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Performing Nature's Footprint

Gabriella Giannachi, Exeter University, UK
Rachel Jacobs, University of Nottingham, UK
Steve Benford, University of Nottingham, UK

The tree, as it builds vertically, continuously searches for equilibrium and carries out, in the number of its branches and the weight and distribution of its leaves, the same analysis of the void as the tightrope-walker with his outstretched arms (Celant 1989: 45)

Over the last five decades we have witnessed the emergence of a growing number of art forms investigating nature and/or the environment. These span from representational art, to land art and social practice, to participatory and interactive art, often utilising ubiquitous computing and aiming at producing more or less immersive experiences, frequently resulting in the generation of what can broadly be described as 'mixed reality' environments (Milgram and Kishino 1994, Benford, et al 2009, and Benford and Giannachi 2011). While in the 1960s, 1970s and 1980s we witnessed the creation of works in which nature appeared as trace, or in which humans effected nature so as to leave a trace, in these mixed reality works, in which nature can be encountered physically but also digitally, physical footprints cohabit with digital, often contextual, footprints – with most of us leaving behind, throughout our lifetimes, a digital trail reflecting our interactions with new and existing services and the contexts in which we use them. Nature is not only, as anthropologist Tim Ingold stated, nature (i.e., 'really natural' nature) and culture (i.e., nature 'as culturally perceived') (Ingold 2000: 41), but also technology (Giannachi 2007), i.e. a nature-computer hybrid. With 'nature' we therefore describe an ecology comprising nature, culture *and* technology, and show how the latter could be considered an impactful factor in the communication of climate change through art.

Nature has always featured prominently in art, whether as representation (e.g., in landscape painting), metaphorically (e.g., in literary texts), formally (e.g., in conceptual art) or at the level of materials. The architect Paolo Portoghesi has shown in his influential *Nature and Architecture* (2000) how most architectural structures mimic natural forms - columns resemble shafts, domes resemble branches, etc (2000: 48-50). Nature, of course, is not so much encountered as produced (Szerzynski et al 2004) and even performed

(Giannachi and Stewart 2006). This means that while nature may exist a-priori of humans, these however cannot define themselves outside of its parameters. The nature/culture/technology ecology is therefore not only how we encounter but also understand nature as well as ourselves within it. In recent years, a number of artists have engaged with these concerns by drawing attention to the very processes at stake in the production, or performance of nature. Artworks were created which started visualising or sonifying processes of manipulation and intervention within nature. Well known examples include David Ash's *Ash Dome* (1977), a ring of twenty-two ash trees near the artist's home in Wales; Joseph Beuys' *7,000 Oaks* (1982), planted between 1982 and 1987 for Documenta 2; and Shelly Sacks' social sculpture project, the *University of the Trees* (2006), a participatory work or 'mobile lab' described as 'flexible framework for social-ecological action' in which the trees are 'our teachers and the ecological crisis is seen as an opportunity for consciousness' (Sacks). What these works share, in their difference, is the exhibition of nature as something constructed by humans, rather than an a-priori, independent from humans.

Land art and the Italian movement arte povera both devised and documented processes of intervention within nature. Interestingly, there are differences between the two. Germano Celant notes that US artists tended towards 'monumental' interventions. A good example is Robert Smithson's *Spiral Jetty* (1970), a 1,500 feet coil built in black basalt rocks located in the Great Salt Lake in Utah. Another example is Michael Heizer's *Double Negative,* a 1,500 feet trench cut into the side of a Meza in the Nevada desert (Celant 1989: 9). On the other hand, European artists, such as the Italian Giuseppe Penone from arte povera and the UK sculptor Richard Long operated at a smaller, more human scale. One of Penone's points of reference is farming (i.e. the manipulation of the land, with all its oral history). He writes with respect to his well-known tree works: 'I was imagining a different density of matter: wood, a hard material, becomes fluid and soft with time. I explored the relationship between the life-time, the breath of the tree and my breath, seen as natural but opposite elements (in Celant 1989: 17). Here, as recently suggested by Nick Kaye, Penone exhibits site as process (Kaye 2000: 150). His manipulation (or farming) of nature is geared toward the exposure of form. He writes: 'all materials preserve the memory of their experience, in their form. The ability to recognise and decipher memory is culture. The memory of a content, of an action, is culture. Sculpture is the revelation of the form of memory' (Penone in Celant 1989: 184). His work on trees is, quite similarly to Samuel Beckett's work on language, a process of reduction: 'To find the form within the material, not to use the material to find the form' (Penone 1996). As Kaye shows, the work 'occurs as *interventions* into unfolding complexes of inter-related biological, organic and inorganic processes, which have implications for the material, space, time and "body" of the work' (2000: 150, original emphasis). Penone documents this very process through photography and writing. The act of witnessing that is implicit in the photographic medium, often involves him, thus visualising the viewpoint from which this culture/ nature production process is seen from.

In other examples of land art, nature is physically removed from a found site (its 'original site') and re-located in a gallery. A good example is offered by Robert Smithson's *Dead Tree* (1969), which consisted of a non-site that re-contextualised a monumental tree from its physical environment to the floor of the Düsseldorf Kunsthalle. Mirrors were inserted among the tree's branches and roots to reflect the viewers and insert them within the installation, so that 'in the context of the Kunsthalle the ordinary tree became "sculpture", an object with mass and weight, which occupied space and existed as a static and "dead" artefact of aesthetic contemplation, a "dialectical object" the meaning of which […] can never be fully contained' (Rugoff 2000: 42). Here, attention is drawn not so much to the production or performance of nature as a nature/culture symbiosis but rather a displacement. Unlike in Penone's work, capturing only the artist's intervention, the viewers themselves are repositioned within this displacement. Yet the implicit doubling, between sites and mirrors, can only but disclose a fragmented relationship – humans here are both included and yet also excluded from the tree's eco-system.

A number of environmental works aimed at cultivating forests, either physically or digitally, as a participatory project. For example, Heather Ackroyd and Dan Harvey's *The Walking Forest* (2009), a time-based artwork, invited participants to collect saplings of oak, hazel, holly, apple, birch and walnut, bring them to the Arnolfini Gallery in Bristol where they would be 'identified, certificated and displayed', and finally distributed and planted out at certain locations within the city. Similarly, Wapke Feenstra's *webxylotheek* (2006), an Anglo Dutch website, consisted of a 'growing tree archive' showing trees of the Pius-harbour area in the Dutch city of Tilburg (NL). In this work, local residents and children from primary schools were invited to 'collect and hand in tree refuse (leaves, flowers, seeds, etc.) from the streets'. The tree refuse was photographed, identified by the biologist Henk Kuiper, and put online. The name of the work itself, 'xylothek' intended to indicate that the work consisted of a collection of wood books: 'each wood book (a book-like box) represents a different tree. The cover is made from the tree's bark, and inside its leaves, seeds, sticks, etc., are stored. From the 16th to the 19th century these books were used as a teaching aid and to describe the different species' (webxylothek). The project's aim was that by 'collecting pictures and traces over a period of a few years the cyclic time of the surroundings is shown to the visitor. *webxylothek* then presents a green cityscape of this part of Tilburg' until the year 2010 (Ibid.). Both *The Walking Forest* and *webxylothek* entail an educational dimension, and both aim to involve the public to create a library of trees. Like Agnes Denes' *Tree Mountain* (1992-6), which consisted of the panting of 11,000 trees by 11,000 people from all over the world on a mountain measuring 420x270x28 near Ylöjärvi, Finland, *The Walking Forest* and *webxylothek* acknowledged that to learn to know nature, this had to be framed as culture. In *Tree Mountain*, for example, the trees are planted in an intricate mathematical pattern derived from a combination of the golden section and a system designed by the artist (Lippard 2007: 42-3), thus showing again, as in Portoghesi's work, the intricate connections between architecture

and nature, between habitus and habitat. Interestingly, *webxylothek* also entailed two further characteristics which are distinctive of a number of works: they emerged from an art/science collaboration (and so were scientifically accurate) and they were developed over a prolonged period of time, giving participants the opportunity to engage in a process rather than offering them an impressionistic snapshot of this process at a given moment in time.

Artists and scientists are increasingly turning to ubiquitous and mobile computing for the exploration of the environment. The Ambient Wood project, for example, was a multi-site project developed through the EPSRC funded Equator project in the UK (2002) by the Universities of Sussex, Bristol, Nottingham and Southampton. The project devised a playful learning experience through which children explored a physical environment that had been augmented digitally. The first Ambient Wood study took place in Sussex where children aged 11-12 worked in pairs in two different woodland habitats to learn about 'distributions and interdependencies'. The experience intended to support 'scientific enquiry, through collaborative learning and encouraging exploration, discovery, hypothesizing, experimentation and reflection'. In Ambient Wood I, pupils were handed a PDA, a probe tool and GPS to explore the habitat by collecting information about moisture and light. They were then asked to go to a den to discuss their findings and generate hypotheses, which would subsequently be tested back in the woodlands. The children's position was recorded via GPS, which allowed for topical information to be passed on to them, such as knowledge about specific living organisms. A periscope allowed them to access information about 'invisible' aspects of the woodland, such as seasonal changes or microscopic beings (Ambient Wood). Interestingly this project allowed for the juxtaposition of real and physical data. This juxtaposition generated a hybrid learning environment in which children could test hypotheses about the environment and experience their consequences. This early work demonstrated that ubiquitous computing could be used to augment environments through data that would otherwise be unperceivable. It also showed the importance of framing, i.e. of defining a separate learning space in which findings could be thought through in a different context.

An artwork using ubiquitous computing was developed by Ryoko Ueoka, Hiroki Kobayashi and Michitaka Hirose from the University of Tokyo. With the title *Wearable Forest* (2008), the work consisted of a 'clothing system that bioacoustically interacts with distant wildlife in a remote forest through a networked remote-controlled speaker and microphone' (Kobayashi et al 2009: 300). This work, according to the authors, was based on the concept of a human-computer biosphere interaction (HCBI) aiming to express 'the unique bioacoustic beauty of nature' and allowing 'users to interact with a forest in real time through a network and acoustically experience a distant forest soundscape, thus merging human beings and nature without great environmental impact' (Ibid.). The piece, which was inspired by Zen Buddhism's view of deep meditation 'to achieve a sense of being at one with nature' (Ibid.), allowed for the creation of a hybrid human-computer that was networked with a subtropical forest of the southern Ryukyu Islands of Japan.

Equipped with embedded speakers, LEDs, an embedded CPU system and a wireless internet connection, the dress played the soundscape of the forest through the speakers and used the LEDs to create patterns reflecting the activity level of forest life. Sensors also let the user transmit pre-recorded acoustic data back to the forest installation, creating what has been described as 'a bioacoustic loop' (Ibid.: 304). Similarly, the team developed a networked bioacoustic streaming and recording system by which environmental sounds in a subtropical forest on Iriomote Island in Japan; moving water in a pond in Tokyo; acqua-music instruments in a Japanese garden in Kyoto; and a street in Mumbai in India, were continuously streamed in real time by networked microphones (Ibid.: 301). Another work, *Botanicalls* (2006-), Rob Faludi, Kate Hartman and Kati London, aimed to provide new ways for plants and humans to interact by allowing plants to place phone calls for help. When plants on the Botanicalls network need water, they call a person and ask for it. *Wearable Forest* and *Botanicalls* allow for the creation of human-computer ecologies, which include nature as an interactive factor and thus facilitate new forms of communication between humans and plants.

Our case study for this paper, *Dark Forest*, comprises a number of elements discussed above. Like early land art and arte povera, it focuses on trees and their biospheres. Like other participatory 'citizen science' projects, it involves scientists and the general public within a framed educational setting. Similarly to a number of locative media environmental works, it adopts ubiquitous computing to establish new forms of communication between trees and remote human communities. Moreover, the work explicitly intended to generate new forms of environmental consciousness.

Devised by the UK-based company Active Ingredient, and supported by The Arts Council of England East Midlands and the RCUK funded Horizon project, *Dark Forest* was devised to comprise 3 phases:

1. Research and development in Sherwood Forest and the Mata Atlântica;
2. Exhibition and online documentation of the project, using a blog and a dedicated website;
3. Schools exchange in Nottingham and Rio de Janeiro.

The work emerged from the company's engagement with 'natural' forms within a technological context. There was a particular interest in forests, which the company thought of as representing the unknown, a hiding space, but also a place for rebellion, somewhere one could lose oneself. In British mythology characters such as Robin Hood live in the forest in order to hide from authority. Other fairy tales involve the playing out of fears through journeys into the forest, e.g., Snow White, Hansel and Gretel and Little Red Riding Hood. Active Ingredient's work *Chemical Garden* (2000-2001) was an installation with 1,000 trees made from salt crystals, creating 'a post-apocalyptic forest' that was inhabited by web-controlled robots. *After Hours* (2006) was an interactive screen-based installation where a bar in Nottingham was

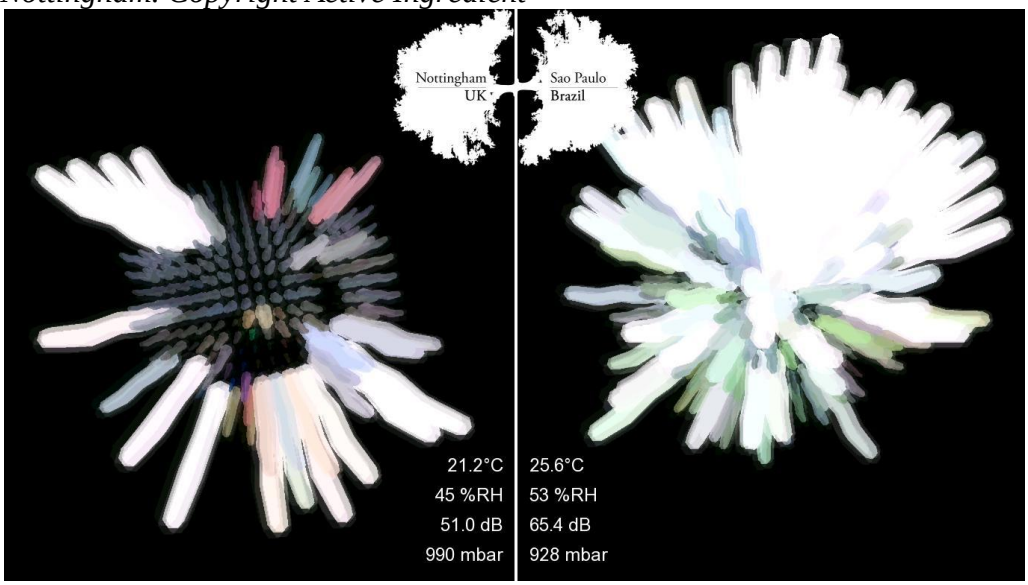
transformed into Sherwood Forest through the amount of movement in the bar. Their touring artwork *Heartlands* (2007) saw the augmentation of a physical landscape on the screen of a mobile phone generated through participants' heart rates which were seen changing as participants explored the physical world around them, so that as their heart rate raised, the augmented world was transformed into a dark forest.

Dark Forest was developed in the aftermath of an invitation to Mobilefest in Brazil to present *Heartlands*. The latter had already raised issues on how journeys through urban environments compared to rural environments. Whilst in São Paulo, the company were originally invited to collaborate on the Mobilefest BR163 Documentary Expedition, which had been developed by Marcelo Godoy through his production company NewTV. The BR163, Brazil's notorious highway joining Cuiaba in the Southern Part of Mato Grosso to Santarem in the state of Para, via some 1,100 miles in the Amazon Forest, is currently unpaved and so impassable during the rain season. However, despite numerous protests expressed by conservationists, the highway is to be paved to facilitate trade in the region. In response to learning about BR163, Active Ingredient developed *Dark Forest*, which aimed at generating a cross-cultural exchange via the exploration of two forests, the temperate Sherwood Forest in Nottingham and the Tropical Mata Atlântica Forest in São Paulo. The piece aimed to look at the same phenomenon within each forest from a number of perspectives (e.g., scientific, artistic, educational) in order to capture the complexity of their response to these environments from a variety of viewpoints.

Active Ingredient chose to investigate the two forests' ecology in terms of their past (cultural habitus), present (natural habitat) and future (changing climate), exploring the past in order to capture how 'we feel when we explore the forests that are here now' (Active Ingredient, Paralelo). This relationship between past, present and future was seen as crucial in the communication of climate change in the two regions.

The aim was to bring together the remote environments of the Mata Atlântica and Sherwood Forest through an exchange between artists, scientists, technologists, and young people in both regions. Myths connected to forests, such 'Saci Pererê' or 'Robin Hood', were revisited, climate scientists, forest managers and a botanist were consulted about data capture and their analysis, and schools chosen as a suitable 'playground' for the experience. The collaboration between disciplines within the context of such distant environments enabled the artists to capture, visualize, and analyze changes in both environments. This was made possible through a live link between environmental sensors (collecting live data based on light, colour, temperature, humidity, decibels and atmospheric pressure) connected to mobile phones that sent the data via an internet connection to a database, that the artists could then use to visualize and interpret as a dynamic 3D sculptural projection (see Figure 1).

Figure 1. *Visualisation of Data between a Tree in São Paulo and a Tree in Nottingham. Copyright Active Ingredient*



This collaboration was extended to work with young people in schools in both regions to explore different ways to interpret these changes in the context of their personal interpretation of the data in terms of past, present and future, and learning about the science. This was achieved by generating a series of animations, performances and sculptures using the data, their bodies and objects found within the forest environments.

The themes that were intended to emerge from the workshops were temporally driven:

present: exploring the present environment of the forest, capturing data in the forest including, e.g. humidity, temperature, atmospheric pressure, decibels, photographs, audio, video, drawings and found objects;

past: discovering information about the history and myths that surround the forest, e.g. stories, images, clues in the present;

future: discussing the future of the forest by imagining the future and posing questions such as: How will the forest survive? How will the sensor data change?

The first phase involved research and development through a collaboration between the company, Mobilefest, newTV and the Mixed Reality Laboratory at the University of Nottingham. The process led to a dialogue between the organizations contrasting and comparing Sherwood Forest and the Mata Atlântica. This resulted in an exhibition as part of Mobilefest 2009 at the Museu da Imagem e Som (MIS) in São Paulo (see Figure 3). The artists were using mobile technology to transfer the data. This was seen conceptually as a conversation between a tree outside the museum in São Paulo and one in Nottingham that visualized the invisible data around the trees. The artists positioned both trees next to each other within the visualization, so that the

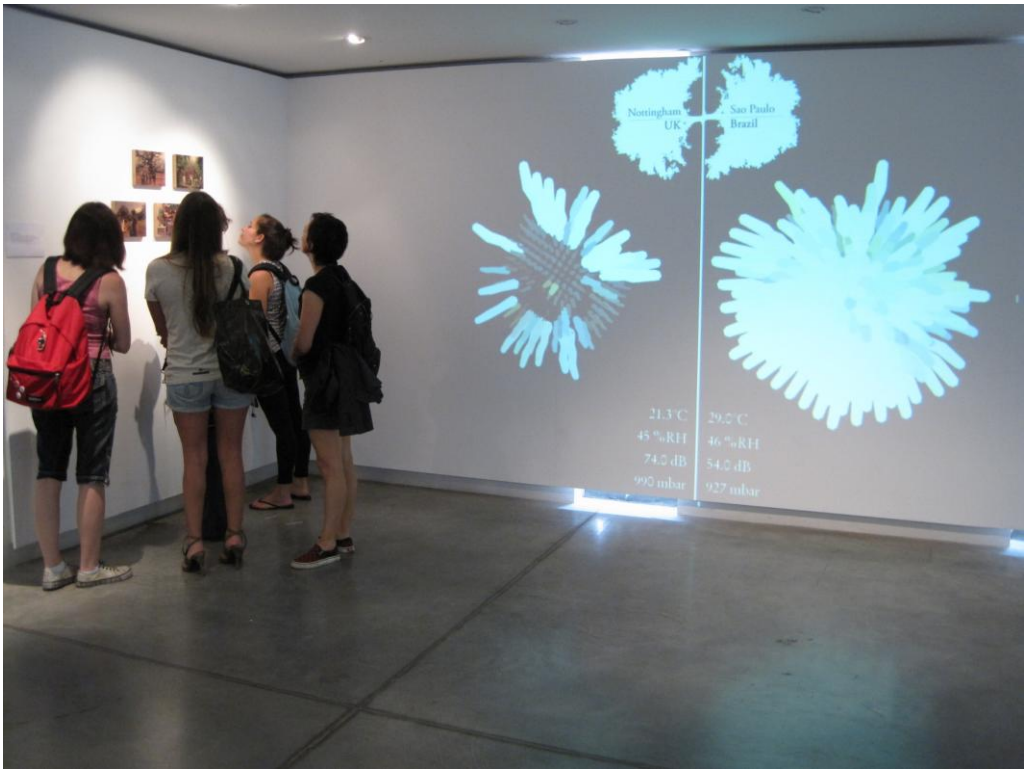
viewer could watch as the dynamic images evolved, to reveal the invisible changes in each environment as a live dialogue (see Figure 1). The difference in scale, brightness and movement within the visualisation was controlled by changes in the light, decibels, humidity and atmospheric pressure around both trees. The background of the image changed as the temperatures rose or decreased, creating an alert by turning red or blue. The work revealed a week in the life of a tree in Nottingham during wintery November, affected by street lamps, rain, cold, grey skies and short days, in contrast, to Spring in São Paulo, with dense green leaves, bright sunshine and intense rain showers, heat and pollution.

The sensor kit was attached to a branch of a tree in the garden of MIS, with the sensors draped like a bromeliad growing deep in the Mata Atlântica (see Figure 2). Audience members, particularly younger audiences, who discovered the tree with the sensor attached, attempted to interact with the sensors shouting at the tree to affect the decibel levels.

Figure 2. *The Sensor Kit attached to a Tree Outside MIS, São Paulo. Copyright Matt Davenport, Active Ingredient*

Discussions about the data occurred between audience members and the artists as they watched the visualization evolve. Both regions appeared to be warmer than expected for that time of year, and both regions experienced flooding during the period of the exhibition, and so the simple visualization of the dialogue between two countries, two sets of trees, two seasons, began to trigger another dialogue about climate change, shared understanding of the environments, distance, time and place.

Figure 3. *Installation at MIS, São Paulo. Copyright Matt Davenport, Active Ingredient*



The second phase of the project involved a collaboration between Active Ingredient and Silvia Leal from Estudio Móvil Experimental and Bruno Rezende Silva from Rio de Janeiro Botanical Gardens, managing workshops and facilitating an exchange between young people in Djanogly Academy in Nottingham and a group of young people in Rio de Janeiro. This time the team worked in Sherwood Forest and the Mata Atlântica (e.g., The Foresta da Tijuca or Tijuca Forest) with mobile sensor kits. As a result of the ongoing collaboration between the artists, scientists and technologist in the UK and Brazil, Active Ingredient led the development of a new installation, which will extend the collaboration with Carlo Buontempo, senior scientist at the Met Office Hadley Centre for Climate Prediction and Research (MOHC).

Since the inception of the project, Active Ingredient felt that as data collection and manipulation was to play a crucial factor within it. The company wrote: 'governments increasingly use statistics and focus groups to form judgements on issues at global and national scale. We as artists (specifically media artists) are using data to inform and create our work' (Active Ingredient, Paralelo). In particular, they noted that truthfulness was not so much a feature of data but rather of their framing. They wrote: 'As we live in increasingly data rich environments, where our very presence in the world generates data on a continuous basis. We must accept its existence and evolve our thinking about how we can manipulate this data for ourselves, see it as a connection between ourselves and everyone in it. We should start to understand it to draw up new

futures where we can situate ourselves at the centre of the data. Know how it works and how it can be interpreted and misinterpreted' (Ibid.). This attention to the framing of data, not only in terms of their management, but also in terms of their interpretation, exhibition and reception, within an interdisciplinary context, is crucial.

We have seen how a number of land art and arte povera artworks fore grounded the tracing of nature as a means to represent the complex symbiotic relationship between humans and the natural environments they inhabit. In these works the traces that represent the effect of one on the other are often re-framed or re-located within a cultural context. This dislocation re-frames this relationship in ways that are culturally and/or aesthetically understandable. In works developed through ubiquitous computing, these traces often appear both in the physical and digital realm. It's important to understand that these are not merely duplications of one another. In other words, physical and digital traces often do not coincide, but rather, like in a cubist painting, offer different perspectives over our environment. Through ubiquitous computing, physical environments are often augmented virtually, and people can experience nature as nature, culture and technology simultaneously precisely because they are offered different viewpoints that sit alongside each other. This juxtaposition between the physical, cultural and technological dimension of nature returns nature as something that is seen to be directly effecting us, however close we may (or may not be) to it. By playing with distance and time, these works address two of the most difficult issues in climate change communication. Traces turn into footprints – not only environmental footprints but also contextual footprints. Thus data is captured that offer invaluable information about a climate that is undergoing a substantial period of change. This suggests that the interpretation of these contextual footprints, generated by our changing relationship with nature, will offer crucial insight into our changing world.

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Bibliography

Active Ingredient, 'Paralelo', unpublished paper.

Ambient Wood, http://www.informatics.sussex.ac.uk/research/groups/interact/projects/Equator/ambient_wood-I.htm, verified March 2010.

Benford, S. Giannachi, G., Koleva, B., and Rodden, T. (2009) 'From Interaction to Trajectories: Designing Coherent Journeys Through User Experiences', Proceedings ACM SIGCHI Conference on Human Factors in Computing Systems (CHI 2009), Boston, MA, April 5-9, 2009, ACM Press.

Benford, S. and Giannachi, G. (2011) *Performing Mixed Reality* Cambridge, Mass. The MITP Press.

Botanicalls http://www.botanicalls.com/ verified April 2010.

Celant, G. (1989) *Penone,* Milano: Electa.

Dark Forest verified http://www.thedarkforest.tv/?page_id=9 April 2010.

Hobbs, R. (ed.) (1981) *Robert Smithson: Sculpture,* Ithaca and London: Cornell University Press.

Ingold, T. (2000) *The Perception of the Environment: Essays in Livelihood, Dwelling and Skill,* London and New York: Routledge.

Giannachi, G. and Stewart, N. (2005) *Performing Nature: Explorations in Ecology and the Arts*, Frankfurt and New York: Peter Lang.

Giannachi, G. (2007) *The Politics of New Media Theatre: Life*®™*,* London and New York: Routledge,

Kaye, N. (2000) *Site-Specific Art: Performance, Place and Documentation,* London and New York: Routledge.

Kobayashi, H., Ueoka, R., Hirose, M. (2009) 'Wearable Forest Clothing System: Beyond Human-Computer Interaction', *Leonardo,* 42:4, August 2009, 300-6.

Lippard, L.R. (ed.) (2007) *Weather Report: Art and Climate Change,* Boulder, Colorado: Boulder Museum of Contemporary Art and EcoArts.

Milgram, P. and Kishino, F. (1994) 'A Taxonomy of Mixed Reality Visual Displays', *IEICE Transactions on Information Systems*, E77-D12, 449-455.

Penone, G. (1996) interview with N. Kaye translated by G. Giannachi, Turin 18 December.

Portoghesi, P. (2000) *Nature and Architcture,* Milano: Skira.

Rugoff, R. (2000) 'Signs and Wonders', *The Greenhouse Effect,* London: Serpentine Gallery, pp. 13-60.

Sacks, S. http://www.universityofthetrees.org/ verified April 2010.

Szerzynski, B., Heim, W., Waterton, C. (2003) *Nature Performed: Environment, Culture and Performance,* Oxford: Blackwell.

Webxylothek, http://www.wapke.nl/projects/detail.php?id=42 verified April 2010.