Bowers J, Shaw T.

Reappropriating Museum Collections: Performing Geology Specimens and Meterology Data as New Instruments for Musical Expression

*In: NIME 14: New Interfaces for Musical Expression*. 2014, Goldsmiths, University of London: NIME.

# Reappropriating Museum Collections: Performing Geology Specimens and Meterology Data as New Instruments for Musical Expression

John Bowers
Culture Lab, Newcastle University
King's Road, Newcastle, NE1 7RU, UK
john.bowers@newcastle.ac.uk

Tim Shaw
Culture Lab, Newcastle University
King's Road, Newcastle, NE1 7RU, UK
t.m.shaw@newcastle.ac.uk

## ABSTRACT
In this paper we describe an artistic response to a collection of natural history museum artefacts, developed as part of a residency with an arts organisation. Drawing on a critical literature in studies of material culture, the work incorporated data sonification, image audification, field recordings and created a number of instruments for exploring geological artefacts and meterological data as aesthetic material. The residency culminated in an exhibition presented as a 'sensorium' for the sensory exploration of museum objects. In describing the methods and thinking behind the project this paper presents an alternative approach to engaging artists and audiences with local heritage and museum archives, which draws on research in NIME and allied literatures, and which is devoted to enlivening collections as occasions for varied interpretation, appropriation and aesthetic response.

## Keywords
Collections, Heritage, Sonification, Installation, Sound-Art, Field Recordings, Digitisation

## 1. INTRODUCTION
In this paper we describe how we have drawn upon NIME (New Interfaces for Musical Expression) and allied literatures to experiment with a specific way of working with museums to incite curiosity, provoke imaginative interpretation and facilitate the future, creative appropriation of collected artefacts. Our work takes a critical yet practical orientation to collaboration with institutions and is devoted to creating new sonic (and related) devices and displays and exploring new working practices. We hope that our work is an interesting step in enabling NIME (and related) research to reach out to public settings in a mindful fashion while doing justice to various critical scholarly traditions.

It is often argued that new technologies and innovative archive digitisation can enhance a museum's reach, improve visitor experience and bring collections to life that may otherwise be under lock and key. New technologies are often seen to have an important 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 7].

Our work seeks to add to this literature in a manner specifically informed by some recent critical contributions to archaeology, anthropology and material culture [e.g. 6]. 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 creative artistic ways. In particular, again drawing on [6], we sought to explore museum artefacts *as materials* with potential for creative appropriation. 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'* [6] into the future.

Drawing on [5], we sought to create playful, ambiguous artworks which did not didactically mandate any particular interpretation of museum artefacts but allowed them to be imaginative 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, playful simulations of geological and meterological processes. Several of our sonic and visual displays are oriented around this concern. Secondly, we wished 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 novel sonic forms.

## 2. INTERGLACIAL / ERRATICS
As part of the Pacitti Company's (www.pacitticompany.com) *Performing Collections* series of events, we were invited to respond during the course of a winter residency in 2014 to a number of artefacts from the natural history collection at Ipswich Museum in the UK. Using the artefacts as materials we designed and developed a number of sonic instruments and used forms of data sonification to create a multi-channel sound and image installation. As the residency unfolded, with us working in public [cf. 3], a more recognisable exhibition form gradually evolved. Other than a commitment to work with natural history artefacts and the general orientation described in the introduction, the only other constraints set in advance were the title of the residency and the technologies and skills we brought with us. We entitled the residency *Interglacial/Erratics* to bring to mind a connection between our era and that of glaciation and to play metaphorically with the notion of an 'erratic', the geological term for a rock carried from its indigenous place to another by glacial forces. Our repertoire of software and hardware technologies included Pd/Gem,


*NIME'14*, June 30 – July 03, 2014, Goldsmiths, University of London, UK.

Max/MSP, Python, Gadgeteer, Arduino, assorted sensors, contact microphones, a solid state recorder, several laptops and image projectors, amongst other, relatively transportable, items. Other items were sourced or delivered during the workshop in response to emerging design ideas.

**Figure 1: Geological samples and fossils.**

Upon arrival at the Pacitti Company's space we were confronted by a number of boxes that had already been delivered by Ipswich Museum staff. The boxes contained approximately 40 artefacts that had been chosen by the museum specifically for this project most of which of local provenance. They comprised mostly geological and fossil samples, including several evidencing glacial action and other curiosities such as a 330 million year tree root. Some of the objects were designated 'handling artefacts' and others, including a fossilised elephant ear and a woolly mammoth tooth, were packaged individually as rare examples not to be touched.

## 3. OUR CONSTRUCTIONS

Over the course of our residency, a number of constructions emerged responding to the artefacts we had been loaned. In some cases, we engaged directly with the materiality of the artefacts, albeit looking for transformations of them into unusual sensory forms. In other cases, we juxtaposed things with other materials and data to suggest new relationships or contexts of interpretation. Some of our constructions involve the deployment of ideas from the NIME and allied literatures in novel ways, others are more prosaic but still play their part in the overall work. Not all of our ideas made it through to a level of development where we felt we could include them in our (relatively) final assembly of things to exhibit.

*Sonic Microscope and Image Sonification.* In collaboration with a photographer who visited our residency, we took many close-up photographs of the samples which had been loaned to us. Some of these are shown in Figure 2. We took these as materials for sonification in a number of ways. A simple technique was to scan the images horizontally and vertically line by line and to use the grey values, suitably normalised, as entries in a wavetable. In Pd/Gem, four oscillators, tuned to a dramatic droning chord, played back these wavetables, the scanned data creating timbral modifications characteristic of each geological sample. A smooth rock sample would create rounded wavetables and drones with fewer overtones than a more particulate sample. A stock of images was selected and chosen from at random and sonified in this fashion live to accompany a large projection of the image.

An artist visiting the residency, Giovanna Maria Casetta, was inspired by this technique and returned with a USB microscope so create and manipulate the image material live. Based upon this we developed a Sonic Microscope which can employ a variety of sound synthesis methods based on scanning the image or obtaining statistical (e.g. luminance histograms) data from it. We only have space here to outline our explorations. In addition to the wavetable scanning technique just described, we have explored an analogy of the famous ANS synthesizer's technique, whereby a scan across the image is used to create amplitude values for an large oscillator bank (we have worked with 60 or more). This creates characteristically aetherial spectral sounds which vary in relation to the form of the image. We have also explored a granular synthesis technique in which the pixel grey values in a vertical or horizontal scan map to the frequency of a sinusoidal grain. Again, this technique is sensitive to characteristics of the image in legible ways. A crystalline sample will produce a pulsing grain cloud. A particulate sample will produce a more noisy grain cloud. A smooth sample will create a gentle fluctuating tone.

**Figure 2: Textures of geological and fossil samples.**

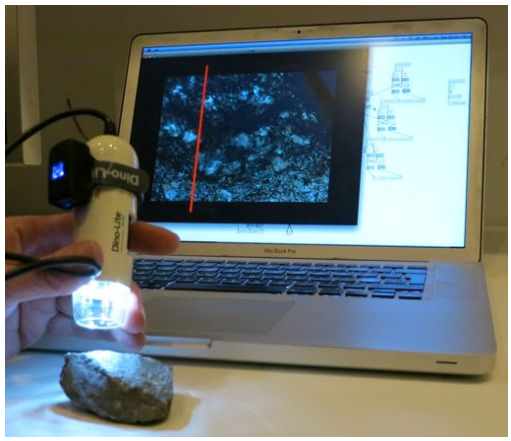

**Figure 3: The Sonic Microscope.**

To give the Sonic Microscope more of an instrumental character, we mounted a 3axis accelerometer (HotHand™) on the microscope body. We have used the data from this in various ways: to select frequencies references or distributions for scanned wavetable drones, ANS-style oscillator banks or grain streams, to effect the rate at which scans or grain streams are computed, to offer forms of amplitude control (e.g. tilt for silence/accenting), and so forth. A small switch mounted on the microscope also enables the player to freeze the image from the microscope so that the motion of the instrument can be played without effecting the image. This enables more abrupt transitions to be played while controlling unwanted sonic artefacts derived from camera movement or wobble.

*Live Proximal and Remote and Historical Weather Data.* To provoke reflection on changing meteorological conditions, we

built some simple visualisations and sonifications of various forms of on-line and archival weather data. Using the wunderground.com ('the weather underground', a site where users can post real-time weather data) API and a Python script, we took data from the nearest weather station (at a local military installation) and counterposed this with data from 'the other side of the world', a station in Auckland, New Zealand. We located a 100 year archive of data from another local weather station and reconstructions of temperature and rainfall data from Central Europe over a 2500 year period.

Using Pd/Gem, we composed very simple sonifications and visualisations of a selection of these data. For example, for the Lowestoft data, maximum and minimum temperature and sunlight data were mapped to colours (e.g. blue for the coldest, red/orange for the hottest) and oscillator frequency (lowest for coldest, highest for hottest). We played back the data archives at various rates including very fast playback which gave the sounds a granular feel and made the colours flicker. Under program control, the display randomly switched from live to historical data and made different selections of playback rate. Spending a little while with this display enabled a number of observers to spontaneously note the seasonal and historical variations in data values. For example, notably higher pitches could be heard as the data sampled enters the last twenty years.

**Figure 4: Gadgeteer Atmospherics atop loudspeaker (left) and Weather Station (right, photographed indoors).**

*Gadgeteer Ambient Atmospherics.* Ambient light level, humidity, barometric pressure and moisture sensors in the indorr space we were working in were captured using the Gadegeteer prototyping platform. The data were then parsed into Max/MSP for sonification. Changes in the local atmospherics had a direct effect on the sonic outcome. By building a non-harmonic, fixed spectra additive synthesizer the Gadgeteer sensors could exploit the same oscillator, resulting in a characteristically contained but ever changing sound.

*Weather Station.* Outside we erected a SparkFun weather station which enabled changes in air direction and speed and rainfall to be tracked and directly relayed through an Arduino micro-controller to a group of stepper motors. The weather station was placed in a variety of locations to explore sonic diversity. The motors were set up to strike and play various sound sculptures within the space. A number of materials were included to complement the collection of artefacts, including non-precious rocks, raw earth, metals and sand sediment.

*Rock Harmonium.* In a manner reminiscent of Bowers and Archer's call to NIME to design 'infra-instruments' [2] and drawing on work by sound-artist Ryan Jordan, we created a 'rock harmonium' in which several rocks were connected across the terminals of a 9v battery. A jack plug was connected using crocodile clips so that the 'ring'made contact to one of the battery terminals and the tip was positioned on a rock. The other end of the jack lead was inserted into a small amplifier (see Figure 5). There were very interesting sonic differences between the different materials with, for example, particulate or moisture containing rocks spluttering in a bursty fashion while granite was largely mute.

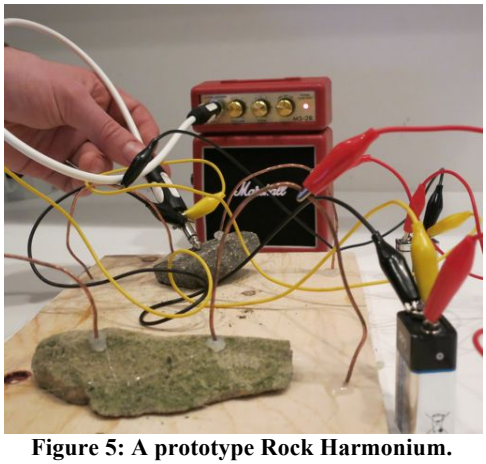

**Figure 5: A prototype Rock Harmonium.**

*Field Recordings.* We located where a number of the artefacts were discovered and captured field recordings from those locations. This material was then played back using granular synthesis techniques in the Borderlands iPad application [4]. The parameters of the grains were directly influenced by the geological data extracted from the particular location. The touchscreen allowed the public to interact with the piece and open up performance possibilities for the installation.

*Recording Water, Ice, Sand and Rocks.* We conducted a number of informal recording sessions involving ourselves along with local musicians and non-musicians exploring geological materials as musical materials. For example, one of our number performed various ways of pouring sand into a resonant metal bowl to which a contact microphone was attached. Using non-precious samples, we created very simple lithophones and recorded visitors percussing them. We placed a contact microphone in a cup of water and recorded its output over a three hour period as it froze in a refrigerator. We made another recording as it melted over the course of three hours when returned to room temperature. The water freezing and melting sounds were played back at low volume as a continuous 'keynote' for the installation. In addition, a Pd patch was created to randomly select and layer up these recordings.

Throughout we attempted to organise our working space so that visitors would have a pathway through it and that areas devoted to ongoing work were partially segregated from areas where artefacts that were relatively complete were on show in some form. At the beginning of our residency, only the loaned items were 'relatively complete' and showable to the public as-is. These were placed on a desk near the entry to the space. As our work unfolded, more constructions became showable and we needed to rethink the overall organisation of the space. Towards the end of our residency we wanted to give a shape to our work and think about the trajectory [1] that a visitor might have through it. In this way, a relatively final form (indeed, an exhibition) emerged.

We gave the work the form of a 'sensorium' – an arrangement in space to create a patterned variety of overlapping sensory experiences, an ecology of activity and presentation which could simultaneously be experienced as a whole as well as its constituent parts explored. As people moved though the space their movement created dynamic crossfades of sound between the pieces. Each construction

could be accessed at close proximity but by zooming out or stepping back, visitors could experience the composition as a whole – as an ecology of objects, sounds and images. To reinforce the character of the sensorium, the room was darkened with the only illumination coming from screens, projections and a few carefully placed small lights.

# 4. REFLECTION

The more detailed evaluation of our work and its process is the subject other papers as, in the space available her, we have concentrated on what we built and our design intentions. But let us sketch five topics around which we feel we can positively review the work we have done and its underlying approach.

*Curiosity.* Our constructions aroused curiosity from visitors in a number of ways. In several cases, we deliberately presented our work with 'wires exposed' and/or code windows showing. By exposing some of the inner workings of what we were making, visitors felt free to engage with us about the techniques, technologies and skills involved in making. We were able to make seemingly quite impressive installations (e.g. a large noisy visual projection and sonification of a microscope image) accessible to people. This also encouraged their playful engagement with several of our pieces and aroused their curiosity about some of the topics we were gesturing towards (geological time-scales, long-term meteorological change, the particularities of Ipswich and its relation to the last ice age, etc.)

*Occasions for Discussion.* Our constructions provoked discussions amongst visitors and between visitors and ourselves. These included technical affairs but also the meaning of individual pieces. Our installation was deliberately not didactic. It was not intended to teach people about the geology of the locality or how meterological and geological systems change over time. But it was intended to provoke imaginative discussions around such topics, which it successfully did.

*Connection to Museum Collection.* The first items visitors would encounter would be the loaned items from the museum collection along with standard interpretative material. This set a frame of relevance for our creative responses and allowed visitors to make comparisons between customary exhibition formats and the kind of work we had done. Several visitors and museum personnel celebrated our work as making (to use one visitor's vocabulary) the "dead objects come alive".

*The Aesthetics of The Sensorium.* Our decision to present our work in a darkened space highlighted its character as a sensorium – as a space where materials were to be encountered through the senses, rather than 'dead' objects to be understood intellectually or didactically. Many of our visitors were clearly affected by the special atmosphere we had created often remarking on its "mystery" when entering the space.

*Provoking Further Creativity.* Throughout our time on site, we were visited by many local artists and other creative individuals. Two visual artists spent most of the duration with us and created a multi-panel video work which we also folded in to the installation. The visual artist who introduced us to the possibility of using a USB microscope to investigate materials has subsequently been inspired to consider the use of geological and related sonic materials in her own work. In this way, our work has provoked the creativity of others in turn.

# 5. DISCUSSION

We have described how, over the course of a residency at the Pacitti Company we created an exhibiton based around creative responses to a collection of artefacts loaned to us by Ipswich Museum in the UK. Our strategy for the residency drew upon the concern to reformulate 'objects' as materials with a potential new life through creative appropriation. We have presented a variety of ways in which we have done this including the creation of devices with an instrumental character (Sonic Microscope and Rock Harmonium), various visualisation and sonification pieces, juxtapositions of historical (indeed paleontological) data with live data, of data from locations which are near to those that are far, engaging in recording sessions which prioritise the sonic possibilities of materials, conducting 'home science' versions of larger geological and climatological processes, and so forth and so on. Some of our work has been enabled by sophisticated technologies, some of it involves banging a rock or crudely electrifying it. In all of these respects, we are materialising museum objects in a very specific sense: encouraging their creative appropriation through aesthetic-sensory work. We have described how we assembled our collection of constructions as a 'sensorium' and have sketched an account of visitors' and participants' experiences in our work.

While there are considerable practical challenges involved in the work we have started to do and have described here, we believe the potential is worthwhile. We do not merely wish to apply the knowledge and techniques we have learnt from NIME and other research areas. Rather, we wish to mobilise that work as a practical contribution to cultural critique. In our work, throughout, we have been mindful of critical contributions to heritage studies and disciplines with an interest in material culture [6]. We are engaged in work which avowedly intends to 'unlock' or 'unfreeze' the collections of heritage institutions and return them to life. And in a parallel argument, we want to initiate a similar shift in 'knowledge exchange': from objects of knowledge to materials of knowing, from ready-made knowledge to making, showing knowing-that to be embedded in multiple ways of knowing-how, and to do so publicly.

# 6. ACKNOWLEDGMENTS

We thank the Pacitti Company for inviting us to contribute to *Performing Collections* and to the Ipswich Museum for providing us with natural history specimens. This research was funded by Creative Exchange an Arts and Humanities Research Council (UK) Knowledge Exchange Hub.

# 7. REFERENCES

[1] Benford, S., Giannachi, G., Koleva, B., et al. From Interaction to Trajectories: Designing Coherent Journeys Through User Experiences. In *Proc. CHI '09*, ACM (2009), 709–718.

[2] Bowers, J. and Archer, P. Not hyper, not cyber, not meta but infra-instruments. NIME 2005.

[3] Bowers, J., Bannon, L., Fraser, M., et al. From the disappearing computer to living exhibitions: shaping interactivity in museum settings. In N. Streitz, A. Kameas and I. Mavrommati, Eds., *The disappearing computer*. Springer-Verlag, Berlin, Heidelberg, 2007, 30–49.

[4] Carlson, C. Wang, G. Borderlands: An Audiovisual Interface for Granular Synthesis, NIME. 2012.

[5] Gaver, W., Bowers, J. et al. Indoor Weather Stations: Investigating a Ludic Approach to Environmental HCI Through Batch Prototyping. CHI 2013.

[6] Ingold, T. Making – Anthropology, Archaeology, Art and Architecture, Routledge, 2013

[7] Petrelli, D., Ciolfi, L., Van Dijk, D., et al. Integrating material and digital: a new way for cultural heritage. *Interactions* 20, 4 (2013), 58-63.