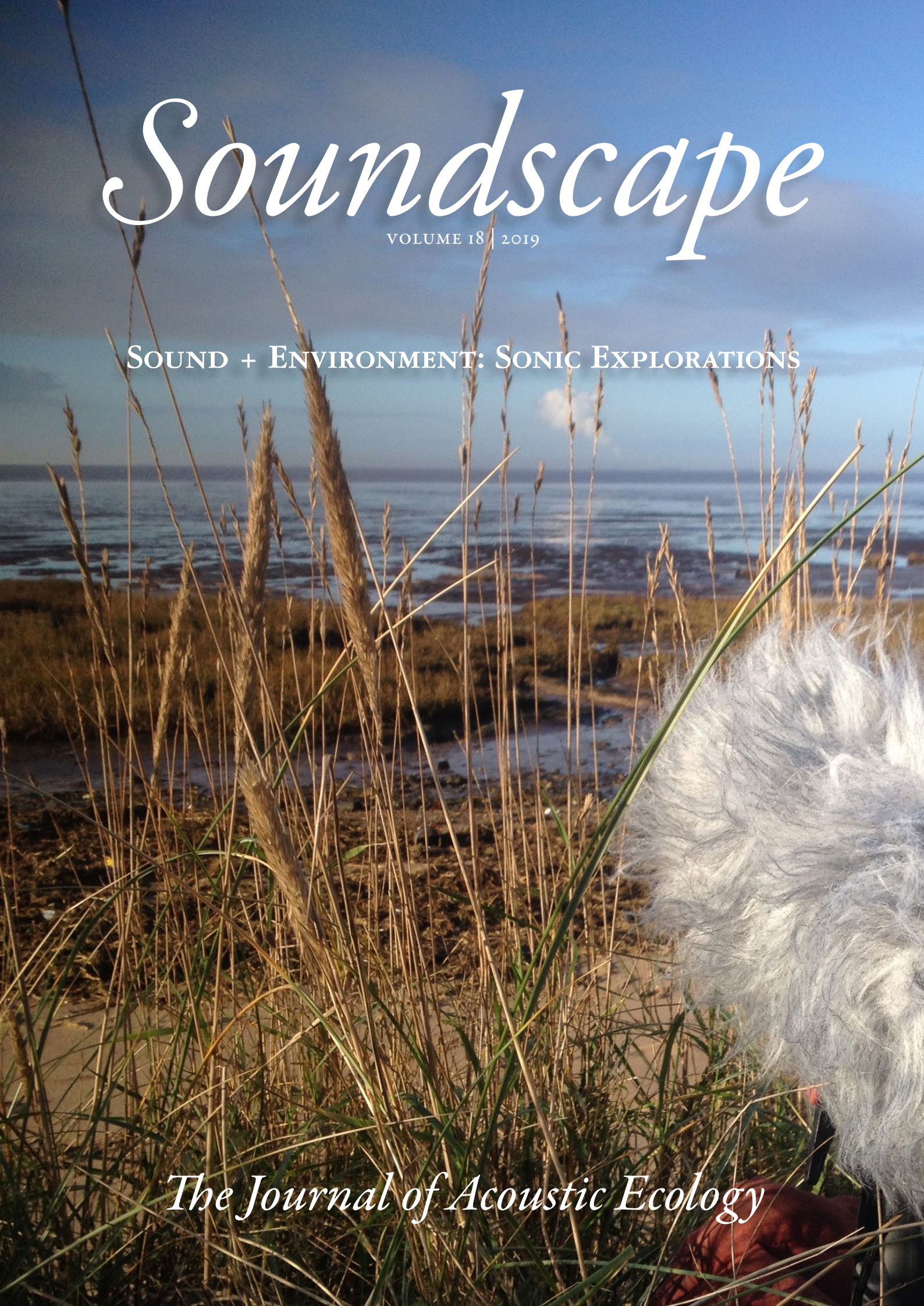

Soundscape

VOLUME 18 | 2019

Sound + Environment: Sonic Explorations

The Journal of Acoustic Ecology

Soundscape

The Journal of Acoustic Ecology
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Soundscape: The Journal of Acoustic Ecology is an English language publication of the World Forum for Acoustic Ecology (WFAE). The publication is conceived as a forum for communication and discussion about interdisciplinary research and practice in the field of Acoustic Ecology, focusing on the interrelationships between sound, nature, and society. *Soundscape* seeks to balance its content among scholarly writings, research, and an active engagement in current soundscape issues, both in and beyond academia while serving as a voice for the WFAE's diverse and global community.

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WORLD FORUM FOR ACOUSTIC ECOLOGY (WFAE)

The World Forum for Acoustic Ecology, founded in 1993, is an international association of affiliated organizations and individuals, who share a common concern for the state of the world's soundscapes. Our members represent a multi-disciplinary spectrum of individuals engaged in the study of the social, cultural, and ecological aspects of the sonic environment.

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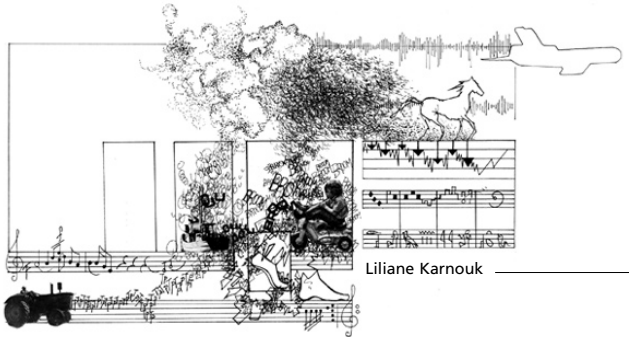
Ideas for journal themes, proposals for new sections, as well as visual materials, are welcomed. You may submit either a proposal or a complete manuscript of a potential article to *Soundscape*. The Editorial Committee would generally prefer to communicate with you beforehand regarding your idea for an article, or receive a proposal, or an abstract (contact information below). Please visit the WFAE website at **www.wfae.net** for further information and instructions for contributions. Texts can be submitted for the following sections in the journal: *Feature Articles*; Current Research: a section devoted to a summary of current research within the field; *Dialogue*: an opportunity for editorial comment from readers; *Perspectives*: reports of events, conferences, installations etc.; *Sound Journals*: personal reflections on listening in the soundscape; *Soundwalks* from around the world; Reviews: of books, CDs, videos, websites, and other media; *Students' and/or Children's Writings*; *Quotes*: sound and listening-related quotations from literature, articles, correspondence, etc.: **Please send correspondence and submissions to:** *Soundscape—The Journal of Acoustic Ecology*, (c/o Leah Barclay, Editor-in-Chief). Email contact: **soundscape-editor@wfae.net**



Liliane Karnouk

Soundscape

The Journal of Acoustic Ecology

VOLUME 18 | 2019

Contents

Guest Editorial

This issue of *Soundscape* titled *Sound + Environment: Sonic Explorations,* publishes expanded articles based on peer reviewed papers[1] selected for the *Sound + Environment 2017* conference[2] held at the University of Hull in June/July 2017. It is one of three journal issues publishing work from the conference. The other journals being *Interference*[3] (ISSN 2009-3578, supported by the University of Edinburgh), and *Sonic Ideas*[4] (ISSN 2317-9694), published by CMMAS (Centro Mexicano para La Música et las Artes Sonoras).

Sound + Environment 2017 was a four-day conference bringing together artists and scientists to explore the ways that sound can deepen our understanding of environments. Through exploring scientific and artistic approaches together, we hoped to engage with sound in order to create complementary ways of investigating, understanding, and taking action. For example, recent developments in the field of ecoacoustics are proving fruitful in assessing ecosystem change. Sound is also increasingly used to monitor built structures and to inform urban design. We can use sound for scientific and artistic exploration, to inform and expand our knowledge of environments and our relationships to the world around us.

The aim of *Sound + Environment 2017* was to nurture meaningful collaborations which could generate new insights. The programme featured paper sessions and panels; workshops; public performances; installations, and interventions. It was hosted by the School of Arts in collaboration with the Institute of Esturine and Coastal Studies, the Institute of Energy & Environment and the Institute of Culture, Place & Policy, at the University of Hull. We received over 240 submissions, and curated a programme of over 100 items, with over 150 conference delegates from 15 different countries. Full details of all abstracts, programme notes, and biographies are available in the conference proceedings[5].

This *Soundscape* issue focuses on five complimentary articles which deal with sonic exploration in one manner or another.

Marcus Maeder discusses his ground-breaking work in *Sounding Soil: An Acoustic, Ecological and Artistic Investigation of Soil Life.* The interdisciplinary project, Sounding Soil, uses innovative techniques to listen to soil soundscapes, making audible some of the behaviours of soil fauna as well as many other acoustic components. Mixing scientific, artistic and citizen science approaches, the project investigates soil soundscapes in agricultural land and forests. The article reports on the research design, and the team's first insights into the relations between land use, soil types, biodiversity, and soil soundscapes.

Katrinem details her investigations of cities through walking, and how her artistic practice has developed in *go your gait! – Artistic research in walking and listening.* She asks the question 'How does the built, controlled, and organized urban environment and its atmospheric qualities influence our walking behavior and perception of space?'. Exploring cities around the world, including Braunschweig, Tehran, New York, and Mexico City, she creates audiovisual compositions, capturing her walking behaviour through video and audio recording devices, sonifying the results.

Soundcamp (Grant Smith, Maria Papadomanolaki, and Dawn Scarfe) outline the collaborative BIOM project, which is developing a network of open microphones in UNESCO Biosphere Reserves, livestreaming soundscapes to the Locuscast global soundmap. Working with partners around the world, the aim of the project is to create new online resources for public engagement and research, bringing together independent work at the intersection of arts, ecology, science and technology.

In *Listening In/Listening Out*, Maria Papadomanolaki gives an account of her workshop *A Certain Geography*, delivered at the *Sound + Environment 2017* conference. A listening workshop, it took the form of a telematic soundwalk, with a remote roamer live-streaming an audio signal of their soundwalk in real-time to an audience listening in a different space. She reflects on this process and the act of collaborative listening.

Mikael Fernström and Sean Taylor, collectively known as Softday, reflect on their practice of Acouscenic Listening in the context of the Creative Soundwalk, which involves a subtle blending of Deep Listening, Tai Chi/Chi Kung, and other mindfulness practices as a means to advance understanding of the everyday. Their article, *An Uncomfortable Audio Ethnography – Sound and politics in the evolution of an Acouscenic Listening approach to Softday's sonically engaged art practice,* reflects on this practice within the broader context of their work.

My thanks go to all of the authors and reviewers for giving their time and expertise to the process, and to Leah Barclay for the invitation to publish this issue of *Soundscape*.

More about *Sound + Environment 2017*

Keynote speakers for the conference were Chris Watson[6] and Dr Leah Barclay[7].

Chris Watson was a founding member of the influential Sheffield based experimental music group Cabaret Voltaire during the late 1970's and early 1980's. Since then he has developed a particular and passionate interest in recording the wildlife sounds of animals, habitats and atmospheres from around the world. As a freelance composer and sound recordist Watson specialises in creating spatial sound installations which feature a strong sense and spirit of place. His television work includes many programmes in the David Attenborough 'Life' series including 'The Life of Birds' which won a BAFTA Award for 'Best Factual Sound' in 1996, and as the location sound recordist on the BBC's series 'Frozen Planet' which also won a BAFTA Award for 'Best Factual Sound' (2012).

Dr Leah Barclay is a multi-award winning Australian sound artist, composer and researcher working at the intersection of art, science and technology. She specialises in electroacoustic music, acoustic ecology and emerging fields of biology exploring environmental patterns and changes through sound. Her work has been commissioned, performed and exhibited to wide acclaim internationally by organisations including UNESCO, Ear to the Earth, Streaming Museum, Al Gore's Climate Reality and the IUCN. She runs several large-scale research projects, including UNESCO Biosphere Soundscapes. Leah is the president of the Australian Forum for Acoustic Ecology, the vice-president of the World Forum for Acoustic Ecology and serves on the board of a range of arts and environmental organisations.

The conference saw the launch of *Trent Falls to Spurn Point*, a specially commissioned surround-sound installation from Chris Watson tracing the course of the Humber River. The installation was the culmination of 18 months of field recording along the length of the Humber estuary, including chemical works, nature reserves and docks. The project was a theatrical sound installation that took the audience on a journey from the confluence of the rivers Ouse and Trent using sound, space and light as an evocation. The installation created a sonic arc of the Humber, sweeping above and below the surface, past a mix of remote wilderness and 21st century technology to Spurn Point where the sounds of the estuary mix and merge with the voices of the North Sea. The final presentation was an ambisonic 3D sound and light installation projected over a sphere of 20 loudspeakers in the University of Hull's Gulbenkian Theatre, with lighting design by Tim Skelly. Several BBC radio and television broadcasts[8] preceded the installation.

Leah Barclay presented a Hull-specific version of her River Listening augmented reality audio walk via her Aurality app using the Echoes.xyz platform. River Listening is an augmented reality sound installation reimagining the world beneath the global rivers in sound. The installation can be experienced by walking along the river with a mobile device and triggering geo-located soundscapes. These geo-located sounds are layered with hydrophone (underwater) recordings and creative responses to the river that connect to the soundscapes of river systems across the world. This installation is part of an interdisciplinary project exploring the art and science of listening to rivers and the creative possibilities of aquatic bioacoustics. River Listening explores rivers as the lifeblood of communities and the potential for new approaches in the conservation of global river systems. To experience River Listening, the free app can be downloaded from the Appstore and any smartphone will act as a sonic compass guiding the listener along the river bank.

Leah Barclay also ran a hydrophone listening workshop for local school children as part of the conference's outreach activities, as well as presenting her original soundscape compositions using hydrophone recordings from the Great Barrier Reef.

A number of other sound installations and performances were featured in collaboration with Hull UK City of Culture and the PRS New Music Biennial, including the work of visiting artist-in-residence, Dave Burraston, who presented an installation and talk as part of his Rainwire project[9], which aims to monitor rain fall through the application of novel longwire instruments to create acoustic rain gauges. Burraston was also mentored by Chris Watson as part of an NSW Regional Arts Fellowship.

In the lead up to the conference, and as part of Hull's City of Culture programme, Peter Cusack curated *Favourite Sounds of Hull*[10] as a continuation of his Favourite Sounds project. Since 1998, he has built a fascinating archive by inviting partcipants to identify their favourite sounds in London, Beijing, Prague, Berlin, Birmingham, Manchester and Southend-on-Sea. The result is a series of intriguing and often surprising results, revealing both the city of the ear, and the significant role that everyday sounds play in our lives. *Favourite Sounds of Hull* is a further step in a journey that encourages the local community as well as those who know and love Hull, to identify and share with the rest of the world, their favourite sounds of their city – a project devised especially for Hull, which ran from the autumn of 2016 and throughout the City of Culture year. Curated by Peter Cusack, and produced by Serious in association with the School of Arts of the University of Hull, the public were encouraged to submit their favourite sounds throughout the year and these were recorded and made available for all to hear at various live events during 2017.

During the weekend, we also collaborated with the PRS New Music Biennial, with installations presented in the City Centre, including an ambisonic sound Installation from artist Jason Singh exploring the voice of Hull; *Ring Out:* An event where kinetic sound sculptures by Ray Lee integrate with soundscapes of Hull city centre; and an installation inspired by Spurn Point from Gavin Bryars in Winestead Church.

Another inclusion in the programme which featured in the city centre was *Offshore: Artists explore the sea.* A major new exhibition produced and curated by Invisible Dust[11] which contained a number of sound-related works. *Offshore* included new and existing works by internationally-renowned artists[12] whose engagement with our seas and oceans resonates with Hull's own very particular relationship to the sea. It was a first joint exhibition for Ferens Art Gallery and Hull Maritime Museum. *Offshore* was curated to uncover the crisis of the health of our oceans. Artists explored oceans role as a source of food and energy, coral bleaching, a dumping ground for waste and the reference point for many of our most haunting and significant myths. Through a range of media, poetry, writing, film and art these artists posed questions about our connection to and

use of the sea. Invisible Dust developed relationships between some of the artists with marine biologists and ecologists from Oxford, Southampton and Hull Universities. Being informed and influenced by the science provided new stimulus to the artists' ideas.

A series of workshops and interventions were run on the University of Hull Campus and in town throughout the conference, as well as a rich and varied programme of paper sessions, installations, and concerts (with sound works diffused over the HEARO[13] 30 loudspeaker sound system). The last day of the conference brought together all participants with a plenary session and panel session chaired by Jez riley French with Leah Barclay, Chris Watson, Alice Eldridge and Dave Burraston. Eric Leonardson also ran a group session to discuss the future of UKISC (UK and Ireland Soundscape Community), an affiliate of the World Forum for Acoustic Ecology, which was well attended, indicating a renewed interest in the network.

A full programme and proceedings of the conference can be found on the *Sound + Environment 2017* website: **https://soundenvironment.net**.

Guest Editor: Rob Mackay

Reviewers: Matthew Barnard; Alice Eldridge; Annie Mahtani; Adam Stanović

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Endnotes

1 Organising committee: Rob Mackay; Matt Barnard; Jez Riley French; Tariq Emam; Kathryn Queen. Reviews committee: Matt Barnard; Matthew Burtner; Joel Chadabe; Peter Cusack; John Drever; Almo Farina; Jez Riley French; Lauren Hayes; Cathy Lane; Eric Leonardson; Rob Mackay; Roger Malina; Annie Mahtani; Brona Martin; Stuart McLelland; David Monacchi; Stephan Moore; Katharine Norman; Linda O'Keeffe; Simon Oliver; Aki Pasoulas; Louise Roberts; Phil Rubini; Grant Smith; Pete Stollery; Matt Stone.

2 **https://soundenvironment.net**

3 **http://www.interferencejournal.org/**

4 **https://sonicideas.org**

5 **https://soundenvironmentnet.files.wordpress.com/2018/06/sound-environment-2017-proceedings.pdf**

6 **https://chriswatson.net**

7 **https://leahbarclay.com**

8 **https://www.bbc.co.uk/news/av/uk-england-humber-40420309/humber-estuary-sounds-recorded-for-hull-university-s-city-of-culture-project**

9 **http://rainwire-project.blogspot.com**

10 **https://www.favouritesounds.org/?projectid=55**

11 **http://invisibledust.com**

12 Artist new commissions: Saskia Olde Wolbers, Mariele Neudecker, Badgers of Bohemia, Kasia Molga, Martin Parr, Bik Van Der Pol, Phil Coy, John Wedgwood-Clarke and Rob Mackay, Jonathan Baldock and Ian J Brown, and new essay by author China Miéville.

Artist works: Tacita Dean, John Smith, Adam Chodzko, Alexander Duncan, Tania Kovats, David Malone, Verena Paravel and Lucien Castaing-Taylor, Emily Richardson, Shimabuku, Zineb Sedira, Lawrence Lek

13 **https://hearo.blog**

Report from the Editor

It is wonderful to have the latest edition of Soundscape bring together research from the WFAE's UK and Ireland Soundscape Community (UKISC) affiliate with guest editor Dr Rob Mackay.

Rob Mackay is an award-winning composer, sound artist and performer who works in a highly interdisciplinary context across acoustic ecology, geology, theatre, audio-visual installation work and human-computer interaction.

This edition highlights selected papers from 'Sound + Environment 2017' – a four day conference hosted at the University of Hull that brought together artists and scientists to explore the ways that sound can deepen our understanding of environments. Rob conceived and directed this event and I was privileged to take part in the conference. I was thoroughly inspired by the incredible program and Rob's talent and passion for bringing people and ideas together around the field of acoustic ecology. I was thrilled he accepted the guest editor invitation for Soundscape to curate a series of research highlights from the conference. There is some ground-breaking research presented in this edition, but I will allow Rob to introduce the articles and authors in his guest editorial. I also wanted to acknowledge the work of Matthew Barnard, Alice Eldridge, Annie Mahtani and Adam Stanović who peer reviewed these articles and personally thank Rob Mackay for his fantastic work in bringing this edition together.

Please join the WFAE on our social media platform in the coming weeks and months as we profile each of these authors and showcase content from the research featured in this edition.

– **Dr. Leah Barclay,** Editor-in-Chief

Report from the WFAE President

My report briefly summarizes news presented in our previous edition of *Soundscape*, volume 17 with several additional notes. This edition, guest edited by Rob Mackay, affirms a breakthrough for the WFAE's UK and Ireland Soundscape Community (UKISC) affiliate. Rob's effort in organizing the successful *Sound + Environment 2017* conference at Hull University deserves our deep appreciation and gratitude. It offered a prime opportunity to convene a large gathering to discuss the relationship between the WFAE and UKISC. This led to reactivating UKISC and it is my pleasure to report that Rob has taken on the role serving as chair of UKISC, as well as its voting representative on the WFAE's Board of Directors. Look for UKISC's new web presence as we continue the process of making it a viable, regional support for acoustic ecology.

Following its launch in 2016, development of the WFAE's own web presence continues. A positive response for a call to the membership for submissions to our new WFAE online library, combined with a large body of content saved from the old library (on the former wfae.proscenia.net site), provides a sizeable collection of publications, projects, organizations, sites, and other resources that should be freely accessible sometime this year. As the former online library was frequently cited in scholarly publications, we hope the new online library will be an improvement with new and easily searchable content. Once launched, the library will continue to grow. I also hope those who maintain publications and websites will update their links to reconnect to the new library page.

In June, WFAE Secretary Tyler Kinnear announced he will be leaving his position to pursue numerous new professional opportunities and commitments. Tyler replaced Christopher DeLaurenti as WFAE Secretary in late 2017. While this comes as a loss to the WFAE, the WFAE Executive Committee sincerely thanks Tyler for his brief but excellent service. We express our pride and excitement for the auspicious advancement in his personal life and professional career development. Tyler remains a member of CASE/ACÉS and began his service on the WFAE Board as CASE Representative in late 2016. In May 2017, Tyler completed his PhD in Musicology at the University of British Columbia. He serves on the editorial board for the Ecomusicology Review and teaches as an Adjunct Instructor at Western Carolina University. You can read his publications at **https://wcu.academia.edu/TylerKinnear**.

Completion of this edition of *Soundscape* provides an opportunity to direct time and attention to upgrading the journal's role and functionality, while Editor-in-Chief Leah Barclay manages the creation of the journal's next edition. Communicating submission policies and guidelines for authors will, among other features under discussion, boost the journal's value and professionalism. With a new level of participation by the Journal Editorial Committee, we anticipate future guest editors, mainly the WFAE's Affiliate Organizations and our growing body of Individual Members assures *Soundscape* realizes its purpose as the voice of the WFAE.

As mentioned in my previous report for volume 17, new conferences are coming up in October 2019. The Central European Network for Sonic Ecologies (CENSE) conference, *MURMURANS MUNDUS: Sonic Ecology and Beyond* happens 3–5 October in Ústí nad Labem, Czech Republic. Continuing from where the founding conference of the Central European Network for Sonic Ecologies in Budapest 2018 left off, leading to the formation of Central European Network for Sonic Ecologies (CENSE), this conference has four thematic blocks as its focus. The call for papers and performances closed on July 31. For details please visit the conference website: **http://murmurans.ujep.cz**. The relationship between the WFAE and CENSE remains under discussion.

The launch of Red Ecología Acústica – México/Acoustic Ecology Network – Mexico (REA-México) takes place with a conference at the **Fonoteca Nacional** in Mexico City, on October 21–23. I look forward to participating in the effort to establish a new WFAE Affiliate Organization in Mexico, with an important role to play in supporting greater involvement in acoustic ecology throughout Latin America. Immediately following the REA-México conference are two more hosted by the Department of Arts and Humanities of the **Universidad Autónoma Metropolitana**: an *International Immersive Seminar* from the research group *Practice as Research in the Arts, Transdisciplinarity, Sound* and the launch of *Leonardo Laser Talks Mexico* in conjunction with the **International Society of the Arts, Sciences and Technology (ISAST)**. These seminars and conferences conclude on October 27.

To conclude and reflect, I am pleased to note that on and around the date of July 18, the birthdate of R. Murray Schafer, many individuals and organizations made time for deep and expansive listening around the world when they participated in "Listening With," the theme for **World Listening Day 2019**. The theme was created by internationally acclaimed composer Annea Lockwood who celebrates her 80th year with a vitality and exuberance that charms and inspires, with a deep passion for listening, not just *to* the natural world but *with*. As we proceed into troubling times ahead for the global and local environment, it is all the more necessary to thank and appreciate those who contribute to our understanding of our future unknown.

—Eric Leonardson
August 2019

Eric Leonardson, a Chicago-based audio artist, serves as the Executive Director of the World Listening Project, founder and co-chair of the Midwest Society for Acoustic Ecology, and President of the World Forum for Acoustic Ecology. He is Adjunct Associate Professor in the Department of Sound at The School of the Art Institute of Chicago (SAIC). As a performer, composer, and sound designer, Leonardson created sound with the Chicago based physical theater company Plasticene (1995–2012). Leonardson performs internationally with the Springboard, a self-built instrument made in 1994 and often presents on acoustic ecology to new audiences beyond art world contexts; engaging and connecting communities in the interrelated aspects of sound, listening, and environment.

Sounding Soil: An Acoustic, Ecological & Artistic Investigation of Soil Life

by Marcus Maeder*, Martin M. Gossner**, Armin Keller***, Martin Neukom****

Abstract

The interdisciplinary Sounding Soil project explores the soil's soundscape and renders experienceable and investigable the activity and diversity of soil life in an artistic-acoustic observatory. The main aim is to increase soil awareness in the general population as well as among decision-makers involved in soil policies and food producers. While moving through or digging the soil matrix, the soil fauna produces noises. Moreover, some animals seem to use the soil as a communication medium, forming a complex soundscape. Land use and agricultural management may have marked effects on the soil soundscape. Thus, the (acoustic) richness of a local soil animal community may serve as an indicator of the functioning of a soil ecosystem. In the scientific module of the Sounding Soil project, we implement and test acoustic indices to assess soil biodiversity and community composition. In the art and citizen science module, several Swiss farmers and subsequently the broader public record the soundscapes of their soils with a low-cost recording device. The result is a sound art installation as a publicly accessible observatory, integrating our scientific findings with recordings by participants in the citizen science module. This article describes the character of soil soundscapes in agricultural land and forests and reports on our research design and first insights into the relations between land use, soil types, biodiversity, and soil soundscapes.

Keywords: Acoustic Ecology, Artistic Research, Bioacoustics, Ecoacoustics, Soil Ecology

Introduction

Soils mostly present themselves to us as a diverse surface while the interior remains hidden. We cannot see the manifold organisms and life processes present in soils, but we may hear them if we listen closely. Soil ecosystems are complex with closely interwoven biotic interactions. Soils are highly sensitive to disturbances, such as human farming systems or forest management. Healthy soils are of key importance because they provide indispensable ecosystem services (Haygarth and Ritz 2009; Greiner et al. 2017). Soil systems filter and regulate water, provide nutrient cycles, and deplete toxic substances (Bouma 2014; Adhikari and Hartemink, 2016). Sustainably managed soils enhance the resilience of agricultural systems and can adapt to changing climatic conditions while also contributing to the reduction of greenhouse gases in the atmosphere by carbon sequestration (Lal 2004). In contrast, soil degradation has increased in recent decades. This applies not only to its spectacular form in the tropics, with immense land loss through deforestation and erosion, but to what is directly at our front door, in the fields where our food is produced, through degradation with mineral fertilizers, pesticides, and antibiotics, as well as soil compaction by increasingly heavy machinery (Oldeman 1994; Stolte et al. 2016).

There seems to be a basic perception problem regarding these environmental issues; the pedosphere and its functions or state of health cannot easily or instantly be translated into a sensual experience. It is a black box for experts to open and interpret, and then they can convey their findings to "non-experts" (Bouma 2010). For the most part, the ground beneath our feet is not an object of our observation or contemplation; it is just there, and because it eludes

Fig. 1. What is going on below the surface?

* Zurich University of the Arts ZHdK and ETH Zurich, ** Forest Entomology, Swiss Federal Institute for Forest, Landscape and Snow Research WSL, *** Swiss Soil Monitoring Network NABO, Agroscope, **** Zurich University of the Arts ZHdK

our direct perception, we treat it like some dead mass. Therefore, increasing awareness of soil ecosystems is crucial.

We require first-hand experience of soil life and its health. This is true not only of the consumers of agricultural products but also of the producers in the fields, wholesalers, and political decision-makers, as well as researchers seeking effective methods for exploring soil ecosystems. Accordingly, new forms of investigating and experiencing soil ecosystems are necessary; they could increase environmental awareness and influence our attitudes and behaviours towards the pedosphere as the basis of nutrition for all future generations.

There is a need for technical enhancement and facilitation of research on, and assessments of, soil health, especially for making rapid appraisals of soil biodiversity, community composition, and activity as indicators of soil ecosystem functionality (Wagg et al. 2014). Multifunctional, fertile, healthy soil provides essential nutrients for crop and plant growth, supports a diverse and active biotic community, and enables undisturbed decomposition (Mäder et al. 2002). Conversely, a community of diverse and numerous soil fauna may serve as an indicator of soil ecosystem multifunctionality (Lavelle 1996; Griffiths et al. 2016; Aksoy et al. 2017). In particular, soil invertebrate communities are "deeply affected by human activities; in most agroecosystems, they tend to disappear. Little if any mention is made of possible links between the elimination of such important regulators of soil processes and the lack of sustainability of most agricultural systems" (Lavelle 1996, 4). Measurements or estimations of soil biodiversity and activity, therefore, become increasingly important in assessments of soil ecosystem functionality, but they tend to be technically complex and time-consuming (Griffiths et al. 2016). In general, the investigator must take a soil sample and analyze it in a laboratory or conduct experiments with microcosms (Jones and Bradford 2001). Consequently, the sampling process (normally comprising digging up the soil) will either disturb or destroy the pedon or an artificial setup will detract the investigation.

An acoustic investigation and appraisal of soil fauna biodiversity and activity may offer an alternative to costly and invasive methods (Sueur et al. 2008). Almost every organism produces sound waves as its life manifestation. Be it movement activity or communication, we can potentially hear which organism does what under which circumstances on the one hand, and we may contextualize the organism's acoustic activity with the sounds of the environment on the other hand. Acoustic appraisals of the richness of local species are often much more affordable than, for example, an all-taxa biodiversity inventory (Depraetere 2011).

An ecoacoustic investigation entails placing audio recording devices with microphones or microphone arrays in a particular environment. Such a setup may be enhanced by acoustic microscopy using high-end amplifiers and highly sensitive acoustic probes that render audible the activities and processes in an ecosystem that are not normally perceptible, such as the activity of the soil meso- and macrofauna (Mankin et al. 2000; Chesmore 2008).

The Soil Soundscape

Soil acoustics

Soil acoustics differ fundamentally from atmospheric acoustics.[1] Most soils have a very heterogeneous structure consisting of organic, mineral, gassy, and fluid components. In general, soil structures show strong attenuation effects on sound waves, especially on sound frequencies above 2 KHz (Oelze et al. 2002). Attenuation of sound in soils is caused by the porous structure that scatters, reflects, breaks, and bends any sound waves travelling through the soil matrix (Bourbié et al. 1987). Moreover, the attenuation and

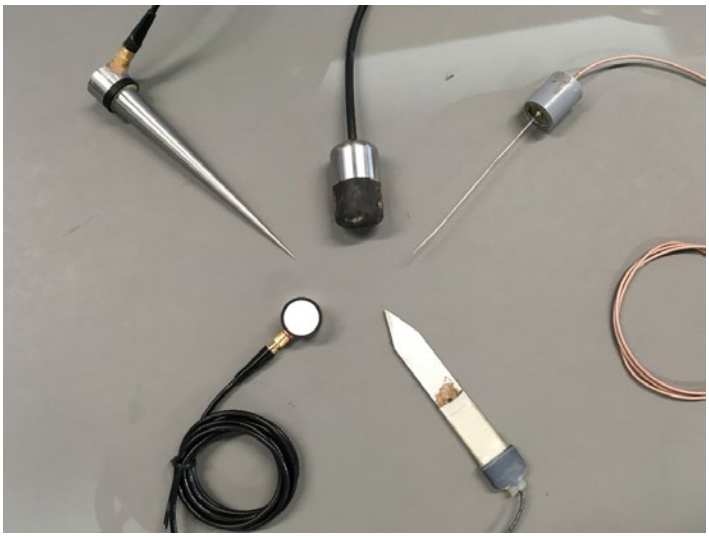

Fig. 2. Sounding Soil prestudy in summer 2016: Testing different acoustic sensors at the WSL, Birmensdorf/Switzerland.

propagation speed of sound in soils depend on the moisture content and density of the soil structure (Lu and Sabatier 2008). Therefore, the bandwidth of signals to investigate is much narrower than it would be in recordings with microphones through the air. It ranges from the infrasound spectrum (0–20 Hz) up to the lower parts of the audible domain. High frequency or even ultrasonic signals (above 20 KHz) may be detected and measured as well, but only very locally/close to the acoustic probes. These signals seem to be of physical origin and are associated with water infiltration and drainage of the soil pore system (Moebius 2013).

The structure of soil soundscapes

When a soundscape is analyzed using ecoacoustic methods, it is generally separated into different groups of sound sources comprising geophonies, biophonies, and anthropophonies or technophonies (Farina 2014; Farina and Gage 2017). These acoustic components set and represent the structure and ecological interrelations of a landscape to different extents and in various degrees (see fig. 3). Sounds of an inanimate nature are subsumed under the term geophonies (e.g., the sounds of wind, rain, waves, rockfall, or rivers), while sounds of an animate nature belong to the realm of biophonies (vocal or vibratory communication of animals, acoustic emissions of plants, and all other physiological noises of organisms). Human vocalizations (language, shouting, etc.) would also constitute part of the biophonies – in contrast to the other noises that stem from human/civilization activity, such as technological sounds or traffic noise, which belong to the category of anthropophonies or technophonies, respectively.

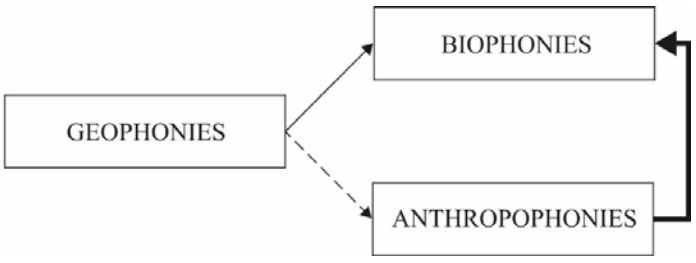

Fig. 3. Graph by Almo Farina: "Geophonies are the sonic sources that have direct influence on biophonies and secondarily on anthropophonies. Anthropophonies can strongly impact on biophonies" (Farina 2014, 11).

Geophonies

Numerous geophysical sound sources are identifiable in soil. The geo-acoustic literature predominantly focuses on the acoustic detection of movements in the earth mantle or in rock layers and on seismic investigations of soil, rock layers, or seabeds via active acoustic methods.[2] However, a few acoustical studies in soil physics exist on the movement of soil water (Flammer et al. 2000; Moebius 2013) or constantly occurring changes in the physical soil matrix, such as pore displacements (DiCarlo et al. 2003). Acoustic parameters may be used to monitor changing soil properties, such as porosity, water content, and water potential (Lu and Sabatier 2009). According to Farina's (2014) graph in fig. 3, the geophonies of soils represent the physical (re-)sources of soil life: the sounds of infiltrating, draining, and moving water and of formations of macropores by cracks or collapsing parts of the soil structure may serve as acoustical indicators of the state and dynamics of soil faunal and floral habitat conditions. The geophysical components of the soil soundscape, however, appear episodic; much more acoustic activity is to be found in the realm of biophonies.

Biophonies

Little is known about the acoustic activity of the soil fauna and flora. A handful of studies have been carried out to investigate soil insect infestations acoustically (Mankin and Fisher 2002; Brandhorst-Hubbard et al. 2001) and the vibrational communication of insects using the substrate as a nearfield communication medium (Virant-Doberlet and Cokl 2004; Cocroft and Rodriguez 2005). The most frequently occurring acoustic manifestations of soil animals consist of moving and feeding noises by the meso- and macrofauna.[3] The frequencies of such physiological noises (crawling, chewing, digging, etc.) vary with the body size (cf. fig. 10), morphology, and species-specific behaviour of the animals present in a pedon (Mankin et al. 2011).

Beyond that, certain animals living in the soil or on its surface communicate acoustically or seismically (vibrational communication) with each other, which makes listening to soil a surprising and fascinating experience. These signals are produced by the stridulatory apparatus (legs, mandibles, or other body parts) of soil insects (adults as well as larvae). Some studies have investigated the stridulation signals of submerged ants, signalling their position to conspecifics (Markl 1965), or signals for recruiting nestmates for food resources (Baroni-Urbani et al. 1988), while other reports may be found on the vibrational communication of grass- and leafhoppers using the substrate (plants, ground) as a communication medium for mating purposes (Heldmaier and Werner 2003).

Monica Gagliano et al. (2012) investigated the acoustic emissions of plant roots and anticipated "that plant acoustic radiation is not simply an incidental mechanical by-product attributable to cavitation [acoustic drought stress signals/indicators, the ed.] alone; recent evidence illustrates that the young roots of corn generate structured, spike-like, acoustic emissions." Whether these acoustic emissions – as Gagliano (2012) argues – have a signalling or communication purpose in and between plants remains an unanswered question.

Anthropophonies/Technophonies

Even less is known about the human impact on soil soundscapes. To the best of our knowledge, no study has investigated the ecological effects of noise pollution in soils. We may assume that anthropogenic sound and vibration emissions exert an influence on soil animal behavior as well as species composition, abundance, and interaction as they do in other elements or ecosystems (Codarin et al. 2009; Francis et al. 2012). Investigations of soil animal behaviour remain complicated and costly, as it is not possible in most cases to visually observe soil animals. Thus, observing soil animals by acoustic means is a very promising method, and it can also be useful in investigations of noise pollution effects in soils. The question is, however, what sounds of human/civilizatory origin may be heard/detected in soils. There are not only diverse vibratory emissions by streets, highways, construction, or mining sites that spread in large areas underground (Kim and Lee 1999); even airborne noise is capable of penetrating the interface between pedo- and atmosphere, especially if these emissions consist of deep frequencies/long wavelengths that are not reflected by the soil surface. One example is aircraft noise (fig. 5).

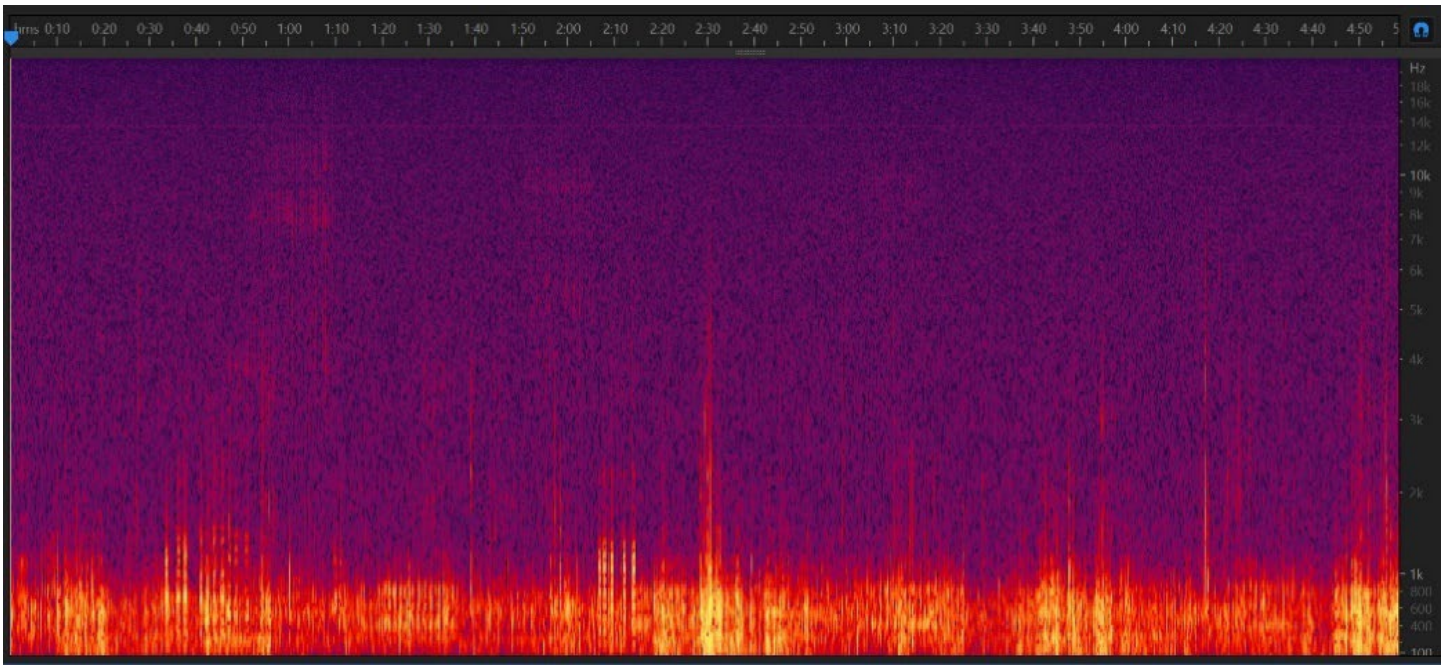

Fig. 4. Spectrogram of the acoustic activity of a soil community in a meadow, Valais, Switzerland. Some biotopes show an immense diversity of soilborne biogenic sound sources. The overlapping of movement noises, communication calls, and wind/moving vegetation makes ecoacoustic investigations of soil soundscapes a challenge.

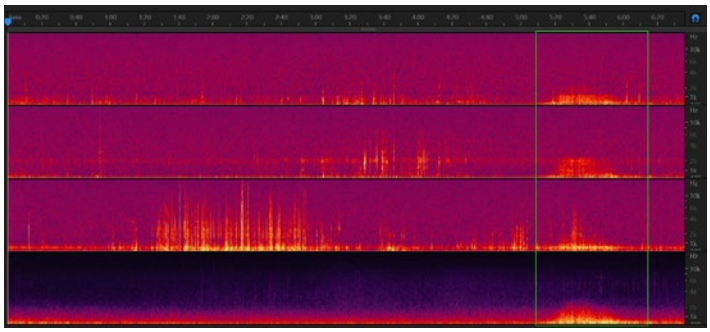

Fig. 5. Spectrogram of a 4-channel recording in forest soil (brown earth with mull humus). Channel 1 (top): acoustic sensor plugged into the soil surface; channel 2: sensor lying on the soil surface; channel 3: sensor plugged into the soil at 1 m distance to channel/sensor 1; channel 4: Electret microphone at 2 m height above soil surface. Aircraft noise (marked by the green box) appears on every channel of the recording.

Furthermore, the impact of anthropophonies and technophonies on ecosystems has become an issue in artistic investigation and production. Leah Barclay showed impressive examples of the effects of boat traffic noise on the water fauna in rivers and the sea (Bianchi and Manzo 2016) at the Sound & Environment Conference 2017. One of the goals of our Sounding Soil project in that context is to investigate and render artistically experienceable such effects in soils – not only regarding noise pollution but especially concerning the forms and intensities of land use (agricultural and forestry management) and their effects on the soil soundscape.

An Exploration of Swiss Soils

Land use and humus forms

In summer 2017, we conducted a recording and sampling procedure in 20 different soils in Switzerland at well-defined monitoring sites of the Swiss Soil Monitoring Network (Gubler et al. 2015). The sampling plots were selected along a gradient of land use (agricultural plots: from intensive to extensive or organic management) and humus forms (forest soils: from mull to mor) with three repetitions (type of land use/humus form). The sites were selected to cover a wide range of different soil types to allow for exploring possible differences in the composition of their soundscapes and investigate whether different types of agricultural management as well as forest soil humus compositions influence what may be heard below ground.

Recording and measurement techniques

As soils consist by a bigger part of solid structure, detection and measurement equipment from the physical acoustics domain is used: piezo contact sensors, geophones, accelerometers, etc. (Mankin et al. 2000). Such sensors must be physically coupled to the soil matrix by burying or plugging them into the soil. We modified self-built contact sensors developed previously for recordings in plants (Maeder 2015) to couple them with a soil area with a radius of about 30 cm and a depth of 30 cm – that is the top soil layer, which serves as the main habitat of most soil organisms.

The sensors consist of a simple piezo diaphragm (15 mm diameter), on which we soldered a gilded copper needle (1 mm thickness and 10 cm length). The housing of the sensor is made of a grey plastic tube and a backing/water sealing system consisting of epoxy resin and silicon (see fig. 6). The needle operates as a waveguide for acoustic waves to capture sound events in the soil, and then transmits these waves to the piezo element, which transforms the vibrations into electrical voltage. These signals are very weak and need to be preamplified. We modified hydrophone charge preamplifiers from Avisoft Bioacoustics, allowing us to amplify the incoming signals by a factor of 100 (+40 dB) or 1,000 (+60 dB), respectively. The preamplifiers were then connected to an Avisoft USGH 116h (one channel) or 416hb (4 channels) A/D interface, which is used in bioacoustic investigations (cf. www.avisoft.de).

The captured signals from the soil were then recorded/logged with a tablet or mini PC running the Avisoft Recorder software. The recordings were made with 50 and 25 KHz sampling rates and a bit rate of 16 bits and were then analyzed with Avisoft SAS Lab© and Adobe Audition© software, as well as custom-built Cycling74 MAX© patches. However, as this recording setup is costly (apart from the self-built sensors), we are currently developing a low-cost recording device for use in the later described citizen science part of the Sounding Soil project.

Fig. 6. Mobile recording device with preamplifier and self-built acoustic sensor.

There are important factors to consider in the conception and planning of acoustic recordings in soils. Periods of windy and rainy weather must be avoided or be excluded from the analysis. Raindrops may hit the sensors or their cables and produce artifacts, similar to how wind moves cables or vegetation (which produces movement noises that are transmitted via the stem and roots to the soil). Proximity to heavily used streets, highways, train tracks, or construction sites should also be avoided because the vibrations of heavy machinery may spread for hundreds of metres in soils. If the soil under investigation lies in an area where considerable animal movement is expected, the recording area must be protected with barriers or lattices.

Last but not least, the recordist and her/his recording devices should be positioned as far as possible from the sensor to avoid recording her/his own movement noises (at least a cable length of 3 m between the preamplifier and recording device, in contrast to the sensor cable, which should be as short as possible – ideally 20–30 cm). The aforementioned problems with low frequency/vibratory environmental noise may be partially solved by using high pass filters at 50–100 Hz.

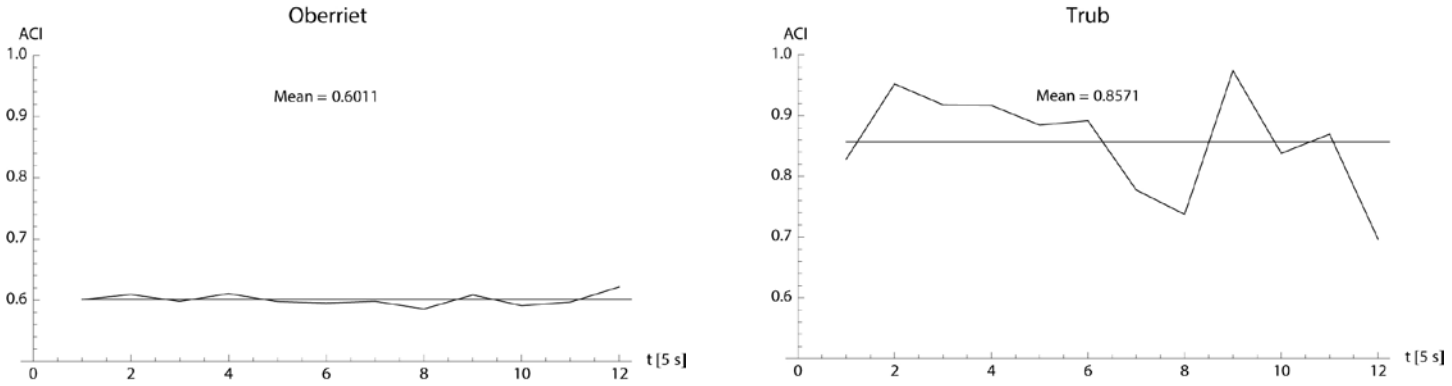

Fig. 7. Acoustic Complexity Index (ACI) measurements of two arable soils (1 min excerpts, 5 s intervals). Left: arable soil with industry potatoes and conventional agricultural management (Oberriet, Switzerland). Right: arable soil with oat, cultivated under organic agricultural management (Trub, Switzerland). The example on the right shows higher ACI rates.

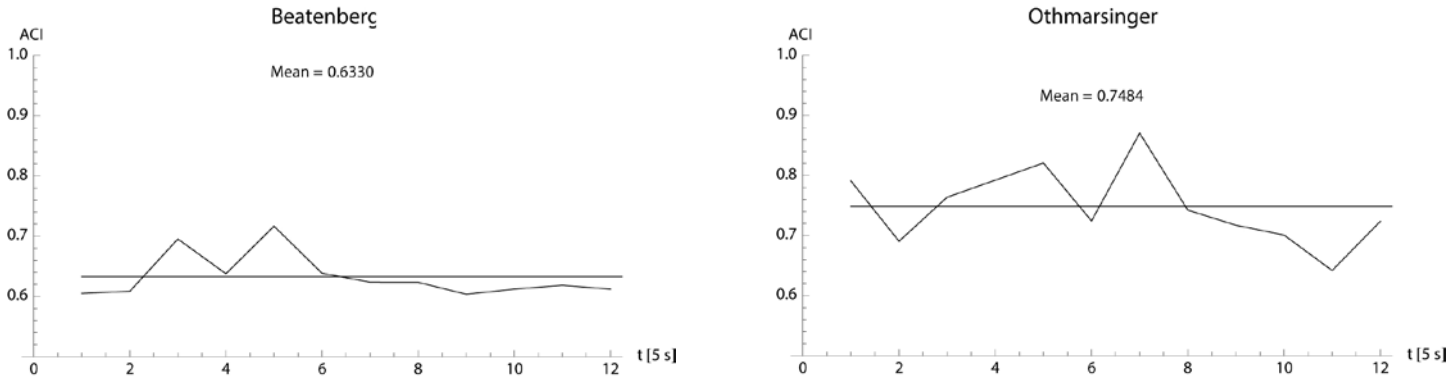

Fig. 8. ACI measurements of two forest soils with different humus layers (1 min excerpts, 5 s intervals). Left: a mor humus soil (Beatenberg, Switzerland). Right: a mull humus soil (Othmarsingen, Switzerland). The example on the right shows higher ACI rates.

Ecoacoustic investigations

Our recording and sampling in summer 2017 was aimed at investigating if gradients of human land use and humus/litter composition influence the complexity of a soil soundscape (figs. 7 and 8). Acoustic complexity has played an important role in recent ecoacoustic research (Pierretti et al. 2011). It may serve as an indicator of biodiversity in a particular sector of an ecosystem or landscape (Harris et al. 2016). The diversity and complexity of audio information in a soundscape may be measured by different acoustic indices (Sueur et al. 2014), which are applied on audio recordings.

In our first analysis, we used two different acoustic indices and compared them: the Acoustic Complexity Index (ACI) and the Acoustic Entropy Index (AEI). Since the AEI is very sensitive to background noise in the environment, we decided to use the ACI for our field recordings[4] – these had a standardized length of 15 minutes in total, and we selected a 1-minute excerpt of each recording for our analysis (a segment of the recording with the fewest background noise). The excerpts were filtered with a lowpass filter at 2 KHz and then analyzed with the ACI algorithm in 5-second steps and an FFT window size of 1,024.

On the same plot where we took the audio recordings, samples from the top soil layer were taken with a Kempson corer of 30 cm diameter and 20 cm length, suggested as a suitable method for assessing soil fauna in the frame of a Rapid Ecosystem Function Assessment (Meyer et al. 2017). The litter layer was separately collected in plastic bags. The samples were brought to the laboratory and the soil/litter animals were extracted using the Berlese/Winkler methods (Sabu et al. 2009; Meyer et al. 2017). The collected animals were identified, mostly on the level of taxonomic orders, and counted (Dunger 1983).We then compared/correlated our ACI measurements with the taxonomic countings (fig. 9).

We found significant differences in acoustic complexity between different land-use types, with the highest values in extensively managed grasslands and lowest in arable fields (fig. 9). Intensively managed grasslands and forests had intermediate values. The high variability within grasslands may be explained by the farmers' different treatment methods within the management schemes – some manage their land more sustainably than others, and in the case of

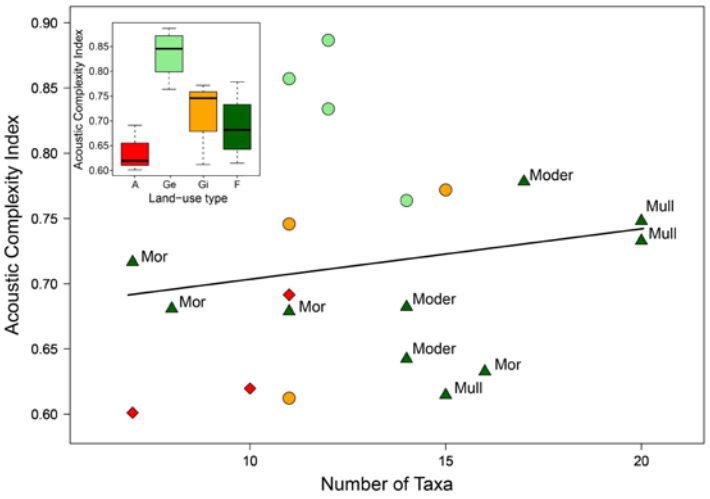

Fig. 9. The ACI as a function of the richness of soil taxa assessed by Berlese incubation of soil cores (Kempson method). Different land-use types are indicated by different colors and symbols. A = arable field, G = grassland (I = intensively managed, e = extensively managed), F = forest (respective humus forms are indicated by the labels). The black line shows a linear regression across all sites.

a declaration of intensive management with regard to fertilization plans, grazing, and moving patterns. The high variability within forests can be explained by the different activity in different soil types.

The results show an overall weak, positive relationship between acoustic complexity and higher taxa diversity (total 26 taxa), assessed by traditional methods (fig. 9). In arable fields and grasslands, we expected decreasing management intensity results in an increase in the diversity of the soil fauna and consequently in high acoustic complexity. In forests, we expected a corresponding gradient in our ACI measurements according to the qualification of different humus forms as worse or better habitats for soil organisms (a gradient from mor/worse over moder up to mull/better). The weak observed correlation in open land-use types as well as in forests might have been due to the low taxonomic resolution, or the abundance of particular taxa might not well reflect their activity during the recordings. We will study this in more detail in the next step.

By analyzing the composition of acoustic signals (i.e., their peak frequencies) and soil fauna, we found a good indication that low- and high-frequency sound signals are associated with an abundance of particular soil dwelling taxa (fig. 10). While low-frequency signals seem to be associated with an abundance of taxa with a large body size (e.g., Diplopoda, Isopoda, Chilopoda), high-frequency signals seems to reflect taxa with a small body size (e.g. Collembola, Enchytraeidae, Diptera larvae). This provides a first indication that an acoustic signal at a particular frequency may be able to detect the occurrence of particular taxa.

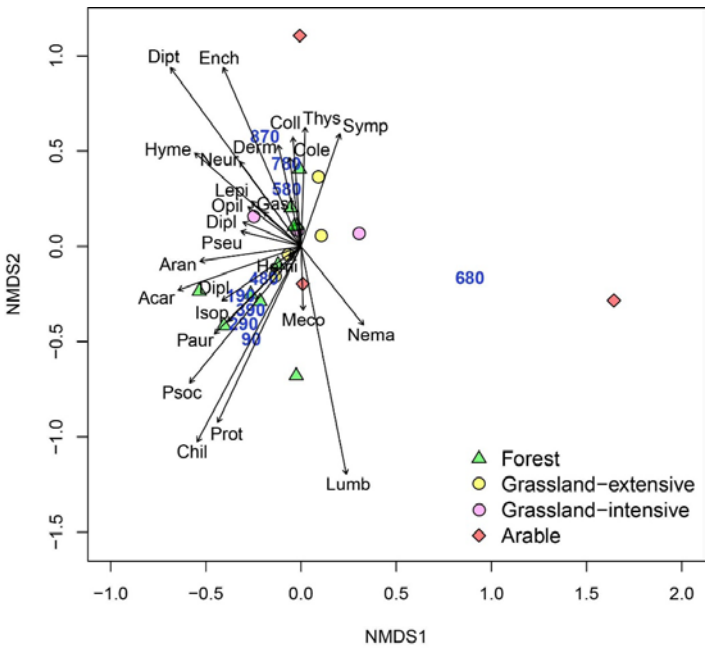

Fig. 10. Ordination diagram (Bray-Curtis distance, k = 3, Stress = 0.04) showing the differences in acoustic composition in terms of the recorded frequencies (Hz; blue numbers) among all 20 sites (symbols). The arrows illustrate how different soundscapes are correlated with the abundance of particular soil-dwelling taxa (Acar = Acari, Aran = Araneae, Chil = Chilopoda, Cole = Coleoptera, Coll = Collembola, Derm = Dermaptera, Dipl = Diplopoda, Dipl = Diplura, Dipt = Diptera, Ench = Enchytraeidae, Gast = Gastropoda, Hemi = Hemiptera, Hyme = Hymenoptera, Isop = Isopoda, Lepi = Lepidoptera, Lumb = Lumbricidae, Meco = Mecoptera, Nema = Nematoda, Neur = Neuroptera, Opil = Opiliones, Paur = Pauropoda, Prot = Protura, Pseu = Pseudoscorpiones, Psoc = Psocoptera, Symp = Symphyla, Thys = Thysanoptera).

The recordings and information regarding soil type that we gathered during the 2017 campaign are being used in the artistic and citizen science part of the Sounding Soil project. We developed a sound art installation/an acoustic observatory that includes the soil recordings and renders our investigations and findings accessible and perceptible for a broader audience.

Art and Citizen Science

Enhancing soil awareness: Situated environmental experiences

Approaches in cognitive sciences and environmental education that are linked to embodiment theories interpret human learning and knowledge as a product of interactions between body/mind and the environment (Csordas 1994; Kiefer and Trumpp 2012). Philipp Payne (1997) suggested using the body as a "localized" site for understanding, explaining, and acting on environmental problems as a strategy for overcoming the gap between theory and practice as well as between expert knowledge and "naïve," first-hand experience. Instead of lifting learners out of their everyday lives and their communities of practice and alienating them in abstract environmental learning circumstances, Payne proposed taking a closer look at what constitutes "lived" experience (fig. 11) – in other words, how new, different, and situated experiences can make self-evident one's own responsibility and accountability for environmental problems and also install a critical ecological ontology.

Sound as an intimate sensory impression that triggers emotion (Bachorowski and Owren 2003) is a substantial part of almost everyone's daily experiences and social interactions (Martin 1996). Sound, and especially sound art as a reflective "sound practice," seems to be the investigation and intermediation instrument of choice for situated environmental experiences (Maeder 2014, 2017). Situated experiences constitute what pedagogy recognizes as situated learning (Anderson et al. 1996), where agency and learning are embedded in social, cultural, and biological contexts. A situated experience is a physical experience (through the body senses) that emerges in a dialogical engagement in a specific problem-solving context (Frie 2011). As a theoretical concept, it not only describes something trivial, like "learning by doing," but may also serve as the theoretical background of the experience and learning process in citizen science projects as well as participatory artworks.

Listen to your soil

The Sounding Soil project, especially its artistic module, is conveyed through a citizen science part, where, first, a specific group (farmers of the NABO network) and, later, the general population are invited to contribute to the project with their own soil recordings and observations. The citizen science project (starting in summer 2019) will be accompanied by interviews documenting involvement processes and describing the effects that our project had on the participants' and the general public's perceptions of soils.

Sounding Soil is an open research and art system (Busch 2009) with several interfaces for involving the public in scientific and artistic explorations of soil ecosystems. This structure comprises a participatory art installation, where participants contribute to the project with their own soil recordings, which will be integrated into the installation's playback console. The soil recordings may be made with a low-cost recording device that will be developed for public use (standalone recorder with probes, remote control via mobile phone app, and uploaded to an online sound map) and that may be borrowed for a certain period.

An artistic-acoustic soil observatory

The artistic research component consists of experiments with stagings of soil sounds and their ecological meaning. Of interest is how to adequately describe soil sounds and implement them in

Fig. 11. Soil listening session at Zentrum Paul Klee, Bern, June 2018.

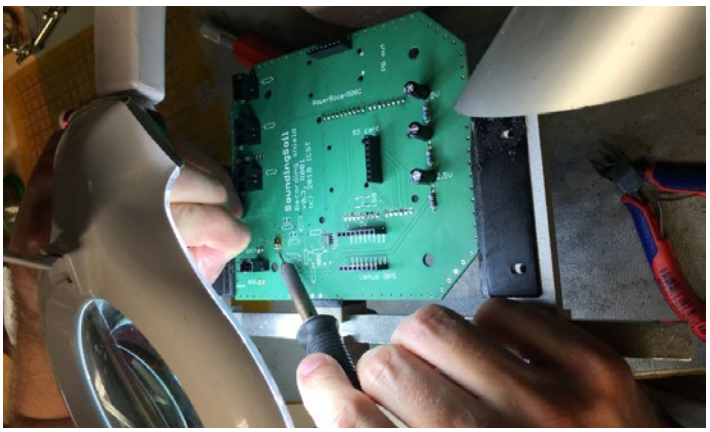

Fig. 12. Development of a low-cost recording device for the citizen science module of the Sounding Soil project at the Institute for Computer Music and Sound Technology, Zurich University of the Arts ZHdK.

terms of eco-cultural meaning (Schafer 1993; Hinton et al. 2006), and how shifting/intensifying meanings of sound could influence the attitudes and behaviours of the project contributors. Beyond that, research on the aesthetic implications and conditions in ecology and environmentalism has found its discipline in eco-aesthetics (Miles 2014); new art forms, such as eco-art, environmental art, and bioart, have emerged in the past few years (Weintraub 2012). These genres use and transform scientific methods to produce artworks that often integrate ecocriticism and environmental–aesthetic questions. They also possess the potential to introduce and integrate new and aesthetic research methods in the natural sciences (Maeder 2017).

The Sounding Soil installation (unveiled in October 2018 at Zentrum Paul Klee, Bern/Switzerland) consists of a modified ship container, which carries a soil receptacle on its roof. In the dark interior, visitors may listen to our soil recordings and the recordings of the citizen science project participants. The single recordings may be selected in a sound map on a touch screen console and be played back spatially – that is, the four channels of our recordings are placed at different levels/parts of the spatial audio speaker system. The channel containing the aerial microphone recording, for instance, is placed on the top/ceiling of the container, while the soil surface channel is placed slightly lower and the soil channel is mapped on the lower half of the speaker system.

The spatial distribution of the sound sources and the dark environment with minimal light falling in through small tubes in the ceiling/soil receptacle (simulating soil pores) provide an immersive experience and create the impression of being within the soil. Additionally, information about the recording plots, some soil science basics, as well as sustainable soil treatment and consumer behaviour are available on the console of the installation.

Conclusions

Our study is among the first to explore the soundscapes in soils and their relationships to land-use and habitat characteristics as well as biodiversity. The first results of our scientific investigations

showed that variability in the acoustic complexity of soil soundscapes among sites can be related strongly to land-use intensity in open land, increasing from arable land to intensively to extensively used grasslands and between humus forms in forests. Moreover, we found good indications that differences in the acoustic complexity and composition of soil soundscapes can inform us about the diversity and composition of animal communities in soils. The further development of easily applicable devices for recording and analyzing soil soundscapes, thus, opens new avenues for evaluating soils in terms of nature conservation issues that can also be used in the frame of citizen science.

Our current approach is biased by punctual recordings without considering temporal variation in the activity of soil organisms. In our next step, we will conduct longer measurement and recording series to obtain further insights into the temporal and spatial dynamics of the acoustic and biological diversity in soils.

Based on our experience and results, we will evaluate the use of the art installation by measuring accesses and interactions at the console in different public settings (museums, agricultural fairs, science nights, etc.). We will also explore in which context our project will have the biggest impact in terms of ludic engagement (Morrison et al. 2007), learning effects, and environmental concern. Furthermore, we will collect information about the socio-geographical backgrounds of the citizen science participants. These surveys and measurements will help us develop and improve our artistic-scientific observatory, its presentation forms, and concomitant communication. As such, we aim to initiate higher sensitization to the fascinating and fragile soil ecosystems – not only among the general public but also, and most importantly, on the part of political decision-makers and agricultural producers and their lobbies.

Up-to-date information about the undertaking of this project may be obtained at **www.soundingsoil.ch**. The console/sound map of the console in the Sounding Soil container is reachable under **www.soundmap.soundingsoil.ch**.

Acknowledgements

Sounding Soil is carried out in cooperation between the Zurich University of the Arts (ZHdK)/the Institute for Computer Music and Sound Technology (project lead), the Swiss Federal Institute for Forest, Snow and Landscape Research WSL, the Swiss Soil Monitoring Network (NABO), the Institute for Terrestrial Ecosystems and the USYS TdLab at the Swiss Federal Institute of Technology (ETH) in Zurich, and the Biovision Foundation for Ecological Development. In particular, we would like to thank the staff at the WSL Entomology Lab and Forest Soils Group for their generous support during the analysis of our soil samples: Kevin Kleeb, Doris Schneider-Mathys, Stella Mathis, and Marco Walser. We would also like to thank Julia Franzen and Michael Müller from the Swiss Soil Monitoring Network NABO for their support during our field samplings.

Endnotes

1 Like in ecology, soils may also acoustically be understood as an interface between the atmosphere and lithosphere. On the one hand, sound from the atmosphere at least partially penetrates the soil structure (Chang and Li 2007), and seismic/geo-acoustic events spread in the soil space (Belyakov 2004). On the other hand, the pedosphere possesses its own complex acoustic characteristics, which clearly differ from atmospheric and geo-acoustics, because of their mixed structure and dead and living organic matter contents.

2 For example, it is possible to emit sound wave pulses into the soil and measure the returning reflections. This technique is used in the mining and oil industries and in landmine eviction and archeology.

3 The meso- and macrofauna consist mainly of insects (mites, collembolans and arthropods, etc.), but also other invertebrates, such as worms and Enchytraeidae.

4 The recording setup consisted of a 4-channel recording system with components by Avisoft Bioacoustics and a Microsoft© Surface Tablet PC running Avisoft Recorder© Software. The recordings were led with a sampling rate of 50 KHz, 16-bit. Channel assignments: 1 – acoustic sensor plugged into the soil, 2 – sensor placed on the soil surface, 3 – sensor plugged into the soil at 1 m distance from sensor 1, 4 – electret microphone on a stand at 2 m above ground. Sensor 1 was protected with a windshield case, which also prevented insects present on the ground and close to the sensor from escaping the sampling area.

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Fig. 13. The Sounding Soil installation at Zentrum Paul Klee.

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go your gait!
Artistic Research on Walking & Listening

by katrinem

I am a walker and listener.

Investigating sound and space has long been an integral part of my artistic work. I started early with comprehensive training in classical music, studying violin, viola and composition. I played in orchestras and ensembles and focused on spatial performances and new performance practices. I have always had a special relationship with our most natural form of locomotion – walking. Long walks and hikes with my family were a vital part of my childhood. Even all the schools I attended were in walking distance. *Walking and Listening* is not only my artistic approach, it is also my way of life. It is how I experience my environment and how I explore new sites. For over 15 years now I have been investigating the walkability of cities and their associated spatial perception, through my work series *go your gait!* This exploration results in various types and styles of artwork: performance, composition, site-specific installation and exhibition, workshop, photo collection, audio-visual composition, text and scores.

I am particularly interested in the extent to which we are able to find spaces for walking in our urban surroundings, why and how we use them, and how conscious we are of their environmental influences on us. This interest brought me to various questions. An essential one is: How does the built, controlled, and organized urban environment and its atmospheric qualities influence our walking behavior and perception of space (in public space)? I have been investigating this question based on human auditory perception, by attentive and conscious listening during walking in urban space. To do so, I have developed various methodologies, which I will describe below using a few selected art projects. What seems most essential to me is to constantly sensitize myself: to refine my walking technique and footwear and to open my own perception of auditory space as wide as possible.

In 2012, I took part in the project *Finger Exercise*, initiated by the Austrian curator and artist Silvia Keller, in which each artist was allocated one month for a self-chosen daily exercise in the field of her or his artistic praxis (for instance, finger exercises on the piano). My intention was to pause for a few minutes every day of April, close my eyes and try to hear as far away as possible. I did it sometimes during the day, whenever I thought of it. I did it while I was eating, cooking, in the elevator, on the street, while shopping, on the plane... I also did this exercise on a flight to NY, which turned out to be a bad idea when you can't escape a constant loud background noise for several hours. Previously, I thought I was always listening well, but with this daily exercise, I became particularly aware of our brain's unconscious ability to fade out unwanted input. Since then, it has been a fixed exercise for me, but I have also developed it further within practical workshops, such as with schoolchildren where we examine their routes to school, or with adults where we explore their everyday paths...

Before I describe observations from my artistic research, I would like to talk more generally about walking in urban space. The liveliness of a city is reflected in the activities of its inhabitants: how, when and where they move around in it[1]. Most big modern cities are perfectly designed for motorized traffic but not for pedestrians. Walking is the most individual form of mobility in terms of its direction and speed. Sidewalks, pedestrian areas, traffic-free roads and squares are the public spaces most preferred by those navigating a city on foot, marking its pavement and paths with the pulses of their steps.

> *The interesting thing about getting to know a city on foot is that you never leave the large, perceptible urban setting. Meanwhile, a slow pace of movement enables a high attention level for sensory impressions – ideal conditions for exploring a city from an aural point of view.*[2]

Everything that we experience around us is structured by the rhythm of our own gait. A gait is a person's most distinctly individual pattern of movement[3]. Audible in the sound of footsteps, our rhythm emerges from the regularity with which we place one foot in front of the other. We reproduce this individuality almost exclusively in public, where one person's step rhythm joins in polyrhythm with that of another. While the sound of the rhythm often becomes masked by a city's background noise, the rhythm can be sensed from the visible motion. Seeing someone's gait can easily evoke an imagined sound of the step rhythm in our mind, as we are so familiar with the act of walking. The ways once walked leave no visible trace, but crisscross over the city like an invisible network. At all points where these crossings accumulate, we find vibrant city spaces.

Each placing of our foot upon the ground can be thought of as a fundamental tone that operates like a chain reaction on the body: Mass upon mass. Accordingly, the firmness and character of the ground play an important role in our foot's stability at the moment of placement. The footwear used not only serves as a mediator in this meeting of foot and ground but creates a new set of conditions, depending on its material, fit and function – for example, high heels, flip flops, boots, sneakers, etc. When we are purchasing shoes how much do we pay attention to the way they sound in our environment and how they seem to our own ears? After checking the fit and look of the selected shoes it is unconventional to test their sonic character as well, e.g. by going for a "test walk" outside the store. How important is it to us to hear our own steps and to like their sound?

Alongside our footwear, there are various factors, usually occurring in combination, that influence our walking movement in urban space and the chosen size and speed of our steps. These include:

- individual intention and condition of health
- whether a path is being followed for the first time or is a familiar path
- architectural structures
- the materiality, appearance and acoustic quality of the surface underfoot
- temperature, weather and light conditions
- direct and indirect activities in the spatial surroundings (other pedestrians, traffic, etc.)

- sonic and visual events (e.g. outdoor sound systems, billboards, video screens)
- walking alone or in groups

Each of these factors could be discussed in length. I will point to just a few aspects in relation to projects and exhibitions below, such as: narrow revolving doors in Midtown Manhattan (*Path of Awareness_NY*); stairs and obstacles on the walkways in Tehran (*Path of Awareness_tehran*); pushbutton-controlled traffic lights for pedestrian in Boston (*Path of Awareness_boston*); step pattern (Place Study *Gendarmenmarkt*) or how the built space strengthens or weakens wind conditions (*my Gait_carré*).

With the following selection I offer an insight into artworks based on my artistic research on walking and listening, emphasizing two aspects: observing a site (*part1, Platzstudien – Place Studies*), and personally experiencing space while walking (*Path of Awareness, my gait!*). *Path of Awareness* is described in more detail, since in my opinion this format can comprehensively show very different aspects of my interests.

Go Your Gait! Part 1 (2004)

This is a five minutes long audio-visual composition. Every 30 seconds, "actors" go to a section of 30 meters. They cross the section of meadow-path-water visible to us in the video image. Due to their different walking speeds, the entrance to the picture is almost always at a different time. Alongside the "actors", other random walkers bring their rhythms into the picture. At the end of the video I walk through the picture myself. The picture detail is chosen in a way that only the legs can be seen. The image to the left is the score. Throughout the entire length of the work, my own step is constantly audible and only synchronizes itself at the end when I myself walk through the picture.

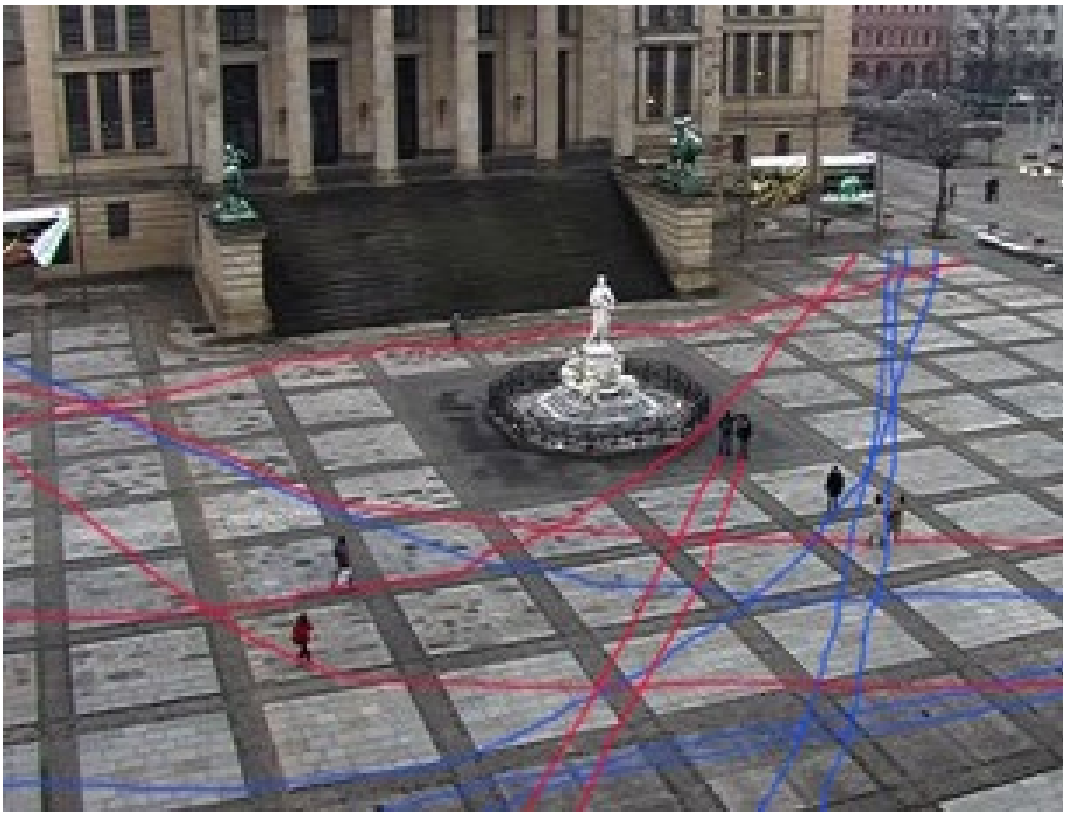
My step sounds were also used to sonify the steps visible on the video, adjusted in tempo and length in order to emphasize the rhythmic differentiation of our step sizes and speeds.

GENDARMENMARKT BERLIN (Place Study, 2007)

The audio-visual work *Gendarmenmarkt* was created in 2007. In this work, all walking movements at the Gendarmenmarkt in Berlin are sonified according to a compositional principle that I determined according to the grid pattern made by paving stones on the square.

The "players" go their ways, creating audible traces that begin to mix with and against each other. The rhythms and structures emerging for a few moments from individual gaits occupy the square for a short while, then release it. The sine tones used to sonify footsteps are distinct from the familiar stepping sound, having an abstract technical simplicity, and thus direct focus on the rhythmic aspect. Duration, force of impact, dynamic and panning are used as differentiating parameters.

vimeo.com/188150869



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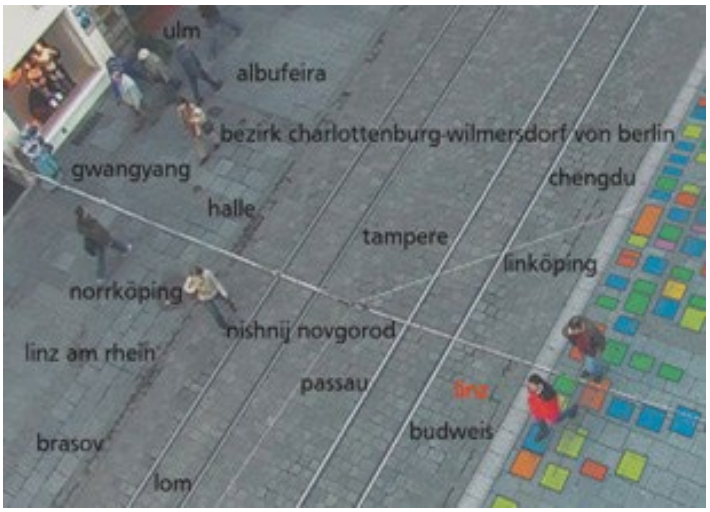
GANGARTEN (Place Study, 2007–2009)

Out of experiences gained in *Gendarmenmarkt,* the project *GANGARTEN (ways of walking)* was developed, in which Linz was reflected through its partner and friendship cities. For this, I visited sixteen cities in a timeframe of two years: Albufeira, Braşov, Budweis, Chengdu, Gwangyang, Halle (Saale), Linköping, Linz on the Rhine, Linz, Lom, Nischni Nowgorod, Norrköping, Passau, Tampere, Ulm and Charlottenburg-Wilmersdorf of Berlin. My plan was to investigate places and locations where residents of these cities could be found walking, and to acoustically portray their individual gaits.



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In preparation, I developed a category of criteria for maintaining a consistent approach at every place. Accordingly, I consciously decided to only consider individuals walking alone and without baggage, bicycle or dog. I also chose timeframes for my research that were other than vacation times, and during which a reasonable temperature could be found on site.

The selection of sites and locations was undoubtedly the most difficult task. It was necessary to have at least twenty meters of free walking space available so that pedestrians could fall into their own innate walking rhythm. This, along with the absence of significant influence from acoustic and visual distractions, formed the two main criteria for my search. The sites also had to be places and locations used predominantly by local residents, which might first require a deeper search, depending on the focus and touristic orientation of a given city. A significant part of my stay at each location was dedicated to this process of discovery, which I documented in a travel diary.

I recorded the chosen sites with video, analyzed the gathered material and sonified the gaits of individual people with sounds similar to pure tones, so as to emphasize rhythmic structure, thus generating a score out of space (architecture, pavement, surrounding, etc.), streams of movement, and residents' gaits. The polyrhythmic footstep patterns are interwoven with specific "city sounds" encountered during my stays, such as the sound of the ocean; an air conditioner in Albufeira – aptly named "Silencys"; the squeaking of e-bikes in Chengdu; the bells of the temple, or the seaweed toaster at the market in Gwangyang, and so on. Besides sixteen audio-visual works, first shown in the context of *Linz 2009 European Capital of Culture*, radio pieces were produced, as well as a catalog with excerpts from travel diaries, pictures and videos.

PATH OF AWARENESS (2011–)

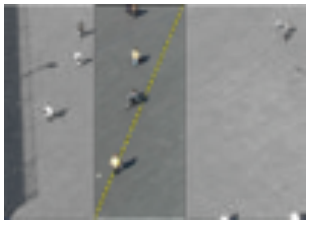
During this journeying for GANGARTEN, an incessant roaming and researching of familiar and unfamiliar cities to find out how they might be experienced on foot, the idea for the Path of Awareness format began to develop. The work's approach involves a change of perspective from previous works such as the Place Studies. Rather than observing footstep patterns in a space, the object of exploration is the individual's personal experience of space while walking. Particularly, in relation to the interplay between a sound event (a footstep with soundful[4] shoes) and the surrounding architecture, influenced by the permanently changing interactions.

Essential elements of this configuration are a moderate speed of walking, the regularity of the step-by-step motion, and a readiness to open up our auditory perception and keep it as wide open as possible. This is in stark contrast to our customary behavior of unintentionally filtering out elements we do not wish to hear. We have acquired this habit of selective listening for all our living spaces, whether at home, elsewhere, or on the go.

Most of our daily paths are connective routes between locations where we have something to do. The place left behind continues to resonate, nevertheless, often our thoughts have already arrived at our intended destination. Or else, we are linked, en route, into a virtual space via mobile communication systems like Smartphones or audio players. The way becomes similar to a ‹tunnel› through public space. By proceeding in this manner, we accept not only reducing our auditory perceptive space but also weakening our relationship to our real-world surroundings, since hearing is inextricably connected to one's sense of space.

In *Path of Awareness*, the path itself is the destination.

To reach it, a route is delineated, one that offers diverse opportunities to focus on walking itself, on footwear, on the walkability of urban habitat, and its architectural as well as atmospheric qualities. As I like to tell participants: Let us confront this act of intentional listening amidst our own gait. This is how we can sense clear spatial thresholds – that is, transitions from one auditory space to another – and perceive minute spatial shifts. The soundful shoes we wear along this way become soloists in space, instruments that enter into a dialog with their environment, provide us with spatial orientation and locate us in space[5].




Chosen sites in Halle (DE), Nishnij Novgorod (RU), Lom (BG), Tampere (FI)

Working Procedure on a *Path of Awareness*

Each Path is composed while walking and listening.

A given start/end point is always the beginning of the process. It is also the 'host' venue for the path, a place where you can listen to the audio-visual composition, meet for the guided walking and listening performances, and obtain scores to experience the Path on your own.

Photo: Melody Rozimand

For the development phase (10–20 days), I always ask for an accommodation close to the 'host' venue and try to avoid staying in hotels. Needing to deal with everyday tasks, such as shopping for food or finding a place to do laundry, makes it easier for me to immerse myself in new places. In Midtown Manhattan, for example, I stayed directly in a guest room at the Austrian Cultural Forum, which commissioned the *Path of Awareness_Midtown_NY*, on East 52nd Street.

In Strömstad, a city at the west coastline of Sweden, the venue *Konsthallen Lokstallet* is in a solitary location away from the city center, so they organized a construction wagon with a bed, kitchen and toilette next to the exhibition hall to meet my needs. It took me some time the first night to get used to all the unusual sounds around me, which penetrated through the thin walls. Coastal wind and animals were audible around, under, and on top of the wagon. (After my return to Berlin, I had to re-adjust myself to the quietness of our apartment, where the threshold between outside and inside is much more distinct.)

My construction wagon with a breakfast table in front of it was a perfect start for my observations. The horn and machines of the first ferry from Oslo woke me up, along with the following queues of cars at my front door. All in one direction in the morning, and back in the evening. Predominantly cars with Norwegian license plates, and well-stocked with various purchases in the evening: a consumption migration. A mall in the suburban area was built to serve these needs, with the typical consequence of causing numerous small specialist shops in the city center to close down.

View from Konsthallen Lokstallet and my construction wagon.
Six times a day a ferry docked and left.

Konsthallen Lokstallet is located directly opposite the landing dock, a perfect spot to start and to end that Path: at one of the two moments, a ferry will definitely play along.

Each Path is composed in such a way that the chosen route also lets you experience the characteristics of the site.

My method to decode the evident as well as hidden patterns of a site is a persistent repetition of walking, pausing, observing and talking with inhabitants, over and over again… My walking speed at the beginning is very leisurely with frequent breaks and the walking distances are rather short or simple and repeated often. I call this my synchronization process with the new environment, in which I gradually become invisible – a part of it. During this period, I don't allow myself to 'escape', in order to stay in synchronization with the place. This mostly means not traveling somewhere else, but of course I allow time to relax for one day on site.

Most of the cities, where I do my research to develop a *Path of Awareness*, are places I am visiting for the first time. For orientation, I use offline maps on my cell phone, but never a trail tracking system. I train myself constantly to memorize the ways I have been walking and also significant details along the route. Furthermore, I make notes and drawings and record special events with photos/video/audio.

Each evening, I draw the day's route in the city map by hand. This process also aids in reflecting on the collected impressions and triggers questions and new investigations. And of course, my geographic understanding of the city grows too.

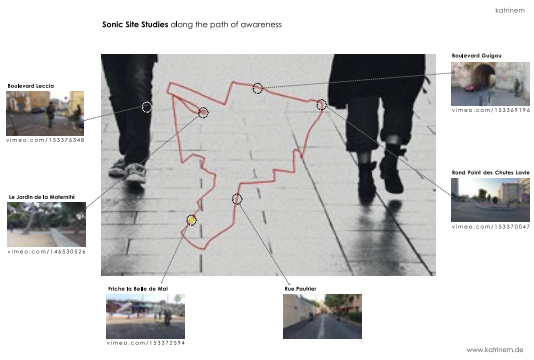
During this process, the shape of the Path gradually emerges.

On these research trips, I keep my equipment very simple and small. I prefer to travel as light as possible: A set of binaural microphones, a Sony audio recorder, a windshield for the microphones, my mobile phone with a small tripod, and my workbook. All in all, it is not more than 2 kg and fits into a small backpack.

The clothing I use is also well considered and functionally designed. A cap or straw hat, soft soled shoes and one of my working dresses, which are designed to suit my needs by Cecile Bouchier, an artist and set designer living in the Mojave Desert in California. Each dress is constructed of non-rustling material and easily adaptable to different temperatures. It has large pockets in which my workbook fits, but also the Sony recorder during recording sessions. A loop is placed on one shoulder, to guide the microphone cable from my ears to the recorder in my pocket, so that the cable does not hit the dress zipper when recording while walking.

During the development period of a *Path of Awareness*, I never walk around with soundful shoes. Instead, I try more to merge with my environment. This is in stark contrast to the *guided walking and listening performances*, in which the audience experiences the path while I use specially tuned soundful shoes.

Most of the time, I work and walk alone. Sometimes local students join me in this development period. I introduce them to binaural recordings, methods of site studies and mapping, and in return, I get dialog partners for all my arising questions. Often this is in a country where I cannot understand, or perhaps even read, the official language.



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For example, during the development period for *Path of Awareness_la friche* in Marseille, students from Aix-en-Provence and myself explored and documented six sites along the Path with binaural recordings and footage at different times of a day and different weekdays.

My first *Path of Awareness* was realized at klangstaetten | stadtklaenge in Braunschweig 2012. Since then, 20 Path of Awareness works have been developed in different cities, including, Berlin, Boston, Linz, Marseille, Madrid, Montelupo Fiorentino, Mexico City, New York, Strömstad, Tehran…

Each *Path of Awareness* consists of multiple elements

Shape: The route of the path is precisely traced on a city map and then abstracted, so that only the shape remains.

Performance in Berlin. Photo: Martina Huber

Strömstad, Tehran, Marseille

Audio-visual composition: This is a recording of my walk along the path with a pair of soundful shoes, binaural microphones and a head-mounted video camera. In postproduction, I combine the binaural recording with stills or excerpts from video footage, corresponding to the rhythm of walking. For example, in my work Path of *Awareness_Mexico City*, the audio-visual composition has a 40 step structure: A still is shown for 20 steps, followed by a black image for the same length. The visual aspect serves more for orientation, and the auditory for location, in space.

All audio recordings were done with the same equipment and input level, to get comparable impressions from the different recordings and cities. They were not changed or adapted in post-production. To best experience the auditory details and depth of these audio-visual compositions I recommend using headphones while watching it.

Performance in Midtown_ NY. Photo: Sarah Emler

Excerpts of all Path of Awareness works:
vimeo.com/showcase/3785847

Guided walking and listening performance: With a slow and steady walking rhythm with a pair of soundful shoes, I guide a limited number of participants (wearing soft-soled shoes) along the path. In order to not disturb the rhythm of the walk, there is no talking or pausing, except when necessary for traffic lights or for safety reasons. Changes of direction are indicated at the moment with a simple hand signal. Right ... left ... stop ...

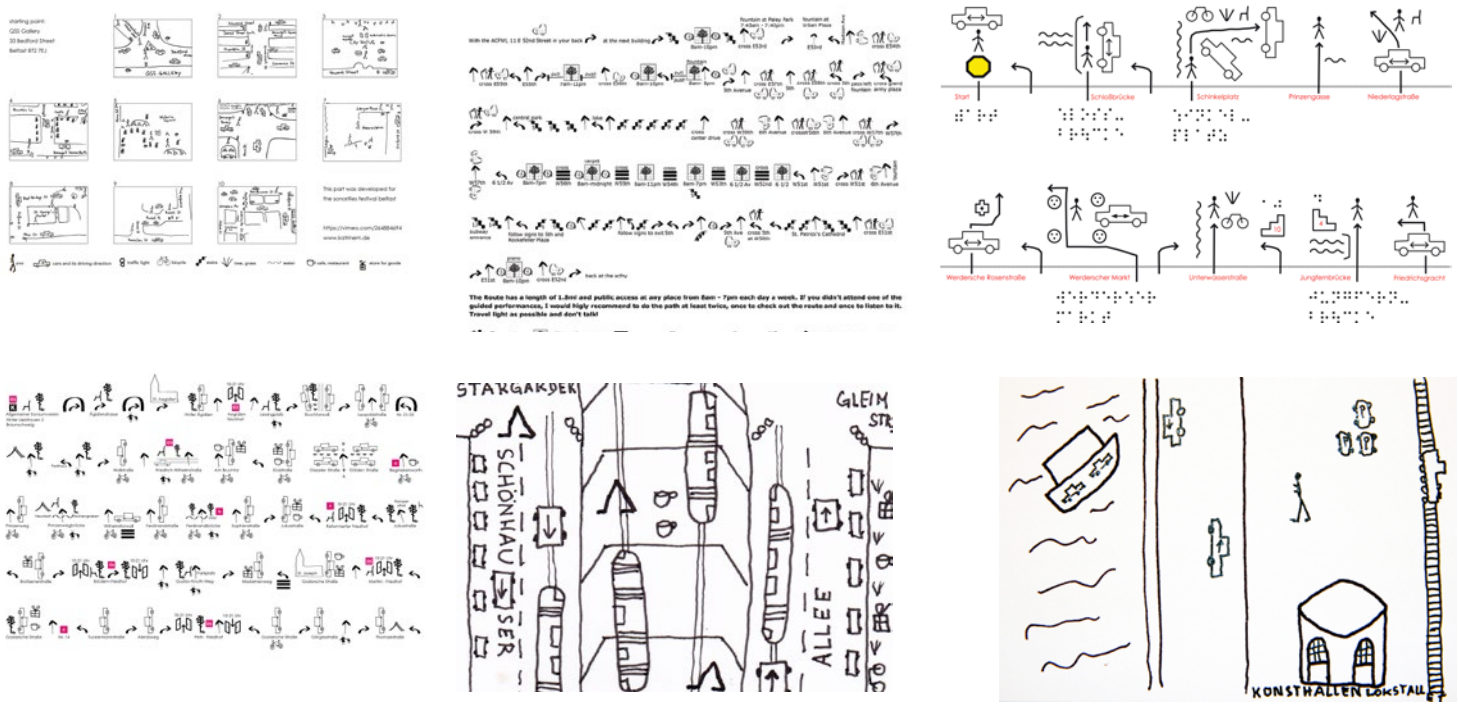
The participants stay close: walking next to me or behind me – not in a line, but more like a swarm. We are not necessarily walking synchronously. Everybody can find a rhythm that fits best and keep it for the entire length of the performance. The number of participants is always limited, depending on the Path and the city. A group of 10 persons is fine, sometimes up to 15.

I recommend that the individuals travel as lightly as possible, because all bags and backpacks influence the posture and gait, and subsequently the auditory perception. Sometimes venues offer lockers to store anything that would impede walking.

For me, this kind of performance builds on all my previous performance experiences. Having an audience behind me and navigating safely through what is often a dense environment requires a heightened level of focus and vigilance, even a tension, that embraces all those involved.

Score: I produce a Score as an invitation for individuals to experience the path on their own, with their own soundful shoes. For each city, I create site-specific symbols to indicate site-specific situations. I highly recommend doing the path at least twice: once to check out the route and once to listen to it.

Description: Here are some descriptions, or excerpts from my field notes of different walks.



Scores: Belfast, Midtown NY, tactile version Berlin_Humboldt Box, Braunschweig, Berlin_MeinKiez and Strömstad

Description of *Path of Awareness Braunschweig* (2011)

The route in Braunschweig was selected such that it takes about fifteen minutes at a leisurely pace. One comes repeatedly to stretches making it possible to find a uniform step rhythm. The path goes over different surfaces, on simple footpaths, through various passageways, alongside high- and low-traffic streets, and past building architectures of different centuries. If one follows the pavement in front of the Allgemeinen Konsumverein to the left, after a curve, a view opens onto the house fronts of Leopold Street through two high and elongated building passageways. On entering the first passageway, the sound of one's footsteps becomes directly present and close. A good introductory tuning for the whole way. On leaving the first passageway one is received in the courtyard by a soft rustling of trees and ivy that climbs the house wall to the right. The second passageway has the effect of a soundbox again but is also modulated by activity from the seldom frequented Leopold Street.

It is necessary to cross this street – the walking rhythm is interrupted – and follow the flow of the one-way street to the clearly marked path bearing left into a building passageway. Shortly before exiting the passage one is all the more surprised by the sound effect of a flutter echo that builds up between side walls running completely parallel. An acoustic phenomenon inviting one to play with it … The path now leads to the right onto Friedrich-Wilhelm Street alongside many recessed entrances of houses and stores. Here the passing traffic completely masks the sound of footsteps. We turn off at Hinter Liebfrauen and leave the pulsing traffic vein. A facade structure with many recessed entrances can be found here as well, and the step sounds, now audible again, begin once more to play with this structure as well as with parked cars and the gaps in between ...
vimeo.com/50495775

Field notes for *Path of Awareness Midtown NY* (2015)

On the 2nd of September around 6 pm, I arrived at 5th Avenue and 53rd. The first thing I noticed was that I was almost the only person who wanted to leave the subway (E train) at this stop, but many others waited there to get in. My first impression was that this part of New York was a business district rather than a residential area.

At the Austrian Cultural Forum (ACFNY) on the 52nd Street (between 5th and Madison Avenues), after putting down my luggage, I immediately started to discover the environment by walking around in very slow motion. After this long flight from Europe, it was the best way to be connected with the city and to "arrive" in Midtown in all kinds of senses. Over the next 10 days, I explored the environment of the ACFNY by walking at different times during day and night. In Midtown you constantly have to deal with a very high noise level, especially when you're trying to keep your auditory senses open. Most of the streets in Midtown are organized as one-way streets and the directions alternate regularly, with traffic lights at each crossing. I watched other pedestrians and learned how they cross the streets. Pedestrians familiar with the area just turn their heads in the direction of the expected traffic. It seems as if traffic lights don't concern them. I started to time traffic lights and observed where pedestrians speed up and slow down. I became interested in what people were carrying, which particular paths they choose, and much more.

My measurements of the traffic light phases were about 45 seconds per direction, with different symbols for cars and pedestrians. For car traffic, the red-yellow-green lights, for the pedestrian a white walking human and an orange stop-hand. Mostly, in the middle of the "green" phase, when they show the walking human, it changes to the flashing stop-hand, sometimes combined with a countdown.

You can see many pedestrians in Midtown, mostly adults. The three biggest groups are commuters, shoppers, and tourists. Commuters usually walk alone and seem to follow an invisible

line in a purposeful pace (brisk gait), talking on their phones, carrying some to-go-drinks. Usually, the commuters carry a bag or a backpack in which a laptop fits in easily. Their main time is between 8 am-10:30 am and 4 pm–6:30 pm. The shoppers are easy to spot: marked by the stores' shopping bags that one can see from afar– rarely alone, usually in pairs, constantly talking to each other, or on their phones. Compared with the commuters, their walking speed is a little bit slower and the direction is not clearly intended. The largest concentration of shoppers is between 5pm-8pm on a weekday. The tourists are often underway in pairs or larger groups. They meander a little bit back and forth through the streets without any recognizable aim or they block the traffic in front of sights and events. During lunchtime, all groups mix up in the little parks, in the public access areas, or in the private properties.

As I already experienced upon my arrival, Midtown is not a residential area. In the evening and during the night, when business rests and the stores are closed, there are fewer people and cars on the street. The speed of movements and noise level of traffic calm down significantly. This is the time for maintenance in Midtown: construction sites get busier, garbage trucks pop up, and the stores get their new supplies. All these actions are enormous sound events in the general soundscape of air conditioning and traffic, with variations from the changing of their positions. For the path, I also chose a variety of walkways through private properties with public access. Mostly these have narrow revolving doors, with space for only 1 person, a real barrier between outside and inside and a significant interruption to any walking rhythm. Each of them has different opening hours, so that the path itself is only reachable at its full length between 8 am– 7 pm. When I had finished planning the route, I trained myself to walk fluently along it at different times of day and night and listened to the changes in sounds.

In the score to *Path of Awareness Midtown_NY*, the rhythmic structure of midtown can be seen: the grid, the one-way streets, the traffic lights, the cross walks, and the various opening hours of the public access ways through the private properties. All elements of city design that influence our walking. (score image p.20)

Excerpts from field notes of *Path of Awareness Tehran* (2016)

After my arrival in Tehran, I realized immediately that for the inhabitants walking is not the preferred way of moving. For me, without any knowledge of the language, it was impossible to follow the common behavior of using the collective cab system, or a car by myself, and also it was not in my interest.

To start my research, I choose a destination at some distance and then tried to reach it by walking. Offline maps on my smartphone gave me the necessary security of orientation. Navigating through the city by walking was a challenge and adventure. Tehran is cut in parts by expressways and highways. Reaching available pedestrian bridges and underpasses, and crossing them, always creates detours. Often these roads are equipped with fences in the middle, which makes a spontaneous crossing impossible even without any traffic. Sidewalks – when they exist – are often narrow, uneven and rough, with many obstacles and fanciful step structures. Cars and motorcycles were everywhere and always had the right of way. (During my entire six weeks in Tehran, end of 2015 and autumn 2016, I saw no bicycle).

It took me some days to realize I did not see women with their babies walking in the city with a stroller, or wheelchair users on the street, or even children walking alone on their way to




school. For all of these people, it is nearly impossible to navigate through the city on foot, because of the conditions of walkways and also for safety reasons (because of the traffic dynamics mentioned above).

What does it mean to grow up in a city where you could not learn to walk alone? What does it mean to experience your city only by sitting in the private bubble of a car?

Tehran is filled by motorized traffic sounds. The general noise floor on many sidewalks, or pedestrian bridges next to highways, or busy streets makes it impossible to communicate or to experience the urban environment in a joyful and inspired way.

I also experienced that the scarf around my head, softly covering my ears changed my hearing perception. How does clothing influence my connection to the environment around me?
vimeo.com/184479324

MY GAIT! (2011–


Photo: Ursula Rogg

Simultaneously with the development of the format *Path of Awareness*, I started with the concept for *my gait!*: a long-term study of my own walking rhythms. I was motivated to do this research project out of my interest to directly investigate my residential area in terms of walkable routes and their atmosphere[6]. The routes are chosen such that they always originate from my respective place of residence. At the same location, the same route. The requirement is that I walk on my own, without baggage.

For this purpose, I developed an audio-visual-sensory system[7] comprised of step-data collection via pressure sensors in shoe inserts, binaural audio recording and, synchronized to this, video recording with a field of view camera. In addition, cameras on ankles and wrists capture a view of the surroundings from a moving body. Results and materials from this research find their way into scores, compositions, audio-visual works and texts.

My gait!_carré is one of these results. For this, a carré at Prenzlauer Berg was chosen, which was documented and recorded by the observation tools mentioned above.

The urban space is typical of this quarter of Berlin, having the form of an unequal rectangle with 2 long and 2 short sides. One short side is the Schönhauser Allee, one of the main traffic arteries, which runs from Alexanderplatz to the north. On Schönhauser Allee the U2 subway, runs as an elevated railway, and 2 car lanes run in each direction, which are also used by a tram. The other side streets are of varying width with continuous cobblestones, which are used as

shortcuts by local experts at peak times. The sidewalk has a width of at least 2 meters on all sides and is made of slabs that do not form a flat surface so that you quickly get used to lifting your feet when walking. Between sidewalks and roads, there are 2 kinds of "buffers", parking cars in vertical and longitudinal position and trees planted at a distance of about 8–10 meters. Towards the façade, the carré forms a closed form, i.e. there are neither gaps in the buildings nor open passages for the public to the courtyards.

The central image of the work is the video captured with the field of view camera, which provides orientation when walking along. The images of the cameras on both legs and the right arm, which provide views of the façade structures from the perspective of the walking system, act like peepholes in the central image.

The even, pendulum-like movement of the arms stands in contrast to the movements of the feet, which contain short moments of standstill, even if we ourselves have the feeling of constant locomotion.

For this series, binaural recordings are combined with the step pulses and the wind noise is transformed into tonal structures. The wind noise arises when walking per se, but may also be amplified by the architectural arrangement of the Carré.

vimeo.com/99946193

Conclusion

Walking, as a highly complex interplay of motion sequences for which our body is ideally constructed, continually fascinates me. This act of walking, which we learn with so much effort as toddlers, usually only comes to our attention once again when the rhythm and processes of our musculoskeletal system are disrupted. Walking rhythm is a pulse that accompanies us along all paths with a not stoic regularity, and radiates toward inside and out.

Hearing is among our first senses to develop. Its varied uses (for sensing orientation or atmosphere, etc) are rarely (consciously) employed in everyday living conditions today, and thus they atrophy. For some years now I have also been working specifically with schoolchildren – mainly in Germany and Austria – who often do not have music lessons in school due to a lack of teachers and financial constraints, and often have barely cultivated any language for talking about what they are hearing. After just a few days of attentive listening exercises and experiments on acoustics, there is a noticeable change. How long will this change last?

This makes me wonder: Have we perfected the art of ignoring what we hear on a daily basis, so much that a natural attentiveness has been forgotten?

One essential aim of my work is to contribute to a broader understanding of cities in general, how we perform our social and economic interactions within them and to offer questions and discussions based on personal experiences on site. Walking means to perform a rhythm in space. Doing it attentively makes us aware of other rhythm structures and patterns which regulate public space – from the traffic lights, to the culturally-defined calendar of rituals like national holidays. A more socio-political based understanding of this question is presented in Henri Lefebvre's last published work *Rhythmanalysis*[8]. Rhythm is found in the workings of our towns and cities, in urban life and movement through space. Equally, it is in collisions of natural biological and social timescales, the rhythms of our bodies, and society. Holger Schulze, whose work is advocating for a participatory listening attitude especially in his text *Spatial Body Sound – An Anthropology of With*[9] writes: "Hence, in an anthropology of with, the statics of fixed and impervious objects of thought are replaced by a highly flexible and vibrant mode of thought and perception, one that responds to transformations in the material around us with fitting perceptual transformations. Immersion is no longer just an intellectual game, but has consequences in our daily actions, in every single situation here and now."

In working, exchanging and cooperating with other artists, scientists, architects and city planners[10], I seek to expand, reassess and refine my own approach to the topic of walking and listening in urban spaces. Throughout this process, a central concern is the way sound and space work together in creating atmospheres[11].

Every city, every place recounts its auditory narrative, just as every space speaks and a sound event is colored by its surrounding environments. Season, topography, architecture, economic & social structures and dynamics – all of these can be heard[12]. Gender, age, culture and personal history play an important role in how we make sense out of an auditory event. How we hear, perceive sound, is connected to a variety of conditions and circumstances, some of which I hope I have been able to illustrate through a few of the examples from works. City design, the organized built environment, sets conditions that influence our sense of certain architectural or urban places. Invisible and subtle, these structures are directing our social and economic interactions – shaping ways we walk and ways we feel in our living spaces.

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Endnotes

1 cf. Atzwanger, Klaus: *Lebensraum Strasse: Aspekte menschlicher Gehgeschwindigkeit*. Zolltexte Wien, 2. Edition, 1995, Seite 19–21.

2 *Listening Sites Bonn* by Sam Auinger, 2010. This statement emerged during a research period in Paris, 2009, based on shared experiences and convictions by Sam Auinger and myself.

3 cf. Whittle, Michael W.: *Gait Analysis: An Introduction*. Butterworth-Heinemann, 4. Edition, 2007.

4 Soundful shoes, by which I mean shoes that can produce an audible and noticeable tap which might resonate and create an interplay with the physical environment along the walk. The soundful shoes which I use have a specially adapted and tuned heel for the purpose of the performances. The word is a playful translation for what I use in German, *klanglich*.

5 For further more extensive research on the auditory experience of spaces, see for instance: *Spaces Speak, are you listening? Experiencing Aural Architecture* by Barry Blesser and Linda-Ruth Salter, MIT Press Ltd, 2009, as well as, *Sonic experience – A Guide to Everyday Sounds* by Jean-François Augoyard and Henri Torgue, Combined Academic Publ., 2005, among other sources.

6 Böhme, Gernot: *Atmosphäre, Essays zur neuen Ästhetik*. Edition suhrkamp, 2013.

Böhme, Gernot: *Architektur und Atmosphäre*. Verlag Wilhelm Fink, 2006.

7 In collaboration with Roland Babl. Imanol Gomez and Gerald Schalek.

8 Lefebvre, Henri: *Rhythmanalysis – Space, Time and Everyday Life*. Bloomsbury, 1992.

9 Schulze, Holger: *Spatial Body Sound. An Anthropology of With*. In: *Sam Auinger & Friends*. Folio Verlag, Wien/Bozen, 2007, p.75–83.

10 In this regard I would like to mention particular Sam Auinger, Gernot Böhme, Peter Cusack, Elen Flügge, Annea Lockwood, Bruce Odland, Dietmar Offenhuber, Bettina Oppermann, Penelope Wehrli et al.

11 "But, of course, acoustic space is also experienced in real space. Nevertheless, it is bodily space, the space of my own presence, which is constituted by the extent of my bodily awareness"

Böhme, Gernot: *The Great Concert of the World*. In: *Sam Auinger & Friends*. Folio Verlag, Wien/Bozen, 2007, p.47–58.

12 Auinger, Sam: Lecture *city sound – a hearing perspective*. bonnhoeren – stadtklangforum, Kunstmuseum Bonn, May 2010.

Biosphere Open Microphones (BIOM) – Towards a network of remote listening points in the UNESCO Biosphere Reserves

by Soundcamp: Maria Papadomanolaki, Dawn Scarfe, Grant Smith

Abstract

BIOM is a collaborative project to develop a network of open microphones in the UNESCO Biosphere Reserves, making real time sounds from these environments available on the Locustream soundmap. It brings together independent work at the intersection of arts, ecology, science and technology to create new online resources for public engagement and research. Participants include Biosphere Soundscapes (Brisbane), Locus Sonus (Aix-Marseille), Cyberforest (Tokyo), Jasper Ridge Biological Preserve (Stanford, CA), Sound + Environment (University of Hull) and Soundcamp (London).

This work can be considered as part of the wider development of 'sensing practices' associated with the 'becoming environmental of computation').[1] It shares overlaps with a variety of approaches including citizen science, civic science, street science, participatory sensing, crowdsourcing, DIY media, and citizen sensing. Its distinctive features include a concern with sounds at the scale of the soundscape, and an interest in the way humans and non humans hear and listen to such sounds, in addition to their significance as generalised data sets (e.g. for biodiversity indexing). This gives a character to the work shared across different projects, at the same time as it aligns it with other initiatives where (trans)formative exchanges are possible among people, technologies and their surroundings.[2]

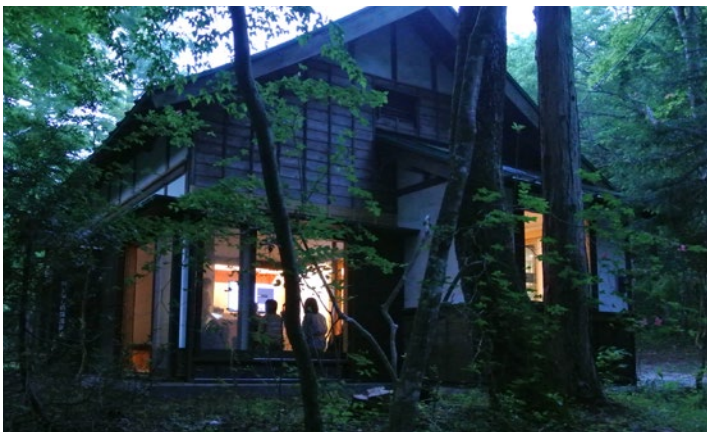
In this paper, Soundcamp outline the BIOM project, describe work that informs it, and share ways to be involved.[3]

Cyberforests and concerned citizens

The drawing on the following page (page 24) depicts a sensing situation. The microphones are deployed in a remote location: Tabushima Island is uninhabited by people. They have provided detailed sound transmissions since 2014 in a technically challenging installation with an off-grid satellite array. They reflect Cyberforest's long experience with this field, live streaming sound and images from a range of sites across Japan since 1997.[4] Innovative elements of the wider research programme include the recruitment of Sooty shearwaters as mobile weather sensors for the Japanese meteorological office.[5]

The stream has provided startling experiences for remote listeners who have happened on the sounds of the shearwaters emerging from their nesting burrows at first light or returning in the evening, anticipated by the cries of the waiting chicks. The live link introduced a strange periodicity into the day of those tuning in from different timezones. For regular listeners, a gap was felt when the Tabushima equipment was damaged by typhoons on two occasions, and the stream stopped.[6]

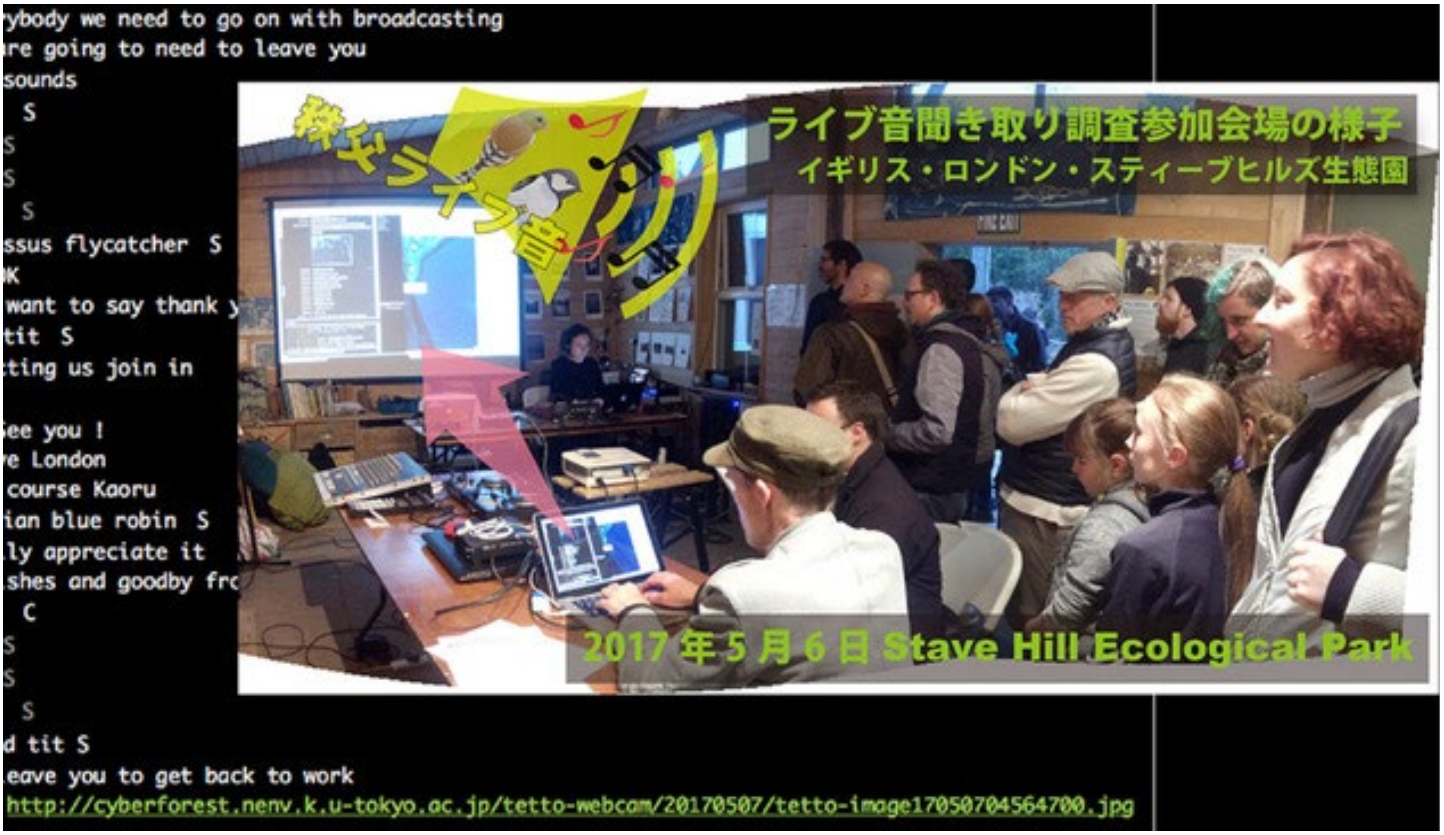
Along with other streams in the cluster of microphones operated by Cyberforest, the sounds of Tabushima are logged 24/7 to a public server, where they are available for listening and analysis. The project has created long term data sets going back up to twenty years, which are currently being analysed in collaboration with SABIOD (Toulon).[7] But the texture of the Cyberforest project comes from the live audio feeds and the conversations and activities they give rise to. This is exemplified by the remote audio census program:



Remote audio bird census with students and visitors, Fuji Iyashinomori study centre, May 2016

Each spring, ornithologists working in association with Cyberforest open the live streams in forests owned and managed by the University of Tokyo to identify and count birds by ear. They listen from separate locations in their homes or offices, and communicate using Limechat, a version of Internet Relay Chat (IRC), using a simple notation to rapidly annotate what they hear. The stereo field allows them to reference the location of birds singing, calling or drumming to left or right, to the fore, middle or back of the sound space as heard in their headphones or on speakers. The ornithologists are often joined by Cyberforest researchers and sometimes by students and other listeners.

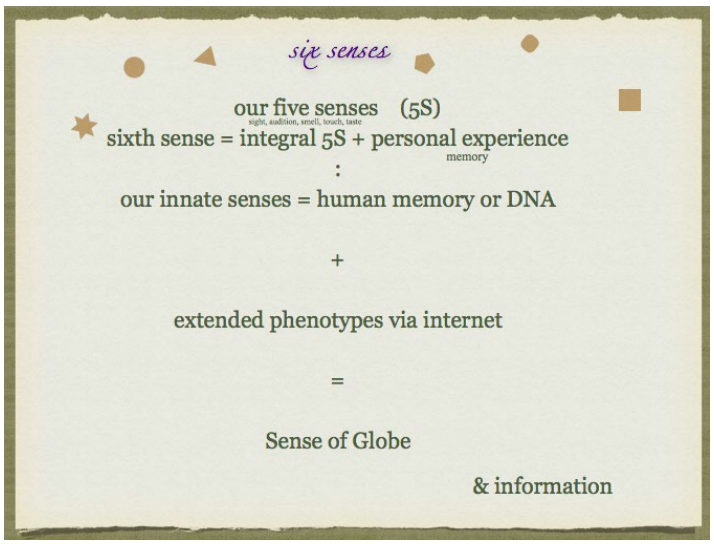
Microphones installed on Tabushima, an island uninhabited by people. Live relay by Cyberforest, University of Tokyo.
Drawing by Sam Baraitser Smith from a webcam capture on 20/8/2015



Joining the census from the London soundcamp May 2017. Image: Kaoru Saito

In May 2019, the ornithologists Reiko Kurosawa and Mutsuyuki Ueta (Japan Bird Research Association), together with Kaoru Saito (Cyberforest) were joined by audiences at two soundcamps,[8] one in London and the other in Marseille.[9] Despite the primary purpose of the census being scientific, translations and commentary helped non-specialist audiences follow the identification of unfamiliar species. Listeners remarked on the speed and skill of the ornithologists in identifying not just residents but migrating birds appearing sometimes for the first time that season, in a dense and rich dawn chorus. After 20 minutes listening in Hokkaido, the census moved south to the lower slopes of Mount Fuji, where daybreak at the start of May comes later. Here again the audience noted the precision and attentiveness which the ornithologists brought to the process of notating the unfolding dawn sounds.

Ornithologists could be observed 'reading' the soundscape, their attention moving from deeper in the forest to close at hand, from left to right of the field, quickly noting a positive identification or an agreed uncertainty (medium woodpecker). The audience could also detect and share their enthusiasm at the appearance of key 'cultural birds' (Ueta's term) for the first time that spring. If there were nobody up at 4AM to listen in to the forest in Hokkaido, these sounds would presumably not be heard by people. There was a sense, then, of a consciously ethical act of witnessing that has led these researchers to maintain their regime of listening, logging, and sharing the remote sounds, over many years and even beyond retirement. This seems like a good example of the way people and technologies can assemble or enact 'relations of concern'.[10] This is referenced perhaps obliquely by core members of the Cyberforest team, who are referred to humorously among themselves as the 'deep foresters' – people whose preoccupation with the digital and analogue forests they are engaged with presumably exceeds narrow professional interest, becoming indistinguishable from their general experiences of the world. We are reminded how for Whitehead such contacts are constitutive of the subject – and not merely something added on.[11] When he talks about the potential to acquire a 'sense of globe',[12] Saito has these kinds of exchanges in mind: involving real-time remote listening at the level of the soundscape, and accessing a number of streams from around the world.[13]



Ken Ishida. "Acoustic Data for Animal Monitoring, or Sense of Air Waves for Nature and Us." Presentation slide for 'Sense of Globe' University of Tokyo, 2016

Soundmap – becoming planetary[14]

In 2015, the Cyberforest streams were added to the Locustream Soundmap, which presents feeds on the open microphone platform operated by Locus Sonus since 2006.[15] By transposing the distribution of microphones on the ground to the screen, this soundmap provides an intuitive public interface where live sounds hosted on an Icecast server can be activated by clicking on a microphone icon.

The soundmap is the default way of interacting with the streams online and has become the most familiar of various ways in which

Locustream Soundmap (2006-ongoing) by Locus Sonus. Screenshot, 4 June, 2019

Locus Sonus have presented the streams (which includes a basic list of server mountpoints available as an option from the map). This simple spatial transposition has consequences as, de facto, the project becomes about places and listening in to other places. The map interface has a predictable levelling effect, with all the streams appearing together on the same virtual plane, as if on the surface of the earth.

As with any map, the top down perspective gives a deceptive sense of uniformity across sites, which can be differentiated to some extent by inserting a descriptive text and image, available as a popup. This provides context and local detail, reminding the user that the distribution of data across the map is not uniform. The interface makes clear the way streams are concentrated in some parts of the globe, while drawing attention to exceptions: streams in oceanic regions or the Global South, what is silenced or inaccessible. Most significantly, as Angus Carlyle has described, the emergence of sound has the effect of disrupting some of the map's topographical consistency, (re)introducing a vertical axis and a sense of being at ground level. Sound exists incongruously with the lofty view and fixed pins. The "all-possessing eye" "starts to.. lose its certainties" when sound flows from the screen.[16]

This sense of emplacement resonates with Gabrys' use of the term 'planetarity'[17] as something comprising 'multiple earths,'[18] each of which is elicited by different practices of inquiry and attention by specific constellations of organisms, people and equipment in certain surroundings. "Rather than bringing the Earth into view as a total object, as is often discussed through the figure of Earthrise, the planetary remains that which cannot be fixed or settled".[19] The soundmap sustains a tension between an abstract, encompassing overview, and the dissonance of many different sounding milieux.[20]

Cerro Pelón and Jasper Ridge – communities of transmission

In 2017 an icon appeared on the soundmap showing the installation of a live solar powered stream in the Monarch Butterfly Biosphere Reserve (BSR) on a mountain above Morelia in State of Mexico.[21] The site is one of 686 in the World Network of Biosphere Reserves designated by UNESCO in 122 countries. It sits within

Solar streambox, Cerro Pelón, Monarch Butterfly BSR, January 2018. Photo by Rob Mackay

the frame of the Man and the Biosphere Programme (MAB), an interdisciplinary programme set up in 1971 'to establish a scientific basis for the improvement of relationships between people and their environments,'[22] and dedicated to finding innovative social and environmental approaches to sustainability. The programme is growing: the total number of BSRs has increased from 669 in 2017.[23] The Monarch Butterfly BSR (Reserva de la Biósfera Santuario Mariposa Monarca) has been a UNESCO World Heritage site since 2008. It includes the butterflies' main winter roosting place, used by about 70% of the migratory eastern population of monarchs in

North America (some 1 billion butterflies). The stream attracted wide interest among the network of Monarch researchers and advocates, as a tool for public engagement, music composition, and expanding appreciation of the habitat's importance and fragility. It is a pilot for an extended project to link key points in the butterflies' migration routes from Mexico to Canada, drawing attention to the need for collaborations across disciplines and borders to conserve a charismatic indicator species.

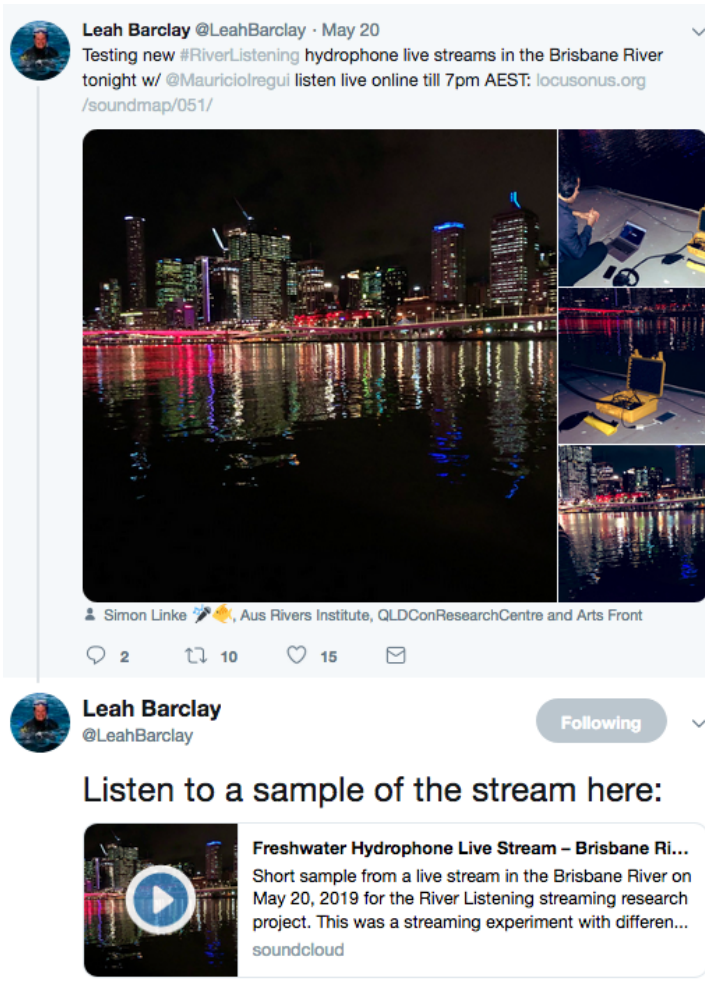
The stream has been significant in bringing together a group of people of varied backgrounds and research interests,[24] who have embraced the technical challenges of the installation, finding inventive ways to carry out running repairs with remote Whatsapp support, and working through the frustrations of prototyping and field testing in a mountain location where batteries have to be carried up on horseback and the mobile connection is patchy. The formation of this group resonates with Jeff Kolar's description of the 'community of transmission',[25] and seems to involve a similar sense of interest in sharing sounds of things that are at once everyday and extra-ordinary: periodically the butterflies animate this otherwise unexceptional patch of evergreens; then they are gone. The broadcast, itself fragile, distributes this sense of tenuous presence / absence in ways that are different from conventional media portrayals of an iconic species. Despite the design of custom microphones and pre-amplifiers, the stream has so far not relayed sounds of the butterflies themselves in a convincing way. Rather, it has shared, perhaps, a sense of the locale as experienced by the arborists themselves, who are engaged in managing the habitat and spend most time out in the field at different times of the year.[26] The close involvement of Pato Moreno, one of the arborists on the team, has been key to keeping the installation running. This has given rise in some cases to streams conveying an intimate spatial sense of listening in the meadow at the forest's edge: insects, hummingbirds and other unidentified 'critters' come close to the microphones; on the weekend, sounds of people and music drift up from Macheros in the valley; on weekdays, blasts from nearby mining operations and sounds of overflying aircraft recall the site's situation within wider social and economic realities.

The stream runs off-grid over 4G and is subject to ongoing testing and temporary outages. Captions on the Locus Sonus soundmap include listening notes and links to assist with identifying commonly heard species, prepared in collaboration with ornithologists at the Universidad Nacional Autónoma de México (UNAM).

***

> Bones and muscles and feathers fan forcefully, crossing the threshold between water and air. Brays and gurgles, creaks and groans, roars and mewls, chirrups, howls – these cries of sorts. Thin, high and sharp pings, peeps and squeaks – these whistles of sorts. These whistles and cries slide disconcertingly across the zoological spectrum; having blocked out the announcements I have no compass to orientate me to beak or mouth or throat sac or chitin. I am sinking into a lush Le Douanier fantasy and then another border is tunnelled under: the sky is slowly torn in two by an overflying jet.
>
> *Angus Carlyle Listening to Jasper Ridge Biosphere Reserve on 1st May 2015 14:45–15:2527 in Sounds Remote, Soundcamp / Uniformbooks 2015*

A new phase of the project is in preparation with Jasper Ridge Biological Preserve (JRBP), the Golden Gate Biosphere Reserve and other partners, to develop a network of microphones spanning the monarchs' main migration routes. Jasper Ridge already has a history of operating a live audio feed: Trevor Hebert's 'Birdcast'[27] has been used as a point of contact with the reserve by less mobile visitors, and citizen sensing projects with professionals and lay experts have included bird surveys and bat counts assisted by algorithmic listening. Starting as a technical proof of concept for a cross-site WiFi network, Birdcast has created a dedicated listenership to its sounds of wetland and scrub from a carefully chosen location at the intersection of micro-habitats.[28]

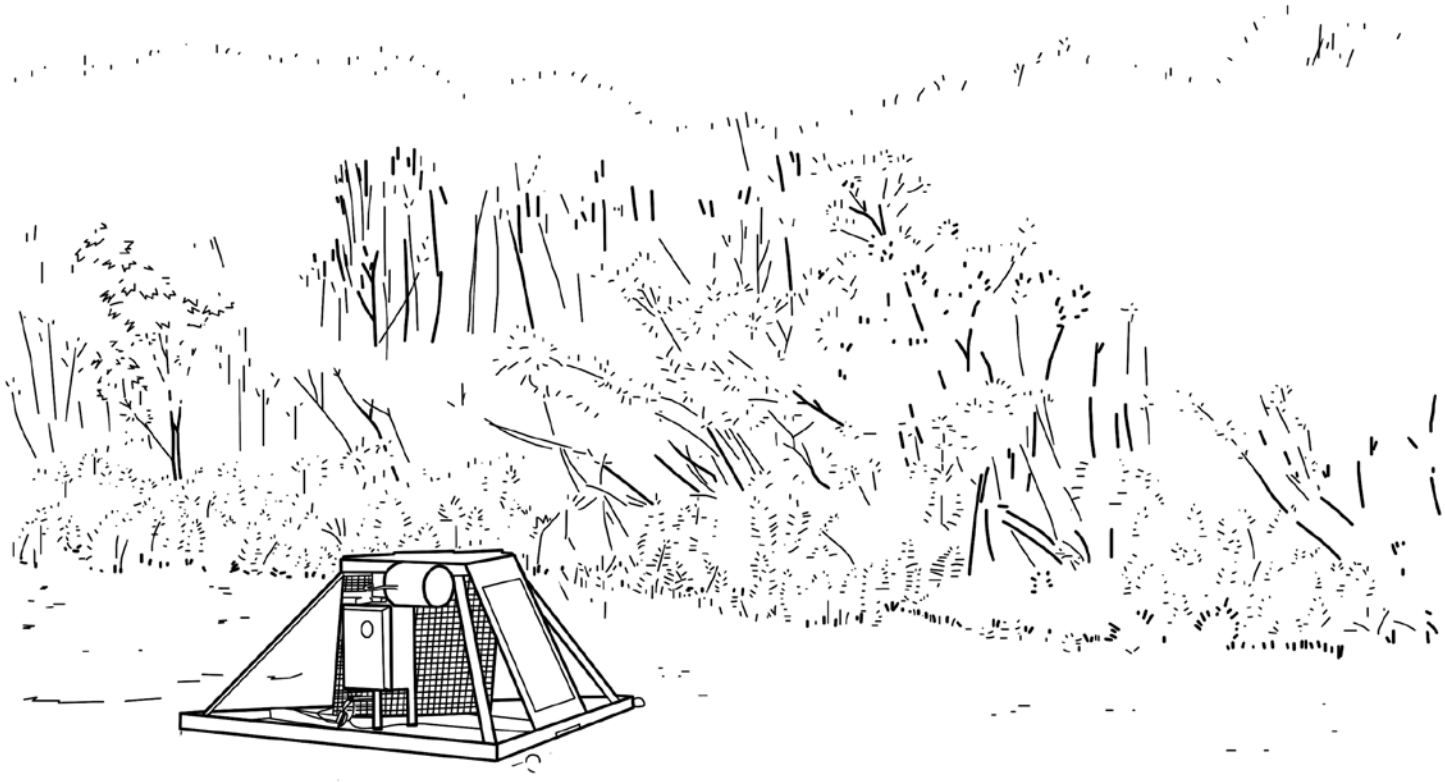


Tweet from @LeahBarclay 20 May 2019. Listen to sounds beneath the river at **https://soundcloud.com/leah_barclay/freshwater-hydrophone-live-stream-brisbane-river-excerpt**

Biosphere Soundscapes – fish and other things

With Biosphere Soundscapes, Leah Barclay has been listening to things, especially fresh water ecosystems, in settings linking research, sound art and public engagement, in the UNESCO Biosphere Reserves since 2011.[29] Biosphere Soundscapes has used live streaming to widen awareness of the value and precarity of freshwater ecosystems in the Noosa Biosphere Reserve in Queensland, where the program originated, and internationally.[30] Key elements of this work have included: sound recording projects with indigenous groups as extensions of claims to land and cultural recognition; establishing data bases of sounds of freshwater organisms (fish, crustaceans, insects) to support research and public engagement; and citizen art science projects involving young people in sound recording with hydrophones.[31]

The Biosphere Soundscapes programme has included extensive work with live streaming as part of River Listening[32] and other projects. Live transmissions of a fresh water dawn chorus for the Reveil broadcast relayed snapping shrimps, grunting catfish and large fish bumping into the microphones.[33] A new long term installation at Mary Cairncross Scenic Reserve,[34] makes broadcast quality



Pond Station, Zach Poff (2015-ongoing), Wave Farm, Acra, New York. Drawing: Sam Baraitser Smith

sounds from a subtropical rainforest canopy available on site and online. The new stream is immediately noticeable as the only icon currently on the map in Australasia. At a micro level it opens onto a new locale: an open-ended 'live archive'[35] in which the listener can begin to orientate themselves among scattered constellations of frogs and insects at night, varying over time from dense and syncopated to sparse, with occasional squacks and a recurring descending drawn-out *zzzzz* that sometimes appears to move swiftly across the sound space. This is a forest remnant on a main road, surrounded by agricultural land and close to major population centres. So the sounds of fruit doves at daybreak, heard in Reveil 2019, which evoke the writing of Steven Feld,[36] overlie a background of rush hour traffic, and at night, as now, there is the bellow of a cow, shouts, hammering and a dog, all quite muted by distance, with high pitched rustling foliage close by.[37] It is anticipated that it will acquire online listening notes and a dispersed listenership who gradually familiarize themselves with its circadian and seasonal flows, as has been the case with the Cyberforest microphones.

The Mary Cairncross installation has also served as proof of concept for placing a streambox powered over ethernet high in a large tree 100m from the Reserve's interpretation centre, where the stream and soundmap are presented along with other exhibits. It gives remote access to the canopy biome and a sense of the site early and late when it is closed to the public.

Biosphere Soundscapes aim to make an appreciation of sound and ecoacoustics part of education and public policy, while continuing to demonstrate and develop that understanding at a base level through community engagement. This provides an essential pool of experience and approaches for the BIOM project going forward.

Another point of reference in this emerging field is Zach Poff's *Pond Station*. Consisting of a custom array of hydrophones and other sensors, *Pond Station* is a permanent floating monitoring platform that relays live sounds from near the bottom of a pond at Wave Farm in the Upper Hudson Valley, New York. The pond becomes animated as the water warms through the day, and as the whole pond warms up in spring. Over a longer cycle, duck weed has grown more thickly on the surface, reducing light penetration and overall biotic activity. The Pond Station has inadvertently become a monitor of the effects of agricultural run-off on freshwater diversity. It has also effectively enlisted Poff as an activist, looking for ways to mitigate the effects of enrichment on the pond's soundscape.[38]

The Spit – Listening to uncertainty

> DS (Walney): i wonder if listening at night puts you in a different frame of mind?
>
> JK (Seoul): could be. i think listening is not like a discrete object , but more like... water. it doesn't have fixed shape. everyone discovers something different while listening. the listeners situation affects how they listen.
>
> DS: do you literally picture yourself there… somewhere in the scene?
>
> JK: i feel like i stand still. the static position of the streambox affects how I listen remotely. it kind of forces me to find something.
>
> DS: a bit like the audio equivalent of a bird hide?
>
> JK: haha, yes, similar to a bird hide.
>
> *Dawn Scarfe and Jiyeon Kim discussing a live stream from 'the Spit' 14:58 28/08/2017*

Soundcamp have collaborated with Full of Noises and the Cumbria Wildlife Trust on a live stream from South Walney Island (2016 – ongoing), also available on the Locuscast soundmap. The location is a Site of Special Scientific Interest (SSSI) whose unstable shingle ecology means that it is normally inaccessible to the public.[39] A Raspberry Pi based streambox places the listener low down on a wind-blown spit, which separates an area of tidal salt marsh and mudflats from the Irish Sea.[40] The stream has led to a residency

The Spit, South Walney Island, Cumbria, UK Cumbria Wildlife Trust, Summer 2018. Trailcam photo by Sarah Dalrymple.
http://soundtent.org/biom/places/south_walney.html

program on the island and various public presentations, including Gull Spit (Soundcamp for FON, Autumn 2017), which explored connections between the site and the city of Barrow-in-Furness across the bay. An installation in Barrow Market played live sounds from the Spit, together with other off-grid microphones and showed archival materials from the island's history as a field station for Herring gull research. Sarah Dalrymple, warden at South Walney, visited the market space to give a talk about Gull ecology. South Walney Radio invited listeners to tune into the island from the project space, an un-let retail unit with changing rooms converted into makeshift listening stations.

Listening to South Walney can be an austere experience. The wind vibrated the speaker cones in the modified changing booths in Barrow Market, modulating with a high to medium pitched turbine drone from what is currently the largest off-shore windfarm in the world. Extended passages of hiss and drone border on the fully abstract, evoking an ill-defined, shifting object, very schematically imagined, in a literally flattened ontology of weather, syrinxes, water, nuclear waste vessels, air encountering a variety of surfaces over time.[41]

This is a different mode of listening than that employed during a Cyberforest bird census. A listener with a particular interest in ornithology will pick out species. But often what can be heard is not diversity but repetition; not variability but a restricted set of sounds: there is a paring away here, the open flat stretch reduces resonance, sounds are stretched thin. Over time you can tune to the soundscape and hear it more acutely. You can become a kind of (ignorant) expert.[42]

The live streams are sometimes interesting because nothing happens[43] and because, even when it does, of the uncertainty they embody: not only is the sound source hidden (acousmatic); it is often unclear, unfamiliar or maybe still to reveal itself or be announced. We listen particularly closely to something we hear but can't identify: the *informe* which evades naming occupies a particular zone of curiosity.[44] Partly through perplexity, the listener to remote soundscapes can perhaps acquire a sense of the texture of an environment not available through other modes of engagement. The sense of soundscape that results remains fluid, fleeting and unresolved.

The Walney stream tells us there is something inseparable about the concentration of nuclear infrastructure, nature reserves and migration. Despite the routine imposition of boundaries between them (in industrial, heritage and wildlife discourses), these things can be heard to be entangled in compelling ways.[45]

Reveil – Listening to things with others for a long time

Reveil is a 24 hour broadcast of live sounds of daybreak coordinated by Soundcamp, which relies on the practices above and has been interested to draw them together, in an annual event since 2014. Starting near the Greenwich Meridian at 5AM, Reveil travels west following the grey line just ahead of sunrise, when birds and other organisms generate a continuously changing wave of sound. Live audio feeds are supplied by streamers around the world using devices from phones, laptops and Raspberry Pi's to commercial broadcasting equipment. Domestic scale projects join formal research networks to realize a collective composition of environmental sounds lasting one earth day. Reveil links a series of micro festivals (soundcamps) on International Dawn Chorus Day.

Together with other projects described here, Reveil anticipates the concerns of the BIOM project. Developing a broadly ecological approach, in the spirit of Guattari's Three Ecologies[46] or Gablik's 'connective aesthetics,'[47] it has been interested to link separate sound and ecology projects, sometimes revealing connections that were unsuspected or obscured, and setting up new solidarities and exchanges.[48] [49]

The broadcast creates opportunities to listen to things other than human speech and music. It includes only a few minutes' total announce time, opening a space that is uncommon in the radio spectrum. Although Reveil shares ground with Bruce Davis' Wilderness Radio,[50] in fact few of the feeds for Reveil come from wilderness areas. The program's occasion on International Dawn

Chorus Day invites participants to consider the contributions of birds and other organisms to the soundscape. This extends to fish, amphibians, machines, weather, diversifying attention at a time when human sounds tend to be reduced, and even congested urban soundscapes can reveal sonic 'wild life'.[51]

Reveil has helped widen participation in the Locus Sonus open microphone project, by providing technical support, a focus for collaborations on DIY broadcasting tools, and opportunities for group listening outside conventional cultural spaces.[52] The crowd-sourced nature of the broadcast means that the ways people interact with Reveil are participatory and experimental from the outset, and include the 'noise' of transmission, from microphone handling to EMI affecting analogue devices, to network hiss.

This extends to the quality of the 'real-time' connections provided by the streams. A performance at Soundcamp 6 involved an improvisation between two environmental streams, live electronics and two keyboards, separated between London and Jeju Island, South Korea. The performance conveyed a sense of distance partly through the way the players negotiated the challenges of coordinating rhythms and harmonies with lag times on the network fluctuating up to several seconds. Making a real-time connection, as Jean Cristófol argues, is about participating in a common process, not about establishing an immediate link.[53] Rather than trying to minimise or compensate for latency and other artefacts of transmission, Reveil takes them as an indicator of what is at stake when a remote stream is established.

For the 'DIY environmental broadcaster,' the experience of setting up a stream in the dark at daybreak is of having your attention divided between the sounds around you and that you are making, the equipment you are working with, the transmission device(s) you are using to access a network, and the remote frame of the broadcast you are trying to synch with in the window between civil twilight and sunrise, at the point when the station will pick up your stream and these quite fluid entities will coincide, along the grey line of first light as it reaches your location.[54] Frustrations and anxious calculations, together with tiredness as the broadcast continues, together contribute to a curious collective sense of 'environmental concern.'[55] [56]

Reveil creates opportunities to listen to live environmental sounds together – in one place and many,[57] for a long time,[58] in situations where co-production and crowd-sourcing tend to blur artist and audience roles. Those sounds reflect collaborations across arts and sciences, through co-productions and research partnerships.[59]

Taken together, these elements are looking for ways to provide a sketch or 'proposition' of an emerging set of practices and places, which draw attention in their different ways to sound as a common resource that tends to escape private or public designation.[60] Reveil is interested to imagine what can be gained by thinking these practices together and bringing them into communication. This is a basic inspiration for Biosphere Open Microphones.

BIOM

It was proposed to develop the BIOM project within the frame of the UNESCO MAB program, as an extension of Biosphere Soundscape's work in the UNESCO Biosphere Reserves (BSR's) and because it resonates with the program's support for innovative relationships between people and their environments. The partners are those organisations that have already been involved with live environmental sounds in different ways over an extended period. The program was launched at Sound + Environment 2017, with the following aims:

BIOM aims and objectives

- To establish a new network of live streams from UNESCO Biosphere Reserves, available in real-time via an online soundmap as a public resource for artists, researchers and activists.
- To use the UNESCO Man and the Biosphere programme as a frame to make real-time connections and share learning and experiences between sites.
- To preserve the diversity of the current pool of live streams, which spans from domestic interventions to formal research programs, across the arts and sciences.
- To work with local groups to set up and operate new streams, using a range of approaches from commercial broadcasting technologies to DIY streamboxes and mobile apps.
- To support installing resilient open microphones in a variety of habitats in UNESCO BSRs, with the sounds publicly available for remote listening in real-time (with streaming servers hosted by Locus Sonus).
- To record the audio from the open microphones, creating long term public data-sets for the sites (with archive servers hosted by Cyberforest, University of Tokyo).
- To be led by local groups in the setup and maintenance of the open microphones, making them a hub for learning and engagement in the BRs.

BIOM streams

The following longer term streaming projects are currently in BSRs:

Shiga Highland Biosphere Reserve Shiga Nature Education Park, Nagano, Japan – Cyberforest (University of Tokyo), Shinshu University Institute of Nature Education **soundtent.org/biom/places/shiga.html**

A long term stream is operated by Cyberforest in collaboration with the Shinshu University Institute of Nature Education. The project comprises real time stereo sound transmission, data logging and public engagement, with phenological research, citizen science activities and machine based audio analysis by the SABIOD big data program at CNRS, University of Toulon. In an annual remote bird census, ornithologists listen in pairs to the live streams around dawn, communicating by IRC chat to log the species and estimate the numbers of birds they hear. The census moves from one site to the next each day. The Shiga stream is part of a program streaming live data from the University of Tokyo forests since the early days of the public internet.[61]

The area around Kobushi is currently being proposed as a new Biosphere Reserve. This would include live streaming points at Tetto and Yatake. Sounds from these sites can be heard on the Locus Sonus soundmap. Logs over many years can be accessed at the Cyberforest project page.[62]

Jeju Biosphere Reserve Jeju Island, South Korea – Weather Report **https://www.mixcloud.com/weather_report/stream**

Weather Report, an arts collaborative based in Seoul, have operated temporary open microphones from Jeju island over 3 years, including a stream from Culture Space Yang, Georo Village and a soundcamp in Gyorae Forest Park in May 2017. Weather Report have developed work with music and live remote streaming of environmental sounds, enabling local and remote audiences to become more aware of acoustic and environmental changes over time. This links to research and advocacy around local development.

Monarch Butterfly Biosphere Reserve, Cerro Pelón, State of Mexico – University of Hull, Universidad Nacional Autónoma de México, Forestry Service, Arborists' training program, Morelia **soundtent.org/biom/places/cerro_pelon.html.**

A collaboration between Rob Mackay and a cross disciplinary team from Mexico, UK, US and Canada. See Cerro Pelón above. The stream is available on the Locus Sonus soundmap at **http://locusonus.org/soundmap**. It runs off-grid over 4G and is subject to ongoing testing and periodic outages.

Golden Gate Biosphere Reserve, Jasper Ridge Biological Preserve, CA – Stanford University, Golden Gate Natural Recreation Area, Bodega Marine Reserve **soundtent.org/biom/places/jasper_ridge.html.**

The BR is a highly diverse and culturally rich complex of urban, multi-use and wild environments with coastal forests, chaparral, scrub, prairies, rare serpentine grasslands, and islands. Birdcast, a live audio stream by Trevor Hebert, shares a changing soundscape of waterfowl, amphibians, songbirds, large mammals and overflying aircraft. Launched in 2013, Birdcast soon became popular with online communities, letting ornithologists and lay experts supplement conventional bird surveys, listen out of hours and hone ID skills, and providing contact with the site for older and less able birders. New streams, archiving and additional remote sensing equipment are planned, which would reach new ecosystems above and below water, opening collaborations with other stakeholders (see Jasper Ridge above).[63]

Noosa Biosphere Reserve, Noosa, Queensland, Australia– Biosphere Soundscapes **soundtent.org/biom/places/noosa.html**

The Noosa BSR comprises 60 distinct ecosystems, with more than 300 bird species and 1300 plant species, with many endemics. An ocean corridor supports marine fauna including some 18,000 humpback whales on annual migration. Permanent streams are under development as part of an extended research and public engagement project by Biosphere Soundscapes, exploring the Biosphere Reserve via a range of recording, field studies and live streaming activities, and through public and specialist research programs with attention to both terrestrial and aquatic ecologies (see Biosphere Soundscapes above).[64]

Next steps and how to be involved

BIOM welcomes proposals for new sites and related activities. We can provide advice and technical assistance.

Raspberry Pi based streamboxes are easy to build using streaming software from Soundcamp or Locus Sonus.[65] They can also be purchased assembled or as kits.

You can start by setting up an account at Locus Sonus:

- **http://locusonus.org/soundmap/dev/admin/login** >
- 'open a new microphone and join the Locustream SoundMap project'.

A summary of methods, equipment and resources is available here: **http://soundtent.org/streaming_recipes.html**

A detailed discussion of streaming and the Locus Sonus open microphone platform is available at: **http://locusonus.org/wiki/index.php?page=Locustream.en**

Please contact one of the partners to discuss planning and setting up a stream.

Conclusion

BIOM is a diverse open microphone network, a public resource, and a creative response to the variety of planetary soundscapes and ways of encountering them.

BIOM will involve more sites, and get more people listening to them. It will engage people directly in setting up streams and talking about them, beyond conventional cultural spaces and research laboratories. Listening is not (just) about sitting, or even walking, quietly: BIOM invites listenings that embrace noise, dissonance and the paraphenalia of sensing – organic and non.

In a simple yet insistent way, BIOM is about widening participation in ecoacoustics and environmental sound art by working with affordable equipment. But participation is not confined to supplying data or oiling the networks of the smart city. As Jennifer Gabrys reminds us, participation is 'always a diverging rather than [...] unifying set of engagements',[66] and BIOM is imagined as a framework for a variety of both collective and divergent activities, with different tones and modes.

The projects described here span a great variety in terms of their artistic and scientific concerns and the kinds of engagement they invite. Yet they also share certain commitments to ecologies, translation and exchange. This poly-vocal quality is reflected in the current paper, which documents different periods, grabs, feats and failures of attention over time and across sites, as attested by different people, listening 'out of synch, but in time.'[67]

Endnotes

1 Gabrys, Jennifer 2016, Program Earth, University of Minnesota Press, Minneapolis, 20

2 Ibid. 54, 118, 132

3 This paper is based on a presentation at the Sound and Environment Conference, University of Hull in July 2017. We are grateful for thoughtful suggestions from two anonymous reviewers.

4 Saito, Kaoru et al (2015), Ambio 44(Suppl 4): 572. Accessed June 4, 2019. **https://doi.org/10.1007/s13280-015-0708-y**

5 A study into shearwater fishing behaviours fitted the birds with GPS transmitters. By accident it was found that, as the shearwaters fly or rest on the water, their movements can be disaggregated from wind and ocean currents, revealing detailed local weather patterns. Ishida, Ken: Remarks at Sense of Globe conference, University of Tokyo 2016

6 Soundcamp, personal communication

7 SABIOD accessed online 9th June 2019. **http://sabiod.univ-tln.fr/**

8 Soundcamps are micro festivals of sound and ecology linked by Reveil: a 24 hour radio broadcast that picks up live streams from the soundcamps and a network of other streamers around the world. See **http://soundtent.org**

9 Suko, Yasushi. "Natural sound from Japanese forest was relayed to Marseille". Accessed online 4 June, 2019. **https://www.youtube.com/watch?v=tgUVqbP6uBk&feature=youtu.be**.

10 Gabrys, Jennifer. "Practicing, materialising and contesting environmental data" (2016). Big Data & Society Accessed June 3, 2019. **https://doi.org/10.1177/2053951716673391**

11 Stengers, Isabelle 2011, 2014, trans. Michael Chase, Thinking With Whitehead, Harvard University Press, Cambridge, Mass., eg 256–260 and elsewhere.

12 Saito, Kaoru. "Cyberforest: a sense of globe." Presentation for TEDxUTokyo 2015. Accessed online 4 June, 2019. **http://tedxutokyo.com/en/speaker/kaoru-saito**.

13 As a concept or proposition, 'Sense of Globe' perhaps sits somewhere between the model of a subject whose range of experience is extended by engaging with online environmental sounds or other media, and the promise of more fluid, (trans)formative relationships between people and their environments through such activities.

14 Gabrys, Jennifer. Becoming Planetary. Eflux. Accessed online 4 June, 2019.

15 Sinclair, Peter. Locus Stream Open Microphone Project. 2018 ICMC Daegu, South Korea. Accessed online 4 June, 2019. **https://hal.archives-ouvertes.fr/hal-01791828v2/document**

16 Carlyle, Angus. 'The God's Eye and the Buffalo's Breath,' presentation at WFAE Viseau, Portugal 2015. **http://invisibleplaces.org/2014/pdf/ip2014-carlyle.pdf** p. 10 Accessed online 5 June 2019.

17 "'Planetar-ity" was figured as a word set apart from notions of the planetary, the planet, the earth, the world, the globe, globalization, and the like in their common usage. Planetarity is not susceptible to the subject's grasp. The globe is on our computers. No one lives there. The "global" notion allows us to think that we can aim to control globality. The *planet* [our emphasis] is in the species of alterity, belonging to another system (Gayatri Chakravorty Spivak in Cassins, Barbara, The Dictionary of Untranslatables, trans. Emily Apter. Accessed online 6 June 2019.

https://slowrotation.memoryoftheworld.org/Barbara%20Cassin/Dictionary%20of%20Untranslatables_%20A%20P%20(14416)/Dictionary%20of%20Untranslatables_%20-%20Barbara%20Cassin.pdf

18 Gabrys, Jennifer (2016). Program Earth: 14, 104.

19 Gabrys, Jennifer. Becoming Planetary. Eflux. Accessed online 4 June, 2019. **https://www.e-flux.com/architecture/accumulation/217051/becoming-planetary/**

20 For the value of the *milieu* for thinking about sound, we are grateful for the comments of Roberto Barbanti within the framework of the symposium Pratiques de l'écoute, écoute des pratiques #8: écologies sonores, écosophie et communs auditifs, 21–11-2018, organised by antiAtlas, Locus Sonus and Iméra.

21 Mackay, Rob et al. 'Following the Flight of the Monarchs', presentation for Ecoacoustics Congress, Brisbane 2018. Accessed online 9 June 2019. **https://ecoacousticscongress.files.wordpress.com/2018/07/ecobooklet_monday16july_final.pdf** p106. The live stream is a collaborative project by Rob Mackay (University of Hull, UK) with Pablo Jaramillo (Universidad Autónoma de México), David Blink (College of the Sisquiyous, USA), the Forestry Service in Morelia and a local NGO: Butterflies and their People who provide training in arboriculture. Technical and remote support by Soundcamp, UK. The stream is available on the Locus Sonus soundmap at **http://locusonus.org/soundmap** > cerro-pelon. A remote capture of the stream giving a sense of the soundscape is at **http://soundtent.org/present/acoustic_commons_marseile/cerro_pelon.html**.

22 UNESCO. About MAB. Accessed online 6 June 2019. **http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/man-and-biosphere-programme/about-mab/**

23 World Network of Biosphere Reserves 2017–2018. Accessed online 9 June 2019. **https://unesdoc.unesco.org/ark:/48223/pf0000259695**

24 Some of these are involved directly: ecologists (Pablo Jaramillo-López and ornithologist colleagues at UNAM); arborists with the locally based NGO Butterflies and Their People (butterfliesandtheirpeople.org); forest rangers (Pato Moreno and colleagues); musicians and sound artists (Rob Mackay, David Blink, John Sanders, Vaughan Garland); poet Rolando Rodríguez; a video artist Jessica Rodríguez; documentary maker Anna Chahaneau; and local networking engineer Franco Ramírez. A wider group has included the 800 members of the Kansas based Monarch Watch citizen science network (monarchwatch.org). The livestream has been the subject of discussions with scientists for potential ecosystem monitoring, as well as being as used in live performances and exhibitions (Ambient@40 Conference – University of Huddersfield; CENSE Conference – Budapest; British Science Festival – University of Hull). It will be featured on a radio programme forthcoming on the BBC.

25 Kolar, Jeff: personal communication. Jeff Kolar (founder and director of the Radius, Chicago) was talking about the collective experience and effect of participating in Eric Leonardson's *SoundTent* at *Camp Sherwin*, a live transmission from Marion Mahony Griffin Beach Park on the shore of Chicago's Lake Michigan on Saturday May 2, 2015 at 5am CST. **https://theradius.us/episode63**. It resonates with Tetsuo Kogawa's thinking on mini radio, for example at: **https://anarchy.translocal.jp/radio/micro/radiorethink.html**

26 The idea that exchanging sounds can usefully be thought of as linked to the (paradoxical) process of pointing and drawing attention to the common-place was suggested by Ella Finer in a round table discussion organised in the frame of Soundcamp 6 with members of the Acoustic Commons Study Group, Tower Hamlets Cemetery and Stave Hill Ecological Park, London, 4–5 May 2019. See also Michel de Certeau: The Practice of Everyday Life.

27 Jasper Ridge Biological Preserve is a field station of Stanford University. More information and the Birdcast live stream by Trevor Hebert is available at **http://jrbp.stanford.edu/about/facilities/live-audio-stream**.

28 The network development is being led by Rob Mackay (University of Hull).

29 Barclay, Leah and Toby Gifford, Acoustic Ecology in UNESCO Biosphere Reserves, Biosphere Journal Volume 1-1 #2 Accessed online 9 June 2019. **https://biospherejournal.org/vol1-1/second-article/**

30 Barclay, Leah 2014, Biosphere Soundscapes, Leonardo 47(5):496–497 October 2014

31 Barclay, Leah and Toby Gifford, Acoustic Ecology in UNESCO Biosphere Reserves, Biosphere Journal Volume 1-1 #2 Accessed online 9 June 2019. **https://biospherejournal.org/vol1-1/second-article/**

32 More information: **https://leahbarclay.com/portfolio_page/river-listening/**

33 Eudlo Creek (2019); Mary River, Noosa Biosphere Reserve (2018); more recently from the Brisbane River with Mauricio Ireguí (see tweet above).

34 Mary Cairncross Scenic Reserve, Queensland. Live stream accessed 6 June 2019 at **http://locusonus.org/soundmap/**

35 Soundcamp (2018) "The Live Audio Archive". Leonardo, Volume 51 Issue 3 June 2018. **https://www.mitpressjournals.org/doi/abs/10.1162/leon_a_01536**

36 Feld, Steven (1982). Sound and Sentiment: Birds, Weeping, Poetics, and Song in Kaluli Expression. Durham and London: Duke University Press 2012. See eg: 30, 31-2ff.

37 Listening notes, Grant Smith (London), 7 June 2019 14:59 UTC+1. Recording available.

38 **https://www.zachpoff.com/artwork/pondstation** accessed online 9 June 2019. Zach Poff in conversation with Soundcamp for The Acoustic Commons, Resonance Extra, 15 December 2017: **http://soundtent.org/acoustic_commons**

39 Soundcamp. BIOM South Walney. Accessed online 4 June, 2019. **soundtent.org/biom/places/south_walney.html**

40 The Walney stream has been a useful prototype for an installation over mobile networks in a site exposed to strong winds off the sea. Soundcamp and Octopus Collective's Andrew Deakin developed a rubberised timber enclosure based on a small vernacular building, weighted with stones, to house the microphones, and custom wind-screens with wool wadding. The box creates a roughly binaural sound space, in which the listener can track seabirds, insects, nuclear waste vessels, and seals as they pass and approach and recede.

41 'That no-matter-what is something indicates nothing other than the possibility of a flatness: that by which everything is equally.' Garcia, Tristan 2010, 2014: Form and Object: A Treatise On Things, Edinburgh University Press, trans. Mark Allan Ohn and Jon Cogburn, 30. Also Gabrys 2016, 153–4.

To listen directly and for detailed listening notes including Maria Papadomanolaki's 'Transmitting turbulence', see: **http://soundtent.org/south_walney/GULLSPIT.html**]

42 'Artists can contribute fundamentally to [...] the art of detection, the augmentation and radicalisation of sense perception – listening, seeing, detecting physicality, and bringing to attention – which is perhaps more connected to the idea of art as a form of intense connoisseurship.' Weizman, Eyal (2017) "We Are All in the Mud". Interview with Lucas van der Velden, Sonic Acts Research Series #32. Accessed June 9 2019. **https://sonicacts.com/portal/we-are-all-in-the-mud**

43 Sinclair, Peter, in conversation with Soundcamp for The Acoustic Commons, Resonance Extra, 22 December 2017 **http://soundtent.org/acoustic_commons/**

44 'The *informe* is the agent of uncertainty in perception. It is that which casts doubt, a sort of anti-identification.' Bonnet, François 2016, The Order of Sounds, Urbanomic, Falmouth, 282ff.

45 On entanglements as problematic and indispensable connections, see: Tsing, Anna Lowenhaupt (2015) The Mushroom at the End of the World: On the possibility of life in capitalist ruins. Princeton: Princeton University Press 2015: 5–6, 168 and elsewhere. Also: Haraway, Donna J (2008). When Species Meet. University of Minnesota Press.

46 Guattari, Félix (1989). The Three Ecologies, trans. Ian Pindar and Paul Sutton. London: Bloomsbury 2014.

47 Suzi Gablik suggests that 'connective aesthetics' emerge from a "fieldlike conception of the self that includes more of the environment – a selfhood that releases us into the sense of a radical relatedness". Gablik, Suzi (1992). Connective Aesthetics, American Art, Vol. 6, No. 2 (Spring 1992): 2–7.

48 Solidarities or 'communities of inquiry' comprising experts, lay experts and others. See, for instance: Donna Haraway, "Symbiogenesis, sympoiesis, and art science activisms for staying with the trouble". In Tsing, Anna et al (2017) Arts of Living on a Damaged Planet. University of Minnesota Press. Chapter 2: M25ff.

49 Ways that disparate projects can find surprising solidarities in response to precarity and precarization are described notably by Isabell Lorey in Lorey, Isabell (2015). State of Insecurity. London: Verso. See for example the introduction (p15) and her account of the activist research activities of Precarias a la Deriva pp 91 ff.

50 Davis, Bruce (1975). "FM Radio as Observational Access To Wilderness Environments". Alternatives, Spring 1975: 21–2.

51 Ella Finer: Falling Outside: Sonic Miscellanies and the Wild Life of Sound. Accessed online 7 June 2019. **https://www.gold.ac.uk/calendar/?id=12262**.

52 At the London soundcamp in Stave Hill Ecological Park, the Reveil feed is played out in a canvas bell tent (soundtent), where a group of listeners can follow the broadcast, while continuing to hear the local sounds around. The blueprint for a soundcamp referenced by some twenty soundcamps in other locations each year, includes having some kind of point for group listening, which may be minimal, depending on power and network conditions.

53 Jean Cristofol 2008, 'Flows, stocks and leaks' **http://temporalites.free.fr/?browse=Flux,%20stock%20et%20fuites** accessed online 4 June, 2019.

54 The crowd-sourced, experimental broadcast sounds different from most radio, with its emphasis on achieving a consistent and unbroken surface. The 2019 Reveil broadcast included a vivid transmission by Nhung Nguyen, in which periodic dropouts enhanced the sense of movement as the artist walked through a market in Hanoi in the very early morning, negotiating a way through traders, nightowls, market paraphernalia, and variable mobile networks. See Reveil 2019, schedule of streams: **https://paper.dropbox.com/doc/Reveil-6-2019--AetD0w6c36RBIJwySPolNixSAg-0uREPQ0BhaC4o9uztt7p2**).

55 'A relation does not spring up between two terms that are already separate individuals, rather, it is an aspect of the internal resonance of a system of individuation. It forms a part of a wider system [Simondon in Gabrys, 2016, 105]. Gabrys offers a detailed and rewarding account of how subjects (or superjects) arise out of such relations of resonance within milieux, whether, for our purposes here, as streamers, listeners or both. Her account offers ways to understand work with environmental sound as part of wider kinds of 'sensing' that are at once more active and more collective than classical accounts of listening that focus on quiet and receptivity. Gabrys' account is based in close readings of Whitehead, sometimes as 'thought together with' Isabelle Stengers; and of Simondon and others.

56 In streaming, the remote and real time sense of place is transposed onto the immediate environment of a listener, cohabiting, contradicting and enriching the personal, social and political significance and understanding of the world around us, on a micro and macro scale. Such a concern echoes Westerkamp's idea of listening as a hugely enriching process to understand what is happening and to 'reconnect to our environment' in "How opening our ears can open our minds" CA:CBC.2017. Accessed online 4 June, 2019. **https://www.cbc.ca/radio/ideas/how-opening-our-ears-can-open-our-minds-hildegard-westerkamp-1.3962163**

57 At the London soundcamp in Stave Hill Ecological Park, the Reveil feed is played out in a canvas bell tent (soundtent), where a group of listeners can follow the broadcast, while continuing to hear the local sounds around. The blueprint for a soundcamp referenced by some twenty soundcamps in other locations each year, includes having some kind of point for group listening, which may be minimal, depending on power and network conditions.

58 Experiences with extended listening are relatively rare. Reveil has had chances to listen for a long time to the sounds of Kolkata, as sounds of crows, dogs and cuckoos give way to sounds of human activities, or a bog in Estonia as a dense, detailed dawn chorus builds. They can involve more abstract listening experiences, comparable to listening to music (drones etc) in which restricted sets of sounds establish a register that varies slightly but decisively, as the listener becomes attuned to subtle variations. This is a feature of passages of the Reveil broadcasts, where typically time-poor listeners have the strange luxury of listening to seemingly interminable stretches of austere hydrophone drones as the broadcast creeps across the Pacific in real time See: Soundcamp (2016). "Sounds nothing like the sea". Performance Research Volume 21 No 2 April 2016: On Sea/At Sea and a digital supplement at **http://soundtent.org/on_at_sea/on_at_sea_working.html**. Accessed November 1 2019.

59 In addition to partnerships with Cyberforest at the University of Tokyo, the University of Hull and Aix-Marseille University, recent work has included a live stream from the Milpe Bird Reserve in Ecuador by Paola Moscoso and a team from the Sussex Humanities Lab, linked to Alice Eldridge's research on 'humanising algorithmic listening.' See Eldridge, Alice et al (2016). "A new method for ecoacoustics? Toward the extraction and evaluation of ecologically-meaningful soundscape components using sparse coding methods". PeerJ, 4. E210. 2016.

60 A milieu is altered, to some extent, when its sounds are placed online, putting them (in some senses, to some degree) in the public domain. Potential shifts in value, register, sense of ownership and access are seemingly at stake. Opening a site to remote listening can be linked to a wider concern with sound as it crosses and queries boundaries between public and private space. Elsewhere we have suggested this can usefully be thought of as a kind of 'acoustic commoning'. See, for example, a series of site specific conversations and broadcasts entitled Acoustic Commons: **http://soundtent.org/acoustic_commons**. Soundcamp 6 (May 2019) included a round table discussion convened by Ella Finer with the Acoustic Commons Study Group. See also **http://www.antiatlas.net/pratiques-de-lecoute-ecoute-des-pratiques-8-ecologies-sonores-ecosophie-et-communs-auditifs**. The idea of 'latent commons' is discussed by Anna Tsing, 2015, 133, 255.

61 Kaoru Saito et al. "Utilizing the Cyberforest live sound system with social media to remotely conduct woodland bird censuses in Central Japan" Ambio vol. 44, Suppl 4 (2015): 572–83.

62 Cyberforest project page: **cf4ee.nenv.k.u-tokyo.ac.jp/en/pad/otanomo.php** For streams from the proposed Kobushi BR, follow #Tetto or #Yatake, or go to the soundmap at **http://locusonus.org/soundmap**

63 Golden Gate Biosphere Reserve. Accessed June 9 2019. **http://www.unesco.org/mabdb/br/brdir/directory/biores.asp?mode=all&code=USA+42**

Listen to the Noosa Biosphere Reserve: Barclay, Leah (2017). Accessed 9 June 2019. **https://soundcloud.com/leah_barclay/dawn-in-the-noosa-biosphere-reserve-excerpt-from-reveil2017-live-stream**

64 On the Noosa BR see **noosabiosphere.org.au / biospheresoundscapes.org** Listen at **soundcloud.com/leah_barclay/dawn-in-the-noosa-biosphere-reserve-excerpt-from-reveil2017-live-stream**

65 Available at **http://locusonus.org/locustream/#phone** and **https://itunes.apple.com/us/app/ locuscast/id866992547?ls=1&mt=8**. Or go to **http://soundtent.org** and choose 'Stream'.

66 Gabrys, Jennifer: Program Earth, University of Minnesota Press, Minneapolis 2016, p 223.

67 Moten, Fred and Wu Tsang: Who Touched Me? If I Can't Dance I Don't Want to be Part of Your Revolution, Amsterdam 2016, p7. **https://monoskop.org/images/b/ba/Moten_Fred_Tang_Wu_Who_Touched_Me_2016.pdf** accessed 9 July 2019).

Listening In / Listening Out: Reflections on A Certain Geography Workshop Held at the University of Hull

by Dr Maria Papadomanolaki, Senior Lecturer, University of Brighton

Abstract

'A Certain Geography' is a listening workshop in the form of a telematic soundwalk. A roamer sends a live audio stream from a remote location to an audience listening in a different space. The transmitter and the receivers listen in collaboration, often communicating their experiences via twitter. The experience is further supported by a text score created in response to the site of the workshop which is projected in the space where the audience is located, functioning both as a prompt for the audience's listening and as a score for the roamer's soundwalk. The workshop poses questions about listening to in situ and remote soundscapes: How do we listen solitarily and in collaboration? What is the role of the body (or the absence of it), memory, conversation, text and writing in enacting critical forms of listening to the environment? This essay reflects on observations gathered after a workshop developed in response to the University of Hull campus as part of the 'Sound + Environment' Conference (University of Hull, 2017) by taking the above questions as a framework for highlighting and contextualising the process.

Beyond the Acousmatic

'Chemistry 14:23
Pure argon a door locks
Rust and spider webs
Private land
Whistling
Pebbles won't bring the sea'

Excerpt from text score written in response to the University of Hull Campus

'A Certain Geography' presupposes a certain kind of agreement between the remotely transmitted and the received through the absence of the roaming body. This absence is not to be confused with the disassociation of meaning from the source.[1] The absent body of the roamer is not intended to be removed from the context entirely. It is, on the contrary, a transmitter of the 'making of' the roaming subject.[2] This absence therefore is not rigid and non-transparent but hopes to rekindle our making as listening with that of others through a process of exploration. It creates a framework for listening together.

This absence is filtered through the actual site and the roamer's own interpretations of it, as experienced on the written score used to geographically and temporally mark the trajectory walked (this is also projected on the wall inside the space where the audience is located). The score reflects a variety of sensory and critical responses to the site, making audible the 'making' of the site, the signs, writings and slogans on the walls, the edges and cavities of the buildings, the thresholds of accessibility around the campus, the weather conditions, the real and symbolic features embedded in the experience. It cohabits in and out of sync with the transmitted sound. It is there to be accessed by people who cannot hear or sense as others might do. It is there to be read or ignored, or both. The absence of the body and the presence of the text hence exist at the core of a 'sensorial materiality in its contingent context.'[3]

Participants have commented[4] on how the sounds of footsteps and bodily actions have made them think about and remember their own bodies through imagining the roamer and her environment, guessing where she could be: walking on grass, a wooden floor, an open space, inside a building. For other's the presence of text created a sense of anticipation, of listening out for a certain sound that might happen, making their own associations between the read and the heard.

The live transmitted sound was commented to offer an engaging and enriching experience as the soundwalk involved spaces, environments and activities that were at various degrees visited and experienced already by the group. Balancing between 'profound' and 'casual'[5] explorations through sound, the site was sounded through all the imperfections and transformations that took place beyond the acousmatic topography diffused through the speakers in the room.

The campus at the University of Hull is manufactured using building materials often encountered in many newly refurbished and regenerated sites across the UK[6] and globally. Steel and Glass, highly reflective surfaces, small and enclosed courtyards, fencing and signposting to mark private zones and cordoned off building sites are all part of the experience. Logos and slogans decorate the walls and windows across different areas to highlight and empower the communities living, studying and working there. The wind and rain, prominent during the workshop, provided additional layers

and all these together were present in the listening room through the speakers: remote, off-site, off-screen but vibrating through the listening community that was tuned in, listening in and listening out.

Listening In

'Getting closer to my reflection
Until it is lost
Reflect and conquer
Focus on off
Beach pebble
The kingdom of iron never fails
falls
Interzone
Hello?
Cave 14:42
Together we shine brighter'

Excerpt from text score written in response to the University of Hull Campus

Image 1: Leah Barclay interacting with the roamer via twitter using the #locustream hashtag

'A Certain Geography' uses the Locus Sonus Locustream Global Soundmap[7] to make its stream available to its audiences. The map provides a platform of open microphones from around the world. These microphones are a combination of permanent and transient streams. It provides an opening to listen in to human and non-human activities that would not be accessible otherwise[8].

Many of the projects featured on the map, similarly to 'A Certain Geography' are available to be listened in to, and are respectively informed by and inform a durational exchange between the streamer and their tentative audiences. As with 'A certain geography' an open microphone on the map exposes a series of technological, social, geographical and aesthetic choices made by the streamer to a wider framework of known and unknown receivers/listeners and it therefore poses questions about privacy, vulnerability and ownership. In an era where technological advances allow smart assistants to listen in to our lives and to breach our privacy for the sake of aggressive capitalism[9], we can think of these projects as a necessary counter-action; reverse-engineering 'listening in' to generate intimate, delicate translocal transmissions[10], ecologies[11] and networks commoning[12] through sound.

One of the participants commented[13] that they felt as if they were eavesdropping to a very intimate, private walk. In fact, the comparison or association to 'eavesdropping' has been mentioned in many different contexts where this piece has been presented, but such a comment often oversimplifies the scope and purpose of the project. As already explained, a gesture of 'listening in' here refers to a notion of listening together or expanded listening where the intimate and ubiquitous[14] is shared openly and accounts for different kinds 'making'. Echoing Alarcon's[15] and Schroeder's[16] ideas on networked listening, the workshop uses remoteness as a process of establishing a transient and in-between space where the roamer and the audience transcend the boundaries of their own bodies and selves to create a shared experience.

Disruption

The roamer uses a pair of binaural in-ear microphones, a microphone pre-amp, her mobile phone connected to a 4G network and an open source app developed by Locus Sonus[17] to stream the sounds to the Locustream server from where the sound is picked up and played out through the speakers of the auditorium at the University of Hull. The room itself is not the perfect environment for such an intimate listening experience. The amphitheatric and quite noisy seating, the dimmed but present rows of lights and the two big projection screens already amplify the disruption between the inside and the outside, making reception of the transmission inside the building quite difficult.

As explained earlier in this essay, the whole idea behind this workshop is the exploration of the creative tension between presence and absence. That heightened sense of remoteness, as already argued, can help establish an enriched understanding of our environments but one has to also account for the fact that this sound is mediated and is prone to self-noise and interference, to drop-outs in the signal, to buffering, latency and to complete disruption of the transmission.

The workshop at the University of Hull was prepared for a total length of 25 minutes of which the participants had the pleasure to experience only the first five. Using the #locustream hashtag the participants and the streamer exchanged impressions and interactions (Image 1) until the signal was lost. The roamer could not access updates on her phone and she could not be contacted as her phone could not receive messages any longer so the workshop resulted in a complete disruption between the roamer and the audience. The roamer did perform the full 25 minutes only to realise upon returning to the auditorium that the signal was down. Upon request, she had to repeat a 10 minute section of the trajectory, followed up by a conversation where members of the audience shared their thoughts, impressions and questions.

'A Certain Geography' has to incorporate these technologically mediated artefacts in how it is presented. It has to 'play' with the notions of latency, disruption, remoteness and listening in. But again, I would argue that this is one of the strengths behind the project as it doesn't make any assumptions of an idealised or HiFi listening scenario or an ideal audience of listening experts or, for that matter, subjects that can hear[18]. As some of the members of the audience commented, it would be interesting to expand this workshop further by working with visually impaired people or people experiencing hearing loss. In such a context, how can this sense of disruption and the notion of absence be negated, sensed and shared?

Maria Papadomanolaki is a Greek sound practitioner and researcher currently based in London. Papadomanolaki has studied linguistics and literature at the Aristoteleion University of Thessaloniki before moving on to sound art and sound studies, having completed a PhD on the topic 'Sonic Perceptual Ecologies' at CRISAP, LCC, UAL. Her work and research focus

on the role of sound in the way we engage with our environments, with memory, placemaking and perception. Special importance is placed on the synergy of atmosphere, voice, text, experimental radio practice, live audio transmission, soundwalking and the environment. Papadomanolaki is a member of the London-based artist collective 'SoundCamp'. She is a Higher Education Academy Fellow and she is currently working as a Senior Lecturer/Course Leader at the University Of Brighton's Digital Music and Sound Arts course. **http://www.voicesoundtext.com**

Endnotes

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An Uncomfortable Audio Ethnography – Sound and Politics in the Evolution of an Acouscenic Listening Approach to Softday's Sonically Engaged Art Practice

by Mikael Fernström* and Sean Taylor**

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Abstract

Sound art is at the vanguard of contemporary fine art practices seeking to establish a platform for meaningful creative debate on a range of contested anthropogenic, social, political and environmental issues. This paper explains how Softday's practice of Acouscenic Listening may be utilised as a methodology for the Creative Soundwalk, thus creating conditions for a participatory sound art praxis, which advances a novel understanding of the everyday. The etymology of the Creative Soundwalk is defined through the assimilation and application of key theoretical frameworks that demonstrate where and how the practice may be positioned within the everyday. The practice is influenced by the work of experimental composers, scientists, artists and researchers who have created the conditions for this particular interdisciplinary line of enquiry. The practice incorporates adapted Deep Listening, Tai Chi/Chi Kung, creative soundwalks and mindful sonic meditation practices and philosophies. This study clarifies how Softday's practice of Acouscenic Listening supports a creative turn in the execution and delivery of the Creative Soundwalk, and explains how interdependent both elements are in communicating this new creative praxis. This paper also discusses the development of this creative approach for sound art and acoustic ecology, developed over a nineteen-year timeframe within a collaborative art/science. Importantly the theories we have included locate both the practice of the Creative Soundwalk and Acouscenic Listening within the everyday.

Keywords: Soundscape Ecology, Human Geography, Sound Art and Ecology, Acouscenic Listening, Creative Soundwalk, Climate Change Art.

1 Introduction

For over nineteen years *Softday*[1], the art-science collaboration of artist Sean Taylor and computer scientist Mikael Fernström, have engaged with issues relating to social art practice, natural cycles in time, climate change and its global effects. As a collaborative team we use our arts practice to explore relations to and understandings of nature, expressed through sonifications and multimedia artworks and performances. We are interested in exploring 'the cracks' between various media and creative genres such as expanded theatre, sound art, socially engaged practice, sculpture, music, dance and the application of new technologies.

Our acoustic environment is an impermanent, invisible realm made manifest in sound. This realm is transitory in that it is constructed from ephemeral sound events and amorphous forms. Softday's practice of Acouscenic Listening is the mechanism through which we can gauge the extent of our subjectivity in relation to this temporariness. Acouscenic Listening is a portmanteau of the words 'acoustic' and 'scenic' (as in picturesque), which is the concept of experiencing constituent sonic events characterising a landscape. In 2010 Softday were working in Killybegs, Donegal, on the *Marbh Chrios* (Dead Zone)[2] social art project, as part of the Lovely Weather Donegal Residencies: Art & Climate Change[3]. The work we conducted there was based on collated scientific data specific to contested marine 'dead zones' (Diaz & Rosenberg, 2008). We represented this data with algorithmically generated music, sonifications and visualizations in a live performance in Mooney's Boatyard in Killybegs. On one of our numerous field trips to Donegal Bay to undertake soundscape recordings we found ourselves reflecting on the subjective experience of our sonic engagement with space and place. We mused on how best to contextualise these concerns. We both concluded that perhaps the components of our field recording praxis could be defined as an interest in two relational areas of research – acoustic space and its relationship to the everyday, Deep Listening and its connection to social art practice.

The elaboration of Acouscenic Listening is the distillation of a shared creative and listening practice that Softday has developed since 2010. Acouscenic Listening is influenced but differs from the Deep Listening work of American composer Pauline Oliveros, (with whom Sean Taylor worked for over four years).

Though the understanding and application of Oliveros's Quantum Listening theory, constitutes a key starting point towards an on-going investigation of everyday Acouscenic Listening practice, there are recognisable differences in how this theory is applied in our practice. The focus of Softday's Acouscenic Listening and Creative Soundwalk practice cultivates an understanding and appreciation of soundscape to body on a finely tuned level. The application of the Creative Soundwalk as a socially engaged activity provides the source material for further creative actions and facilitates the creative practitioner's ability to unlock the rhythms and narratives of soundscapes. Acouscenic Listening through the application of the Creative Soundwalk creatively re-construct spaces of listening, in order to assign aesthetic meaning to them. The production of the Creative Soundwalk sound map/graphic score promotes a co-authored and collaborative practice that democratises the creative decision making process.

We consider Acouscenic Listening to be a developing sound based fine art practice that has evolved from central concerns in

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our collaborative work and includes elements of performance art, socially engaged practice, acoustic ecology and applied traditions of Eastern thought and practices including Qigong and Tai Chi. Acouscenic Listening also promotes an alternative pedagogical model; counteracting the reliance on and promotion of a traditional bias for individual studio based Fine Art practice. The practice proposes alternative delivery modes to counteract a dependency on the white cube gallery system and calls for public performances to be held in sites more conducive to engagement with new audiences.

The Acouscenic Listening approach towards the Creative Soundwalk as a structured immersive excursion engages participants to become 'active listeners' (Quantum Listening), improvisers and sound makers. Such sonorous immersions in public space potentially create the conditions for spontaneous, attentive, collaborative opportunities or actions of creativity for artists, performers and audience. This enables the listening subject to become fully immersed in the present moment both during the soundwalk and during the improvised performance of the graphic score. Being continuously in the moment enables the participant to let go of preconceived views, and enter into what psychologist Mihaly Csikszentmihalyi has termed as a state of flow, "the state in which people are so involved in an activity that nothing else seems to matter" (Csikszentmihalyi, 2002).

Acouscenic Listening calls for an expanded sound art practice that is alive with all aspects of human sonic experience of the everyday. The practice of Acouscenic Listening underpins the creative turn in the Creative Soundwalk. This in turn fosters a unique approach to sound and performance art and encourages greater interaction between artists and audience in creating, educating, performing, and recording sound/body-based work with a global position.

Sound operates as an axis, and listening provides us with alternative associations to both time and space, and the way in which we interact with them. We explain the experiences, contexts and methodologies that we have investigated and analysed with a view to explicating and underpinning the Creative Soundwalk within the practice of Acouscenic Listening as a viable 'sonically engaged' fine art practice. We investigate similarities that exist between Acoustic Ecology, creative listening and performative art practices and the legacy of sound walking as an art form embodying relationships to environment and the creative re-production of space. The Creative Soundwalk is further defined through the assimilation and application of key theoretical frameworks that demonstrate where and how the practice may be positioned within the everyday. In this essay we explicitly contextualize the Creative Soundwalk within the Acouscenic Listening work of Softday as social and political sound art praxis. This work is predominantly undertaken in collaboration with specific communities of interest (Lennon & Taylor, 2012). This, in turn, leads to the design and creation of collaborative, co-authored and improvisatory sonic art works that differs from more historical soundwalk modes.

Initially Softday worked with sonification, using for example artificial neural network algorithms to create musical mappings of environmentally related data sets for performance by classically trained musicians. The sonifications were complemented by field recordings of soundscapes from the contexts of the data sets, including sounds from normally unheard sources, e.g. using hydrophones. Since then, we have increasingly been using soundwalking to inform our work.

Westerkamp (2006) suggests that a participatory soundwalk has three specific functions which may be defined as orientation, dialogue and soundwalk composition As both an environmental activist and composer Westerkamp advanced the concept that the soundwalk as a form of dialogical exchange with the acoustic environment could be intrinsically linked to politics, embodiment and storytelling traditions. Her research suggests that the proliferation of anthropogenic (man-made) sounds over natural sounds and silences in industrialized soundscapes contribute to alienation with the acoustic environment and thus has a negative impact on the health of communities. Westerkamp argues that the praxis of soundwalking assists the listener in restoring a meaningful dialogical exchange with the acoustic environment, nature and body. She highlights the social benefits of the soundwalk, as an opportunity to dedicate a specific time frame within a social group context. Westerkamp also observes that a fundamental outcome of soundwalk activities and shared listening experiences create interconnectedness amongst social groupings.

Our research led us to experiment with various creative approaches to soundwalking and sound (sounding) mapping. Influences included the writings of Angus Carlyle and Cathy Lane (Carlyle & Lane, 2013) and the work of contemporary sound artists/composers Francisco Lopez, Andrea Polli, David Toop, Stephen Vitiello, Viv Corrigan, Christina Kubisch and others. Softday initiated projects such as Sonic Sidewalks (2010)[4], 12 Stations (2011)[5], Underground Unknown and Forgottens (2012)[6] and Protest in Silence (2013)[7]. As Softday, we were also invited to participate in various international sound mapping projects including; *Europe – A Sound Panorama,* Karlsruhe, Germany (2011)[8], and S*ounds of Europe* (2012). These experiments and projects led to the eventual creation of a situated approach to soundwalking/mapping that became the Creative Soundwalk.

Traditional soundscape walking meditations can be either singular or shared experiences, encouraging participants to create subjective maps based on areas of appeal, mapping mentally and mindfully a relationship to place and memory through environmental sound. The Creative Soundwalk differs from traditional soundwalk methodologies in terms of its objectives to locate the practice within the everyday and to encourage its participants to be active listeners, researchers and creative participants.

Our soundwalks are normally conducted with a community of interest creating a collaborative sound map of an area or location of interest. The sound map is then represented as a graphic score with the participants' annotations spatially distributed as the experienced place is recalled, and using colour coding to signify for example biophony, geophony and anthrophony (Krause 2012). The participants, using their own bodies and voices, then perform the soundmap. Each performance is recorded and discussed by the participants and further iterations/performances of the soundmap may be created. What started as our own intuitive approach for creating environmentally related sound art has now become a more formalised method for exploring soundscapes collaboratively. We are now seeing, or rather hearing, that it is the context of the data that is the critical aspect of our works.

In our latest works, we have extended this method to include the participants' own field recordings of their own soundscapes. We trained participants to use inexpensive recording equipment and open source software tools to edit and process their soundscape recordings and to collaboratively perform with their recordings as a laptop ensemble. As a basis for performance, a graphic score was collaboratively created and after several iterations of the performance, as part of the reflective practice, the participants finally performed the work in public.

2 Acouscenic Listening and the Creative Soundwalk

Sound can be an invasive phenomenon of everyday experience in that it assists our engagement with, immersion in, and commentaries with the environment in which we live. Auditory engagement further challenges the dominance of the pragmatic visual object and counteracts a prevailing bias or dependence upon a predominantly ocular-centric reading an environment through

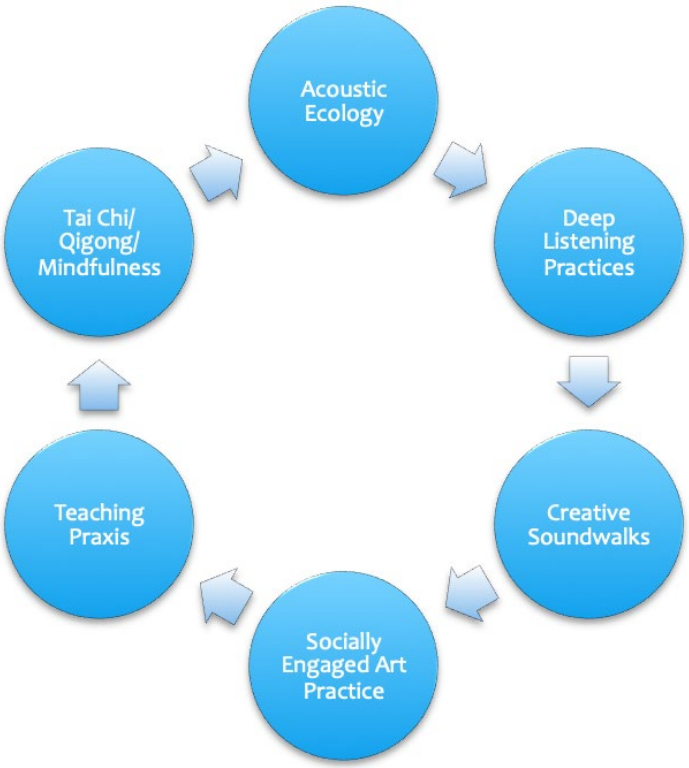

Figure 1. Components of Acouscenic Listening and the Creative Soundwalk

predominantly visual metaphors. The American composer and artist Max Neuhaus demonstrated through a series of what he termed 'Lecture Demonstrations', that by re-locating his audience to the street, (place) instead of the traditional concert hall or gallery, he could create a new way for them to listen (space):

> "Most of us think that what we think about a place is determined by what we see in it. And I think it is for most of us, consciously. But unconsciously there is a perception of a space which deals with how it sounds, what sounds are there, and how sound acts in it and on our sense of sound". (Neuhaus, 1984)

The city as an incessant inundation and movement of sonic action may be experienced through the listening body as sound incorporates and mediates a connection between space and narrative. Sound textures can be referred to as the strata of sounds within a musical composition and their relationships to each other. The aural texture of an urban soundscape may be constructed by an attentive listener sensitive to the combinations of competing sound signals arising from background noise, and these aural textures may be considered as static images by the auditory system (Rabinowitz & King 2011). Sound is also concerned with phenomenology, memory, imagery and associations. This may be referred to as sound's specific relational condition. Sound is something that reacts with space as Salomé Voegelin (2010) suggests, "sound narrates, outlines and fills, but it is always ephemeral and doubtful".

In 1974 the American composer Pauline Oliveros published 'Sonic Meditations' a seminal work that broke away from the prevailing traditions of western music, and challenged the need for standard music notation in favour of prose instructions (similar in composition to Alan Kaprow's 'Happenings' or Fluxus event scores). Oliveros (2010) defined Quantum Listening as "listening in as many ways as possible simultaneously – changing and being changed by the listening". Quantum Listening directs our attention in a non-judgemental way to what is heard, amassing meaning, and interpreting the meaning of what has been listened to, whilst deciding on further creative actions. Quantum Listening can be regarded as similar to Schaeffer's Reduced Listening (1966). A typical Acouscenic Listening and Creative Soundwalk workshop begins with an introduction by Softday to Quantum Listening (Oliveros 2010), psychogeography, soundscape practice and the Creative Soundwalk as methodologies and processes to creatively transform acoustic space through the formation of collaborative and improvisatory sonic art works.

Participants are further introduced to R.Murray Schafer's (1993) three main elements of the soundscape: keynote sounds, sound signals and soundmarks, important elements that make the acoustic conditions of any space unique.

Acouscenic Listening intensives and workshops also begin with warm-up exercises (predominantly Qigong health exercises) and slow breathing exercises. A slow-walk meditation follows this. Meditations should be undertaken outdoors if possible otherwise a large room is sufficient (Hanh, 1991). Participants are also introduced to Qigong and Tai Chi exercises in order to consciously quieten the mind and body and bring a listening attention to the soundscape. Participants undertake *Ear Tuning* exercises adapted from traditional Chinese Qigong exercises and from R. Murray Schafer who emphasized that ears should be 'cleaned' as a prerequisite to listening (Murray Schafer, 1967).

The soundscape of a city is more than just a cacophony of background noises and rhythms with no clear purpose or value. Henri Lefebvre implies that the cyclical daily rhythms of life conveys meaning significant to the disclosure of a city's purpose "once one discerns relations of force in social relations and relations of alliance, one perceives their link with rhythm" (Lefebvre, 2013). Sound textures refer to the strata of sounds within a musical composition and their relationships to each other. The evolving aural textures of an urban soundscape may be constructed by an attentive listener sensitive to the combinations of competing sound signals arising from background noise. These aural textures may be considered from a Fine Art perspective as static images of the auditory system whilst also containing metaphorical and affective associations (Rabinowitz & King, 2011).

The focus of Softday's Acouscenic Listening practice cultivates an understanding and appreciation of rhythms to soundscape to body on a finely tuned level, expanding the potential for connection and interaction with one's environment, body, technology and performance with others in sound and related arts. When working with the quotidian, this is realised through focused creative soundscape walking meditations, a methodology that has become a key element of our Acouscenic Listening practice.

A Creative Soundwalk is always undertaken in silence. Walking in silence is an unfamiliar experience for most people, but it is an important element that creates the space where the main aim of the creative soundwalk is to heighten the participant's concentration to the myriad sounds and other sensory dynamics of the moment and environment being walked through. In this engaged state the mediating participant is aware of all that happens with transient and situated sound of place occurring within a real geographical time frame. The soundwalker engaging with acoustic space creates a scenario, an improvisational interrupt, a change of perspective that deepens the embodied listening experience, where each listener is free to interpret and contribute to a fluid sonic environment at any given moment. Acouscenic Listening practice is grounded in an embodied approach to listening that integrates direct engagement with sound production and awareness of the environment and refers in particular to Pauline Oliveros's global mode of listening (Oliveros, 2010) .

In John Drever's (2009) assessment, "the salient concern in soundwalking is everyday life" and a key concern of the Creative Soundwalk is the corporeal exploration of sound location, narrative and its relation to the everyday. A Creative Soundwalk encourages

the interaction of the individual listener to space and place through immersive or embodied experiential mapping and a basic understanding of psychogeography. Traditional soundscape walking meditations can be either singular or shared experiences, encouraging participants to create subjective maps based on areas of appeal, mapping mentally and mindfully a relationship to place and memory through environmental sound.

Softday identifies a route for auditory exploration, and provides a map of the Creative Soundwalk route for each participant. The walk may take 1–2 hours in duration. The map contains some key listening points on the route for longer more immersive listening experiences. On a Creative Soundwalk traditional field recording methodologies for preserving audio are put aside in favour of a more informal diaristic style of approach to registering sound events. The Creative Soundwalk participant is asked to notice and notate as many sound events as possible as they pass through various soundscapes. Participants document and share their experiences of the soundscapes visited utilising Quantum Listening and note taking. The Creative Soundwalk differs from a traditional soundwalk in terms of its objectives to locate the practice within the everyday, to encourage its participants to be active listeners, researchers and creative participants. In order to achieve this, a creative turn is applied to co-authored subjective maps created by participants on a Creative Soundwalk.

The Creative Soundwalk straddles a polemic between epistemological and practical realms to establish a creative space for meaningful dialogue between the listener and the everyday. In order to do this two elements are applied. The first is the social turn, a term devised in 2006 to describe the return to a socially engaged art form that is collaborative, participatory and involves people as the medium or material of the work (Bishop, 2006). When applied to the Creative Soundwalk this approach to social art practice may be referred to as *intermedial*, a concept that challenges and "re-calibrates inherited understandings of what is within and what is without the art event" (Jackson, 2011). This concept is similar to artist Dick Higgins 1965 description of how Fluxus artists worked across or between creative genres, an approach that he defined as *Intermedia*. An *intermedial* approach to the creation of significant art works has been at the heart of our Acouscenic Listening Practice since 2012.

The second integral element is the *creative turn* which specifically refers to the process by which the co-authored subjective maps created by participants and the artists on a Creative Soundwalk are constructed. The *creative turn* in this context, refers to a conscious moment within the process of a Creative Soundwalk where the original topographical information is put to one side, and new thinking about the potentiality of performing the map as an improvised graphic musical score emerges. The word '*potential*' is important in this context as not all Creative Soundwalks we have undertaken with the public have led to creative sound works. By potentiality, we mean the *possibility* to act upon topographic information, which is in itself not limited by the mapping process. We therefore suggest that the Creative Soundwalk creates moments of speculation, experimentation and reflexivity, constructing spaces of experimentation and improvisation without the constant demand of proven results.

The Acouscenic Listening approach to the Creative Soundwalk may be considered closer to the *dérieve* or 'drift', defined by Guy Debord (1958) and the Situationists as

> "a technique of rapid passage through varied ambiences. Dérives involve playful-constructive behaviour and awareness of psychogeographical effects, and are thus quite different from the classic notions of journey or stroll".

Softday differentiate between the conditions of the dérive and the flâneur as defined by both Charles Baudelaire (1965) and Walter Benjamin (2002), in that we consider the flâneur to be a passive wanderer/observer of the city and never an active participant in the actions of the city. The Creative Soundwalk as a form of collaborative dérive undertaken with small communities of interest involves a primary determination of soundscapes, unlocking the possibility for a subjective understanding of recording, mapping and applying form and value to the 'inherent indeterminacy' of the everyday (Pable & Hutton, 2015).

While a traditional soundwalk may be exploratory, scientific, phenomenological, experiential, etc., an inherent aspect of an Acouscenic Listening approach to Creative Soundwalk practice is playfulness, which is an essential ingredient that is fundamentally suited to encouraging creative self-expression for a layperson. Play and improvisation are intrinsically linked when encouraging participant to consider how the Creative Soundwalk map as a graphic score may be performed. We define improvisation in this context as the spontaneous invention of sounds and movements within a supported creative context, understood by participants as both fictive and aesthetic (and hopefully not just a linear representation of the mapped sonic events). Softday define play as engagement with the most authentic manifestations of our creative individuality and our inherent inquisitiveness. Play helps the participant to consider a myriad of potentials in the sound map score thus broadening the range of possibilities for performance. Play also gives the participant permission to expand their own stream of consciousness and create new narratives within the score.

Play liberates the listener from an overdependence upon competition, cogent discourse, rationality and aesthetic angst in relation to music/sound, inherent through pre-existing controlling paradigms of social and cultural conditioning. The Situationists (1958) in their critique of the primitive social functions of play state "its goal must be at the very least to provoke conditions favorable to direct living". Likewise play is comprehended by Lefebvre (2002) as the portent of a "rediscovered spontaneity", play transforms, hidden or forgotten aspects of the everyday into moments of intensified presence he writes: "Play recalls forgotten depths and summons them up to the light of day. By making them stay within the everyday, it encompasses art and many other things as well".

The attentive listener plays an active role in actively perceiving sound in the world and simultaneously plays a creative role in developing an impression of a given soundscape, which in turn may lead to greater emotional satisfaction, creative stimuli and communicative experiences of the everyday. The Acouscenic Listening approach to creative soundscape mapping reveals a myriad of sonic events that are often mundane, habitual or ambiguous. Our desire to reveal the minutiae constituent parts of a soundscape finds purchase in the writings of Georges Perec, who along with Michel de Certeau, and others, integrated new ways of engaging with urban spaces through concrete experiences of the everyday.

Michel de Certeau (1984) puts it succinctly when he states, "the approach to culture begins when the ordinary man *becomes* the narrator, when it is he who defines the (common) place of discourse and the (anonymous) space of its development". In an Acouscenic Listening workshop or intensive, when Softday works in and with communities of interest, we identify those potential collaborators who wish to sonify the narrative of a soundscape. As Perec (1997) asks:

"How do we speak of these common things, how to track them down rather flush them out… how to give them meaning, a tongue, to let them, finally, speak of what is, of what we are.".

Perec stipulates that the quotidian exists below the listening threshold of the noticed but remains both omnipresent and hidden at the same time. We hear but we don't often listen. This statement may appear contradictory but the vast majority of subjects filter their listening in an everyday context, potentially missing out on the minutiae of data and narratives located within any given soundscape. Filtered listening prevents this information from being remediated

for creative ends. The Creative Soundwalk directs participants to register as many possible sonic events in a democratic and authentic manner in the particular soundscape under investigation. A complex soundscape may also reveal localized histories and memories that can lead to the creation of fresh narratives for further creative development.

As Lefebvre states, this social place is the space where participants use and transform the information of the everyday and the soundscape they are mapping. Potentially, it offers the engaged listening subject the possibility of maintaining a creative transformation of space and place on a daily basis, beyond the Creative Soundwalk exercise. The Acouscenic listener is now more aware of the potentiality of prevailing conditions that occur in a soundscape, and that soundscapes are in a constant state of flux (no soundscape will sound exactly the same, depending on time and conditions). Redressing the value of creative listening narrows the gap between art and everyday life.

Lefebvre's concepts about rhythmanalysis remain dispersive and incomplete (his book *Elements of Rhythmanalysis* was published posthumously). However it is our contention (and the subject of our on-going research) that they offer the Acouscenic listener a pathway that can frame and study the dialectics of power that are revealed during a Creative Soundwalk in urban settings, particularly in the interrelations between sound/music, the body and everyday life within society.

Participatory art practice requires the involvement of a specific community of interest to engage in a creative investigative process within a social space (Finkelpearl, 2013). Softday use the term 'consensus reality' as a methodology for achieving a level of agreement in the nature of the shared experience of space that also challenges hegemonic relationships of authorship and creativity (Berger & Luckmann, 1967). Dialogue plays a crucial role in how any Acouscenic Listening artwork may progress. This means that both the artist and participants determine the appropriate form for any creative intervention in a soundscape and potential outcome by applying dialogical and discursive methodologies in order to establish consensus.

This participatory approach to cultural production is further underpinned by art historian Grant Kesters' positioning of Dialogical Aesthetics as a tool for social art practice. Kester demonstrates through the work of a number of contemporary artists work (Wochenkrasleur, Steven Willats, Jay Koh, etc.) how Dialogical Aesthetics employs both discursive elements and social relations as its subject and material. Kester (2000) challenges our understanding of what contemporary art may be by placing little significance on visual experiences in favour of discursive exchange. Kester also challenges the primacy of the art objects aesthetic, which is also secondary to reciprocal exchanges. We believe the objective of Acouscenic Listening practice is to create the conditions where artist and participants not only determine the appropriate form of the creative outcome but also establish its aesthetic value or to state it simply, at this stage of the creative process 'the art is in inherent in the dialogue'.

We explore the continuous integration of everyday sounds in sound/music composition, a tradition instigated by Russolo through Cardew, Cage, the Fluxus movement and others, that seek to insert sounds of the banal, the mundane and the everyday directly into live performance. We regard this approach as a means of giving aesthetic credibility to these sounds.

The Acouscenic Listening Workshop

Since 2012, Softday have been conducting creative workshops based on our practice in Acouscenic Listening, drawing upon and combining methodology from Acoustic Ecology and Socially Engaged Art practice. We are interested in the dialogue that occurs between the listening participants, place and space, a dialogue embarked upon through the language of sound. The participants are introduced to some theoretical contextual and practical frameworks for the use of Acouscenic Listening as both a creative deep mapping exercise and holistic sound art practice. A typical Acouscenic Listening workshop may be broken down into a number of learning outcomes:

- Theoretical context and practical frameworks for the use of Acouscenic Listening.
- Participation in and understanding of the Creative Soundwalk.
- Introduction to psychogeography and deep mapping.
- Introduction to collaborative, co-authored sound art practice.
- Critical reflection on aspects and potential creative outcomes of the workshop.
- Introduction to Eastern thought, pedagogical theory and practices, and Acouscenic Listening.
- Introduction of group sonic meditations work.
- Introduction to graphic music scores and the application of a creative turn to the completed soundmap.
- Performance, recording and dissemination of the completed sound work.

A key element of the workshop is derived through consensus by the participants and Softday to collectively develop, document and track the evolution of the proposed work, from its original 'pitch' by the artists as a workshop concept, to the collective mapping, movement meditations and improvisations, to final performance and public dissemination of the creative work. Agreement is also sought on how work in progress may be documented (audio/video/photo). Continuous critical reflection on the delivery of workshop elements also assist both the participants and the artist/educator to reflect upon the learning experience, and to inform all participants steering the development of the work towards a possible shared vision. Reflection also highlights any emergent misunderstandings or antagonisms within the shared group experience as the workshop evolves.

The artist's role in this process is both socially communicative and creatively pedagogic, working with participants to share 'expert' and 'lay' knowledge, and allowing participants to find their voice or form of expression that can co-exist with others in a communal discourse. Participants are introduced to *Qigong* and *Tai Chi* exercises and adapted *Ear Cleaning* exercises. *Ear Cleaning* exercises were first proposed by R. Murray Schafer who emphasized that ears should be 'cleaned' as a prerequisite to listening (1967).

The Acouscenic Listening Creative Soundwalk is undertaken in silence with the agreement of all participants. Walking in silence is an important element so that there are no demands on the attention of the participants from mobile devices or conversation. During the Creative Soundwalk, mindfulness techniques are applied in order to consciously quieten the mind and bring listening attention to the soundscape. This process can be described as 'training the muscle of our attention'. Interrupting the cycle of incessant communication affords the participant the space to temporally 'switch off' from the demands of technology and 'switch on' the listening body to the evolving soundscape environment.

This silence may also be thought of as a meditation or at very least a temporary agreement between the participant and the artists to employ a mode of consciousness in order to cultivate an embodied response to the sonic environment. In this state the meditating participant engages in, or is aware of, all that happens with transient

and situated sounds of place occurring within a real geographical time frame. This action creates a temporary social bond within the group, even though each participant may articulate a unique listening experience upon completion of the walk. The participant engaging with acoustic space creates a scenario, an improvisational interrupt, and a change of perspective that deepens the embodied listening experience. The Acouscenic Listener should therefore except that they are immersed in incomplete positions of uncertainty and 'not-knowing', continuously searching for the value of 'sounds-in-themselves' in order to establish the sound objects as well as establishing themselves.

Opening up the listening experience for potential transformative aural events is dependent upon where and how listeners place their attention. In this state the meditating participant engages in or is aware of all that happens with transient and situated sound events occurring within a real geographical time frame. Canadian composer Barry Truax suggests, "Any human auditory interaction with a citizen's everyday urban environment initiates a dynamic mediation of the auditory space as a sonic construct" (Truax, 2001). The collective mapping of the Creative Soundwalk as a social construct is dependent upon the participants' ability to collate a multiplicity of subjective and sensory auditory responses. This is necessary in order to fully comprehend the aural characteristics of the soundwalk and creatively bring these responses into form. The mapping of the sound walk practically demonstrates to participants how sonic knowledge may be represented as visual knowledge of space and place. On reflection, participants note that their focus is changed, their listening is heightened and perceptions of the soundscapes being explored are altered.

Upon completion of the Creative Soundwalk participants are invited to collectively create a soundmap of the experience. This map is not necessarily an accurate graphic representation of sonic features that appear in the sound environment, as is the case with detailed topographic maps. The sound map is a graphic score with the participants' annotations spatially distributed as the experienced place is recalled, and using colour coding to signify for example biophonic, geophonic and anthrophonic sound sources. The participants then, using their own bodies and voices, perform the soundmap. The Acouscenic Listening sound map is at this juncture a visual representation (a graphic art work in itself), which suggests no limitations as to how it may be further represented or transformed. Therefore, the map (Fig. 2) can be received as subjective truth insofar as a sound map is an abstraction derived from the territory of the sound environment, but is not the thing itself, as scientist and philosopher Alfred Korzybski suggests; "the map is not the territory".

Understanding cartography as a form of creative abstraction assists the participants to reflect upon the space of the Creative Soundwalk not necessarily in terms of its topology but more in terms of its unique acoustical properties.

Participants are encouraged to consider the soundmap that they have co-authored, as a graphic score for live group performance. Graphic instructions are considered as an alternative means of contemporary music composition whilst also functioning as a map of the musical territory, democratising both music composition and improvised performance. In effect, we are essentially imparting a rudimentary form of musical composition to the participants. The soundmap/graphic score is used as a medium in which to explore methods of creation and exhibition. We also address the salient features of collective decision making in terms of where, how and under what conditions art takes place within the creative process. In this respect the performance of the graphic score is not such much a finished work of art but a by-product of larger concerns pertaining to the separation of art and everyday life (Fig. 3).

Each performance is recorded and discussed by the participants

Figure 2. Holy Island soundmap/graphic score August 2016. Photo: Robert Corrigan

and further iterations/performances of the soundmap may be created. What started as our own intuitive approach for creating environmentally related sound art has now become a more formalised method for exploring soundscapes collaboratively. What we observe, or rather hear, at this juncture is that it is the disclosure of the hidden and personal narratives in relation to that mapped data that emerges as the critical aspect of our works. A sonified data set can be almost anything, while a collectively experienced, internalised and re-represented soundscape being expressed as a collaborative performance can help to communicate both personal context and affective aspects of the work.

This subjective and reflective approach with embodied listening results in the inclusion of the lived experience of listening to a soundscape. The sound sources are neither distal nor proximal; they become instances of human experience and can be communicated as a creative narrative structure. Acoustic gestures function as aural triggers that locate the active listener in the tempi of the everyday, assisting in the social and cultural characterization of both space and place. It is important to take time to help the listening participant to learn a process of aural way finding. Auditory engagement with space and place is the result of a reciprocal process between the listener and the sonic environment. The environment suggests distinctions and relations, that enable the listener to pick up information in the ambient acoustic array (Gaver 1993) and to select, organise, and transform the meaning of what is heard.

The ambient acoustic array can provide us with rich information about place and activity in the world. Without having to think about it, hearing contributes to our immediate awareness of surrounding

Fig 3. Mapping the Limerick City Soundwalk, October 2016.
Photo: Sean Taylor

Figure 4: Softday public Soundalong, Harplinge, Sweden, July 2014.
Photo: Mikael Ericsson.

space. For example outdoors, aspects of the soundscape can be rapidly picked up. A blindfolded person can be led around between different places and their hearing will immediately pick up subtle cues about the structure of the environment and surrounding activities (McGrath et al. 1999). Hearing also helps shifting attention between events happening around us, including behind, above or in places in the immediate environment where the actual source is visually occluded (Van Valkenburg et al. 2004). Therefore the listener plays an active role in perceiving sound in the world and simultaneously plays a creative role in developing an impression of a given soundscape, which in turn may lead to greater emotional satisfaction, creative stimulation and communicative experiences of the everyday.

A statement such as "everybody can sing but it sounds different" may seem humorous, but herein lays an acceptance that everything that can make sound may also be listened to and an original aesthetic can be negotiated and agreed among the participants as the development of the work is progressing. In our research we developed the concept of 'sounding' as opposed to 'singing' the graphic score, which allows for a more democratic performance of the work, which we now refer to as *Soundalong*.

We first used the *Soundalong* concept in a live performance context for *Sonic Pareidolic Ceromancy* at the Harp Art Lab, Harplinge, Sweden, in April 2014. In the case of the Swedish performance, the audience was given pre-agreed visual clues in the form of letters/words during key moments of the live performance, which they sounded and improvised upon, under the direction of Softday (Fig. 4). We have since modified and used the 'Soundalong' concept for public performances of the *Song of the Urban Bees* at the Crescent Hall, Limerick in October 2014 and *Chant des Abielles* at the Centre Culturel Irlandais, Paris in September 2015 and specifically for Creative Soundwalk outcomes.

From a creative perspective, it is interesting to note that the first iteration of the Creative Soundwalk composition resulted in the majority of performers attempting to imitate the mapped sounds of the environment from the graphic score. This is often an unconscious reaction by the performers to dissociate the concepts of sense (purpose, meaning, etc.) from the senses. Performers were encouraged to imagine the sound map as an embodiment of the topographical information, to sound the place, using the appropriate language of the soundscape to create a specific narrative order within the composition. Sometimes it takes a number of iterations of the performance in order for participants to begin to feel comfortable with the composition transitioning to an artwork and to understand the value of improvisation in relation to a developing aesthetic appreciation of the score. It is in these moments where intention, artistry and aesthetic are synergised and developed. This is where the work comes alive for both the artist and participants and suggests diverse possibilities for the composition. We observe that participants become more animated by and familiar with the score, as if they are in a different decision making headspace or place of listening.

The practice of Acouscenic Listening promotes embodiment based on the assumption that thoughts, feelings, and behaviours are grounded in bodily interaction with our environment. From an Acouscenic Listening perspective the body may be likened to an operating system, it is the context from which the listener feels, attends, thinks, breathes, moves, relates and perceives the world during the course of the Creative Soundwalk, in order to best positioned to take further creative action. Within the framework of multimodality the emphasis therefore is on the relationship between physical experience, multimodal resources and social spaces. This relationship is a symbiotic one where meaning making is grounded in physical experience "We know not through our intellect but through our experience." (Merleau-Ponty, 1962)

Mindful listening to one's fellow improvisers encourages performers to extend the *Soundalong* concept to also include awareness of the acoustic space where the performance is taking place, to other incidental sounds, and to the performers' own sources of sound. Combining the *Soundalong* with movement elements, whilst listening attentively to what other performers are sounding, opens up reciprocal dialogues about how the work may be constructed. Working organically from this position significantly changes the nature of the performance and creates a space for a far more meaningful and empathetic rendition of the score.

Agreement is sought from the participants on whether all of the preparations of the live improvisations should be recorded or not. When permission is given to record the improvised sessions, these recordings are played back to participants for further commentaries on the aesthetic of the work. In this respect the composition is always in a state of flux or incompletion. The recordings of the group performance of the Creative Soundwalk operate as creative works-in-progress, perpetually open to new processes and interpretation. Copies of the co-authored sound map/graphic score and audio recordings are shared between all participants with agreement that participants may undertake additional work on the graphic score if they so wish. Participants are also asked if they wish to share the results of the workshop (both the map/graphic score and audio compositions) on social media platforms. If there is no consensus, the recordings and documentation stay with the authors. The possibility of undertaking additional work on the graphic score either by Softday, the participants or others may be considered as a form of re-mediation. A re-mediated approach to an original Creative

Soundwalk graphic score considers concept, assessment of counteractive alternatives, remedy selection and remedy design, through to construction and implementation of the chosen remedy as *secondary/new* artwork or performance.

Any performance thereafter is a re-mediation, in an allegorical sense. When re-mediation of a graphic score occurs at a location different to the original soundwalk setting and without the original collaborators present, any new performers automatically constitute an alternative community of interest. Potential new performers assume the role of sonic "narrators and translators" to the original community of interest who created the graphic score. This out of context re-representation of the original narrative of the Creative Soundwalk by new performers communicates an imaginary space of sonic allusions and metaphors. Further improvisations of the work blend real and fictive sonic details into a concoction of arbitrary but interrelated narratives. Turning to literature once again we find parallels between these imagined re-mediated soundscapes and descriptions of fictional cities in Italo Calvino's seminal literary work "Invisible Cities". Calvino's imaginary cities are not just accounts of incredible physical spaces but also may be read allegorically as cities of memory, cities in flux, historical entities that morph over time. Performers of a re-mediated Creative Soundwalk imbue the graphic score with their own perceptions of memory, space and place and invite the audience to do likewise. This is done in an order to temporally locate both performers and audience in a specific but fictive time and place. Performers in collaboration with an audience re-construct the narrative of the soundscape and bring it to life, even if the original location of the soundwalk is not familiar or known – "It is not the voice that commands the story: it is the ear" (Calvino, 1997). Therefore a Creative Soundwalk graphic score created in Sweden, Paris or Limerick may be re-mediated and performed in a myriad of ways. Any attempt to re-create the aural experience of the original listeners who participated in the Creative Soundwalk is an abstracted exercise, just as American composer Steve Reich's *City Life* (1995) composition with its inclusion of samples of speech, car horns, door slam, air brakes, subway chimes, pile driver, car alarms, heartbeats, boat horns, buoys, fire and police sirens remains a fictive impression of city life on the streets of New York.

Case study: Using Acouscenic Listening in the Amhrán na mBeach (Song of the Bees) projects

This section examines how the Creative Soundwalk and the practice of Acouscenic Listening (as both a philosophical concern and practical methodology) functions within the work of Softday. In this section we outline how Acouscenic Listening and Creative Soundwalk methodologies have influenced the direction of the on-going Amhrán na mBeach (Song of the Bees) project 2012–17, and how these practices may be applied in order to re-mediate contested environmental narratives and spaces in a creative way for public dissemination. This approach sets the work of Softday apart as a distinct new approach for creative sound art composition. The Amhrán na mBeach (Song of the Bees) project is a good example of how Acouscenic Listening as a form of social action can be linked to the urgent call for arts critical role in making the science of climate change both intimate and aesthetically attractive. Though this project does not specifically depend upon the Creative Soundwalk for delivery of the creative content, it does outline how responsive and adaptive the practice of Acouscenic Listening can be.

Lefebvre (2013), in his final publication, *Rhythmanalysis: Space, Time and Everyday Life*, suggests that the most essential external rhythms that the rhythmanalyst interprets are those of nature, as both nature and the cosmos are the instigators of cyclical rhythm. We suggest that Softday may be considered as contemporary creative rhythmanalysts in that we explore rhythms in nature through the incorporation of methodologies related to the practice of Acouscenic Listening and the Creative Soundwalk. These methodologies are augmented with field recordings and (often contested) scientific environmental data sets. Through the application of sound art we attempt to create an awareness of those rhythms of nature and society that may be fractured or taken for granted.

The Amhrán na mBeach (Song of the Bees) project was initiated as a result of a conversation with Dublin based curator and apiarist Jenny Haughton during the Lovely Weather Culture and Climate Change conference in Letterkenny, Co. Donegal, Ireland in 2010. Jenny drew our attention to the global condition of honeybees and in particular current threats such as Colony Collapse Disorder (CCD). Colony Collapse Disorder (CCD) relates to the mysterious disappearance of honeybees (Apis mellifera), a fatal condition that has swept through US and European honeybee apiaries since late 2006. The honeybee is the perhaps the most celebrated collector of nectar and pollen as bees pollinate a cornucopia of flowering plants, fruits and vegetable foods. It is estimated that pollination services provided by insects, mainly bees, are currently estimated at €153 billion a year. With 71 out of the 100 crops that provide 90% of food worldwide being pollinated by bees, it would appear that we take our pollinators for granted. In Ireland crops such as apples, strawberries, raspberries, tomatoes, carrots and onions are reliant on insects (mainly bees and hoverflies) for pollination and without pollinators many of our native plant species would quickly become extinct.

In March 2011 we initiated a dialogue with Simon Sleeman O.S.B. the apiarist at Glenstal Abbey in Murroe, Co. Limerick, who agreed to collaborate with Softday on developing a project that would creatively address the global impact of CCD on honeybees and food production from an Irish perspective. The research and development stages of the project was funded by CREATE, the National Development Agency for Collaborative Arts in Social and Community Contexts on behalf of the Arts Council of Ireland.

We used field recordings and soundscape analysis to further inform our research. We quantified issues of interest with large numerical data sets, or, where these issues were abstract various forms of sonification or auditory display were used as part of our compositions. We met with local and national beekeepers and conducted empirical research with beekeeping organisations such as the Galtee Bee Breeding Group (GBBG) who are part of the Native Irish Honeybee Society and representatives of the Federation of Irish Beekeepers Association (FIBKA).

In 2011 we established a community of interest of Irish beekeepers that wished to work with us on the further development of the project. Employing Acouscenic Listening methodologies we conducted a series of Creative Soundwalks at the Glenstal Apiary and trained our community of interest to apply Bernie Krause's taxonomy with three basic sound source classes when listening to their own apiary environments – Geophony, Biophony and Anthrophony. We introduced our beekeepers to Quantum Listening theory and the concept of the Creative Soundwalk in order to deepen the listening experience of the individual beekeeper to the unique soundscape of the apiary space through immersive experiential audio mapping and a basic understanding of psychogeography. In this instance the psychogeographic turn assumes that the sonic investigation of the environment of the beekeeper's apiary has a direct effect on the beekeeper's emotional and cognitive state, which is beneficial for encouraging creative behaviour (Fig. 5).

Following on from this, we undertook a series of intensive workshops at Glenstal Abbey, with our group of Irish beekeepers. We formed the Softday Apiary Ensemble (Ciarán Casey, Jenny Haughton, Simon Sleeman, Áine Nic Giolla Coda) a musical entity that was influenced by composer Cornelius Cardew's (1969) 'Scratch Orchestra' concept. Cardew defined a Scratch Orchestra as "a large

Figure 5. Soundwalk recording in Glenstal Abbey apiary, Murroe, County Limerick, May 2011. Photo :Sean Taylor.

number of enthusiasts pooling their resources… assembling for action (music making, performance, edification)". He noted, "The word music and its derivatives are here not understood to refer exclusively to sound and related phenomena (hearing, etc.)".

Our ambition for the Softday Apiary Ensemble was to enable all our beekeepers to record, process and play the sounds collected from their own habitats. There are several critical skills that a performer has to have to carry out these tasks. In our pedagogical approach to these workshops with the beekeepers, we discussed a number of conceptual and aesthetic issues that Acouscenic Listening highlighted, including how participants responded both differently and uniquely to the sound environment they recorded and the technology that we utilised (Fig. 6).

Throughout the project, we used both Open Source software and software designed by Softday, as such software was available at no financial cost to the beekeepers.

In preparation for the performance of Amhrán na mBeach (Song of the Bees), a graphic score was collaboratively created for a live concert (Fig. 7 and 8). The use of a graphic or text score draws from of a number of historical and experimental alternative methods of contemporary music composition from the late 1950's onwards. The Softday graphic score draws influences from experiments in musical notation by John Cage, Event Scores or Happenings of the Fluxus art movement, the Graphic Scores of Cornelius Cardew and the Text Scores of Pauline Oliveros.

What attracted Softday to employ a variation of the Event Score in this context was the realisation that the performance could produce its own intrinsic aesthetic value, where performers were encouraged to improvise and extend their own interpretation of the graphic score. The Softday score as a form of Fluxus Event Score or Happening involved the re-contextualization of actions, movements, concepts, and objects from the everyday life of the beekeeper as a live sound art performance.

We decided to stage the live performance of Amhrán na mBeach (Song of the Bees) not in a conventional concert hall or gallery, but in the church of Glenstal Abbey.

It is important to note that all aspects of the choreography of the performance and interpretation of the graphic score was discussed with and agreed by the participants. Both Lefebvre, and Debord acknowledge the influence of the theatrical methodologies of Bertold Brecht for creating constructed situations that turned the traditional passive spectator into an actively engaged participant. This creates the conditions for a form of egalitarian theatre (Softday prefer to use the term expanded theatre) production where the beekeepers were the main focus and participants in their own creative work. Here we also favoured the Brechtian technique of direct address by performers to audience. Direct address was employed to break what French philosopher and critic Denis Diderot described as the (invisible) 'fourth wall' of artistic creativity, which extends the idea of crossing that imaginary boundary between, in this instance a performative

Figure 6. Softday Apiary Ensemble Rehearsal, Glenstal Abbey, County Limerick, 2011. Photo: Sean Taylor

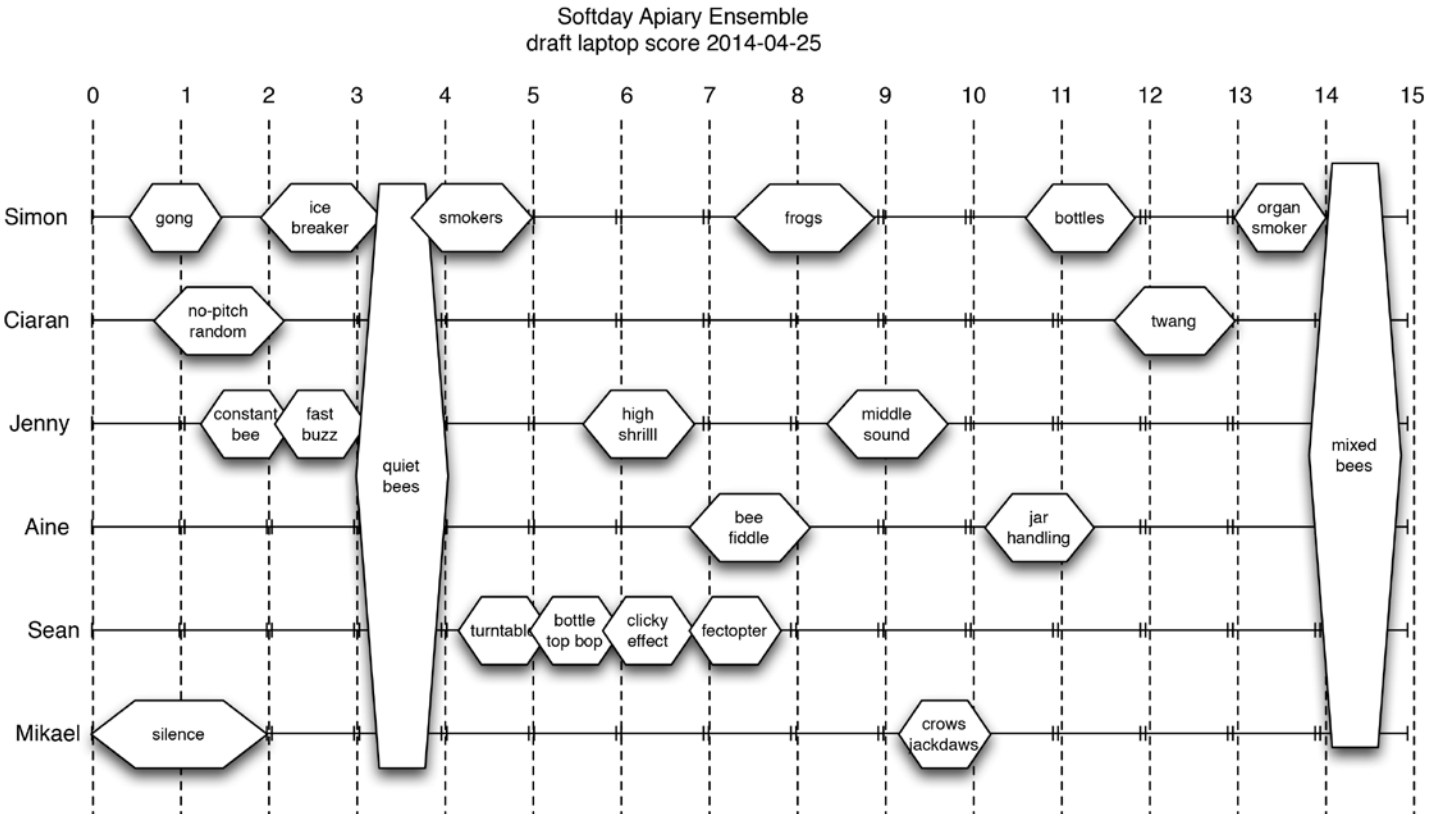

Figure 7. Amhrán na mBeach (Song of the Bees) Softday Apiary Ensemble Graphic Score, Glenstal Abbey, Murroe, Co. Limerick, 2012. Image: Mikael Fernström

sound artwork and its audience, thereby transforming the passive spectator (Brecht's terminology for the audience) into active participant (Stevenson, 1995).

Some of the participants in the project had never considered partaking in or listening to contemporary sound art/music before, but during the process of engagement and development of this work they discovered that such art forms were accessible to them. Evaluation feedback from participants suggested that the experience of being socially included in the project in this manner significantly enhanced their creative experience of the artwork.

We also created scores for the Irish Chamber Orchestra and for the Glenstal Abbey Choir, in Western Music Notation, generated from algorithmic sonification of four years of scientific data about bee diseases and colony losses in Ireland. The world premiere performance of *Amhrán na mBeach* took place in Glenstal Abbey Church in April 2013. We produced a limited edition artefact of the Amhrán na mBeach (Song of the Bees) project, which contained a full HD

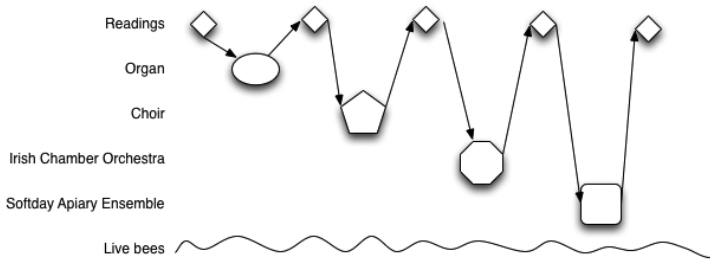

Figure 8. Amhrán na mBeach (Song of the Bees) performance Graphic Score, Glenstal Abbey, Murroe, Co. Limerick, 2012. Image: Mikael Fernström.

video documentation of the live Glenstal Abbey performance, audio recordings, and an e-book documenting the process and progression of the project, from conception to performance (Fig. 9).

In July 2014, Softday created and performed a Swedish version of *Amhrán na mBeach* entitled 'Sonic Pareidolic Ceromancy', which was performed at the Harp Art Lab in Harplinge in Sweden as part of the BZZZ! International Sound Art Festival 2014[9]. In Sonic Pareidolic Ceromancy we disclosed and contrasted the Irish bee data and sound compositions with Swedish CCD bee data and field recordings in collaboration with, a community of interest comprised of Swedish beekeepers, performers and musicians. Softday undertook a public Creative Soundwalk in the village of Harplinge, located in the Halmstad municipality in county Halland in South West Sweden. The soundwalk formed part of a series of socially engaged processes and fledgling Acouscenic Listening experiments that eventually informed the finished version of Sonic Pareidolic Ceromancy. Twenty-two members of the public participated in the Harplinge soundwalk and the creative outcome of that soundwalk was the first Acouscenic Listening co-authored sound map/graphic score. We visited a number of apiaries in county Halland and undertook empirical research and field recordings with the beekeepers.

In August 2015 Softday was offered a month long art residency at the Centre Culturel Irlandais in Paris. For this residency we proposed to work in collaboration with a Paris based curator and director of Leonardo/Olats Annick Bureaud on a new project inspired by urban beekeeping in Paris and our scientific and creative findings conducted during our Amhran na Beacha (Song of the Urban Bees) art project of 2014.

In Paris Softday established a new community of interest and began a dialogue with a number of Parisian beekeepers and musicians in an attempt to reveal the unique and hidden soundscapes of Paris apiaries and to create a sound art performance inspired by the everyday soundscapes of Paris and data around pollination and bees. Paris boasts some 400–500 urban beehives that are located in municipal parks, private gardens and on rooftops of iconic buildings such as Opera Garnier, Galeries Lafayette Haussmann, Grand Palais, and the École Militaire. In our initial research period and before the residency

Figure 9, Amhrán na mBeach – Song of the Bees, USB Artefact. Photos: Robert Corrigan.

commenced, we contacted the Association L'Abeille de Grand Paris (The Association of the Bee of Greater Paris) who introduced us to a number of urban beekeepers in Paris.

During the period of the residency at the Centre Culturel Irlandais, Softday mapped a considerable amount of urban hives and undertook field recordings at apiaries and locations across the city. Employing Acouscenic Listening methodologies we also conducted a public Creative Soundwalk workshop exploring the unique soundscapes of the Rucher école apiary at the Jardin du Luxembourg in the 6th Arrondissement. Participants on the Acouscenic Listening workshop created a sound map/graphic score of the Jardin du Luxembourg soundwalk (Fig. 10). In this instance participants did not wish to continue working with Softday in realising the full performance of the sound map/graphic score. Each participant was given a jpg-file of the sound map for further use if they so wished. In September 2015 we premiered the live performance of *Chant des Abeillies-Song of the Paris Bees* with Parisian sound artists Dinah Bird and Jean-Philippe Renoult, at the Centre Culturel Irlandais.[10] The improvised performance included field recordings of the Paris apiaries and city centre soundscapes, audio interpretations of the Jardin du Luxembourg Creative Soundwalk soundmap/graphic score, a public *Soundalong* and other acousmatic sound elements.

After the original performance of *Amhrán na mBeach* we have had several opportunities to deliver re-mediated versions of this work. In a re-mediated version where we don't have access to an orchestra or trained laptop beekeepers, we use samples from the recordings we made during the original performances. While a re-mediated performance can be quite different to the original performance, a re-mediated performance is a statement or reveal of the oft-unheard narratives and memories from the original community of interest that we are bringing forward to new audiences. Some of the audience at the original performance were direct stakeholders or participants in some way, while audiences experiencing a re-mediated work can only have an indexical relation to the original work.

Figure 10. Mapping the Le Rucher-école at Jardin du Luxembourg soundwalk, Paris, August 2015. Photo: Sean Taylor

Conclusion

The practice of Acouscenic Listening folds the traditions of soundwalking and Deep Listening into the discourse of spatial practice theorized by Oliveros, Westerkamp, Lefebvre and De Certeau and creatively engaged by Debord, the Situationists and Fluxus. These theories of spatiality and listening reveal connections between urban space and everyday life, in relationship to the body, creative/social action and the re-mediated environment.

The work of Softday through the Acouscenic Listening methodology and the Creative Soundwalk, offers new artistic perspectives on the relationships between body, landscape, soundscape and the everyday whilst challenging assumptions that the predominance of anthropogenic sounds can be linked to a lack of environmental quality, or that they inhibit the perception of other natural sounds. Encouraging participants to function as self-directed listening learners is an important cognitive strategy in order to improve perceptual intuition to aural clues. This creates the possibility for participants to practice and enhance their skills beyond the Creative Soundwalk experience, in an everyday context, and attain proficient levels of personalised listening skills. This physical approach to listening to sound offers yet another approach to learning through listening.

Acouscenic Listening and the Creative Soundwalk retains the concept that contemporary art production requires levels of technical and theoretical knowledge, but it also accentuates the value that non-art specialities bring to the creative process.

The resulting Acouscenic Listening manifestations sit at the intersections of cultural anthropology and contemporary sound art practice, whilst drawing on a range of creative languages. We argue for a creative re-exploration of the human listening experience in

a non-judgemental frame of mind, where an active listener can consider all aspects and elements of a soundscape with an open mind. Furthermore, as discussed in the Amhrán na mBeach case study, the methodology can be used to help fuse data and context in a work of sound art.

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Endnotes

1 **https://softday.ie/**

2 **https://softday.ie/deadzones/**

3 **http://donegalpublicart.ie/dpa_lovelyweather.html**

4 **https://softday.ie/sonicsidewalks/**

5 **https://softday.ie/wld2011/**

6 **https://softday.ie/wld2012/**

7 **https://softday.ie/antiausterity/**

8 **https://softday.ie/hypoxia/**

9 **https://softday.ie/bees/spc.html**

10 **http://softday.ie/bees/paris/**

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