Performing Data:
Engaging the Public with Climate Data Through Art

The Prediction Machine is a collaboration between Rachel Jacobs, Radar Loughborough University Arts and the Mixed Reality Lab / Horizon, University of Nottingham with Matt Little, Ian Jones (Sherwood Wood), Matthew Gates, Robin Shackford, Dr Candice Howarth from Anglia Ruskin University and Dr Carlo Buontempo from the MET Office UK.

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It is notoriously difficult but increasingly vital to engage the public with complex scientific issues, especially climate change (Lejano et al., 2013: 62). Traditional approaches to public engagement tend towards a focus on behavioural change through distribution of scientific data, scientific information and governmental policy on the one hand (Hulme, 2009), or a reliance on media representations of climate change on the other (Boykoff 2011). In turn, this research can support policy makers in exploring new approaches to engaging the public and communities, one that challenges a more traditional persuasive, behavioural change approach that relies heavily on public understanding of the science (Stilgoe and Wilsdon 2014).

This research investigates how creative strategies can support public engagement with issues of climate change, through an interface between scientists, artists and the public. Artists are increasingly using scientific data within their practices (Rimmer et al. 2009: 64:106, Polli 2011, DiSalvo et al. 2008, Giannachi et al. 2012). These artists are shifting beyond taking an instrumental role and moving away from the creation of 'infographics' as representations of scientific data (Bloom 2011). Many are working with environmental data as a tool or medium to trigger conceptualizations of the environment (Ede 2005; Polli 2011). There is an increasing body of research that explores how artists are working in this space specifically with climate data (Giannachi 2005; Gabrys 2012) suggesting that artists are using strategies that *embody* data within their artworks, encourage *human-scale, intimate, situated, emotional and sensory* experiences of climate data, and that often encourage *dialogue* around the socio-political issues of climate change (Jacobs *et al.* 2012, Bureaud 2011; Bloom 2011; Malina 2009; DiSalvo *et al.* 2009; Aoki 2009). The significance of these approaches are supported by research into the importance of personal and local perceptions of climate change, discussing issues around human's ability to perceive fear, risk and threats and the global and long term nature of climate change (Spence 2011; O'Neill 2009). Curtis *et al.* (Curtis *et al.* 2012) question why so few scientists consider working with artists when they are struggling to communicate climate science to the public, and call for further research.

Performing Data

The concept of *'performing data'* emerged from previous research into how artists engage the public with climate data (Jacobs *et al.* 2012, Blum *et al*, 2013), informed by notions of dialogue, liveness, presence and influenced by the traditions of performance art [4]. Performing Data is defined as:

- Data that can be replayed or experienced live in real time and real physical space
- Data that can be used to create and control sensory, embodied, immersive experiences and mechanical and electronic artefacts, in order to represent a meaningful narrative based experience (replayed or live) of the data
- Data that is remediated as sensory, embodied, immersive and mechanical time-based artworks.

The Performing Data Platform

Ubiquitous digital technologies have the potential to offer mechanisms through which we can attempt to learn a deeper sense of ourselves, and our world. They can help illuminate hidden patterns of social, physical and environmental behaviours, in order to question our assumptions about the world and our situated activities. Such radical and fundamental change in our collective perspectives bring with it profound ethical, artistic and humanistic questions across the sciences and the arts. In turn these provide opportunities for exploring new ways to interpret and investigate scientific data, and our personal relationships with it.

Previous examples of research projects that have begun to explore this territory have typically involved capturing data from ubiquitous technologies and then presenting it to people in creative ways so as to provoke interpretation and drive compelling experiences. A notable example is Horizon's *Day in the Park* project in which bio-data was captured from riders on rollercoasters and other thrilling experiences and was subsequently presented to spectators, to the riders themselves, and sometimes also directly used to control the experience itself. A second key example was Active Ingredient's work *A Conversation Between Trees* in which both live and historic environmental data were presented to visitors to art galleries in material and performing ways, stimulating an emotional engagement with the data. A final example was the *Vicarious* project in which professional film-makers incorporated bio data into promotional films.

The key idea that is now emerging from this body of work is that of *performing data* – rather than visualizing data in conventional ways such as through graphs and statistics: *Through performance the data is revealed to people in various material and embodied ways, sometimes slowly, sometimes, as if live, sometimes in tangible forms, and sometimes by requiring them to enact being sensors.*

Technical Description

The Performing Data Platform is system that allows artists who work with scientific data as a *'live'* stream that is presented and *'performed'* in real time and space.

The core elements of this platform involves:

- An interface and set of APIs to capture scientific data from bio and environmental sensors
- An interface to mediate data offline (through the Vicarious interface)
- An interface to mediate data online to small to medium audiences (through the Timestreams Wordpress plugin)
- APIs to output data to a wide range of visualization software including: Javascript, Unity, Max MSP, Wordpress Blogs, Open GL
- APIs to output data to a wide range of physical and electronic interfaces including: Arduino and Jung
- Tools to broadcast data to large online audiences (through the Pub Nub Data Stream Network)

Who is it for?

The Performing Data Platform has several user bases:

- Experienced programmers to set up the data capture and mediation

- Creative technicians and hackers with programming knowledge to support artists to integrate the data into their 'performing data' artworks
- Artists, designers and hackers with a small amount of programming knowledge to mediate the data as part of their 'performing data' artworks
- Communities and audiences who engage with data, mediated through the artworks

The Research
The goals of the *performing data platform* research is to broaden the impact of this body of work:

A. To create, package and internally release a technical platform for *performing data*, that allows creative practitioners, educators and companies to author and deliver new data-experiences to audiences.
B. To deliver and evaluate a series of high impact, performance-led and in the wild demonstrator projects to show the capabilities of this platform
C. To deliver and evaluate wider impact events reaching out to different creative communities and support them in exploring the potential of the platform.
D. Dissemination to academic, policy makers, NGOs and arts communities as well as the general public.

The Performing Data Team
The Performing Data Platform is being developed by an interdisciplinary team, comprising of HCI researchers, artist/researchers and creative technicians.

Alongside this core team additional collaborations are occurring with other artists, climate scientists, engineers, public venues (such as Hastings Pier, Radar Arts Loughborough University, Loughborough Library, FACT) and other institutions including Middlesex University, Anglia Ruskin University and Lancaster University.

Outputs
The outputs of *The Performing Data Platform* features work by the artists Brendan Walker, Rachel Jacobs, Diane Wiltshire and Caroline Locke.

A series of workshops, talks and events will take place alongside the artists work including a one-day event at Hastings Pier, a workshop as part of Tropixel Festival, Brazil and a lab event and exhibition at FACT, Liverpool.

The Prediction Machine

The Prediction Machine is an interactive artwork based on 'end of the pier' fortune telling machines. The machine prints out predictions based on a mixture of scientific and experiential data. The artwork is presented as a public exhibition to tour to different urban and rural locations in the UK.

Moments of climate change are tracked and recorded at a local weather station and sent to the machine, using the *Performing Data Platform* to capture, mediate and output the data. The machine shows a visualisation of the live weather data – temperature, precipitation and windspeed - combined with projected climate data for 30 years in the future (using data from the Met Office UKCP weather generator) [1]. The platform uses an API to send the data to a Unity interface running on a laptop hidden within the machine. The machine then prints out the predictions as narrative text, based on this scientific data (**Figure.1**). The machine also has a screen showing a digital visualisation of the current temperature, precipitation and windspeed, interspersed with talking heads videos and observations by local people who participated in the project (**Figure.2**). The machine prints out a description of the current weather, a future projected scenario for 30 years in the future and a prediction based on this data, devised by local people during a series of workshops that take place prior to the exhibition.

The Prediction Machine artwork involves four elements:

1. A series of public engagement workshops with people who live and work near the weather station. The participants in these workshops feed into the design of

the machine, contribute to the predictions and the talking head videos and take part in a dialogue with the artist, climate scientists and researchers
2. The machine is then presented as a public exhibition
3. A final public 'performance' event occurs at the end of the exhibition to mark the changes in the climate observed the duration of the project.
4. An interactive website enables users of the machine to type in a code (given with the prediction) to review the data captured at the date and time that they visited the machine, to find out more about how the predictions were made and with descriptions of how the science informed the artwork.

How the artist engages with climate data
The artist has designed the machine to be a tangible interactive object that presents climate and weather data – in order to provoke emotional and personal responses. The artist uses three strategies to present climate data in her work through sensory engagement, performativity and providing multiple interpretations.

The data is *embedded* in the design of the machine. It plays out and 'performs' climate data as *multiple interpretations* that provide both a *sensory* and *temporal* experience of climate data that is connected to our everyday experiences. The sign at the top provides a warning system that indicates live increases in air temperature levels captured at the local weather station, the sign pulsates if an extreme weather event is being recorded; A screen powered by a hand crank provides a visualization of the numerical data being captured at the weather station, combined with haunting 'talking head' videos of observed weather experiences recorded by local people; The machine prints out *'climate fortunes'* that visitors to the machine can take away with them, telling them if a '*climate change moment'* might be occurring and giving them a prediction for what might be happening with similar conditions 30 years in the future.

How the public engages with climate data
The users of the machine and participants in the workshops are also invited to *embody* climate data. They are invited to conduct a *'human sensing activity'* designed by the artist to enact how scientific sensors work. By comparing personal and sensory observations with scientific data captured at the weather station they are invited to engage in a process of 'performing' and 'interpreting' scientific data as both a logical and emotional experience.

Users of the machine are also invited to embody the process of recording, marking and responding to climate data through their interactions. The hand crank acts as an embodied example of the energy required to power the technology in our everyday lives - as well as providing a metaphor for our ongoing impact on the environment and climate. Users are also invited to take the predictions (in the form of small cards) away with them as gifts or souvenirs of the moment in time when they interacted with the machine and imagining a future climate scenario based on that moment. This invites them to reflect on the difference between weather and climate, how difficult it is to comprehend if we are experiencing a 'climate change moment' and how what we are experiencing now might impact on the future.

The Prediction Machine has been commissioned by Radar Loughborough University Arts with support from the Geography Department at Loughorough University. The artwork takes place alongside a wider research project exploring the impact of artists' engagement with scientific data at Horizon Hub/Mixed Reality Lab, University of

Nottingham.

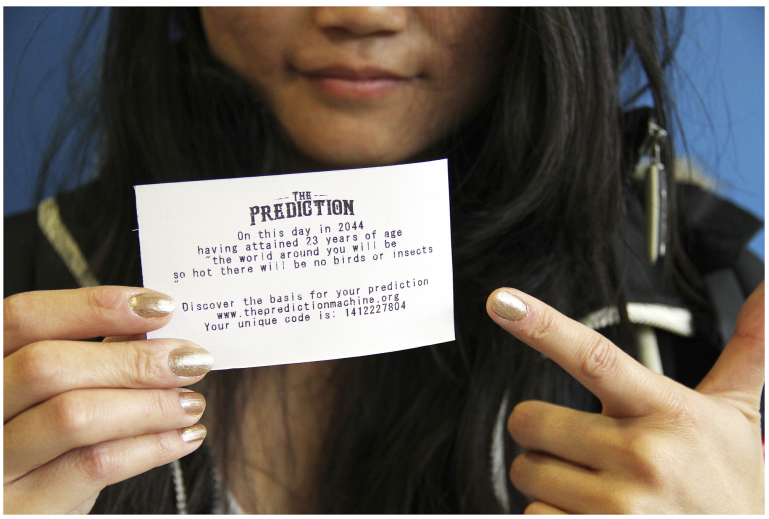

Figure.1 The Prediction print out

Figure.2 Powering the screen with the hand crank

Figure.3 Data visualization and talking head videos

Impact Research

It is notoriously difficult but also increasingly vital to engage the public with complex scientific issues, and especially scientific climate data (ref).

Previous research has established the interdisciplinary foundations for understanding how artists can create a deep emotional engagement with data, walking the line between meaningful and authentic scientific engagement, to foster dialogue across scientists, artists, technologists and the public (Jacobs, 2013). This has the potential to increase impact for the science community and provide a new way to stimulate and shape debate around the major science issues of our times such as climate change. As such it can have a major impact on scientists, science communicators (including festivals and venues), policy makers, technologists designing tools for artists and scientists, the public through targeted community groups and participation in exhibitions and demonstrations, policy makers and of course, the artists themselves.

Impact Research taking place at the Mixed Reality Lab/Horizon, University of Nottingham in collaboration with Dr Candice Howarth (Anglia Ruskin University) and Dr Carlo Buontempo (Hadley Centre, MET Offie UK) involves research into the role of artists in climate science communication and study the impact of this work on these communities. Using 'The Prediction Machine' as a demonstration project to specifically investigate how to engage local communities with climate forecasting.

This research seeks to answer the following questions: *How can we enable non-experts, communities and individuals to recognize and respond to the impact of climate change in their everyday lives through artistic engagement? What is the*

impact on people participating in the exhibitions, workshops and demonstrations of 'The Prediction Machine' and what is the impact of this work on the science community?

Further to this, the research seeks to investigate the following questions for the Digital Economy: *Can tools and systems support the marking and capturing of climate change within our everyday lives? Can accessible tools be developed to support non-experts, communities and individuals to act in response to their everyday/personal experiences of climate change?*

In support of these question, a series of HCI (Human Computer Interaction) tools have been embedded within the artwork in order to understand;
(a) The ways in which self-selecting participants understand and engage with data (climate and weather),
(b) How self-reported and observed factors influence that understanding,
(c) The role of the artist in supporting that understanding,
(d) Points of decision that influence the ultimate instantiation of climate and weather data in the Prediction Machine,
(c) Public response to that artistic interpretation, including intended action, and
(d) The extent to which the technologically-mediated artistic process can be modeled for replication (e.g. what models can help us to better understand what is going on so that others can do the same)

One of the key challenges is the way users of the machine are invited to embody data through their physical interaction with the machine. The hand crank acts as a demonstration of the energy required to power the technology in our everyday lives, providing a metaphor for our ongoing impact on the environment. Yet, this reveals an interesting tension between the physical interaction and the data, exploring how aesthetic and tangible experience occur whilst bringing the data to the fore.

The participants in the workshops were also invited to observe the weather and then use this experience to write the predictions, printed out by the machine. By comparing personal, sensory observations with scientific data in this way the participants were engaged in a process of 'performing' and 'interpreting' the data as a physical, logical, emotional and sensory experience [2]. Users of the machine were then invited to take the predictions away with them as souvenirs of the moment in time when they interacted with the machine, requiring them to reflect for a moment on the weather outside and imagine a future climate scenario based on that moment.

This process raises important issues around how to walk the line between artistic interpretations of data and scientific authenticity. By combining observed experience with scientific data this work questions how explicit to make the link between the scientific and artistic interpretations of data and how much to reveal about the algorithms which control the predictions.

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