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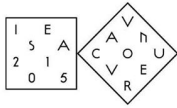
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Public Making:
Artistic Strategies for Working with Museum Collections, Technologies and Publics

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Abstract

This paper discusses the principle of 'Public Making', a strategy of conducting a creative process while working in and with the public to build artistic work. By first laying out a conceptual and theoretical framework around our intentions, this essay goes on to describe our practice through a significant program of work carried out during 2014. Our work included an artistic residency, two installations and a durational performance. The paper culminates on reflections into how Public Making opens up the artistic process and allows for multiple forms of participatory engagement to occur. This work was carried out on a variety of occasions with various cultural institutions including museums, heritage sites and arts organisations. This concept of building and making in and with the public attempts to open the 'black box' of creation allowing publics to engage with technological methods alongside an artistic process.

Keywords

Making, Public, Constructions, Technology, Building, Artistic Responses, Museum Collections, Heritage, Performance.

Introduction

This essay describes a program of work we have embarked on honouring a principle of 'Public Making'. By this phrase, we wish to highlight a dual sense of 'making-in-public' and 'making-with-the-public' to capture how we have conducted ourselves as artists working with museums, heritage institutions, arts organisations and their publics. We create works on-site, in compressed time-scales, with varied participation from visitors in response to heritage collections and the specifics of the site of our activities. We intend to make the process of making come alive for the public and our other collaborators and connect the works made to our labours in a visible, accountable fashion. Our works have a provisional, open character which crosses between installation and performance and which assemble multiple heterogenous elements, materials, technological idioms and creative practices. In so doing, we have ambitions to open up a creative space where the 'objects' of artistic production are seen to be contingent assemblages not only, as is common, through forms of critical theoretical discourse but through publicly accountable work with a specific material character. The potential for digital and allied electronic technologies in

Public Making is specifically discussed. Our work started as a specific approach to working with museum and heritage collections but, as we shall show, it has begun to inform our overall approach as artists who present and perform work in a number of different settings.

New Technologies and Museum Collections

To set the context for how our work has unfolded, let us characterise and briefly review some of the research connecting new technologies and heritage collections. It is often argued that new technologies and innovative archive and collection digitisation can enhance a museum's reach, improve visitor experience and bring collections to life that may otherwise be under lock and key [e.g. 6]. Increasing acknowledgement of this has lead to a number of funding initiatives that investigate new forms of public engagement with museum collections. For example, Tyne and Wear Archives and Museums (TWAM) in Newcastle upon Tyne in the UK commissioned singer Richard Dawson and electronic duo Warm Digits to create musical work in response to the museum's unseen collections [8].

Such commissions are thought to contribute to the development of new forms of public engagement with museum collections, as well as being opportunities to unearth archival material that is not usually on public display. Both of these qualities are thought to have the potential to affect a community's perception of its heritage and the relevance of local history to the contemporary life of a place. Warm Digits' appropriation of images portraying the building of the Tyne and Wear Metro transport system, for example, raised questions around the utopian ideology informing development of Newcastle-upon-Tyne in the 1970s, the impact of such ideologies on the character of the city today and its relationship to the ongoing 'cultural' redevelopment of the city.

Digital technologies are often seen to have a key role in opening up collections and facilitating access to cultural institutions by social groups who traditionally may have not engaged with such resources [amongst many examples, see 8]. Along similar lines, a number of examples exist in the New Interfaces For Musical Expression (NIME) and International Symposium For Electronic Arts (ISEA) literatures of researchers working with cultural institutions or designing exhibitions using new technologies to explore

new artistic possibilities or to revisit cultural events of historical significance.

Interesting though many of these endeavours may be, they often manifest an instrumental character which position the public, their formation and their transformation as an effect of the ingenious design of technical artefacts and systems. Technology is 'deployed' to create or bring about effects. These could be changes of value, appreciation, senses of belonging, identity or whatever. Reciporically, archived, collected or other 'museological' material is seen to be technologically rendered or virtualized as a necessary step in this. Hence, the very many digitization endeavours the world over in the last 20 or more years.

We want to explore an alternative creative space and a different footing for technology in relationship to publics and collected materials and objects. Rather than see technologies as a means to engender extended, yet still institutionally or pedagogically acceptable heritage experiences, we want to open up possibilities for more disruptive technological uses and less reverential orientations to curated objects and archives. For us, this involves opening up the 'black boxes' (cf. Latour [7]) of technical systems and collected materials, tolerating a wider range of creative appropriation, and presenting our own work as a publicly available and contingent enterprise.

Objects, Things and Materials

To aid this, our work has been specifically informed by some recent critical contributions to archaeology, anthropology and material culture. Ingold [4] for example notes how commonly we are presented with ready-made objects without access to the means by which they were produced because, say, they are part of an archeological record or they are part of an industrial production process we cannot inspect. The means of their making is lost or hard to recover. For Ingold, drawing on Heidegger, there is a profound difference between 'objects' on the one hand and 'material' and 'things' on the other. Through the examination of the lived practices of 'makers' of all sorts, Ingold argues that we can approach artefacts as *materials* that have inherent potential, rather than objects with fixed cultural meaning.

In our work, our intention has been to reconfigure artefacts drawn from museum collections and find new ways in which they could be understood and engaged with, in particular, through creative appropriation. In this fashion, we seek to question some traditional thinking around heritage and museum practice, which presents artefacts and objects *from the past*, rather than framing them in the context of their presence in contemporary culture and their 'perdurance' [4] into the future. In doing so we aimed to enable alternative forms of engagement with the collection for both us as artists working with them and our publics, and consequently a deeper, more varied, and perhaps heterodox, understanding of how the materials came to be the objects they are in the museum's collection. Through Public Making (in public, with the public), we

sought to create a stage in which 'objects' could be reworked as 'things' with varied material potential.

Sensory Engagement, Juxtaposition and Design for Appropriation

In a number of landmark pieces of work in Human Computer Interaction, Gaver and his colleagues at the Goldsmiths Interaction Research Studio have advocated strategies for, variably, 'ludic design', 'ambiguity as a design resource' and 'design for interpretation and appropriation'. The intention of much of this work is to explore designs which are open ended and amenable to a number of interpretations of their point and value, rather than engage in more classic forms of 'user-oriented design' which tend to privilege the function of interactive artifacts. In a recent paper, [3] Gaver et al. describe a series of 'indoor weather stations' as a means for furthering this concern to address, in an oblique way, some of the concerns in 'environmental Human Computer Interaction (HCI)'. Drawing on this work, we sought to create ambiguous pieces which did not didactically mandate any particular interpretation of museum artefacts but allowed them to be imaginatively appropriated.

To facilitate this, we employed two main strategies. First, we *juxtaposed* the artefacts with other materials and data so as to highlight questions of variability of interpretation and the varied timescales (and 'spacescales') in terms of which phenomena can be understood. In our case, this involved juxtaposing geological and fossil samples drawn from a collection with real-time atmospherical and meterological data and simple simulations of geological and meterological processes. Several of our sonic and visual displays are oriented around this concern. Secondly, we were concerned to *extend sensory engagement* with artefacts and present relevant phenomena in novel sensory forms. In some ways, this is an extension of the practice that many museums conduct of 'handling sessions' where the look and feel of objects is brought to attention. In our case, however, we were concerned to go beyond what is normally the didactic business of such sessions and make, for example, geological textures and meterological data available in ambiguous sonic forms. In this way, we hoped that public encounters with museum objects, and our work extending their sensation in juxtaposition across time and space-scales, would facilitate new imaginative trajectories for the collections we were working with.

A Program of Public Making

This essay draws upon a program of work which included three practical, creative interventions by the authors in 2014. First, *Interglacial*, an initial artistic residency carried out in partnership with the Pacitti Company, Ipswich and London, UK – an arts organization dedicated to supporting live art and performance, and for exploring artistic strategies for engaging with publics and local institutions.

Second, *Erratics,* a follow up visiting residency at the Pacitti Company building on the themes and concepts explored in the first. As we have hinted and will shortly discuss in more depth, both of these residencies took as their point of departure an engagement with artefacts drawn from a museum's natural history collection. Third, *Salient/Re-Entrant,* a durational performance at the Fort Process one-day music festival in Newhaven Fort, Sussex, UK, organised by promoters Lost Property. Here, we began to extend our approach from museum and heritage contexts to that of a contemporary music festival. The context and presentations for this work varies, but our commitment to Public Making occurred throughout.

During the residencies, which comprised of two three-day periods, we creatively responded to a number of museum artifacts. This work culminated in two multi-channel sound and image installations open to the public. The first residency explored making, material culture and various forms of data visulisation and sonification. A concise description of our explorations in *Interglacial*, focusing on its relevance to sound making technologies, was published in the NIME proceedings in 2014 [2]. The second residency, *Erratics*, built upon these concepts but deepened our allusion to critical themes in material culture, exploring the trajectories of objects and materials and the layering of processes and forms of knowledge.

During our time on both the residencies we built a number of constructions using various forms of technology engaging with specific themes suggested to us by the museum collection. The artefacts were explored in and with the public in a number of ways. One of our participants had a practicing background in evolutionary anthropology and helped us explore and understand possible uses for some of the Neolithic hand tools in the collection. Another, a visual artist, began mapping the objects to geographical location. By locating where certain artifacts were found and identifying what material they comprised of we could compare these objects to geological maps that were also present. We began physically spanning the journey of these objects and their materials. A young person who had a particular interest in the digital video game Minecraft also visited us. With him, we explored the similarities between the museum materials and materials used in the game, giving us an alternative perspective on our work.

Our Constructions at *Interglacial* and *Erratics*

Over the course of the *Interglacial* and *Erratics* residencies, we created a large number of works, devices and bodies of material. By way of overview before more detailed description, let us list the following:

- Sonic Microscope and Image Sonification
- Live Proximal and Remote and Historical Weather Data
- A Sonified Weather Station
- Gadgeteer Ambient Atmospherics
- Rock Harmonium
- Field Recordings
- An Erratic Texture Generator
- Explorations in Cymatics
- Mark Making Devices
- An Algorithmic Glacial Composition

Sonic Microscope and Image Sonification. One participant of our Public Making cohort brought a digital USB microscope to our first session. She had used it in some of her own work around forensics to take close up images of fictional evidence at a fictional crime scene. Using a number of image to sound making techniques we made these microscopic images into sonic instruments. The first method was to pixel scan the live video feed using PureData-Gem. The live image was restricted to a square pixel canvas (500x500) and then scanned horizontally and vertically. Taking the greyscale of each pixel the data was mapped to a wavetable and sonified to a number of drones. The changes in timbre were effected by the differing surfaces of the museum samples we were examining. A highly textured surface would create a dense, complex waveform with tight harmonics, while a smooth, flat surface would create more simple, single tone wave shapes. Taking inspiration from Andre Smirnoff's text 'Sound in Z' [1] we built our own version of the ANS Synthesizer using the sonic microscope. In this construction each pixel line related to a different oscillator. The gain of each oscillator was controlled by the amount of light in each pixel. The image was scanned vertically and became a graphic score adding visual stimulus to the ongoing soundscape. The Sonic Microscope was presented on a table with a number of rock samples so participants could explore sonic and visual textures at leisure.

Figure 1. The Sonic Microscope examining a geological example

Live Proximal and Remote and Historical Weather Data. To provoke thought around changing weather and contrasting climate conditions, we decided to compare live weather data from a local weather station and a station situated at the other side of the world. Using Python to scrape data from wunderground.com (Weather Underground), we took numerical data from a weather

station in Lowestoft, UK and compared this with data from Auckland, New Zealand. We also implemented historical data from a database ranging between 500AD to the present day. The database consisted of paleoclimatological reconstructions of temperature and rainfall from Central Europe. These data were translated into colour and sound using PureData-Gem and presented on a screen with code windows open and inspectable.

Weather Station. Outside we deployed a weather sensor kit to give ourselves a localised perspective on immediate changes in weather. Using a SparkFun weather station we took readings of wind speed, wind direction and rainfall and relayed these to a number of stepper motors striking constructed sound sculptures. The stepper motors were placed around the indoor space in which we were working giving a spatial quality to the sound. Changes in the weather could be heard on the various sound sculptures which consisted of sand, grit and other related geological and metrological material.

Gadgeteer Ambient Atmospherics. To contrast to the remote and outside atmospheric data gathered in our previous constructions, we decided to take some readings from changes inside the immediate space. Using the Gadgeteer prototyping system with a number of sensors attached, we picked up atmospheric data from the room. Ambient light level, humidity, barometric pressure and moisture sensors were interfaced and parsed to Max/MSP for sonification. All outputs of the sensors were connected to an additive, fixed spectra synthesizer resulting in a contained but ever changing sound.
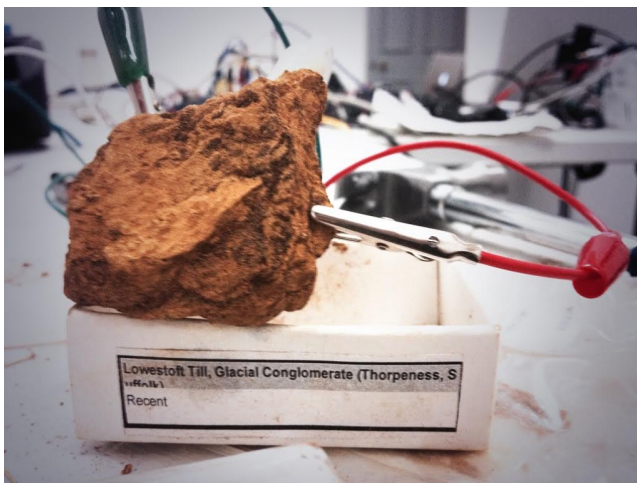

Figure 2. Electrifying a geological sample

Rock Harmonium. To explore the texture and consistency of a number of non-precious rocks from the collection we set up a low voltage circuit powered by a 9-volt battery. The circuit was connected at one side to the battery and the other to a loudspeaker with the various rocks in between acting as resistors (see Figure 2). As current passed through the material varying resistances resulted in noisy splutterings amplified through a mini-speaker. The rocks were set side by side each with an on/off switch giving the construction more performativity so visitors and fellow public makers could play the construction with ease.

Field Recordings. While mapping the various artifacts to specific locations on the maps, we decided to collect a number of site relevant field recordings. Once collected the recordings were processed in a number of ways including granular synthesis, transducer to surface explorations, and various forms of manipulated playback. We approached the collected recordings as another fluid element that could be layered alongside the physical and sonic material.

Recording Water, Ice, Sand and Rocks. We set up a number of informal recording sessions were we performed directly with the raw materials aided by members of the public. To create our own mini glaciation we decided to place a piezo contact microphone in some water and freeze it. The whole of the freezing process was recorded and played back alongside the various site-specific field records we had made previously. We also recorded the opposite change, the ice melting. Subtle cracks, squeaks and groans appeared in the record following a number of gain and filtering processes. We performed with a number of rocks, dropping sand and small rocks into resonant bowls attached with contact microphones. Using a number of non-precious rocks, we set up a lithophones and recorded a number of participants playing them. The lithophones, alongside the Rock Harmonium, allowed new visitors to enter the space and experiment with our constructions almost immediately.

Erratic Textures. In the town where we were working, there are a number of glacial erratics which were dredged and deposited by the riverside when the town's dock was cut in the 19th century. Erratics are rocks which are not indigenous to the area where they are found but have been carried there by glacial movement. One of us has been taking photographs of the surfaces of these rocks over a period of several years, documenting their changes with variations in daylight, the seasons, the growth of lichens and mosses on their surfaces, and changing layers of graffiti (see Figure 3). In PureData-Gem, an application was built which layered four of these photographs at a time, combining the layers with various forms of image subtraction, differencing, multiplication and compositing. The photographs changed their contribution to the composite to yield slowly changing textures which were sonified, using the scanning method described above, and projected. Random selections from a corpus of several hundred photographs were made to create an open-ended 'erratic texture machine'.
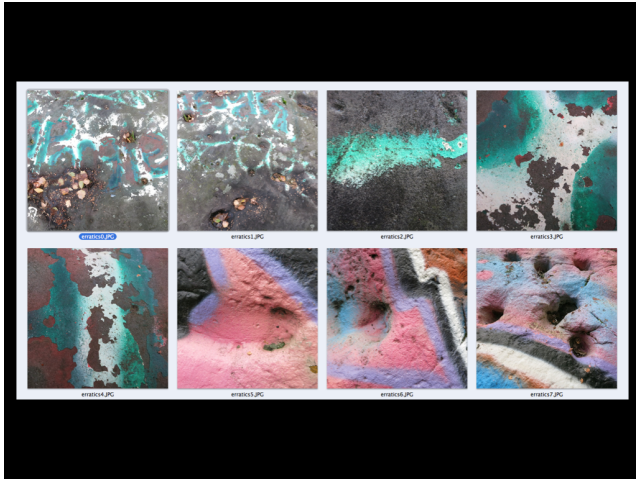
Figure 3. A selection of close up images taken of the Ipswich erratics

Cymatics. Using a range of audio transducers and thin materials for a diaphragm, we set up a number of cymatic experiments using rock, salt and sand as grains. By playing various recordings and live sound synthesis through the apparatus, we created a variety of cymatic formations. This acted as a contrast to our image to sound experiments by imposing sound onto physical matter.
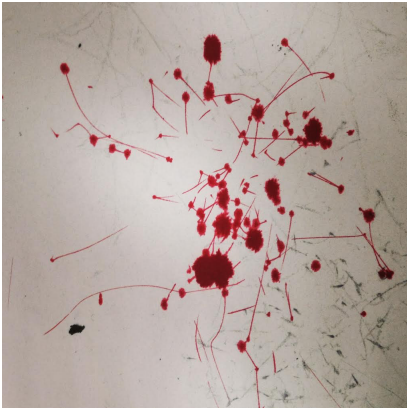

Figure 4. Marks made in response to streams of weather data

Mark Making. As a development of the weather station to stepper motors construction, we decided to attach mark making tools to the motors to create further ever-developing line drawings. Biros, charcoal, pencils and felt tip pens were all attached to various prepared stepper motors which continued to make marks on large pieces of paper laid out on tables or the floor.

Glacial Composition. The corpus of sound files we had made over the course of the two residencies were categorised and variably mixed to create a live, electroacoustic composition. An eight channel granular synthesis/brassage/collage application was built in PureData to process the sound files and algorithmically vary the mix. The combination of categories of sound files contributing to the mix at any one moment was varied to create different impressions of the scale and duration of imagined glacial, meterological and land formation processes, spatialised over an eight loud speaker sound system. The conceit of this was to present a series of thousand year epochal glacial processes compressed into a listening experience of tens of minutes.

Putting It All Together I: A Sensorium

During the making process we attempted to create a working space which could be easily navigable by visitors. Keeping a clear path through the room and setting space between the various construction 'stations' allowed visitors to travel through the environment with ease. We also tried to differentiate areas between 'partially complete' instruments and more finalised constructions. This enabled us to have making tables dedicated to work 'in development' whilst other channels of the installation continued. The various objects from the museum collection were placed on a desk near the entrance to the space. By setting up the environment in this way, our intention was to create a physical trajectory through the installation environment relating to our ideas around material trajectories. A structured exhibition feel quickly emerged as more responses were added to the environment.

Figure 5. A sensorium of constructions

Putting together the work in this way created the form of a 'sensorium', a configuration of overlapping and intertwined sensory experiences. This ecology of activity could be simultaneously experienced as a whole alongside a more detailed exploration of its parts. The environment was built from a collection of 'islands' or 'stations' each demonstrating a differing construction or response to the archival material. Most stations were associated with one or two loudspeakers which were positioned into groups of three, creating a 'lattice' of listening spaces. Whilst visitors navigated the space, complex crossfades between stations could be experienced, allowing ones position within the sensorium to directly inform one's own experience of the composition. In this way each visitors had the opportunity to zoom in and out of each construction and experience the piece as a whole or focus on individual stations. To reinforce the sensory space, the room was darkened, lit by small lights, computer screens and projectors.

Putting It All Together II: An Erratic Assemblage

During *Erratics* we experimented with another way of connecting together the constructions we had made. An assemblage was made combining different constructions with each, in some way, re-inscribing, re-analysing or re-presenting output from another construction. In this way, a chain of re-inscription could be created.
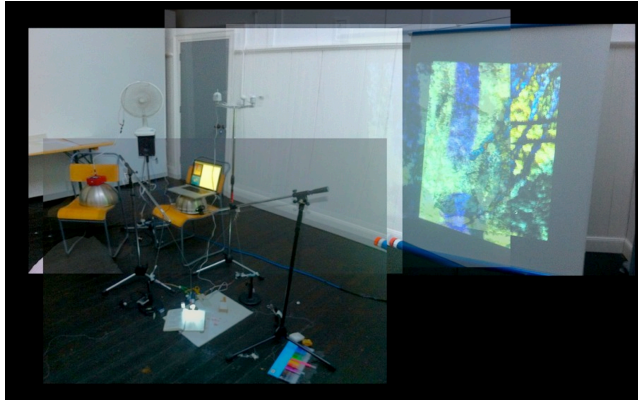

Figure 6. An Erratic assemblage

In Figure 4 a fan influences a weather station which is programmed to move a number of stepper motors which move a pen suspended above a piece of paper. The inscription is surveyed by the sonic microscope which sonifies the marks on the page. The fan also blows against a piezo ribbon contact microphone which is connected to a small amplifier. The sound from the piezo ribbon and the movement of the pen also influence the changes of algorithmically generated erratic textures. In this way, complex chains of re-inscription and re-materialisation could be explored.

By putting the work together as an assemblage we reinforced the spatial qualities of our sensorium. Presenting constructions so they were interacting with each other allowed for further layerings of materials to be configured within the space. Having presented the work in an installation setting, we decided to apply thoughts and conceptions around the sensorium and sonic assemblages through another form of artistic presentation, a durational performance.

Fort Process

Fort Process took place over a single day in September 2014, within Newhaven Fort, situated on the South Coast of England. The fort, built under the instruction of Lord Palmerston between 1865 and 1871, was intended to defend England from the threat of invasion from the French. Its thickly armoured walls, varied spaces and underground tunnels make the fort an extremely suitable venue for a festival of music and sound art. On the day, many of the architecturally interesting spaces accommodated sound installations, performances and visual works from a variety of artists, musicians and makers. Our activities took place in one of the old storage rooms, originally used for the keeping of armaments and explosives. We took this opportunity to build on our museum-oriented work and realise a form of a Public Making performance. Over an 8 hour period we built, performed and manipulated a collection of self-made instruments incorporating into our work sonic, physical and conceptual material collected from research explorations around the Fort. Alongside the DIY constructions, we also performed with various commercially available instruments including a modular synthesiser made up of a selected collection of modules and an OP1 synthesiser from Teenage Engineering. The piece was physically presented to the public in a variety of different ways. We took various roles as performers, from informal conversations around our process, to more recognisable performances in front of watching and listening audience members. We intentionally decided to set up our performance environment without a stage, allowing fluid movement of audience and performer around the physical space. A variety of sound sources were placed around the space creating a spatial, sonorous environment which audience and performer moved through.

Figure 7. *Salient/Re-Entrant:* performing at *Fort Process*

Our Constructions at *Fort Process*

As the public visited us during our performance at *Fort Process,* we deployed and created a number of constructions, devices and systems. In addition, we re-used some of the constructions from *Interglacial* and *Erratics.* Our work, *Salient/Re-Entrant,* alluded to military tactics and features of the architectural and landscape formations. Newhaven Fort features an architectural salient at the front of the structure used as a defense device in case of invasion. Our constructions were based on themes around military technology, communication devices and acoustic exploration of the site. As a contribution to a musical festival organised around timed performances, we decided that our work should have a baseline or background of semi-prepared constructions against which on-site making could take place. For example, *Fields*, which we will shortly describe, was assembled and implemented on-site

with new sound material collected at the fort but was not programmed from scratch. In contrast, our experiments with Sound Ranging emerged as a blank PureData patch edit screen was filled, all the while folding the testing of the patch into the ongoing performance. *Salient/Re-Entrant* saw the following being made and/or configured:

- *Fields*
- *The Granular Grabber*
- Contact microphone experiments
- Sound Ranging
- FM Radio Transmitters
- The Granular Engine
- A Collection of PureData Raspberry Pis
- Field recordings

We describe these now in more detail.

Fields. Using a wireless router connected to a localised server running from a MacBook laptop, participants could connect with their personal devices (smart phones and tablets) to a Wi-Fi network. Once connected, devices are forwarded to a webpage loaded with a number of sound files and virtual synthesis 'instruments'. The connection allows us to perform the sounds and instruments from the centralised server, outputting sound through the inbuilt speakers on the personal devices. Sounds chosen to diffuse included field recordings collected from the site, a sawtooth synthesiser and a white noise generator. Granular synthesis was implemented to allow more performativity to the sound file playback. Parameters such as pitch, grain size and density could be easily controlled using the system's web interface. Each time a new audience member entered the space they could connect and intersect the performance. Audience members often explored the space holding their own personal device, creating dynamic sound diffusions and interesting sonic spatialisations. When a number of participants were connected it resulted in a 'textural shimmering' throughout the environment. The Fields system creatively embellishes the network latency that occurs between devices. This was enhanced using our randomised grain technique, which opens up the possibility for each device to play the same sound file at different positions, resulting in a very densely textured and layered output. The system provided a successful curiosity, as people were connecting, others would be intrigued and ask how to join in. Sounds continued to play from the device even when participants had left the space, creating an interesting boundary to our performance. This bespoke musical diffusion system is an on-going collaboration between Sébastien Piquemal and one of us [9].

The Granular Grabber. Using PureData and the inbuilt microphone on a MacBook Pro, a system was built which momentarily recorded sound from the immediate environment and played it back in a variety of ways using a single voice granular synthesis instrument. Techniques including pitch shift, grain length and position were implemented. A recorded moment, consisting of a sample

of around 5 seconds, would occur between 20 to 60 seconds using a variable time delay. Each moment was played back in a slightly different way using the various granular techniques. The Granular Grabber, sampled the environment throughout the duration of the performance, it created a temporary, never repeating juncture of the sonic space.

Contact Microphones. Various contact microphones were placed around the space to amplify particular surfaces and reveal certain unperceivable sounds. Most successfully this was implemented on a steel ramp at the entrance of the space. As audience members entered, the slight movement from the ramp resulted in a large gestural amplified sound which was presented in front of them from a portable amplifier.

Sound Ranging. A crude software simulation of a military sound ranging technique was created. Two microphones were placed far apart in our performance space and approximate measures of the difference in onset of a sound at the two microphones were made. These measures were then, in turn, used to vary the sounds that were released into the performance space. In this way, how the space reacted to different sounds varied the character of the sounds in turn.
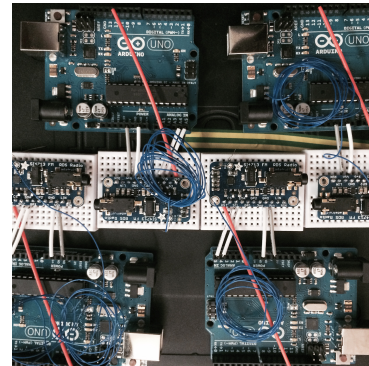

Figure 5. A collection of Arduino controlled FM transmitters

Radio Transmitters. Both the Granular Grabber and the Contact Microphones were broadcast throughout the space using the Adafruit FM radio transmitter. This module allows a live audio feed to be broadcast up to 10 meters. A number of small, handheld radios were dotted around the environment allowing further textured sonic distributions to occur alongside the audience's phones and tablets. One radio was placed near the entrance of the venue. This provided new visitors with a moment of 'grabbed' composition before physically entering the space.

Granular Engine. A number of field recording collected from the site were loaded into a multi voice granular synthesis patch built using Max/MSP The patch is able to play clusters of 'grain clouds', creating a dense, textural sound that counterpoised the smaller, more delicate sounds

from the phones and radios. The patch was controlled using Open Sound Control (OSC) via a bespoke TouchOSC interface on an iPad. Various interaction controls were implemented including volume sliders, toggle switches and a number of XY pads. Grain pitch and duration were readily available controls to provide a rapid way of creating a suitable drone to suit the ever-changing sound environment.

The PureData Raspberry Pi. Using a collection of Raspberry Pis running the Raspbian Operating System (OS) made by Debian Wheezy it was possible to run a number of smaller computers which could be dotted around the space. Each Pi was running a contrasting synthesis patch built with PureData. The patches were programmed through the Secure Shell (SSH) protocol using Apple's Terminal so that extra keyboards and monitor screens were not necessary. The Pi's were then run 'headless' and multiple smaller sound sources could be placed around the environment with ease.

Field Recordings. A corpus of field recordings was created by us on-site during the performance. The Fort contained a number of characteristic sound environments: tunnels, wind-swept fortifications at the top of a cliff, a carponier in which the sounds of the sea were oddly reflected, amongst others. These recordings were used in *Fields*, *The Granular Grabber*, the Granular Engine and played back alongside our other instruments.

Discussion

We have presented how we have developed a vast range of devices, constructions, activities, experimental strategies, working with a variety of materials and forms of sonification, visualization and inscription. We have worked in public and incorporated members of the public into co-creating pieces with us. Our work attempts to make the practice of artistic production a publicly visible and potentially participatory affair. We began by exploring strategies for responding to museum collections as a source of artistic material and built upon this work to create performable installations and make a contribution to a music festival.

This paper documents our constructions and outlines the critical principles behind our notion of Public Making. Elsewhere, we have begun to analyse the public's response to the situations we create and document how our work has enabled people to make imaginative connections with the collections we have drawn upon and, from time to time, critically think about museums and allied institutions [2]. Working in public has also enabled people to critically engage with us as we do our work, interrogating our techniques, our motivations and aesthetic values in ways which go beyond what is typically possible in formats like, say, artists' talks. In contrast, in activities such as those we promote, the work itself is concurrently visible and enables

discussions of technology and value to be concretised and given sense in terms of specific acts of making.

We hope also to have given a hint at how strategies of Public Making can help further a critical heritage and artistic discourse – one which connects a range of heterogeneous technologies and materials, including the digital, to recent concepts from studies of material culture such as [4] and approaches to digital design such as [2]. Our explorations of Public Making are at an early stage and rather than the phrase defining a precise set of techniques or any kind of rigorous method, for us it points more to a set of values we believe important to disseminate – values to do with the visibility, accessibility and accountability of artistic work. These are values, for us, which increase in their importance in a global culture with tendencies to technological fetishism and the obscuring of the means by which materials are sourced, things made, and values taken for granted. For us, Public Making is a way in which the 'electronic artist' can disrupt this tendency.

References

1. Andre Smirnoff *Sound in Z – Experiments in Sound and Electronic Music in Early 20th Century Russia* (London, Sound and Music, 2013), 229.
2. John Bowers and Tim Shaw, *Reappropriating Museum Collections: Performing Geology Specimens and Meterology Data as New Instruments for Musical Expression* (In Proceedings of New Interfaces for Musical Expression, 2014) 175-178.
3. Gaver, W., Bowers, J. et al. IndoorWeather Stations: Investigating a Ludic Approach to Environmental HCI Through Batch Prototyping. CHI 2013.
4. Ingold, T. *Making - Anthropology, Archaeology, Art and Architecture,* (Routledge, 2013).
5. Kazuhiro Jo, Adam Parkinson and Atau Tanaka, *Workshopping Participation in Music*, *(*Organised Sound, 18 2013) 282-291.
6. Petrelli, D., Ciolfi, L., Van Dijk, D., et al. *Integrating material and digital: a new way for cultural heritage. (Interactions* 20, 2013) 58-63.
7. Bruno Latour, *Science in Action,* (Harvard University Press, 1987)
8. Tyne and Wear Achieves & Museums, Half Memory, http://www.twmuseums.org.uk/halfmemory/warm-digits-interchange/, 2014.
9. Shaw, T., Piquemal, S. Fields: *A Web-based Sound Diffusion System*. (In Proceedings of NordicCHI, Helsinki, Finland 2014)

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