Malina
Interviewer: Andrew Yang

Roger Malina's remarkable career spans the natural sciences, art, design, and education. In this interview with Andrew Yang, Malina discusses his exceptional role as editor of *Leonardo* and the challenges involved in working at the intersection of art and science.



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Eduardo Kac: From Holopoms to Outer Space

Interviewee: Eduardo Kac
Interviewer: Giovanni Aloï

Eduardo Kac is considered a pioneer of bioesthetic and telematic research. He is widely recognized for his interactive installations and his Bio Art. His work deals with issues that range from the mythopoetics of online experience to the cultural impact of biotechnology, collective agency, the creation of life and evolution.

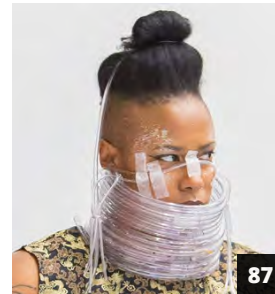


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Aki Inomata: Think Evolution

text and images by Aki Inomata

Inomata's work often involves 3D printing and relies on collaborations with animals. Together, works like *Why Not Hand Over a 'Shelter' to Hermit Crabs?* and *Think Evolution* draw important considerations on notions of deep-time, mobility, temporality, and change.

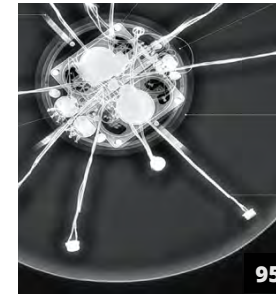


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Engineering Spaces for Cyborgs

text and images by Lee Blalock aka L3B12

Inspired by science fiction, futurism, and technology itself, Lee Blalock's work is an exercise in body modification by way of amplified behavior or "change-of-state".



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Parasitos Urbanos

text and images by Gilberto Esparza

Gilberto Esparza is a Mexican artist whose work involves electronic and robotic means to investigate the impacts of technology in everyday life, social relationships, environment and urban structure. He currently conducts research projects on alternative energies. His practice employs recycling consumer technology and biotechnology experiments.

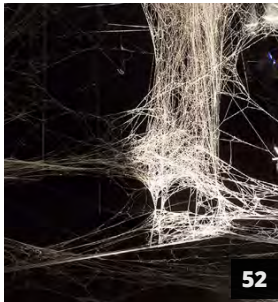


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Art-Eco-Science. Field Collaborations

in-conversation: Keith Armstrong and Tania Leimbach

Art-Eco-Science practitioner Keith Armstrong and sustainability scholar Tania Leimbach explore how artists hope to radically transform our attitudes, perceptions, and modes of participation.

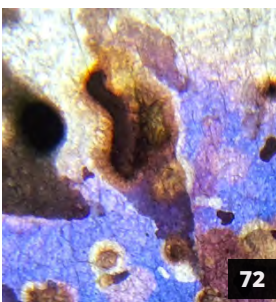


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Tomás Saraceno: Interfacing nature and culture through art and science

text by Elizabeth Atkinson

This essay explores the interconnecting elements at play in the practice of Tomás Saraceno, one very much studio-based and rooted in human/non-human collaboration.



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Sam Nightingale's Para-photo-mancy

text and images by Sam Nightingale

Para-photo-mancy is a series of experimental photographic artworks that utilise the inherent photo(phyto) chemical capacities of plants to produce images.



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Sougwen Chung: Drawing Operations

text and images by Sougwen Chung

An artist reflects on research-based practice, the conception of a special committee Ph.D. in Interdisciplinary Arts and Science at the University of Wisconsin-Madison, and the privileges of working, learning, and teaching at the intersections of disciplines.



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LABIOMISTA: Biology, Art, and Philosophy

text by Geerdt Magjels

images by Koen Vanmechelen

Biologist and philosopher of science Geerdt Magjels talked to Koen Vanmechelen about his work. Each piece tells a story in which the local and the global interact. A reflection on art, science, culture, and society.



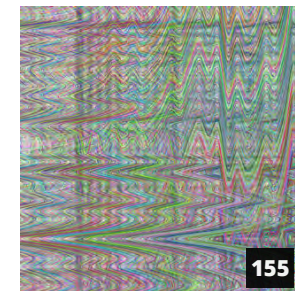
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Bernd Scherer: Curating the Anthropocene

interviewee: Bernd Scherer

interviewer: Giovanni Aloï

Bernd Scherer, director of HKW in Berlin talks to Giovanni Aloï about the importance of engagement in the context of anthropogenic research and contemporary art.



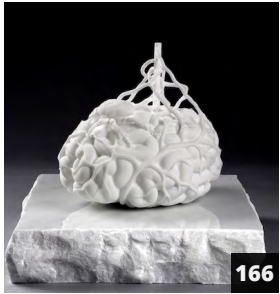
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Embodied Objects

text and images by Laura Splan

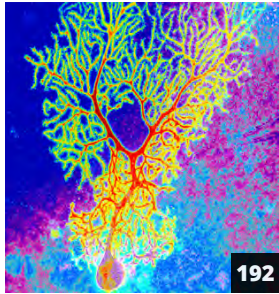
Laura Splan's *Embodied Objects* series uses biosensors to produce data-driven forms and patterns for objects and images. The project examines the potential for objects to embody human experience and to materialize the intangible.

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Let Yourself be a Mirror
text by *Sylvia Solakidi*

As consilience results from transformation through the mirror of the other, Jan Fabre takes from Giacomo Rizzolatti a model for his theatre and Rizzolatti takes from Fabre an image for brain function.



Dana Simmons: Micrographs
text and images by *Dana Simmons*

As a neuroscientist, Dana Simmons studied how autism affects the cerebellum, a brain region that supports our balance and posture, and helps us learn new movements. Dana used a high-powered microscope and manipulated laser light and color filters to create these intriguing neuron portraits.



Contemporary Relics: Threads Across Time in Bio Art
text and images by *Anna Dumitriu*

This article considers the health and safety challenges that my collaborators and I face in producing and exhibiting artworks, which take the form of sculptural objects or installations and incorporate diverse materials such as altered historical objects or textiles combined with bacteria and DNA.



Regenesis Aesthetics: Visualizing the Woolly Mammoth in De-Extinction Science
text by *Sarah Bezan*

Pursuing an iconographical analysis of the de-extinction of the woolly mammoth, this essay explores how the (re)production of the visual image intersects with the creative and variable processes of species revivalism.

Right: detail from *Laura Splan*
Recursive Expressions (Squint #2)
2017, archival pigment print on hot press cotton rag
© Laura Splan

