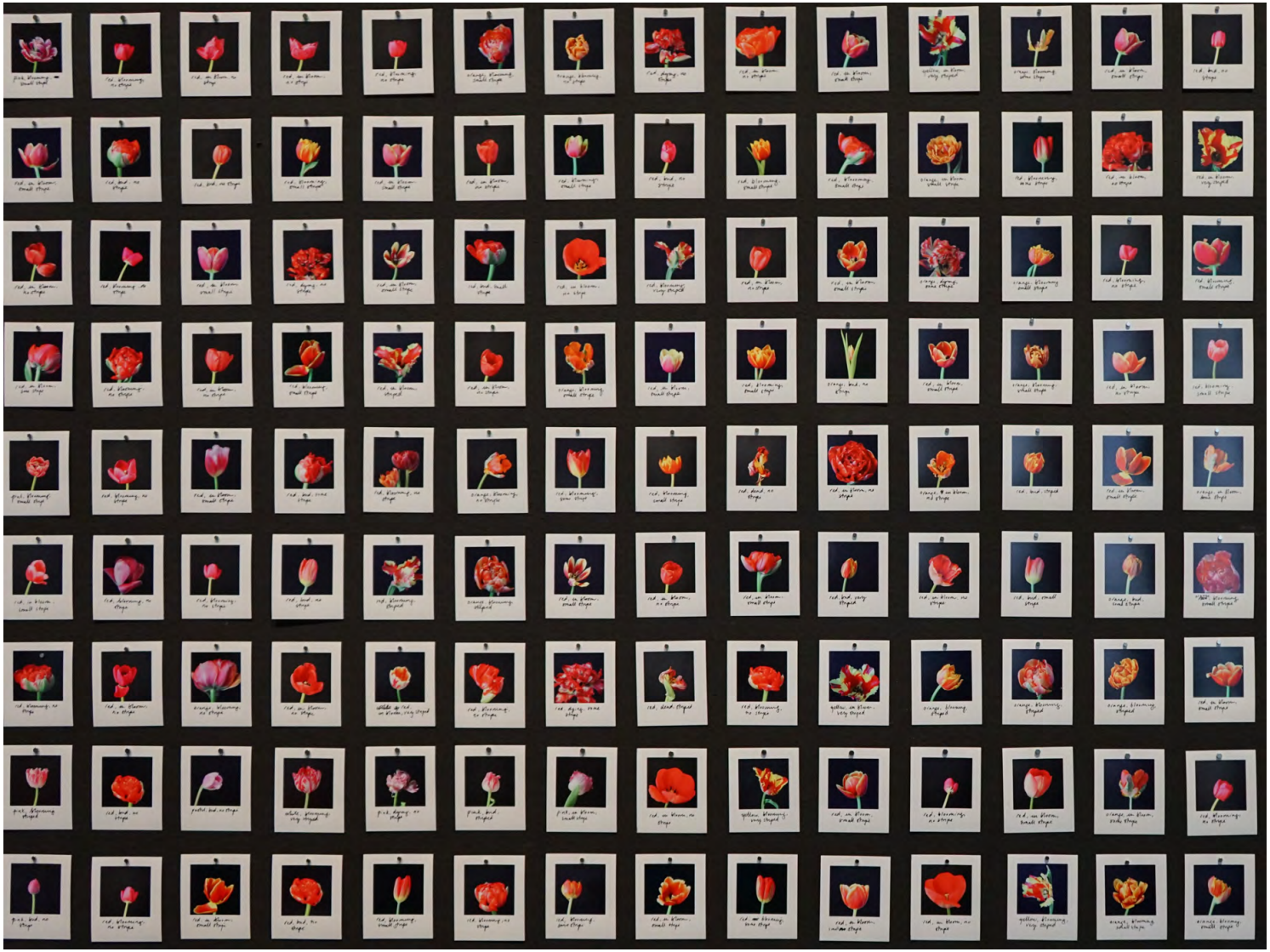


Anna Ridler: A Contemporary Tulipmania

Anna Ridler is an artist and researcher who is interested in exploring how systems function and are built. She works with new technologies and scientific knowledge, exploring how they are created in order to better understand society and the world. Her recent projects have looked at the commodification of nature, particularly in relation to machine learning.

interviewee **Anna Ridler**
interviewer **Jean Marie Carey**

Anna Ridler is an artist interested in systems of knowledge, with a desire to know and to make this process of knowing available. She works with new technologies, exploring how they are created in order to better understand society and the world. Anna has exhibited at cultural institutions worldwide including the Victoria and Albert Museum, Tate Modern, the Barbican Centre, Centre Pompidou, HeK Basel, The Photographers' Gallery, the ZKM Karlsruhe, and Ars Electronica. She has been listed as one of the nine "pioneering artists" exploring AI's creative potential by Artnet and received an honorary mention in the 2019 Ars Electronica Golden Nica Award for the category AI & Life Art. Anna holds an MA from the Royal College of Art and a BA from Oxford University.

Jean Marie Carey: Studying the iterations of *Mosaic Virus* and the photography-AI multiples of *Myriad Tulips* made me think of the connections between artists, horticulturists, and cryptocurrency speculators. The *tulpenmanie* investors in the Netherlands in the first part of the 17th Century and those experimenting with the Bitcoin market are gamblers playing against the house – a few knew or know when to fold and walk, but most lose all. Artists also must have a certain similar illusion or delusion that their efforts will be able to satisfy their financial ambitions on some level while maintaining creative control.

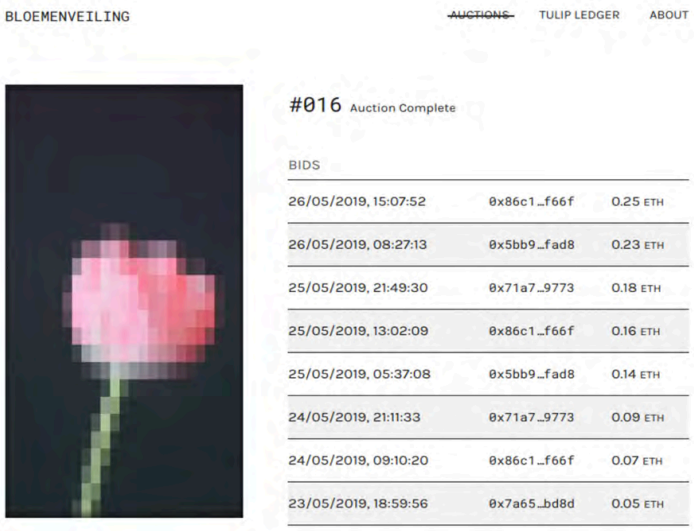
Anna Ridler: The series of works around tulips, particularly *Mosaic Virus* and *Bloemenveiling,* are very much about ideas around the nature of speculation. There is some debate about whether tulipmania was truly a mania (the work by Anne Goulder argues persuasively that it was not) but in cultural consciousness, it is often held up as an example of early speculative behaviour. By linking this moment to the ongoing hype around cryptocurrencies - but also the excessive expectations around artificial intelligence I am able to bring together ideas around capitalism, value, and collapse from different points in history. "Mosaic" is the name of the virus that causes the stripes in a petal which increased their desirability and helped cause the speculative prices during the time. Broken, or striped, tulips were some of the most expensive. In the video work, generated using a Generative Adversarial Network (a form of machine learning), the stripes on the petals of the tulip depend on the value of bitcoin, changing over time to show how the market fluctuates, making this connection explicit.

The disease, discovered in the 1920s, is caused by aphids who infect the bulb, causing it to 'break' from a single colour and develop the distinctive stripes. Once a bulb has become infected, all of its offshoots will also have the virus and be able to produce striped flowers; however, it is also possible for bulbs that were not infected one year to then gain the virus and produce striped flowers the next year. This made the process of producing a striped tulip seemingly alchemic and mysterious. At the height of tulipmania, people would try to force stripes by splicing together a red tulip bulb and a white tulip bulb, or by painting stripes on the earth. There was no connection or knowledge of how the virus affected the tulip bulb, the thing that was generating wealth. To me, this correlates to the rush towards blockchain and its associated technologies a few years ago. There was a huge surge of interest in 2017 after Bitcoin's surge in value from around one thousand dollars to nearly twenty thousand over the course of a few months, but much of this interest came from investors who did not understand the technology, but just saw the movement in the stock market. This rapid change in valuation was not because of investors caring about decentralisation, or smart contracts, but because they are just looking for another way to make money.

Anna Ridler

Mosaic Virus (2019); 3 screen GAN generated video installation; 2019; image courtesy of the artist © Anna Ridler

And blockchain is now, increasingly, becoming part of the art market ecosystems. For *Bloemenveiling* I wanted to push this association further by creating a technological marketplace for artificial tulips, in order to echo the auctions that sprung up in taverns throughout Holland at the height of tulipmania. A model can generate endless tulips but within the art market (which as you rightly point out is its own type of bubble, like blockchain, like tulipmania, like AI) work is only 'valuable' once it is scarce - I could produce infinite tulips, but the ones that are valuable are the ones that are verified, editioned and authenticated. In the piece, short GAN videos of tulips were sold at an auction using Ethereum on the blockchain. Echoing the auctions that sprung up throughout taverns in 17th century Holland at the height of Tulipmania, the piece interrogates the way technology drives human desire and economic dynamics by creating artificial scarcity as bots also compete against the viewer to win the video. The smart contracts that enable the sale and define the work sold contain code to make the video work mirror how real tulips bulbs behave: it shows the video, or blooms, for a week (approximately the amount of time a cut tulip will last for). In the same way that tulips at the height of the mania were not bought or sold as objects but as paper contracts without the knowledge of what would bloom, purchasers in this marketplace do not exactly know what the video work would be



Anna Ridler and David Pfau

until the contract is unlocked. After a week, the tulip is 'blighted', and the moving image piece can no longer be viewed by its owner. In this way, the decay and impermanence of the natural world is reintroduced into the digital world. This project also links to another bloemenveiling (which literally means 'flower market' in Dutch), Aalsmeer, which formed an important component of the research. Described as "the largest flower market in the world" on their website, Aalsmeer reflects the way that nature has been so commodified in recent times. Flowers come from all over the world - Ecuador, Colombia, Ethiopia, Kenya - and approximately 20 million are traded daily in a space that is occasionally oddly reminiscent of a stock market trading floor, dealt like they are any other commodities. It is a dirty, commercial business with all sorts of issues around labour, pesticides and even water extraction, that are all obscured when they are bought. Tulips, no longer the symbol of wealth that they were in the seventeenth century, can be bought for a few pounds because of these systems that are in place and can be found for sale in supermarkets and petrol stations; bred to be hardy and last long on shop floors. Its excess removes its value.

JMC: Heretofore, botanic specimen collection, like art dealing, has had few hard and fast legal or ethical rules. The ongoing discussion over repatriating artefacts

such as the Benin Bronzes and the work of Bénédicte Savoy of the Humboldt forum casting the public eye on cultural objects, what do you think about what we might call "displaced plants," which often become innocent victims of their relocation? I'm thinking of kudzu which was introduced from Japan to and has taken over swamplands, in the American South, or the yellow gorse brought to New Zealand by Scottish settlers which has damaged the island's own flora, but you have likely run across other examples in your investigation of the Netherlands.

AR: My research was very much focussed on the tulip, so I did not get to research other displaced plants whilst I was in the Netherlands. This flower, however, was not native to the country and was introduced to Europe from Turkey in the mid-sixteenth century (which also experienced its own tulipmania). The appearance of tulips that are associated with each region, visually, are quite different - the Dutch tulips open and blousy blooms, whereas the Turkish tulips are tighter, each cultivated and engineered to reflect the preferences of the culture.

JMC: Mushrooms are fungi and not flowers but they are functionally similar to the tulips which appear in your oeuvre in that they are seemingly fragile and immobile, and grown and harvested for profit.

AR: Mushrooms I think are a nice counterpoint to the tulip - there are similarities both how they are portrayed as tropes in seventeenth-century engravings to warn against the dangers of the stock market (tulips as a symbol of speculation, mushrooms to represent the large number of companies that 'sprung up' in the wake of other speculative bubbles) - and also more broadly in the popular imagination. Mushrooms at the period had connotations of rot which links to the ideas around decay that were embedded in the Vanitas paintings that were a huge visual inspiration for *the Mosaic Virus*. These paintings, which featured flowers (often tulips) and fruit, were meant to illustrate that beauty and treasure are only fleeting and would only last a short while before spoiling and falling away. However, the way that they behave is extremely different - whereas tulip bulbs take a long time to grow from seed (sometimes up to five years) and require specific conditions in which to flourish, mushrooms can spread huge amounts of spores quickly and can grow in almost under almost any circumstances.

JMC: I know you spent a long time in the Netherlands, examining flower growth and production from bulb to market as shot original photosets. How did you factor that very subjective experience and the unpredictability of botanic-affection variables – such as weather, parasites, genetic mutations, or dominants – the set of rules for data manipulations to build out your visual model?

AR: A large part of my practice when working with machine learning is making a dataset. Increasingly the idea of the dataset has become inseparable from machine learning and artificial intelligence for its crucial role in its functionality: what is contained in a dataset - images, words, numbers - becomes the knowledge that an algorithm has to create its world. Datasets need to be extremely large in order for the algorithms to have enough information to make inferences; they also need to be cleaned and standardised for them to be usable.

For my work with tulips, I had to create my own dataset. While I was based in Utrecht I took 10,000 photographs of the flowers over the course of three months (and the reason I stopped at 10,000 was that tulip season ended, so while this is a very digital piece, it is driven by the rhythms of nature). It forced me to examine each image and inverts the usual process of creating the type of dataset that is usually

used in machine learning, put together by Mechanical Turks, who label and categorize images scraped from the internet. The process becomes almost like craft - repetitive, time-consuming but necessary in order to produce something beautiful. Each flower will have slight variations. There will be no perfect ideal one. The differences between each are noticed as you are looking for this, rather than similarities, which is what will produce interesting results. And there is a skill to it. If it is too big, if there are too many images, the results will be too good and the quirks and oddities that make it an interesting medium to explore will disappear. If it is too small it will not have enough information and become flummoxed, either producing nothing or one or two variations from the training set again and again. Working in this way, machine learning becomes a process. I would build models, look at the results and then adjust and change what I was photographing, seeking out certain types or colours of tulips in order for the eventual output to be balanced and interesting.

Also necessary in order for the dataset to work in the way that I wanted it was to invent categories and add labels to each of the photographs - what colour for example, what type of tulip, how striped it was, whether it was a bud or dying - in order for the algorithm to understand what is in each image. This project, linking back to how botanical taxonomy has always been a way of collapsing and ordering the world, also emphasises ideas around objectivity and subjectivity in science. I created an idiosyncratic system, one that was entirely constructed by me, and this humanness was something that I wanted to emphasize. In the installation version of the dataset, *Myriad (Tulips),* (the 'real' dataset, the dataset that is used by the algorithm, is a numpy array constructed of 0s and 1s), thousands of handwritten photos are hung in a grid. It is easy to forget in the digital age that information is physical; by placing things back into the real world people can start to comprehend aspects about the data that they did not before. Attention is drawn to the act of categorisation by handwriting each of the labels onto the photographs. These labels show the shifting of these categories even as I wrote them, with words crossed out as I changed my mind - it is hard to decide when a flower is on a boundary, whether it is pale pink or white, red or orange - adjusting according to the time of day, mood, what I had seen before.

But despite all of this apparent control - the labelling, the careful placement of the tulip in the centre of each image, the hours I would spend checking everything - I never could be certain exactly what the model would produce. I could guess, but I would never know. And in this way, it does feel a bit like gardening, or perhaps growing a plant: you have an idea of what it will look like after it germinates and grows, you allowing something (water, light) to work on it, but the outcome, the actual flower or plant will always be individual, unique and something that can never really be anticipated.

JMC: Looking again at your photographs of flowers and their subsequent second life in the formalised artworks gives this new media gave me an underpinning in archeology about older forms of taxonomic organisation, beginning with observation, moving to accompaniment with identification, and culminating in thoughtful reflection. How do you feel about the role of the tulips, and plants in general, as possessing planned and reliable effects in the projection of autonomous agents, such as artists and agencies, in the places where we experience art? In the realm of the type of coding you do, do plants in any way challenge the process of digitization? Or do "intelligent machines" play a role in creating a sort of "language" for plant communication that, until recently, would only have been granted to humans and perhaps animals, who, while they cannot speak, possess the clearly visible self-activity? Before the humanization of society through the Enlightenment – for example in the work of Novalis and Romantic painters such as Caspar David Friedrich who elevated

Anna Ridler
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Process shot of creating *Myriad* and *Mosaic Virus (tulips)*; 2018; image courtesy of artist © Anna Ridler

Anna Ridler and Caroline Sinders
Detail of dataset of Cypress Trees; C-type digital prints; 2020; courtesy of artist© Anna Ridler

the plant-scape to a respectable form of art – plants were considered to possess souls and sentiency. How does the invisible machinery of programming language bring plants back into this type of consideration (if you think it does)? Or does the extraction of organic dimensionality expel the conceptualized spirit, and create a wholly new type of artefact?

AR: This brings up real questions as to what intelligence is. In some sense, plants use the same basic mechanisms that our nervous systems do, they react to stimulus - pain, light - and can send signals to other parts of itself. Does this constitute consciousness or intelligence? It is very different, in terms of complexity and reason-

ing from our brains, but then, there are brains that exist amongst animals that are radically different from our own and what we are used to. Working with machine learning, and by extension artificial intelligence, brings this question to the fore - will we be able to recognise a consciousness that is different from our own? Deep Learning, a branch of machine learning, is the use of neural nets, a class of functions that is constructed from a sequence of linear or nonlinear operations and is loosely inspired by the physiology of the human brain (although many biologists dispute this approximation). Generative Adversarial Networks (GANS), the type of networks I most commonly use in my work, fall into this category. Artificial Intelligence, as Alan Turing defines it, is getting a computer to think like a human - but this has not happened yet. These systems are not intelligent if we mean intelligence to be intelligence like ours.

When a GAN or other system is constructing an image of a tulip say, it is not trying to reproduce what we think of as a tulip. Any knowledge of tulip photographs has been distilled into a set of synaptic weights that a human would never be able to understand. It blindly generates from these weights - an abstraction of the 2D visual form of the tulip. However, this is not to say that I think of working in this way as being merely algorithmic, a known input and a desired output: there is too much mystery for it to be just that. It is usually impossible to understand why exactly these systems act in the way that they do. One of the major objections that scientists have to deep neural networks is that despite their impressive results, they are black boxes where it is not clear how any one component of the systems contributes to the overall results. Indeed it is not clear if the goals of interpretability and explainability and high performance can ever be reconciled. For example, when I was initially creating the tulip dataset, I was photographing a balance of all of the different colours of tulips. However, the images that were being produced by the model after it was fed all of this information were overwhelmingly red. No one knows why, but that type of architecture will always want to produce very bright colours (one of the reasons that a GAN-aesthetic can seem quite garish). There are still so many things that we do not understand.

JMC: On the other hand, in Alex Garland's *Annihilation* (2018), the flora defies any type of scientific model or analysis. The only member of the team of women scientists who successfully copes with the leaves and blossoms that begin to subsume her own genetic make-up does so by yielding. There's an early scene in Annihilation in which biologist Lena (Natalie Portman) examines a cluster of kaleidoscopically mutated flowers. "They're growing from the same branch structure, so it has to be the same species", she murmurs. "You'd sure as hell call it a pathology if you saw this in a human". Yet when the physicist Jose (Tessa Thompson) sprouts leaves and twigs from her arms and wanders into the forest to become a tree herself, the scene is tranquil and moving. Are there aspects of botany that cannot be quantified by formulas or taxonomic classification?

AR: From a formal, scientific view, it is clear that there are still many things that slip through the current systems of classifying things in both botany and also the wider natural world, particularly around algorithmic classification. As mentioned before, algorithms are only as good as the data they have been trained on. This means that they work on species that are known. However, there is a huge number of living organisms - plants, animals, etc. - that have yet to be formally described by science which makes it difficult for them to be detected or classified by current systems. The taxonomy of living things, which describes relationships between organisms, has been created and refined overtime is based on grouping distinct species. This usually correlates well with their visual appearance but not always and there are

cases where things that are somewhat far apart on the tree of life can look similar, which could 'confuse" an algorithm into thinking that they are more closely related than they are. I think, perhaps, there is a tendency to think that algorithmic or computational classification is better or more accurate than that of humans but there are still gaps where it will fail. Algorithms, for example, find it difficult to differentiate between crows or ravens, but this is something that humans can easily infer.

Classification, even within scientific processes, is not infallible. Although it is a human tendency to divide things into discrete categories, this does not necessarily mean that it is possible to do so in an accurate manner - different people privilege different things. This is why I am also drawn, perhaps, to more idiosyncratic or non-utilitarian systems of categorisation, which reflect the subjectivity and preferences of the person who created them - from John Wilikin's 17th-century classification scheme of the world (which had 40 categories including God, diseases, and stone) through to the Borges response to it (a fictional ancient list that instructs how to classify animals into fourteen broad categories: animals that are the property of the emperor, animals that look like flies from a distance, mermaids, animals are tame, and those simply not listed). It draws attention to and ridicules the arbitrariness and cultural specificity of any attempt to categorize the world, and the difficulty of trying to do so. Everything, ultimately, is subjective.

JMC: Botany and women are having an insurgent moment in film, and I wanted to know if you see a connection between this trend, your work, and the vector of disaster capitalism that has been so catastrophic for the health and wellbeing of women. In both Sofia Coppola's remake of *The Beguiled* (2017) and Paul Thomas Anderson's *Phantom Thread* (2017), compelling women characters harness their botanical knowledge to protect, avenge, or injure. Killer plants offer a vision of how masculine aggression can be countered with weaponized domesticity. This makes them the perfect foil for the cliché of the docile feminine which *All Her Beautiful Green Remains In Tears* interrogates.

Could you explain a little bit about your 2018 collaboration with Amy Cutler *All Her Beautiful Green Remains In Tears*? What surprises did the "consciousness" of the neural network informed by romance novels produce? Was the coherence seamless or jarring, or more like the sporadic profundity of the Oracle from *Battlestar Galactica*? What would the impressions of a viewer who knew nothing either about the Disney source material or the programming language of the new narrator gather from this project?

AR: *All Her Beautiful Green Remains In Tears,* a film created by Amy Cutler in which archival nature documentary footage that was mediated through a number of different machine learning tools, is a way of exploring and subverting genre, language, and categories. She constructed the film from repurposed footage from Walt Disney's 1951 nature documentary series *Nature's Half Acre*, with its analogies to post-war suburbia: squeezing the wilderness into the shape of the domestic. It is also, in a way, informed by the content of 14 million romance novels, which also rely on the same tropes and symbols of traditional gender roles and societal conformity. This linking of nature to romance is not new - even the phrase 'the birds and the bees' brings together these two ideas together, sanitising and making both seem more palatable - but by joining these two genres as source material, the film hoped to emphasise this hegemony and also, at the same time, through the process, break it.

I worked with the machine learning systems. Stills from the footage were first fed into a machine learning model trained on closed captioning, which described what was in the image. These initial results reflect the type of programmes that tend to have closed captioning and nature was often coded back into the domestic - cat-

erpillars become cakes, mountains become mountains on a tv screen - because of the probable lack of natural scenes in the original training data. These captions were then used as prompts on a separate network that had been trained on the romance novels, generating a separate different response that seems more emotional and fantastical. Reams of scripts were produced, up to half a page per still, and a large part of the project involved Amy distilling this down into the narrative that then drives the film. The script was read out in the final soundtrack by a separate neural net, trained on my own voice to create synthetic utterances. Even here there is both a collapse and solidifying of language and meaning: the 'tears' of the title was ambiguous when written down and could have been either tears as in rupture or tears as in crying, similarly 'remains' could have either been a noun or a verb.

Because the eventual output was removed from the original image, surprises that occurred through this process: "the colour of roses [that] clung to my skin', 'a view of a pink lighting hanging from a tree'. The shape of the film changed throughout the process - it was not pre-formed but responded to the interesting and unexpected. The unusual and chance phrases or images which surface inevitably lead in particular directions; this way of working balances creative decisions with unexpected associations and movements in the narrative. Some things had to be cut: most footage with insects as there was little recognition in either of the models (the closest it came was to describe something as "a cake in the shape of an insect" rather than an insect itself). It becomes a process – looping between humans and the machine - to construct a story and narrative – suggesting but not choosing. If there is no knowledge of how the film was made some of the questions that we were each interested in exploring - what happens when stock footage of nature is recut and reprocessed through these very failable systems, what messages does it carry, what gets lost - might not be as clear, but others, such around the romantic anthropomorphism of nature, still remain.

The unusual and chance phrases or images which surface inevitably lead in particular directions; this way of working balances creative decisions with unexpected associations and movements in the narrative.

JMC: A system structured around machine learning to produce artwork offers a controlled microcosm of the world we now live in, where algorithms predict our behaviour, tracking everything from search words to our physical movements. Do you find that one interpretation of your work could be that, just as outside it, human behaviour has a profound effect on an environment that we share with other living organisms?

AR: Building these models in the way that I choose to do - from the dataset through to the algorithms - allows me to create my own world, but also the choice of what to do with that world. I try to use technologies that might have been designed for specific commercial reasons to do something very different. Something I am very conscious of is that although this is a constructed, digital world that exists on a hard drive, it does mean that the creation of it did not impact the real, physical one. There is always an interplay. The model is physical and exists in the real world. I am also highly conscious that by choosing to use this technology - from the artificial intelligence that created the moving image pieces that has the potential to generate infinite flowers to the enormous distributed network that sits behind Ethereum is used - that these materials use an incredible amount of energy. To make *Bloemenveiling,* for example, I used a few supercomputers worth of computational power to build something about as fast as a cell phone from the '90s. I've spent months running something for Mosaic Virus that can now create perfect simulacra of nature, whilst all the time using up the natural resources in order to create it. I physically feel a change in temperature in my studio when I make a model because of the amount of energy that is being used by the GPU. AI systems are part of nearly every aspect of an individuals' life, in visible and invisible ways. With the creation of new tools, it's never been easier to make products or even art with AI. We're now entering a period similar to fast fashion, where the use of ML feels almost disposable, without the consideration of consequence of use. This is why it's so important to understand the environmental impact of technology and AI and their links to capitalism. And to reiterate the parallel between botany and machine learning: in the former, the urge to understand and bring back ultimately has led to the destruction of the object in question; I worry this will also happen with this technology, the power, and resources that it uses might lead to unknown, unintended consequences.

JMC: Do you have any unrealized projects – dream projects that have been too big or too small to yet be realized? What are you currently working on?

AR: My current research, due to be shown in Ars Electronica in 2021, is very much around machine learning's impacts and ecological footprint. As part of this commission, which I am collaborating with Caroline Sinders on, we will be exploring deforestation and the politics of climate change, memory, and loss. We are in a climate crisis that is entwined with a series of other crises. I want to pull out the expectations, histories, traces, and contexts that AI has within this - for example, there has long been a collaboration between big tech, specifically machine learning, and big oil (some of the earliest test cases for deep learning have been in the oil industries; there is an ongoing debate amongst technology companies as to how involved they should be in fossil fuels). By bringing back this history out, I want to emphasise the socio-technical powers that AI has emerged from.

A large part of the project will be to build a dataset of a specific type of tree, the Bald Cypress, often considered to be a symbol of the swamps in the American South, which would then be used to create a machine learning generated moving image piece. Bald Cypresses are trees that can live thousands of years (the oldest in North Carolina is believed to be over 2,600 years old) but are currently considered 'threatened'. There will be something quite nice about the difficulty of doing this for these types of tree which is at risk, recording it as much as we can - this can play into a wider conversation about what ends up in datasets are things that are easy to find, and how this becomes the norm. As artists, we both measure and take stock of how much work, research, ephemera goes into our practice, and we've tried to make those processes readable to others. In this case, we keep returning to the 'cost' of tech-based art- the cost in terms of labor, black boxes, and environmental impact. Can AI be sustainable, and how? It has the potential to do a great amount of good but also great harm in society- we hope to make visible these hidden costs in our work and a better way of working found.

Anna Ridler is an artist and researcher who lives and works in London. She is interested in systems of knowledge, with a desire to know and to make this process of knowing available. She works with new technologies, exploring how they are created in order to better understand society and the world. Her process often involves working with collections of information or data, particularly self-generated data sets, to create new and unusual narratives in a variety of mediums and how new technologies, such as machine learning, can be used to translate them to an audience. Ridler holds an MA from the Royal College of Art and a BA from Oxford University. Her work has been exhibited widely at cultural institutions worldwide including the Victoria and Albert Museum, the Barbican Centre, Centre Pompidou, HeK Basel, The Photographers' Gallery, the ZKM Karlsruhe, and Ars Electronica.

Jean Marie Carey has a PhD in art history and Germanistik and is a current U.S.-Norway Fulbright postdoctoral fellow as well as a research appointee through the Marie Sklodowska Curie Actions at the Universitetet i Stavanger Arkeologisk Museum in Stavanger, Norway. Carey studies conceptualisations of interspecies utopias as they are visualised in prehistoric art and the work of Franz Marc.