

Sonic Art

## Bioacoustics and bioart

one audio file



Southeast Alaska and Biophony

Richard Hoadley  
2007-17  
v0.21

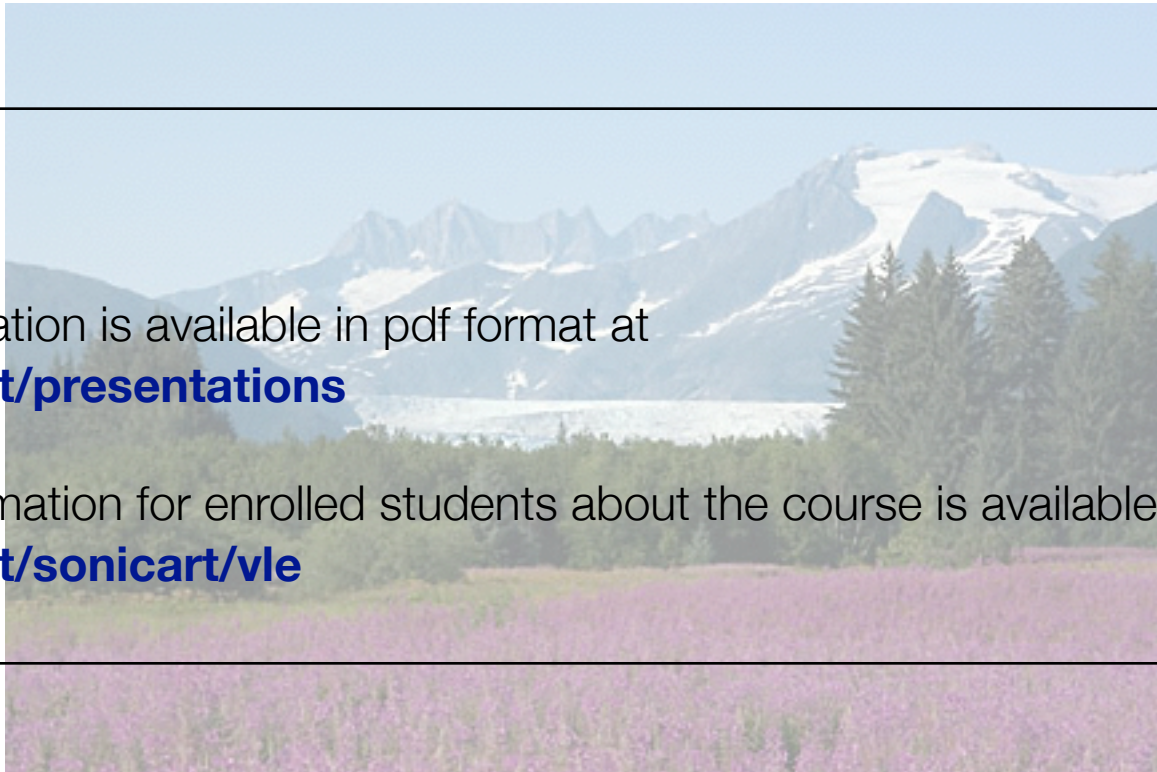
Sonic Art

## **Bioacoustics** and **bioart**

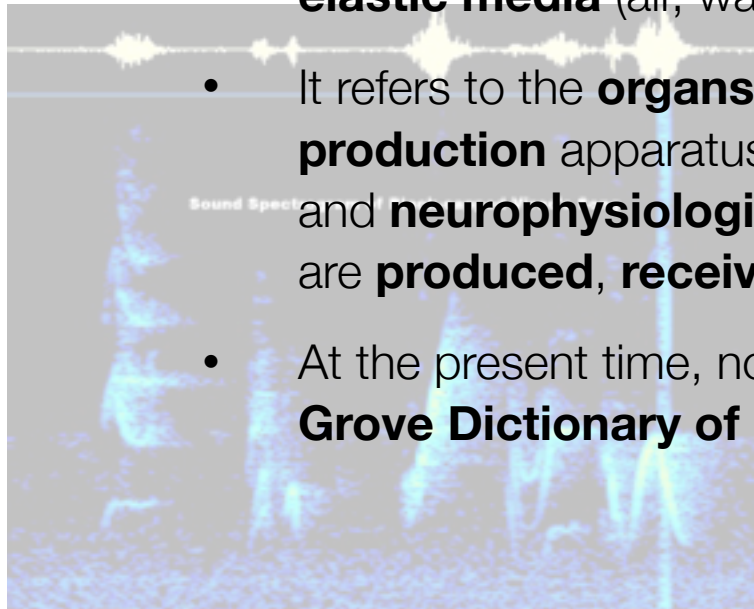
Note

This presentation is available in pdf format at  
[rheadley.net/presentations](http://rheadley.net/presentations)

Further information for enrolled students about the course is available here:  
[rheadley.net/sonicart/vle](http://rheadley.net/sonicart/vle)



- Bioacoustics is a **cross-disciplinary** science
- It investigates **sound production** and **reception** in **animals**, including **man**, the **biological acoustically-borne information transfer** and its propagation in **elastic media** (air, water, etc.).
- It refers to the **organs** of hearing and to the **sound production** apparatus, as well as to the **physiological** and **neurophysiological processes** by which **sounds** are **produced, received** and **processed**.
- At the present time, none of this is covered in the **Grove Dictionary of Music**.



- Bioacoustics attempts to understand the **relationships** between the features of the sounds an **animal** produces and the **nature** of the **environment** in which they are used, as well as the functions they are designed to serve.
- It includes the **techniques** associated with **instrumental and biological sonar** for its use in population **monitoring**, identification and **communication encoding mechanisms** and allows the **assessment** and **control** of the effects of human-made noise on animals.

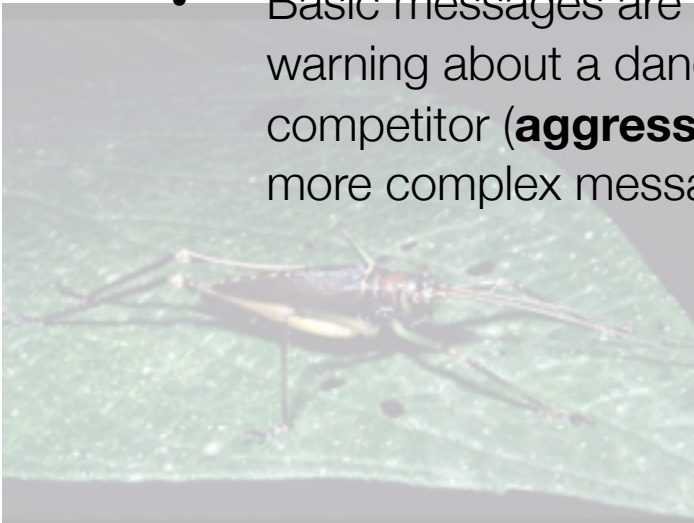
Source: Laboratory of Applied Bioacoustics  
[Laboratory of Applied Bio-Acoustics](#), Universitat Politècnica de Catalunya,  
Barcelona, Spain

- Bioart is an art practice where artists work with live tissues, bacteria, living organisms and life processes.
- biotechnology: genetic engineering, tissue culture and cloning
- Artworks are produced in laboratories, galleries and/or artists' studios. Considered by some as strictly limited to “living forms,” while other artists would include art that uses the imagery of contemporary medicine and biological research.

- Although bioartists work with living matter, there is some debate as to the stages at which matter can be considered to be alive or living. Creating living beings and practicing in the life sciences brings about ethical, social and aesthetic inquiry. The phrase "bioart" was coined by **Eduardo Kac** in 1997 in relation to his artwork **Time Capsule**. Although it originated at the end of the 20th century through the works of pioneers like **Joe Davis** and artists at **SymbioticA**, bioart started to be more widely practiced in the beginning of the 21st Century.

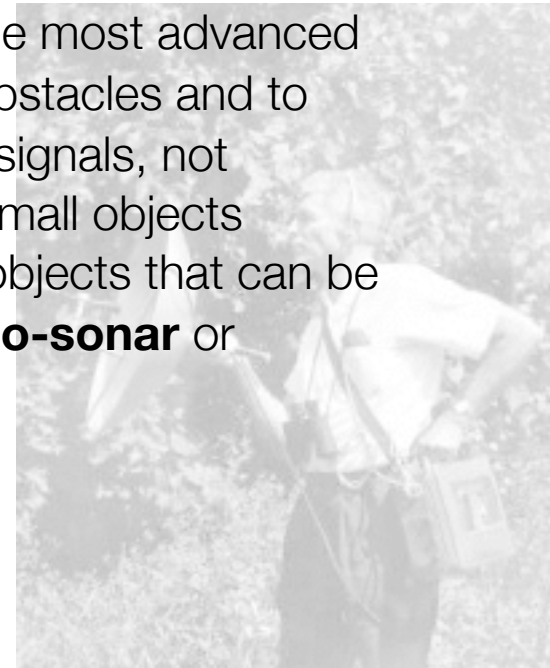
## Definition

- Some animals use sound ranging from **infra-sounds** to **ultrasounds** to send messages to **con-specifics** (members of the same species).
- Basic messages are for calling mates (**sexual** calls), warning about a danger (**alarm** calls) or to intimidate a competitor (**aggressive** calls). In birds and mammals more complex messages can be broadcast.



Definition

- Some animals can also investigate the surrounding environment by **emitting** sounds and listening for **returning echoes**.
- Bats and dolphins have developed the most advanced **echolocation** capabilities to avoid obstacles and to find prey. They use short **ultrasonic** signals, not audible for the human ear, to reveal small objects (shorter the wavelength, smaller the objects that can be detected). This ability is also called **bio-sonar** or biological sonar.



Definition

- A special branch of bioacoustics concerns the **underwater world** and marine mammals in particular.
- The most recent advances in bioacoustics concern the **relationships** among the **animals** and their **environment** and the **impact** of **anthropogenic noise** (noise created by humans).

**The Wildlife Section at the British Library**

**<http://birds.cornell.edu/BRP/> - Cornell Lab of Ornithology, USA**

**<http://www.ibac.info/> - The International Bioacoustics Council**

**Danish Centre for Sound Communication - Odense University, Denmark**

**[http://rheadley.net/courses/tech\\_resources/bioacoustics/index.php](http://rheadley.net/courses/tech_resources/bioacoustics/index.php)**

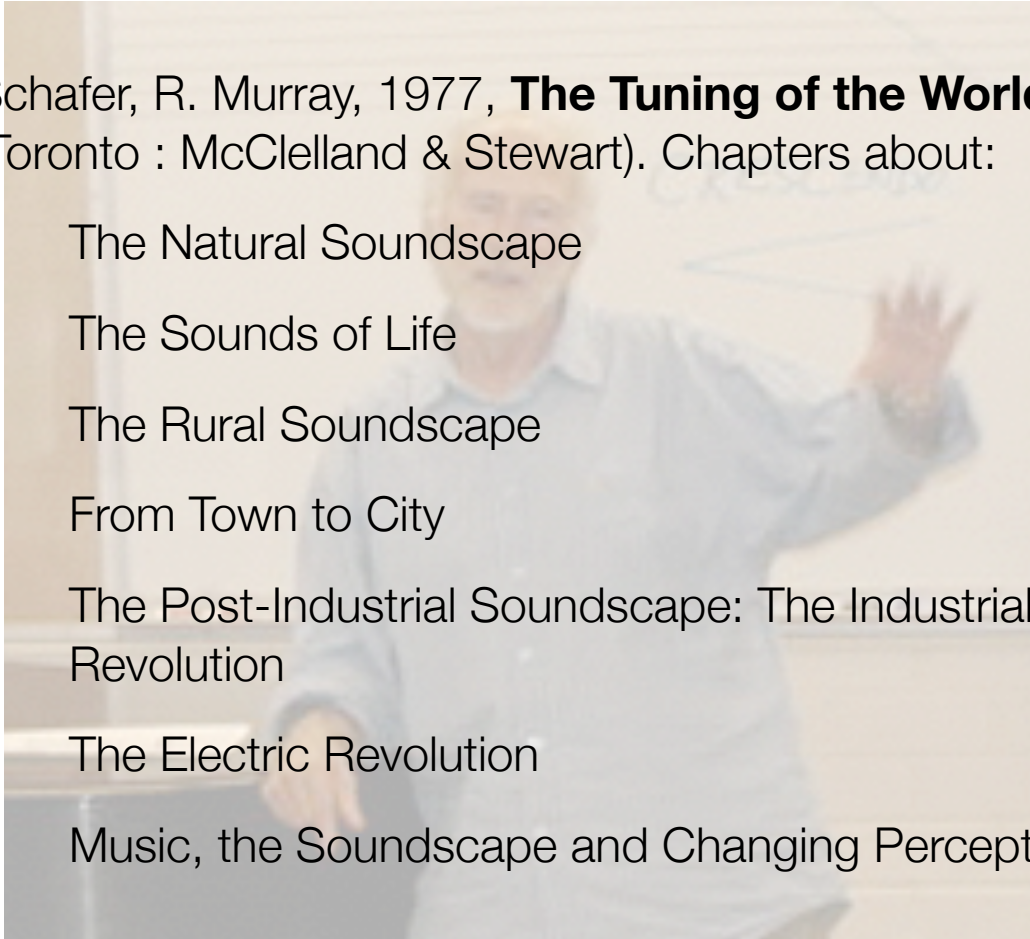
**<http://greenmuseum.org/>**

**<http://www.bl.uk/listentonature> - Listen to Nature**

- One key element here is the role of **nature** as opposed to **'nurture'**, or **pattern**, or **expression** in human terms.
- Do **natural** things have **pattern** or **expression**?
- Do humans **impose** expression, for example, on the 'patterns' of nature?
- Consider Beethoven Symphony No 6, the *'Pastoral'*
- Can aspects of bioacoustics be seen as developing from the **romanticism** of the 19th century?

Schafer, R. Murray, 1977, **The Tuning of the World**, (Toronto : McClelland & Stewart). Chapters about:

- The Natural Soundscape
- The Sounds of Life
- The Rural Soundscape
- From Town to City
- The Post-Industrial Soundscape: The Industrial Revolution
- The Electric Revolution
- Music, the Soundscape and Changing Perceptions



Sonic Art **Bioacoustics**

Bernie **Krause** the **Soundscape**



one transition

Bernie Krause, "It took me ten years to learn to record ocean waves."

Sonic Art **Bioacoustics**

Bernie **Krause** the **Soundscape**

three audio files

- 01 Introduction And Ocean Waves (Near Field)
- 02 Ocean Waves (Far Field)
- 03 Ocean Waves (Composite Mix Of Near And Far Field)

**Sonic Art**

**Environmental Art**

Sonic Art **Bioacoustics**

### A Brief Introduction

Clive Adams, Director of the Centre for Contemporary Art and the Natural World (2002)

- From prehistoric times, peoples have **transformed the environment**, shaping their tools from stone, and, in their cave **wall-paintings, megaliths** and **stone circles**, seeking ways to **connect** with the **forces of nature**.
- Since those times, artists and designers have been profoundly influenced by the **images, colors, patterns, structures** and **systems of nature** around them.

- At times of turbulent change in our history, as in Hellenistic Greece, medieval Japan and Europe at the time of industrial and political revolution, **new art forms** have evolved in order to address the **changing** relationships between **nature** and **society**.
- During the political and social upheavals of the 1960s, a group of artists in the United States and Europe increasingly questioned the restriction of painting and experimented with radical new ways of **responding** to the **environment** and its **ecology**. Rather than paint the landscape, their experiences were realised by **sculpting** the **land** itself, by **photographic sequences** and in **sculpture** made from **natural materials**.

- Since the turn of the Millennium, world concern over **environmental issues** such as **pollution** and **global warming, species depletion, new genetic technologies, AIDS, BSE** and **foot-and-mouth** epidemics has increased.
- Artists, in turn, are responding by answering **collective cultural needs** and developing **active** and **practical roles** in environmental and social issues.

# Environmental Art: Examples: Andy Goldsworthy

multiple transitions



Sonic Art **Bioacoustics**

# Environmental Art: Examples: Andy Goldsworthy



Sonic Art **Bioacoustics**

## Environmental Art: Examples: Street Art

- Banksy, etc.
- See 'Exit Through the Gift Shop' (Box of Broadcasts)



## **Environmental** Art: Examples: Links

<http://www.greenmuseum.org>

<http://www.ecoarttech.net/>

... google 'environmental art sound', etc.

## **Environmental** Art: Examples: Music

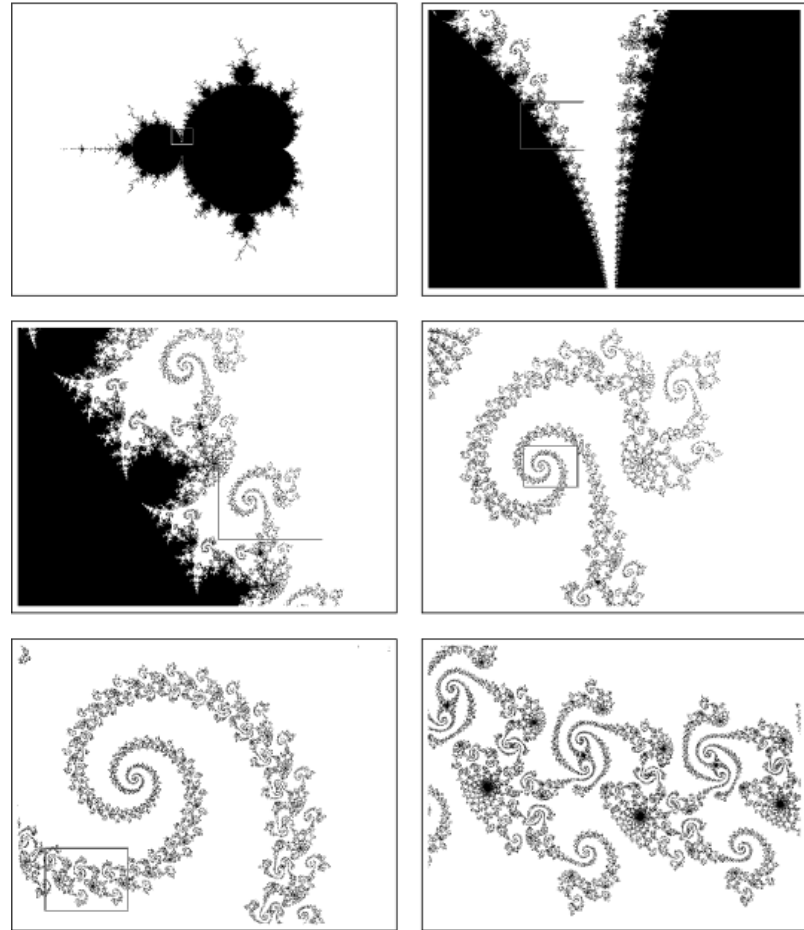
- Vivaldi **Four Seasons**
- Beethoven **Pastoral Symphony**
- Wagner **Rhinegold**
- Messiaen, see **Synaesthesia...**

- György Pálfi, 2002, Hungary
- Using almost no dialogue, the film follows a number of residents (both human and animal) of a small rural community in Hungary - an old man with hiccups, a shepherdess and her sheep, an old woman who may or may not be up to no good, some folk-singers at a wedding, etc. While most of the film is a series of vignettes, there is a sinister and often barely perceptible subplot involving murder.

# The Computational Beauty of Nature

The Computational Beauty of Nature - <http://mitpress.mit.edu/books/FLAOH/cbnhtml/home.html>

Jitter: L-Systems



**Figure 8.3** The Mandelbrot Set: Moving from left to right and top to bottom each subsequent image shows the boxed region from the previous image in greater detail.

Figure from *The Computational Beauty of Nature: Computer Explorations of Fractals, Chaos, Complex Systems, and Adaptation*. Copyright © 1998–2000 by Gary William Flake. All rights reserved. Permission granted for educational, scholarly, and personal use provided that this notice remains intact and unaltered. No part of this work may be reproduced for commercial purposes without prior written permission from the MIT Press.

## **Depicting** the **World** using **Mathematics**

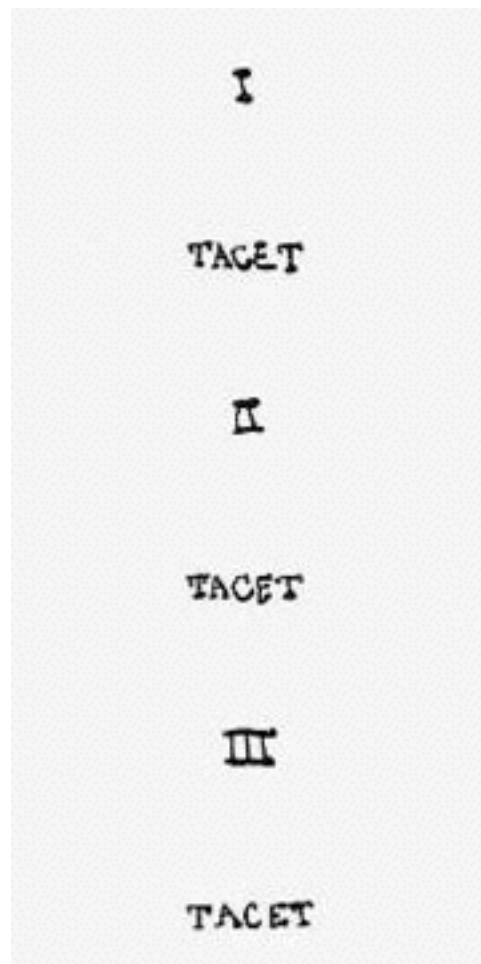
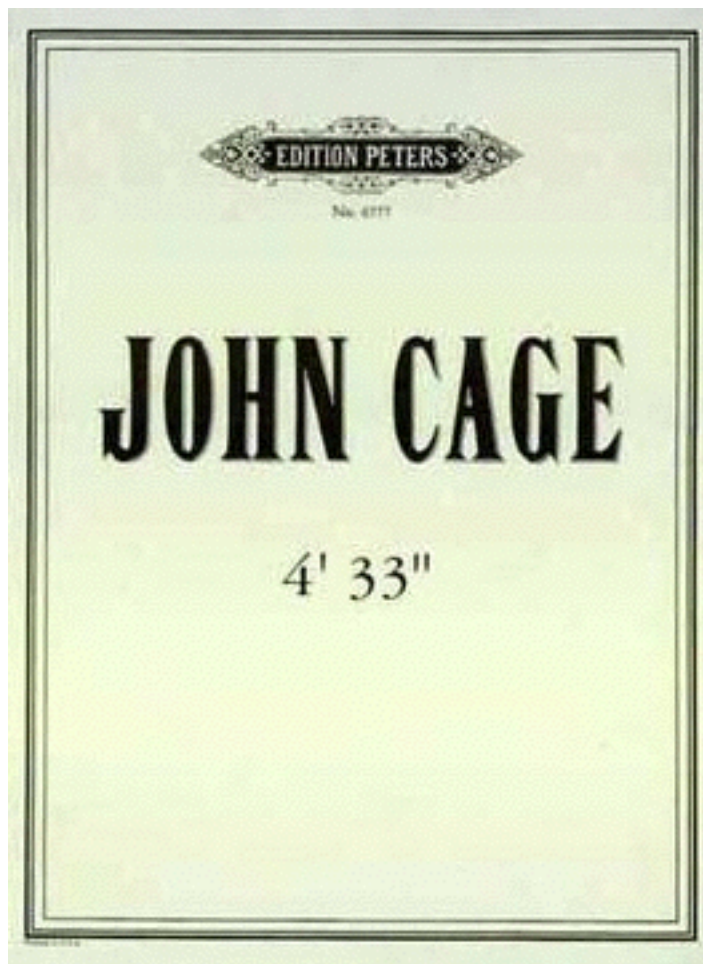
- How much of what we call the world is **definable** through **mathematics**?
- We say that things have **natural 'form'** - this implies **structure** and to an extent **mathematics** is the **abstract study of form** and relationships between forms (data).
- Music can be a **sonification** of these structures.
- Think of some structures - for instance, **fractals**. After a while, ask yourselves whether there is any natural thing that does **not** have a structure. You may also investigate **natural processes** - the **development of populations**, Game of Life, etc.

## Examples and Resources

- **Why Birds Sing?** David Rothenburg
- <http://wfae.proscenia.net>
- World Forum for Acoustic Ecology
- <http://birds.cornell.edu/> - Cornell Ornithology Lab

# John Cage

Possibly the most famous (and shortest) soundscape there is



4'33"

- <http://www.sfu.ca/~truax/wsp.html> - The World Soundscape Project (Barry Truax, etc.)
- B. Truax, **Soundscape, Acoustic Communication & Environmental Sound Composition**, Contemporary Music Review, 15(1), 49-65, 1996. [theme issue devoted to the subject]
- B. Truax, **The aesthetics of computer music: a questionable concept reconsidered**, Organised Sound, 5(3), 119-126, 2000.
- B. Truax, **Genres and techniques of soundscape composition as developed at Simon Fraser University**, Organised Sound, 7(1), 5-14, 2002. [theme issue devoted to the subject]

- Within Ear-reach: Sonic Journeys
- <http://www.west.asu.edu/rlerman/>

### **Tree Pieces (2:20)**

#### **One Palm Tree**

I placed pickups on palm leaves at Volcano National Park, the Big Island, Hawaii.

#### **Spruce Trees, Port Kerwin, Newfoundland**

Pickups at the tops and on the branches of trees at the home of artist, Don Wright.

#### **Two Palm Trees**

Again, pickups on palm leaves, two different trees, the Big Island, Hawaii.

- Within Ear-reach: Sonic Journeys
- <http://www.west.asu.edu/rlerman/>

### **Five Fence Pieces (3:45)**

#### **Fence/River/Las Cordileras at the Chilean-Argentine Border**

Pickups on a scrap of metal fence in a strong wind, near the Chilean village of El Volcan.

#### **Fence around the Oranienbergerstrasse Synagogue, formerly East Berlin**

A cold dark morning at 7:00 a.m.

#### **Fence and Tall Grass near Yuraygir Park, New South Wales**

I placed pickups on the fence and grass.

#### **Barbed Wire Fence at Dachau, near Munich**

#### **Fence and Windharps at Lonquen, Isla de Maipu, Chile**

Lonquen was the site where nine Campesinos were murdered by government authorities. Although subsequent investigations uncovered much of the truth, no one was ever brought to justice.

- Within Ear-reach: Sonic Journeys
- <http://www.west.asu.edu/rlerman/>

### **Three Grass Pieces (2:30)**

South Point, The Big Island, Hawaii

Two blades of grass at the southernmost point in the US.

**August Rice, Sado Island, Japan**

Pickups on the rice stalks, along with microphones in the field in the August heat.

**Windharps & Grass, Tierra del Fuego, Argentina**

A thirty meter long windharp, being strummed and plucked by the wind-blown grass.

- Within Ear-reach: Sonic Journeys
- <http://www.west.asu.edu/rlerman/>

### **Boat Pieces (6:15)**

#### **Drifting w/ Wind Harps, Port Kerwin, Newfoundland**

A small dory at sea with pickups on the gunwale and windharps from port to starboard.

#### **Abandoned Boat Launch, South Point, Hawaii**

At the Southernmost tip of the United States, on the Big Island, the wind was so strong here it caused the boat launch to sing.

#### **Two Screens on the SS Edgerton at Sea, near Cape Cod**

Bronze and Brass window screens on the M.I.T. research vessel.

#### **Return from the Sea in a Dory, Port Kerwin**

Pickups on the gunwales of the dory, and a windharp on board.

Easter Island

Sonic Art **Environmental Sculpture**

Sonic Art **Environmental Sculpture**



2:00 moai; 8:00 bird man cult;

# Spiral Jetty



# Roden Crater



4:00 particularly

Sonic Art **Environmental Sculpture**

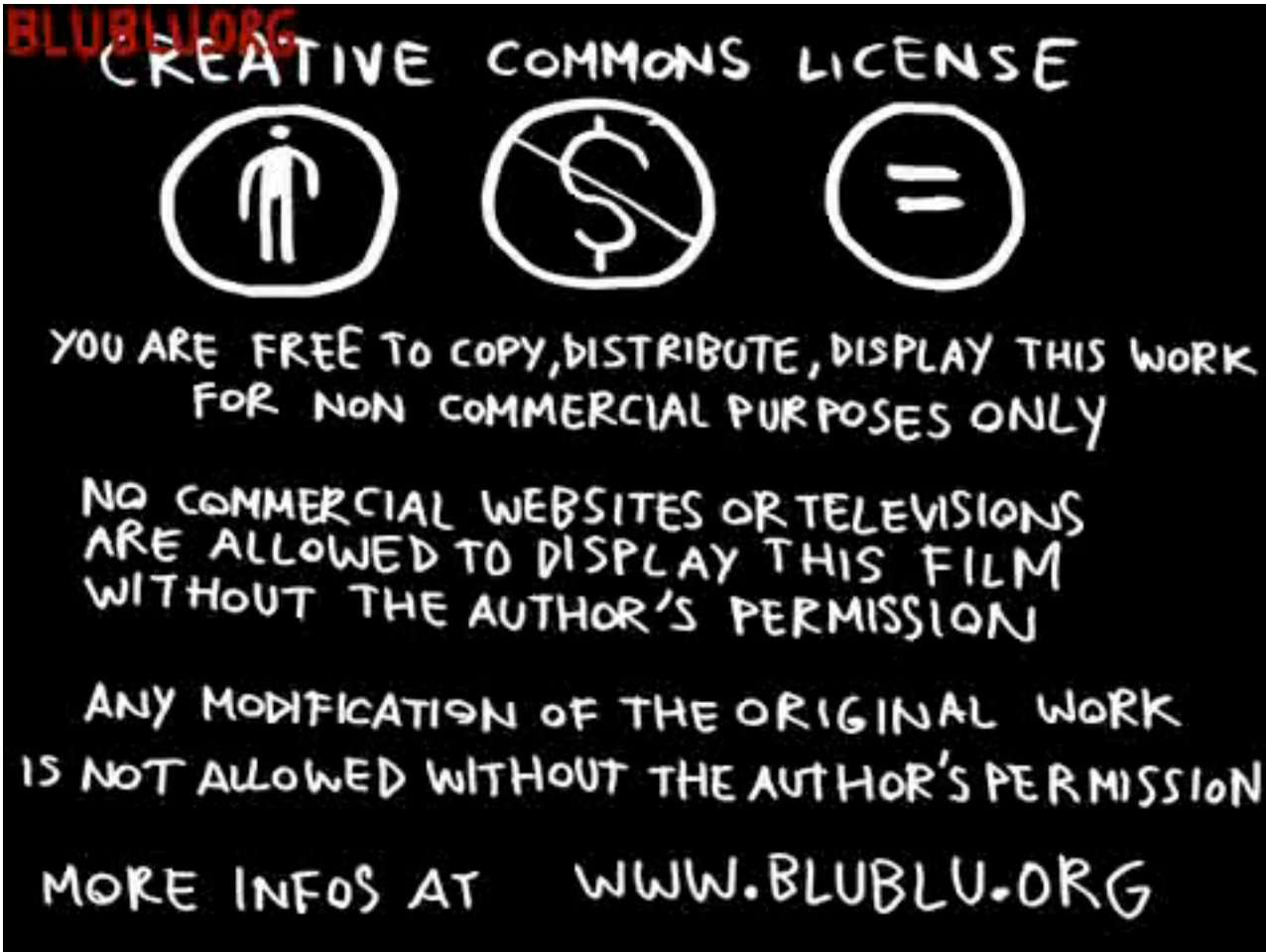
# Sun Tunnels



## Playing the Building



Sonic Art **Environmental Sculpture**



- Ways of Seeing
- Walter Benjamin
- Stelarc <http://stelarc.org/>
- Orlan <http://www.orlan.net/>

- Includes a number of **articles** about **bioacoustics** and **soundscapes**, see especially volume 7, no 1, (2002) on bioacoustics and volume 13 no 2 (2008) concerning 'Local/Global'

## Imagine: **What Is It Like To Be a Bat?**

Thomas Nagel:

“

I assume **we all believe that bats have experience.**

After all, they are **mammals**, and there is no more doubt that they have experience than that **mice** or **pigeons** or **whales** have experience. I have chosen **bats** instead of **wasps** or **flounders** because if one travels too far down the **phylogenetic** tree, people gradually **shed their faith** that there is experience there at all.

## Imagine: **What Is It Like To Be a Bat?**

“

Bats, although more closely related to us than those other species, nevertheless present a **range of activity** and a **sensory apparatus** so different from ours that the problem I want to pose is exceptionally vivid (though it certainly could be raised with other species). Even without the benefit of philosophical reflection, anyone who has spent some time in an enclosed space with an excited bat knows what it is to encounter a **fundamentally alien form of life.**

## Imagine: **What Is It Like To Be a Bat?**

“

I have said that the essence of the belief that bats have experience **is that there is something that it is like to be a bat**. Now we know that most bats (the microchiroptera, to be precise) **perceive the external world primarily by sonar, or echolocation**, detecting the reflections, from objects within range, of their own rapid, subtly modulated, high-frequency shrieks. **Their brains are designed to correlate the outgoing impulses with the subsequent echoes**, *and the information thus acquired enables bats to make precise discriminations of distance, size, shape, motion, and texture comparable to those we make by vision.*

## Imagine: **What Is It Like To Be a Bat?**

“

But bat sonar, though **clearly a form of perception**, is not similar in its operation to **any sense that we possess**, and there is no reason to suppose that **it is subjectively like anything we can experience or imagine**. This appears to create difficulties for the notion of what it is like to be a bat. We must consider whether **any method** will permit us to extrapolate to the inner life of the bat from our own case, and if not, what **alternative methods** there may be for **understanding** the notion.

”

[http://organizations.utep.edu/portals/1475/nagel\\_bat.pdf](http://organizations.utep.edu/portals/1475/nagel_bat.pdf)

Thomas Nagel [From The Philosophical Review LXXXIII, 4 (October 1974): 435-50.]

## Bioacoustics **Project**

- In consultation with the Module Tutor, **design, propose** and **implement** a project based on one or more of the ideas concerning **bioacoustics**.
- The **nature** of the project might be **ecological** as well as **aesthetic**, and should in any case include an **ecological element** - that is, a study of **a certain acoustic soundscape** and the **interplay of sounds** and **sound-making objects** within that **environment**.

Jack Ashley **Daytime** (2006-7)

and **Nighttime** (2006-7)

## Bioacoustics **Project**

- There are many possibilities: there are forms of ‘pure’ bioacoustics, based on ideas by **Murray Schafer** and **Bernie Krause**.
- ‘Pure’ bioacoustics is the **archival** and **analysis** of **very specific ecological environments**.
- In some instances there is a sense of **urgency**, as some of these environments are disappearing.
- Many have commented on the disappearance of the rain forests of South America, for example, but few have taken into account that the **acoustic environments** of these areas **are disappearing** as well.

## Bioacoustics **Project**

- Bernie Krause, in particular, has noted how in **natural undisturbed environments** different groups of creatures come to inhabit particular sonic bands.
- If **unnatural sonic disturbances occur**, these bands are **disrupted** and if the disturbance continues for a time, the **ecology suffers and changes** as a direct result. There are examples where species have left a region due to chain-saws, the sounds of aeroplanes, etc.

Nick Alexander **Bees** (2006-7)

## Bioacoustics **Project**

- The project may be **acoustic** or **electroacoustic**.
- It may be **entirely sonic** or include **image, light, objects**, etc.
- It, or workings towards it will be presented during a **workshop** in **week 8**. The finished project should be submitted at the end of the course.

Dionysius' **Algorithmic Bioacoustics** (2006-7)

## Possible Projects

- **Record** and **analyse** a specific environment, or specific environmental details: trees, plants, the elements
- For instance, water - **underwater, freezing, thawing, marine biology...**
- An example from 2007: **Antarctic Data Jam** - <http://mediashed.org/dataj>
- Pure bioacoustic **recording, survey** and **analysis**: a **soundscape** (see Krause)

## Possible Projects

- Exploit the **Computational Beauty of Nature**
- **Zoo-musicology** - <http://en.wikipedia.org/wiki/Zoomusicology> - (do animals make music?)
- Undertake a form of **sonic environmental art** (be careful, though, these can quickly become complex involved and expensive!).
- If you're going away somewhere, or have an **opportunity** to **investigate** a **different environment**, then do so, but remember, you have **exotic** and **interesting** environments in a **shed**, a **bathroom**, maybe even your **refrigerator**...

## Possible Projects

- Remember that **whatever** your project is, you'll need to submit full **documentation: aims, intentions** and as necessary **photographs, video** and **audio recordings**.
- A **very significant** part of this project's assessment will involve the **quality, detail** and **care** taken over the **presentation** of material.

## Possible Projects

- **Listening/Watching:**
- Why do Whales and Children Sing (CD accompanying book)
- Krause *Wild Soundscapes*
- Hukkle (movie)
- Ecoute (IRCAM)
- Sounds of Life (BBC)
- A Day in the Life of Ants (BBC)
- and quite a few other sound-based documentaries (unsurprisingly) on BBC Radio 4...

## Bibliography

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- Krause, B. (1998), *Into a Wild Sanctuary: A Life in Music & Natural Sound*, Berkeley: Heyday Books
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- Schafer, R. M. (1993). *The soundscape : our sonic environment and the tuning of the world*. Rochester, Vt. [United States], Destiny Books ;American International Distribution Corp.
- *The Book of Music and Nature*, (2001), Middletown, Conn. : Wesleyan University Press

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Sonic Art **Bioacoustics**

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<http://rheadley.net/presentations>

