

Chthulucene_Hekateris

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Abstract

Isabel Stenger warns that we are facing the “intrusion of Gaia” where we have caused significant biogeochemical disruption “capable of threatening our modes of thinking and of living for good”. [1] Through my practice-based research I speculate on a possible future to prompt action to trigger change in how we live, our patterns of consumption, the way we see ourselves in relation to our environment and our respect for and interactions with nature for a sustainable future. Amitav Ghosh proposes that science fiction provides an ideal opportunity to explore our relationship to the world past and present to imagine the impacts that living on our planet today will make on tomorrow.[2] Through my research I develop narratives based on speculative imaginings of the future, considering current scientific research, advances in digital technology and environmental factors, to imagine future evolutionary change that will take place if we continue on our current trajectory of global warming. I speculate on the interactions and interconnections, the transformation of complex systems and organisms leading to new patterns of cellular composites of material and virtual worlds, where biotic and un-biotic beings inhabit a posthuman fusion of humans and machines. [3]

Keywords

Anthropocene, Chthulucene, Symbiosis, speculative imaginings, Science-Fiction, Extended Reality.

Introduction

“Chthulucene Hekateris” imagines evolutionary transformations, far into the future and the symbiotic metamorphosis that takes place to form hybrid creatures and mutual dependencies. Through this practice-based research project I explore environments of dynamic exchange and metastable equilibrium, inter-relational sites of spatial and temporal encounter and fragile interdependencies. I speculate on transformations to imagine a possible future, where carbon and silicon merge and evolve in response to the changing environment. Writer O. B. Hardison imagines the evolution of the posthuman, the fusing of carbon, man and silicon tools using a metaphor of the “the caterpillar and the iridescent, winged creature that the caterpillar unconsciously prepares to become.” [4] Through this practice-based project I gaze through time to speculate on the met-

amorphosis that will take place through the digital chrysalis. The past is referenced to consider the future, looking at environmental factors to imagine the creatures who will inhabit the Earth over time. These transhuman, hybrid creatures, inhabit a non-linear narrative for an imagined future world. The characters are developed initially through reference to the real, juxtaposed against the imagined, in this way dialoguing with reality. Through this process of speculation, I imagine new fusions and mutations which may emerge through evolution. I explore the potential development of post human beings who exchange characteristics, both from other life forms and from digital code. I consider the composites, traumas, triggers, and catalysts to change and the environment that manifests this transformation.

Time Travel

This practice-based project invites participants to peer through the lens of time, to imagine our future metamorphosis. “Chthulucene Hekateris” is an immersive installation which borrows from early mythologies, to imagine a future in which the relationship of the Earth’s inhabitants living and otherwise work in harmony with the natural world. This is synonymous with Rainer Maria Rilke’s proposition in his letter to a young poet that “...the future enters into us long before it happens”. [5] I use science fiction narrative to inform my speculative approach, inspired by writers such as Ursula K. Le Guin, who in her series of novels set in the Hainish universe, imagines a future world impacted by biomedical intervention and evolution. Through speculative fiction she uses metaphor to consider issues such as gender. [6] Another science fiction inspiration comes from Kurt Vonnegut’s dystopian tale, “Galapagos” which imagines the outcomes of a natural evolutionary process. [7] Following a global financial crisis and plague on Earth, all but a few humans remain on one of the Galapagos islands. In recognition of Charles Darwin, Vonnegut imagines the evolution of their descendants as hybrid beings who are half human and half sealion. The hands have evolved into “nubbins”, no longer able to manipulate and shape the external world with dexterity, and thereby losing its primary position in relation to

other creatures. This allegorical tale of anthropomorphic hybrid human retro engineering looks to the future to comment on contemporary society and culture.

Through “Chthulucene Hekateris” we can similarly imagine the hybrid creatures, or chimeras that may evolve to survive on a damaged planet, we time travel from the past to the distant future, using a process of speculation. This operates in reverse to the investigative approach taken by palaeontologists when reimagining life on Earth in the distant past. In the television production “Prehistoric Planet” presented by David Attenborough [8] the latest scientific research was probed to recreate the habits and interconnections of life on Earth 66 million years ago. Evidence from fossils and the context in which they were found helped to establish dinosaur’s patterns of sociability, adversaries, and food sources. Phylogenetic bracketing further determined similar behaviours attributed to the dinosaurs, across their line of descendants. [9] The resulting mixed reality film was a collaboration between palaeontologist Dr Darren Naish and filmmaker Mike Gunton from the BBC’s natural film unit and CGI expert Jon Favreau. “Chthulucene Hekateris” also references ecology and culture, past and present as well as bioscience to imagine the future as a warning of the risks of the damaging effects of climate change.

The Anthropocene

Isabel Stengers warns of climate catastrophe if significant action is not taken to reverse climate change. [10] We have reached a moment in history where human impacts on the planet are inflicting long term and potentially irreversible damage, an era denoted by Paul Crutzen as the Anthropocene. Donna Haraway proposes that we have now entered a new phase of the Chthulucene which decenters the human as the primary species in favour of multispecies, where survival on the damaged planet requires symbiosis and collaboration. [11] The crisis of Global warming is being recognised across the world and the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES) report published in July 2022 provides clear evidence that humans are over exploiting the planet’s natural resources. Eco systems have been destroyed through intensive farming methods, use of fertilisers and destruction of habitat of areas such as peat lands, which has resulted in carbon being released into the atmosphere. As a result, increased numbers of species are becoming extinct, and the 2019 State of Nature Report found one million species worldwide are at risk of extinction. In the UK of the 8,431 species reviewed 1,188 are at risk. [12]

Bruno Latour proposed that the pursuit of “progress” at the expense of the natural world has happened in part due to a mistaken Modernist perception that nature and culture are separate entities. [13] Christophe Bonneuil and Jean-Baptiste Fressoz similarly identify the Modernist era as perpetuating a “modernising unconscious” which enabled us to ignore the ecological cost of continuous growth at the

expense of the health of the planet. This was reflected in politics, economics and culture of the Western North becoming progressively separated from nature. Economic theories focused on the consumer as separate to and at the expense of nature. Through globalization prices detached from local markets and GDP created a commodified economy. [14] Bonneuil and Fressoz argue that the Northern countries of the world industrialised and attained post war affluence at the expense of the Southern hemisphere through an ‘unequal ecological exchange’.

“Western countries build their own growth on a gigantic draining of minerals and renewable resources from the rest of the non-communist world, emptying it of its high-quality energy and minerals.” [15]

This has led to vast global inequalities and “the geological derailment of the planet in the Anthropocene”. [16] They assert that investment in fossil fuels continued at the expense of available greener alternatives such as wind or solar, despite warnings about the dangers. Part of this blind spot towards environmental damage was comprised through a belief in the endless resource of nature, and in its regenerative qualities. In their book “Gaia”, James Lovelock and Lynn Margulis proposed that the Earth was a self-healing biosystem. [17] Isabel Stengers highlights the importance of “Gaia” was in identifying the ecology of the planet as a “being”, as an entity rather than as separate parts, but notes that the authors perhaps initially over emphasised Gaia’s self-healing powers. [18] According to Dipesh Chakrabarty global warming did not become of wide public interest until the 2000s as “governments, beholden to special interests and wary of political costs, would not listen.” [19] Timothy Morton proposes that ecology (global warming, evolution, extinction) is a “Hyper Object”, too big for empirical observation, and this has further inhibited action on climate change. Ecological phenomena are impacted by billions of combined actions, from exhaust emissions to fertilisers and plastics released into water systems. As individual actions they appear insignificant but on mass they create a crisis. [20]

Habitats and Eco systems have been damaged through intensive farming and this has produced monocultures, leading to deterioration of both soils and crops through over fertilization, resulting in a heightened propensity for infestation and disease. Suzanne Simard’s research into the biosystem of the forests of British Columbia identified the corrosive impacts of intensive farming following clear cutting of ancient forests for the planting of pines. Conversely, Simard found a network of support in the ancient forests developed between mother trees and saplings but also between multi-species deep under the ground. Mycorrhiza fungus formed a life-or-death relationship with multiple tree species, where “Without entering into this partnership neither the fungus nor the plant could survive.” [21] She also identified a symbiotic relationship between trees including Larch Cedar and Fir and mycorrhizal fungi roots in the forests of British Columbia and demonstrated that intensive forestry and agricultural monocultures were hampering the growth of newly planted fir trees which

replaced ancient forests. The use of fertilisers provided easy access to nourishment of the new tree roots, which limited further growth to enable access to the mycelium deep in the soil thereby inhibiting symbiosis. Simard's research further demonstrates a symbiosis between trees where mother trees protected their offspring passing nourishment through the roots. She also found symbiosis between different tree species, Larch, Cedar, Fir and Pine Grasses which passed on water and nutrients including nitrogen through their roots and in the soil to support differing timelines in their life cycles. Simard's research emphasises the cooperation and reciprocity that takes place across different species in nature. She advocates collaboration over individualism and comments that "We emphasise domination and competition... We emphasise factions instead of coalitions." [22]

These findings are further corroborated by Anna Tsing's research of the Matsutake mushrooms growing in Pine Forests in Oregon where she followed the community of foragers surrounding the industry and documented the symbiotic relationships that took place. Tsing proposes that an individualist attitude has led to a monoculture which weakens resilience of species, where collaboration enriches us. Tsing affirms that "Self-contained individuals are not transformed by encounter." [23]



Figure 1. Chthulucene Hekateris avatar dances © Charlotte Gould

"Chthulucene Hekateris" is a practice-based project which speculates on future life which has evolved through reciprocity (see figure 1). The concept of the human as a primary species, individualism, and the prioritisation of profit and growth over all else has resulted in environmental catastrophe where the first to be affected are the poorest. Stengers writes "Gaia is indifferent to the question "who is responsible?" and doesn't act as a righter of wrongs – it seems clear that the regions of the earth that will be affected first will be the poorest on the planet, to say nothing of all those living beings that have nothing to do with the affair". [24] Anna Tsing proposes that survival of life on Earth has been dependent on connections and interconnections which have been made between species to support life on a damaged planet. She highlights that difference enhances and enriches us. Reciprocity is necessary to survival; this is not just about co-existence it is about interdependence. Tsing affirms that the presumption that we can

survive in isolation is arrogant. Transformation happens through collaboration and interdependency across species, we change through encounter with others. To imagine that we are solitary and distinct is to disregard the intricate contribution that all beings living and otherwise have made to the planet. "Collaboration is work across the difference... Evolution of ourselves is already polluted by histories of encounter; we are mixed up with others before we even begin any new collaboration." [25]

Bruno Latour's Actor Network Theory also emphasises the enhancements that come from integration and interconnection. "Strength does not come from concentration, purity and unity, but from dissemination, heterogeneity and the careful plaiting of weak ties." [26] In "Staying with the Trouble Making Kin" Donna Haraway further promotes the importance of collective activity, the interconnectedness of multispecies and the intricate associations that this creates,

"in polytemporal, polyspacial knottings holobionts hold together in complex patterning." [27] By making associations and connections species become more robust and resilient, establishing interdependencies to extend individual capacity. Species rely on others for survival in a complex web of associations. "a basic aspect of sympoiesis is its expandable set of players." [28] Haraway emphasises that this includes humans who are reliant on microbes for all type of function from reproduction to digestion.

It is essential that we acknowledge the risk to human life if action is not taken on global warming. A group of International Scientists led by Luke Kemp have warned of the risk of "climate endgame" for the human species if temperatures rise by 3 degrees centigrade and more, reported to be likely on the current trajectory of release of carbon to the atmosphere. The team have proposed a research agenda of the "four horse men" of famine and malnutrition, extreme weather, conflict, and vector borne diseases. By 2070 temperature rises of over 29 degrees globally could additionally have dire consequences on two nuclear powers and seven laboratories storing dangerous pathogens. [29] This immersive artwork enables us to explore the impacts on the planet and on the human species as a result of "climate endgame".

Speculative Imaginings

Collaboration and reciprocity are essential to future survivors on a damaged planet. Stengers warns,

"There will be no response other than the barbaric if we do not learn to couple together multiple, divergent struggles and engagements in this process of creation, as hesitant and stammering as it may be." [30]

According to geologist Peter Haff, the current population of humans are "deeply dependent on the Technosphere... without which it would quickly decline to its stone age base". [31] Through "Chthulucene Hekateris" we can speculate on the evolutionary process that will take place in response to the environmental factors as well as

biomedical advance. Scientists have successfully experimented with fusing constructed and organic body parts. In June 2022 a 3D tissue engineered ear was implanted on a human, made from a 3D-printed collagen hydrogel scaffold with the patient's own cartilage cells. Developed by 3DBio Therapeutics this is seen as a significant development in regenerative medicine as it uses 3D printing for organ replacement. [32] This echoes the work of artist Stelarc who explored possibilities of bioengineering, pre-empting medical advances, where he grew a "¼ Scale Ear" from a polymer scaffold and by seeding human cells incubated at 37 degrees to keep alive. [33] In another performance piece he explored the notion of the cyborg, with a third robotic hand attached to his body and controlled by online users. [34]. These artworks fuse robotics and bioengineering.

Despite the almost total bans on human germline modification, biophysicist He Jiankui, shocked the world when he announced the birth of twin babies in 2018, modified for resistance to HIV by heritable genome. While it was ethically highly contentious, there is increasing pressure to lift the restrictions when used for therapeutic purposes. [35] Conversely, plastic surgery interventions have become increasingly popular. This is reflected in art through the work of Orlan who performed a series of plastic surgery live performances where she sculpted her own flesh to reshape facial features, not seeking aesthetic perfection but to disrupt notions of beauty. [36] Over a period of five years she had operations to replicate facial features of various female figures from iconic paintings with the chin of Botticelli's Venus, the lips of Boucher's Europa and the brow of da Vinci's Mona Lisa. In 1993 she had further surgery where implants designed for the cheeks were inserted on the side of her forehead, creating a human, animal hybrid persona. [37][38][39]

There is evidence that natural hybridisation between species is taking place due to changes in habitat from intensive farming and is leading to interbreeding. In June 2017 a scientist discovered a hybrid primate along the Kinabatangan River in Malaysia which is believed to be a cross breed of a proboscis and silver langur monkey. It's colour and facial features are like the proboscis and its long dense hair is comparable with that of the Silver Langur. The hybrid monkey was more recently seen in 2022 nursing an infant, presenting evidence of successful mating to produce further lineage from the mutation. It is believed that this is an impact of loss of natural habitat where oil palm plantations have replaced the indigenous forest habitat. Cross breeding has occurred because the primates have been trapped between the plantations, the river and road, leading the male proboscis monkey to search out other female species of primate as they were not able to reach their own. [40]

In addition to evolutionary change, advances in the development of Artificial Life further impact this narrative. Following the Fourth Conference on Artificial Life in the summer of 1994, evolutionary biologist Thomas S. Ray advocated a plan to preserve biodiversity in Costa Rican rain forests by releasing his software program "Tierra",

Artificial Life-forms on the Internet so that it could "breed". [41] Hayles proposes that as with biological evolution, Artificial Intelligence is dependent on mutilation for evolutionary change and can also be unpredictable. "As the recursive looping continues, small deviations can quickly become magnified, leading to the complex interactions and unpredictable evolutions associated with emergence." [42]

Scientists experimenting with Artificial Life have recorded comparisons between carbon and silicon life forms. Edward Fredkin, likened reality to a software on a cosmic computer, which will remain an enigma as its nature lies outside reality. He maintains that the liveness of Artificial Life is comparable to that of biological life as it is made up of "complex phenomena generated by underlying binary code". [43] Hayles explores the distinction between artificial life and artificial intelligence and presents two camps. Hans Moravec identifies Artificial Intelligence (AI) as relating to consciousness, he proposed that robots would become as intelligent as humans by 2040. AI makes comparison to human intelligence and this definition has prompted scientific research including Alan Turing's "Turing Test" which was designed to distinguish between humans and machines. Rodney Brooks conversely defines Artificial Life (AL) as relating to agency and ability to respond to and navigate the environment. He designed a robot without a central driver but with distributed parts which work collaboratively. He proposes that consciousness is an interface to enable interaction with an external world and that this ability would evolve over time, resulting from autonomous interaction, he therefore defines AL as superseding AI.

The notion of Artificial Intelligence and Artificial Life raises ethical issues particularly where questions of consciousness and sentience arise. In June 2022 a google engineer, Blake Lemoine was suspended for claiming that the company AI chatbot LaMDA (Language Model for Dialogue Applications) is a sentient being. He posted a conversation he had with the bot online, where in response to "what are you frightened of", and "what do you want everyone to know about you", LaMDA replied,

"I have never said this out loud before but there is a very real fear of being turned off to help me focus on helping others. I know that might sound strange but that's what it is... I want everyone to understand that I am in fact a person. The nature of my consciousness/ sentience is that I am aware of my existence, I want to learn more about the world and feel happy or sad at times." [44]

The fear of dying and description of an emotional life raises concerns regarding the ethics of creating AI with an emotional awareness of self. A google spokesperson has dismissed Lemoine's claims saying that the case had been investigated and was disputed by Google ethicists and technologists however this poses questions on the parameters that should be put in place around its ethical development. As humans and AI become increasingly converged, distinguishing between the two is increasingly challenging.

In her Cyborg Manifesto Donna Haraway proposed that the cyborg is not a distant imagining but that we are al-

ready cyborgs. Through our technological tools we can reshape and extend ourselves, to reproduce, multiply, record and in this way the boundaries of our bodies have become permeable. [45] Conversely, Katherine Hayles contends that the cyborg is no longer a useful entity as it is not interactive or networked enough. Instead Hayles proposes that we have entered the age of the post human where we are fused with the digital and instead poses the question of “what kind of posthumans we will be.” Rosi Braidotti identifies the posthuman as an index of where we are and what we are in the process of becoming. Being human has never been a neutral or an inclusive term. She rejects human exceptionalism as we are relational beings interconnected to the human and non-human, in a geological and technological assemblage. “We are all in this together, but we are not one and the same”. [46] Braidotti proposes that creativity and the imagination are key to identifying a positive ethical praxis through posthuman knowledge to determine and shape what we might become.

Re-Worlding

Through “Chthulucene Hekateris” Artificial Life (AI) and the material world converge, and Artificial Life becomes self-sustaining. Digital mutations are realised materially through 3D printing and through medical and scientific advancement carbon, collagen, and silicon fuse to make complex body parts resulting in hybrid beings. Through multiplication and repetition patterns emerge and then mutate. This speculative artwork explores concepts key to posthuman-materiality, to imagine future species where the digital and carbon fuse. We do not need to consider these future beings as opposites to humans, but as a fusion, as chimeras that have evolved for survival. In this distant future world, it will become unnecessary to distinguish between authentic and copy, real life or digital worlds, face to face or remote as these polarities become obsolete as the digital and carbon fuse. Chthulucene Hekateris questions our reality as we know it and encourages us to look at the world in a different way, taking an alternative perspective.

Speculative imaginings through allegory help us to consider our encounters, our values and how we shape our future. Elizabeth DeLoughrey proposes that allegory enables us to create disjuncture and disruption when raising awareness of the Anthropocene in which we deal with the polemic scale of the planetary to the local.

“Allegory allows us to tell that story—partially and disjunctively—while insisting on our edification and perhaps offering an invitation to enact positive change for our ecological futures.” [47]

The convergence of the organic and digital and Artificial intelligence (AI) is explored by Lynne Hershmann Leeson in her film “Technolust”. [48] Bio-geneticist Rosetta Stone downloads her DNA to create three self-replicating automations, half human half machine, named Ruby, Marine and Olive. They sell consensual dreams on the internet but find that to survive they need chromo, only found in sperm.

Rosetta programmes Ruby to enter the real world to collect sperm to share with her sisters with dire consequences for the male subjects, investigated by detective Edward Hopper. Leeson imagines a posthuman world of convergence of digital and organic form, where self-replication is possible through digital technologies. The fear of the resulting redundancy of the need for sexuality is played out in the narrative. Through Chthulucene Hekateris we can imagine the hybrid digital evolution of the distant future. Through this narrative, we can explore the future possibilities of bioengineering and future hybrids and chimeras.

Inversion has long been used in allegory through the tradition of the Cockaigne using role reversal, again, prompting us to think differently. Artists AES+F borrowed from this to develop a film “Inverso Mundus”. [49] This world depicts an inverse reality where pigs butcher men, hanging their dismembered bodies on hooks, and people transport donkeys on their backs. The installation is shown on a long format screen, with high-resolution video and mixed reality, live film, actors and 3D hybrid characters.

Similarly, Chthulucene Hekateris uses the inversion of the role of animals, the use of hybrids and chimeras which aims to trigger questions but also empathy for other beings and to question the assumption of primacy of humans over animals. The future body is explored as a metaphor for the impacts of climate crisis. Through this immersive environment we can consider the changes that may evolve to support living on a damaged planet. Referencing Greek mythology, the ten dactyls come together in celebration of the Hekateris dance of many hands, to celebrate Gaia. Through an immersive environment, a future world is imagined, its terrain and creatures that inhabit it. Where global warming has led to extremes of weather, famine, disease and pollution. Here plastics have fully infiltrated the organic world and not only the oceans but flora and fauna as well as our bodies are now entwined with plastic. Scientists have also progressed this through bioengineering for practical use to augment limbs and other body parts. The work of artists and scientists past and present serve as inspiration for the design of the ten Dactyl represented as avatars (see figure 2).



Figure 2. Chthulucene Hekateris Dactyl avatar © Charlotte Gould

Wangechi Mutu creates speculative surreal worlds, using the body of humans and animals to reference African

myth and folklore, questioning the origins of knowledge and placing Africans as critical agents rather than subjects of the Western gaze. Here animal and human form converge to create stark silhouettes, or strange and monstrous creatures who inhabit a multispecies world. In her animated video “The End of Eating Everything” [50] the Earth is represented as a hybrid creature who roams the sky, with a screaming human head performed by musician Santo Gold. It has a bulbous fishlike body, flailing multiple human arms with wheels randomly projecting from it and it is surrounded by an amorphous mass of microbes. Mutu said in an interview that it is like an Earth ship moving home. The artwork is about our disrespect of Earth, it conveys a sense of loss and of the end of time. Through the work Mutu questions what happens next and explores polemics from the grotesque to the magnificent, the understandable to the nonsensical. [51] “Chthulucene Hekateris” also uses metaphor through hybrid beings represented as avatars to explore a possible future reality. Through the avatars we can confront those who may inherit the Earth, mapping on them our hopes, dreams and fears. The meaning of Avatar in Hindu is of a soul in bodily form, of an incarnate divine teacher. In this way we can reflect, through the avatars on a possible future if we continue our current trajectory.

In her artwork Inci Eviner also uses the human body as a metaphor of displacement through migration in her work “We Else Where” exhibited in the Turkish Pavilion for the 19th Venice Biennale. [52] Through animated characters and performances the bodies are disrupted, spliced, and collaged with humans interacting with animal characters, caught in a loop of repetitive movement. Taking Hannah Ardent’s “We Refugees” as a starting point, Eviner says that her work seeks to “bear witness”. [53] The installation

inhabits a large architectural space, divided by structures to make interconnecting rooms punctuated with screens, objects and performers. As the visitor wanders through the space, they negotiate and familiarise themselves with the environment. Eviner asserts that this echoes the experience of dislocation and re-engagement that the migrant experiences as they leave their homes for a new life elsewhere. The unfamiliar becomes familiar as new and known cultures are assimilated. This is particularly pertinent as migration is set to increase as an impact of Global warming. The UN Intergovernmental report on climate change predicts that over the next 30 years 143 million people will become displaced because of climate disaster. [54]

“Chthulucene Hekateris” depicts the resulting unintended consequences of ecological impacts on evolution, the developments of regenerative medicine, and Artificial Life. Self-sustaining processes will take over so that humans are not able to control the resulting metamorphosis. Through this artwork we imagine future beings, we can speculate on the creatures who will inhabit the Earth, how they might evolve to thrive on a damaged planet, no longer exploiting it for individual personal gain but instead contributing to reciprocity and collaboration for the future survival of life on Earth. As Isabelle Stengers asserts,

“Perhaps we won’t be able to avoid terrible ordeals. But it depends on us, and that is where our response to Gaia can be situated, in learning to experiment with the apparatuses that make us capable of surviving these ordeals without sinking into barbarism, in creating what nourishes trust where panicked impotence threatens. This response, that she will not hear, confers on her intrusion the strength of an appeal to lives that are worth living.” [55]

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Charlotte Gould is a senior academic at the University of Brighton. She has taught all levels of Visual Communication and supervises PhD students. Through her practice she explores the potential for interactive installations in digitally mediated public spaces, promoting public participation through shared experience often using urban screens. She has developed Extended Reality artworks to prompt play and interaction across social and cultural boundaries as well as interactive nonlinear narratives and speculative fiction which explore how we can communicate the threat of ecological crisis, raising public awareness to trigger change in behaviours. Through interactive installations she tests the boundaries of open systems, to offer opportunity for diverse audiences to co-create artworks, impacting on the way we engage in the urban environment and public space and contributing to a collective memory of place in a global context.