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Walking with the digital: *Heartlands – 'Ere Be Dragons* and *A Conversation Between Trees*

Introduction

An increasing reliance on technologically-mediated forms of experience is an aspect of Western modernity that has been heavily criticised in environmental discourse. Jerry Mander, writing in 1978, suggested that as we have moved into 'artificial environments', particularly in our viewing of the world through the medium of television, 'our direct contact with and knowledge of the planet has been snapped'.[1] This critical stance has been perpetuated in responses to the development of more recent digital technologies. Richard Louv, for example, argues in *Last Child in the Woods* that those who have grown up in the digital age have traded the richness of sensory life for a 'daily immersion in indirect, technological experience' leaving them susceptible to a 'nature deficit disorder'.[2] These concerns have also permeated other forms of environmentally-oriented literature, especially those whose primary mode of exploration is walking. In *Common Ground*, the nature writer Rob Cowen contrasts the practice of walking out into the rural edges of an urban environment to experience 'the rhythms of land and nature', with an ever-more indoor-based participation in a technologically-produced and mediated world: 'Clouds [i.e. 'cloud' data storage], hyper-real TV shows, 3D films, multiplayer games, online stores and social media networks – these are today's areas of common ground […]. Ours is a world growing yet shrinking, connected yet isolated, all-knowing but without knowledge'.[3]

Perspectives such as these perpetuate a long-standing binary division between nature and 'technology' (a term often used as an indiscriminate catch-all for the vast range of different applications of technology in contemporary society). As Sid Dobrin notes, 'technology writ large is cast as a primary origin of environmental crisis, the very kind of situation against which much ecocritical research works'.[4] However, he argues that maintaining 'reductive binaries in our current cultural, economic, environmental, and technological situation is no longer realistic.'[5] At the same time, there is a concern among ecocritics that existing cultural forms such as literature lack the capacity to respond adequately to the spatial and temporal scales involved in the growing environmental crisis, to the extent that Timothy Clark questions whether 'certain limits of the human imagination, artistic representation and the capacity of understanding [are] now being reached'.[6] It is, at least in part, as a result of this anxiety that ecocriticism is showing an increasing interest in

digital technologies and applications, particularly in their potential to offer new ways to engage with the cognitive and imaginative challenges of the Anthropocene. A field of 'digital environmental humanities' is emerging, as evidenced, for example, by special issues of the journals *Green Letters* and *Ecozon@,* focused, respectively, on 'Digital Environments' and 'Green Computer and Video Games'. While expressing understandable caution around the materiality of technological equipment in terms of its sources and disposal, and thus an awareness of the ways in which 'games and gamers may be complicit in, or at least uncomfortably close to, legitimating unsustainable practices at a political or sociological level',[7] these studies have begun to explore the potential of digital environments for fostering ecologically-oriented sensibilities. Alenda Chang suggests that, while no substitute for direct experience, game environments 'can offer a compelling way to reconcile a deep connection to nature and the nonhuman world with an equally important connection to technology and the virtual', and John Parham argues that computer games can assist in 'constituting or shaping environmental or ecological awareness'.[8]

This engagement with the environment through digital technologies has not been restricted to game design. Recent developments include an array of mobile, wearable and even implanted technologies that allow us to envisage a wider range of relationships between the ecological and the digital and the embodied and the virtual. In terms of the latter in particular, the notion of the virtual as separate from the physical environment is perhaps being replaced by understandings of more complex relationships, where the two are interwoven and juxtaposed in various ways. Sensing and geo-spatial (satellite and locative) technologies and complex climate modelling systems provide us with the opportunity to capture the data that underpins our scientific understanding of contemporary climate change.[9] Increasingly these technologies are being developed within citizen science contexts and in collaboration with environmentally-engaged artists. In this way, they can be used to engage non-scientists in ecological discourse and in participatory and community sensing activities, for example, helping communities to capture data on local water quality and pollution levels. Artists such as Active Ingredient, Duncan Speakman, Proboscis, Christian Nold, Wapke Feenstra, and Andrea Polli all look to digital, interactive and data-driven technologies to explore environmental questions in new ways, often linking their explorations with walking, and producing works that confront, inhabit and disrupt the kind of binaries surrounding nature and technology that are prevalent in existing environmental discourse.[10] What, then,

are the specific ways in which digital artworks such as these might assist in the development of greater ecological awareness?

This chapter presents a case study of two artworks created by Active Ingredient – the game-based *Heartlands – 'Ere be Dragons* and, in a fuller discussion, the multi-stranded artwork *A Conversation Between Trees* – assessing their potential for engaging and extending the ecological imagination. Active Ingredient are an arts collective founded in 1996 by Rachel Jacobs, Matt Watkins, Gareth Howell and Zini Pandya. The artists came from a background of interdisciplinary performance, visual and participatory art, at a time when the Internet was just beginning to influence the contemporary arts world.[11] In parallel, notions of sci-art and interactive art provided the impetus for increasing opportunities for collaborations between artists, scientists and technologists.[12] In 2005, Active Ingredient began a long-term collaboration with computer scientists from the Mixed Reality Lab at the University of Nottingham. Their first collaboration involved creating an early example of a locative mobile phone game – *Heartlands* – exploring how interactive and networked technologies can help us make sense of our bodies as we walk and explore different environments. The game was played in a range of locations, on urban streets in cities around the world, including Nottingham, Cambridge, Paris, Sao Paulo, Singapore and Yokohama (as well as a forest in Finland), and used mobile and sensor technology – GPS (global satellite positioning) and heart rate monitors – to mediate the players' sensory experience of the world around them. This process ultimately provided the creators of the game with a more complex understanding of how these technologies might be used in their subsequent multi-faceted piece *A Conversation Between Trees* (*ACBT*) (2011-12) in order to initiate an ecological discourse around forest environments and climate change. *ACBT* combined using environmental sensors placed in geographically-distant forests, gallery-based projected visualisations of this live sensor data, a 'climate machine' that created images of historical global CO2 levels, and a forest walk taken by participants carrying mobile technologies. Where *ACBT* in particular differed from other mixed reality, locative, networked experiences such as Blast Theory's locative artwork *Uncle Roy All Around You* or the commercial augmented reality game *Pokémon GO* was in its attempt to point back to an ecological, emotional and aesthetic understanding of the physical environment – in this case of forests.[13]

The ecocritics Stefanie Posthumus and Stéfan Sinclair point out that the initial logo for the Association for the Study of Literature and Environment featured a person sitting at the foot of a tree, reading a book, and they comment, 'The idea behind the image is that by

going outdoors to read, the literary scholar can begin closing the gap between the written word and the physical world'.[14] They compare this image with the Kindle logo and question whether the acts of reading a text in a book or on an electronic tablet while sitting under a tree 'represent different digital ecologies'.[15] At the heart of this chapter are the questions, what happens when our 'text' becomes a mediated, technological experience we take on a walk with us, combining it with more 'direct' sensory experience of the world? What kinds of 'ecologies' emerge from such an activity? Our investigation is augmented and enhanced by the inclusion of audience/participant responses to *ACBT*.

1. *Heartlands – 'Ere Be Dragons*

Heartlands invited participants carrying smart mobile phones to go on a 60 minute walk through an urban environment without thinking about a destination. It focused specifically on the players' individual and collective responses to walking through a city, capturing their heart rate and overlaying this data onto a map of the external landscape they were navigating. The game was instantiated by four forms of technology: an early smart phone with an embedded screen that showed the game interface; the player's heart rate captured using a heart rate monitor attached to the phone; a GPS unit also attached to the phone that tracked the player's location as they walked; and networked play – using GPRS (General Packet Radio Service) internet on the phone – to enable different players to track each other's locations. A visualisation of all the players' locations and heart rate was also overlaid onto a map of the city that was projected at a central venue, so that spectators could watch as the multi-player game unfolded.

The aim of the game was to maintain a 'healthy' heart rate whilst exploring as much of the environment as possible over one hour, in order to create a digitally rendered abstract map of the player's 'world' on the screen of the phone. The target heart rate for individual players was established through an equation, suggested by health scientists with whom Active Ingredient collaborated at the planning stage, which calculated the optimum average heart rate based on the age of the players. As the player walked, a path appeared on the screen that followed the direction the player was walking in the real world. When the player's heart rate was at an optimum level, this path appeared as a green meadow with flowers; when their heart rate was too high it turned into a forest of dark, shadowy trees; and when it went too low it turned to desert, complete with skulls and cactus. Players scored points based on whether the heart rate was at an optimum level for their age and on the distance they had

walked, represented by the amount of 'meadowed' path they had created. Additionally, the multiplayer element revealed the paths the other players had created, which appeared on the screen as small white 'ghost' trails. If a player followed the ghost paths of the other players – by following them in the real world – they could 'steal' the virtual world of the player, turning the ghost path into their own path and taking points from the other player at the same time.

[Figure 1, *Heartlands*]

Central to *Heartlands* is the concept of *paidia* – freeform, exuberant play – which contrasts with the more rule-based and structured forms of play often found in digital games, particularly those focused on health and well-being.[16] These features of 'open play', or 'ludic design', aim to encourage curiosity, exploration, reflection and ambiguity, all of which might help to foster a greater attentiveness in the players to both the physical and the virtual environments and to the embodied interactions between the two.[17] The game also involves elements of 'rhetorical play', a form that involves three modes of interaction based on Aristotle's modes of persuasion – logos (logic), ethos (credibility) and pathos (empathy) – modes that can potentially help to shape how the players think about their beliefs, behaviours and identities.[18] By designing a game that allows the players to explore freely – to choose whether to compete with others or simply to reflect on the landscape, their heart rate, and the map they are creating – opportunities are generated for discourse across these modes of interaction. It is not only through the strand of possible empathy (pathos) involved in the decision-making process about whether or not to behave competitively that the affective dimension of *Heartlands* emerges: the heart rate sensors reveal in the virtual space the physiological effects of both the players' level of exertion *and* the landscape's affective impact upon them, with their heart rate rising as they enter particular areas. This establishes a deep and multi-faceted level of connection between player and environment (ethos). Feedback from the participants showed many of them beginning to weave their own situated narratives (logos) around why their heart rate was rising in certain places. One participant noted, 'I tried to make a mental connection to the world I was creating (with the heart rate data) and the real world around me. It was a new and interesting experience', while another commented, 'I found it interesting to see a world being mapped out based on my physical movements'.

The combination of these different modes of engagement suggests that the game can be viewed in terms of Gordon Calleja's concept of 'incorporation' – a term he uses to move beyond notions of player 'immersion' in order to denote 'intensified and internalized blends'

of experiential phenomena.[19] He outlines six dimensions to this model: kinesthetic involvement, spatial involvement, shared involvement, narrative involvement, affective involvement, and ludic involvement.[20] *Heartlands* is notable for the way in which it deploys all of these elements simultaneously in ways that cross between the virtual and the real, blurring the distinction between the two (for example, the way in which the kinaesthetic, affective and narrative involvement are experienced by the participants as they walk through the city streets while at the same time these elements are visualised on their mobile screens and woven into the narrative of the game by means of their heart rate monitors and GPS trackers). Dobrin argues that 'virtual worlds and *digital environments* exceed the representational; they are themselves natures and environments in and with which humans and non-humans forge relationships', and that exploring these worlds and environments presents ecocriticism with a new kind of artefact – one that is 'simultaneously virtual and real'.[21] *Heartlands* perhaps presents a further new kind of artefact for ecocriticism – one that is simultaneously virtual and real not just in terms of the game world itself, but in terms of the juxtaposition and interleaving of the game world with a material environment, in a manner that generates a complex awareness of interconnection that might be seen as intrinsically ecological. The game experience was described by one participant as creating a feeling of being '*happy and stimulated at the end. It was curious, but somehow it made me sort of feel love for everything and everybody around!'*

That said, *Heartlands* is not overtly environmentalist; it does not engage with questions of environmental risk and anthropogenic environmental effects. But as Eugénie Shinkle points out, 'It is not simply as didactic tools or ideological vehicles that digital games can foster political change, but in the way that they open up a space for the emergence of new relations between body, mind and technology'.[22] The imagery for *Heartlands* relies, albeit playfully, on relatively simple environmental tropes – pastoral, meadow landscapes as benign, forests as fearful, and deserts as barren – and as such cannot necessarily be said to disrupt existing (restrictive) cultural constructions of nature. Nevertheless, through its kinaesthetic, spatial, shared, narrative, affective and ludic elements, all of which are linked to its central mode of engagement – walking – and its focus on rendering visible the invisible processes of the human body in terms of fluctuations in heart rate, it does potentially foster a powerful sense of complex embodied relationship between the players and their physical environment, in a manner that might not be available to the players immersed in a purely virtual game environment nor, arguably, a walker simply passing through the city streets.

2. ***A Conversation Between Trees***

In *ACBT*, the artists extended their collaboration to look beyond the urban space – to forests, and to the atmosphere, weather and climate that bind human and non-human together in these often-threatened environments. The work was motivated by the recognition that 'the global and long-term nature of climate change data defies easy or immediate comprehension', and by the conviction that 'by engaging the public in emotional experiences on a human scale, artists may open up new opportunities for analysis and debate'.[23] During a presentation of *Heartlands* at Mobilefest 2009 in Sao Paulo, Brazil, Active Ingredient began a discussion with the festival organisers, Godoy and Hartmann. They discussed how similar sensing and mobile technologies might be used to encourage an awareness of deforestation in Brazil. After some consideration, the British artists felt that they were uncomfortable responding to forests on the other side of the world from where they lived. This position became an important starting point for a dialogue about local and global deforestation and climate change, and the potential for locative, mobile technologies to act as bridges between forests in different parts of the world. Instead of arriving in the Amazon 'armed' with mobile sensing technologies, the artists suggested these technologies might enable different communities in Brazil and the UK to connect to local forests and share the data captured with each other. In doing so, they hoped they could begin to deepen the conversation about deforestation and reveal some of the often invisible environmental changes occurring on local and global scales.

The team initially looked to the Mata Atlântica surrounding Sao Paulo. This Brazilian forest stretches along the coast, but according to SOS Mata Atlântica, has decreased by approximately 93 percent since the 16th century.[24] In England, Active Ingredient focused on Sherwood Forest, which had once surrounded Nottingham where they were based, and of which now, also, only small pockets remain.[25] Together the artists visited the forests, walked, talked, collected data and stories, conducted workshops, and initiated dialogues with local communities and schools, deepening their relationships with both forests and investigating how learning about science, technology and local and global environments could be combined.[26] As the project evolved, the team was augmented by the addition of the Brazilian artist Silvia Leal; a senior climate scientist working at the MET Office UK; and a botanist at Rio de Janeiro Botanical Gardens. The *ABCT* project was thus cumulatively developed through conversations between the artists, technologists, scientists, forest managers and school children in the UK and Brazil, ultimately evolving into a touring exhibition in which

the artists explored ways of 'performing' scientific processes in order to explore meaning-making around the scientific data. The exhibition was presented at MIS (Museo da Imagem e de Som), Sao Paulo; and Sherwood, Rockingham and Haldon forests in the UK, alongside an exchange programme between schools in Nottingham and Rio de Janeiro and community workshops.

The *ACBT* exhibition was made up of four parts. Firstly, temperature, humidity, sound, light, colour, atmospheric pressure and carbon dioxide sensors were connected to a networked mobile phone with a camera, placed on a branch of a tree in the Mata Atlântica and to a series of different trees in the UK forests. Secondly, two projection screens were set up on either side of an exhibition space, showing an animated visualisation of the live data captured from the two trees, respectively, as if they were in conversation with each other. The artists programmed a set of ranges that were applied to each dataset (for example, deciding ranges for freezing, cold, warm and hot temperatures) and made some decisions about how these data ranges might influence the visual interface in terms of colour, form, narrative and metaphor (e.g. cold temperatures between 0-10 degrees centigrade meant small blue dots appeared). Both visualisations appeared as rotating spheres with fronds reminiscent of sea anemones, bromeliad leaves, or unfurling ferns that changed colour, height, diameter, 'wateriness' and movement in response to the live data that was being sent every 60 seconds from the forests. The rotating spheres were formed from the photographs that were taken by a camera on the back of the mobile phone attached to the sensors in the trees. The photograph was turned into a grid that separated the image into squares, and the data coming from the sensors then influenced the way the pixels that made up each square of the photograph appeared within the grid. Whilst testing an early version of the visualisation, the artists watched the data (and the programmed rules that applied the ranges and effects to the abstracted image), with no idea how it would respond. Suddenly the grid became alive: the light extruded the pixels in each square of the grid, so that they appeared like a strange life form that jumped in response to the songs of the birds and the sounds of monkeys in the trees, and glimmered and unfurled in response to the temperature, light and carbon dioxide levels.

[Figure 2. *ACBT* exhibitions, guided and interactive walks]

The third element of the exhibition worked with global and historical data rather than contemporary, localised environmental data. It involved an intriguing wooden 'climate machine' which stood in the centre of the gallery and plotted out circular graphs onto large

discs of recycled paper using a soldering iron to scorch the graphs into the paper. This continued for the whole duration of the exhibition. Each disc represented the carbon dioxide (CO2) levels in the global atmosphere for each year between 1959 and 2011, using data from the Mauna Loa Observatory in Hawaii which has been monitoring and collecting data relating to atmospheric change since the 1950s.[27] Once complete, each disc was hung from the ceiling of the gallery, creating a pathway of fifty-five discs. Visitors could walk along and search through the circular graphs, which increased in diameter as they moved towards the present day, forming ever-increasing circles which reflected increasing rates of CO2.

Finally, in an element of the experience reminiscent of *Heartlands,* visitors were invited to take a mobile phone out into the forest where the exhibition they were attending was being staged, to take part in a guided interactive walk. The phone screen displayed a smaller version of the abstract visualisation projected in the gallery, this time showing only one visualisation, a 'mobile' representation of the data from the forest the visitor was exploring. The photograph was captured by the walkers themselves using the camera on the back of the phones they were carrying which was programmed to take a photograph every ten seconds. As with the earlier work *Heartlands*, there was no pre-determined destination for this walk and visitors could go in any direction. A soundtrack played out a narrative written and voiced by the artists Jacobs and Leal, describing their own sensory and reflective journeys in Sherwood Forest and the Mata Atlântica. As the walkers explored the forest they were invited to make links between the nature of the forest, along with any changes or deforestation they might encounter, and the data visualisations presented on the mobile phone screen and in the gallery exhibition. At the end of the 60 minute walk the visitors were invited to stop where they were in the forest and answer a set of questions that appeared on the screen of the mobile phone. They were asked to decide on a scale of 1-10 what humidity, light, sound and air quality they felt in the forest, with 1 being the lowest level and 10 the highest, capturing these experiential, subjective measurements using their own bodies. For example, for humidity the question prompts suggested that people felt their skin, dug a hole in the ground, and touched the soil and bark of the tree – prompts partly influenced by the artists' interest in notions of sensory geography.[28]

2.1 Visualising data, 'the aesthetics of ecology', and visitor responses

The four elements of *ACBT* – the networked environmental sensors, the projected visualisations of this live sensor data, the climate machine that scorched the recorded global

CO2 data, and the mobile technologies taken on a forest walk – enabled the artists to explore different ways of interpreting and presenting the data. Active Ingredient have previously stated in an essay on the work that 'artists are triggered by the value of a piece of data to frame it in a way that suits their poetic process' which in turn encourages them 'to draw up new futures where we can situate ourselves at the centre of the data,' and in doing so to 'present another way into the aesthetics of ecology'.[29] The visualisations of the data captured in the forests were not truly scientific, despite their use of scientific data. Instead they were shaped by the artists' subjective and 'poetic' interpretations. The artists chose to place the sensors in specific trees that suited their aesthetic and personal relationships to the forest, and at times the data captured in the forest was not live (due to issues with the internet signal deep in the forest). In these cases, data from another day was replayed through the visualisations that appeared in the gallery in order to maintain the 'suspension of disbelief'.

From studies of the visitors' engagement with the scientific data embedded across each element of the exhibition it became clear that the details and accuracy of the data, as long as it was in an expected range, were less important than the ideas and emotions the artwork provoked.[30] One visitor stated,

> I think you were trying to make visual some scientific data that's usually inaccessible to normal people […]. I look at figures and graphs and things and I just have a shut-down […]. I do go on the visual impact first of all and start to investigate any ideas further from that and it is intriguing to see the imagery, [to] get in to the ideas through the imagery.

This response suggests that for some people, formal graphic displays of scientific data are less meaningful or accessible than when the data is mediated through more aesthetic, sometimes metaphoric forms. Likewise, too didactic an approach can also shut down rather than stimulate further engagement with environmental issues. As another visitor noted, 'there is an environmental point, there is a message […] how the climate data has changed over the years, over the past 20 years, for the worst [...]. I certainly don't feel like that the message was the overriding [element], was rammed down my throat at all'.

The gallery-based visualisations, that had so surprised and delighted the artists when trialling the technology, also worked powerfully on the audiences. The visualisation of the tropical forest in Brazil often had more movement, which was connected to higher decibel levels in the forest, and often appeared to show brighter colours and more light, while moments of intense 'wateriness' reflected the tropical rainfall. In contrast, the images

generated by the deciduous forests in England were often smaller in scale, with slower movements and more muted colours (these trees were oaks, an ancient ash and a silver birch). A large number of the visitors said that they could sense the nature of each forest and the differences between the climates, bio-diversity and locations simply from watching the visualisations, expressing their feeling that the forests were revealing themselves through these technological, data driven mediations. Others remarked on the similarities, recognising a 'sort of commonality between forests [...] and the fact that their […] ecosystems are generative natural systems'. The process of gaining insight was described by one visitor as being 'like when [you haven't] got [your] glasses on and everything's blurred and you realise that you're actually looking at trees in a different form'. Many visitors said that the visualisation representing the Brazilian tree looked like it was dancing. These comments are a testament to the power of the work to recalibrate ways of seeing, enabling visitors to experience the trees as vibrant, living beings, each forest distinctive in different ways but brought conceptually together in a manner that helped imaginatively to bridge the great physical distance between the forest locations.

One of the key criticisms of modern society's use of interactive technologies is the way that they speed up our engagement with information and the world.[31] Heather Houser has levelled this critique insightfully and specifically at forms of 'infovis' – artistic visualisations that 'act as an interface between the individual and data sets that are too large, complicated, inaccessible, or tedious for him or her to comprehend' – suggesting that these visualisations typically rely upon speed for their impact.[32] In Houser's view, this element of rapidity also tends to allow the infovis to 'slough off' any accompanying literature that might render more nuanced and more political understandings, leaving 'decision-making and power structures outside of the images' frames' and constructing an audience of 'vessels for input' rather than the more 'active constituencies' envisaged by environmental campaigners.[33] The aesthetic treatments of the data in *ACBT,* though they can be regarded as forms of infovis, saw the artists playing with the theme of temporality in subtle and engaging ways, both in relation to the speeds at which the information was delivered through the medium of the artworks and in terms of representing the multiple timescales at which environmental processes occur. Sometimes the data was revealed immediately and at other times more slowly (at least relative to the length of a visit to the exhibition), for example, while the visualisations on the gallery screens relayed (mostly) live data, the guided walk asked visitors to take time to reflect in the forest, and the climate machine was scaled to

slowly reveal 53 years of data over the course of the two-week exhibition. The effect of the latter was described by one visitor as 'allow[ing] you to condense time and see what is happening in the real world […] across years […] past or future' – an effect they found 'a bit scary' – and by another as 'a really good visual way to see the changes over time'.

The artists also thought deeply about the ways in which the materials used in the exhibition might draw out both physical and metaphorical resonances that could further augment the affective impact of the work. The construction of the climate machine in wood, and the way in which it scorched the circular graphs onto paper, which also produced a burning smell, proved particularly effective in this respect: one visitor commented that 'the elements of the wood are really key […] there's a visual kind of rhyme; it also reminds you that you are within a forest'. The hanging paper discs created by the climate machine also appeared to be a crucial element of the work's impact. Another visitor described the paper as 'a very tactile medium' and recounted wanting to touch it 'because it's so circular […] measured and in order' and enjoying 'seeing into the centre of the circles'; others suggested that the graphs reminded them of tree rings. Again, this element of the work could be seen to be extending the visitors' imaginations, enabling them to make connections between the visualisations of rising CO2 levels and the materiality and long lives of trees. This was certainly an element that the climate scientist involved in the project found to be particularly effective, commenting, 'The fact that you made the CO2 trend from Mauna Loa so evident in something people can relate to, I think was really exciting.' These material and metaphorical 'rhymes' – that reflected the 'poetic process' of the artists – added to the sense of a narrative emerging from the cumulative effect of the gallery elements, and encouraged visitors to create their own narratives as they walked. Some searched out the CO2 levels for their year of birth and discussed why a particular year's circle might have increased more than the other years, or, in the case of a group of children, re-interpreting the narrative through their own performative response: one of the gallery staff at Rufford Country Park observed how 'a group of young boys pretended to do a presentation of the data in front of their parents, saying what they had found out, pointing at the projection while the parents sat on the bench'. Their re-working of the data reflected an embodied learning experience, in which the exhibition, while avoiding overt didacticism, had proved to be both informative and meaningful for these children.

The walk in the actual forest was the culmination of the exhibition, focusing the affective and cognitive impacts of the gallery-based pieces back onto the physical

environment and pushing the walkers to experience 'what data feels like in the forest'.[34] Visitors went on their walk with an already stimulated sense of the animacy of the trees, the distinctive qualities of the geographically-separated forests, and an awareness of rising levels of CO2 in the atmosphere. While a few participants felt that the artists' audio commentary disrupted their sensory experience of walking in the forest, particularly those who walked together in a group, responses from others suggested that this element further changed and expanded their experience of the forest, allowing them to notice elements that they did not normally perceive, such as moisture and temperature. They commented that this phenomenon allowed them to consider the forest as 'a poetic framework or Aura' that 'encouraged [them] to open [their] eyes more, be more susceptible to the details around [them].' The cumulative effect of the exhibition also helped visitors to bridge the imaginative gap between different areas of the world. One described how this induced 'the feeling that I haven't just been to Haldon today, I've experienced another forest, a very long way away'.

2.2 Further thoughts on *ACBT*

There were some issues involved in the creation and reception of *ACBT* that perhaps merit further attention in future projects. The artists felt that 'delivering an emotional engagement while remaining "true" to the authenticity of the scientific data is not a simple matter', though it is undoubtedly a crucial one.[35] As Houser, again, notes in relation to infovis, 'though artists may not themselves generate the data they use, their images must retain a degree of facticity at the same time as they engage audiences affectively, cognitively and ethically'.[36] How great that 'degree of facticity' should be is perhaps debatable. For the artists of *ACBT*, the notion that the data could not always be strictly 'live' (for example, when the internet signal was poor in the forest), was not in itself a major issue as long as the data displayed remained within an expected range. But for the climate scientist, this particular form of artistic licence compromised the accuracy of the information encapsulated in the project: he stated, 'from my personal view it's absolutely fundamental the data is live'.[37] There is a danger that if the scientific data is perceived as having been manipulated for artistic or 'poetic effect' it may lose credibility or even inadvertently play into the discourse of climate change denial.

In fact, as already noted, the manifestations of data throughout the artwork were deliberately ambiguous in multiple ways, from delivering artistic impressions rather than charts, to burning what looked like scientific graphs onto paper. As Houser, again, argues, too certain a sense of 'transparency' in relation to data – the assumption that 'raw data' is 'inscrutable and affectively neutral' unless visualised – may shut down valuable processes of

enquiry into the 'making' of that data itself, rendering its consumers passive, uncritical, and distanced from its source.[38] *ACBT*'s ambiguous or poetic uses of data were strategies designed to foster questions rather than give answers, and make space for, rather than close down, further interpretation. The artists felt, ultimately, that their interpretations created an interesting tension around the authenticity of the data, particularly in reference to controversies around veracity and uncertainty in climate science and the spread of misinformation through digital communications. *ACBT* deliberately played with these issues of authenticity, in order to stimulate questions around, and focus visitors' attention on, the 'live' experience of being in the forest. There was some evidence for the success of this approach: as one visitor noted, "In some ways the artist is trying to make people who come to see it make their own judgment, make their own interpretation of what they see".

It is a moot point as to whether this openness to interpretation drove participants to consider their own implication and culpability in relation to the climate change data they encountered – another criticism Houser levels at infovis, which often fails to 'invite the viewer to see him- or herself as complicit in the real-world processes under investigation'.[39] However, for one visitor this was a positive aspect: "I don't think you've touched on how our behaviour might affect climate change and I think in a way that's quite a good thing because people don't necessarily come and engage in these type of exhibitions and then be […] 'guilted' into changing behaviour." The inference here is perhaps that the immersive and affective elements might function more effectively to cause participants to reflect on their own behaviours than externally imposed feelings of responsibility. While not all of those participants who responded were positive about the exhibition or fully understanding of issues of climate change, several, as we have seen, attested to the ways in which the experience of *ACBT* expanded their opportunities to have conversations about climate change and develop an emotional engagement with and awareness of, environmental questions.[40] In this respect, the feature of *ACBT* in which participants were themselves asked to become sensors and enact the process of data capture was a valuable addition; while the photographic element inevitably drove the visitors' attention towards their mobile phone screen every ten seconds, it did so with the effect of getting them to re-appraise the environment through the lens of their own focused sensory perceptions. This experience appeared to situate the walkers 'within' the data, so that they could connect emotionally and viscerally to what the scientific data itself might reveal about the forest.

Conclusion

Both of the case studies described in this chapter – Active Ingredient's *Heartlands* and *ACBT* – enabled the participants to engage in a playful, exploratory, technologically-mediated experience of walking through the 'outdoor' environment, the latter also providing the means to directly explore issues of environmental change. The artists' approaches encouraged responses to environmental issues that were embodied and questioning, fostering an emotional engagement with data rather than taking on an explicitly persuasive or informative role. To return to the anxieties around technological and digital media cited at the beginning of the chapter, neither of these works invites us to withdraw into artificial environments as Mander might have it, nor is the experience they offer 'indirect' in the terms Louv posits, but is one that intrinsically involves a sensory dimension. Rather than removing us from the rhythms of nature, as Cowen fears, they bring to light our involvement in those rhythms and indeed make those rhythms themselves more evident through their visualisations.

Perhaps it is not the use of digital technologies *per se* that is the problem here, but the way in which early generations of Internet technologies chained us to our desks and consoles and so encouraged our retreat from the wider environment outside. After all, our non-digital experiences of the environment are often mediated by technologies – we travel on paths, we wear shoes, we carry a map or even a walking stick. Perhaps what is significant about the digital technologies in *Heartlands* and *ACBT,* then, is that they are examples of digital technologies that bring us into, connect us to, and remediate our experience of, the landscape – they are our paths and shoes, or perhaps better, they serve to transform the senses through which we experience the natural world, in a manner that may assist rather than detract from environmental and ecological awareness. Walking is central to both works – a kinetic act that brings home to the participants a valuably embodied sense of what data 'feels like' both in an urban landscape and among the trees of a beleaguered forest. As such, hybrid forms like *Heartlands* and *ACBT* that benefit from the complex interweaving of virtual and real environments, offer the potential to contribute new cultural forms able to engage with the cognitive and imaginative challenges of environmental crisis and climate change.

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1 Jerry Mander, *Four Arguments for the Elimination of Television* (New York: Harper Collins, 2002 [1978]), 51.
2 Richard Louv *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder* (Chapel Hill, NC: Algonquin Books, 2008), 36.
3 Rob Cowen, *Common Ground* (London: Penguin, 2015), 12.
4 Sid Dobrin, 'Introduction: Frontier 2.0' *Green Letters* 18, no. 3, 2014, 203.
5 Ibid., 203.
6 Timothy Clark, *Ecocriticism on the Edge: The Anthropocene as a Threshold Concept* (London: Bloomsbury, 2015), 24.
7 Alenda Chang and John Parham, "Green Computer and Video Games: An Introduction", *Ecozon@* 8, no. 2, 2017, 1.
8 Alenda Chang, "Games as Environmental Texts", *Qui Parle* 19, no. 2, Spring/Summer 2011, 57; John Parham *Green Media and Popular Culture: An Introduction* (London: Palgrave, 2016), 205.
9 See both Peter John Robinson and Ann Henderson-Sellers, *Contemporary Climatology* (London: Routledge, 1999) and Greg O'Hare *et al*, *Weather, Climate and Climate Change: Human Perspectives* (London: Routledge, 2013).
10 http://www.i-am-ai.net; https://duncanspeakman.net; http://proboscis.org.uk/projects/2000-2005/urban-tapestries/; http://www.christiannold.com/#11; (http://www.wapke.nl/wapke.php) (https://sites.google.com/andreapolli.com/main/andrea-polli)
11 See Gabriella Giannachi, *Virtual Theatres: An Introduction* (London: Routledge, 2004).
12 For a discussion of sci-art see Bergit Arends and Devina Thackara, *Experiment: conversations in art and science* (London: Wellcome Trust, 2003). For interactive art, see Stephen Wilson, *Information Arts: Intersections of Art, Science*, *and Technology* (Cambridge MA and London: The MIT Press, 2002).
13 For discussion of *Uncle Roy* see Flintham *et al*., "Uncle Roy all around you: mixing games and theatre on the city streets." In *DiGRA Conference*. 2003; for *Pokémon GO* see Paavilainen *et al.,* "The Pokémon GO experience: A location-based augmented reality mobile game goes mainstream". *Proceedings of the 2017 CHI*

Conference on Human Factors in Computing Systems: 2493-2498; see also Dorward *et al.,* "Pokémon Go: Benefits, Costs and Lessons for the Conservation Movement" *Conservation Letters* 10, no. 1 (2016): 160-165 for the argument that future iterations of the game could increase awareness of, and interaction with, real-world nature.

14 Stephanie Posthumus and Stéfan Sinclair, "Reading environment (s): digital humanities meets ecocriticism", *Green Letters: Studies in Ecocriticism* 18, no. 3 (2014), 254.

15 Ibid., 256.

16 For further discussion of the 'open play' elements of *Heartlands*, see Stephen Boyd Davis, *et al* , "'Ere be dragons: heartfelt gaming", *Digital Creativity* 17, no. 3 (2006): 157-162.

17 For 'ludic design' see William Gaver *et al.,* in "Cultural probes and the value of uncertainty". *Interactions,* vol. 11, no. 5 (2004), 53-56.

18 For 'rhetorical play' see Coulton *et al* "Designing data driven persuasive games to address wicked problems such as climate change", in *Proceedings of the 18th International Academic MindTrek Conference: Media Business, Management, Content & Services*, (ACM, 2014), 185-191.

19 Gordon Calleja, *In-Game: from immersion to incorporation* (Cambridge, MA: MIT Press, 2011), 3.

20 Ibid., 4.

21 Dobrin, 'Introduction', 205.

22 Eugénie Shinkle, "Corporealis Ergo Sum: Affective Response in Digital Games", in *Digital Gameplay: Essays on the Nexus of Game and Gamer*, ed. Nate Garrelts (Jefferson, NC: McFarland, 2005), 33.

23 Rachel Jacobs *et al*., "A Conversation Between Trees: What Data Feels Like In The Forest", *CHI'13. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Paris, France, April 27- May 02, 2013.

24 https://www.sosma.org.br/nossa-causa/a-mata-atlantica/, accessed 26 April 2019.

25 http://sherwoodforest.org.uk/, accessed 26 April 2019.

[26] The workshops were for children from secondary schools in Nottingham and Rio de Janeiro, and involved them capturing scientific data from their local forest and using internet technologies to share information with the children in the country on the other side of the world. For a more detailed account see Rachel Jacobs and Silvia Leal, "Digital Participation Through Artistic Interventions", in *Digital Participation through Social Living Labs,* ed. Michael Dezuanni *et al.* (Cambridge: Chandos Publishing, 2017), 37-54.

[27] Mauna Loa Series, trends in CO2 www.esrl.noaa.gov/gmd/ccgg/trends/, accessed 16 May 2019.

28 In which, 'the sensuous – the experience of the senses – is the ground base on which a wider geographical understanding can be constructed', Paul Rodaway, *Sensuous Geographies: body, sense and place* (London: Routledge, 2002), 3.

29 Steven Rimmer, (Ed.) *Paralelo - Unfolding Narratives: in art, technology and Environment*, Sao Paulo: MIS and Imprensaoficial, 2009.

[30] The artists surveyed the audience perspective through conducting twenty semi-structured interviews that took place immediately after the experience, and through feedback questionnaires that were also made available to all visitors, as is common practice with public exhibitions. The artists opted for an interview rather than a primarily observational approach in order to focus on the visitors' own feelings about the work and to avoid interfering with their experience.

31 See for example, Nicholas Gane, "Speed up or slow down? Social Theory in the information age", *Information, Communication and Society* 9, no. 1, 2006, 20-38

[32] Heather Houser, "The Aesthetics of Environmental Visualizations: More than Information Ecstasy?", *Public Culture* 26, no. 2, 2014, 319.

[33] Ibid., 326-328; 334.

34 Jacobs *et al.,* "*ACBT".*

35 Ibid., n.p.

[36] Houser, "Aesthetics", 320.

37 Jacobs *et al.,* "*ACBT",* n.p.

[38] Houser, "Aesthetics",

[39] Ibid., 321.

[40] See Jacobs *et al.,* "*ACBT"* for a more detailed and substantial account of audience response e.g. one visitor wrote in the questionnaire, "as soon as I walked in, it just, I couldn't see the reasoning behind it, it did nothing for me visually … I couldn't see what it was all about".