Sound and Music Guide to Field Recording

Field recording is the practice of recording outside of the studio environment; alternatively called phonography (an audio analogue to photography). A growing field, emerging from artists/engineers using portable, often more rugged equipment derived from the broadcast environment to record their surroundings.

Sound and Music are involved in two major events presenting works derived from field recordings: Bill Fontana's *River Sounding* and Chris Watson's *Whispering in the Leaves*.

Why do people record their own environments?

"I started having these experiences, I would be somewhere, and the everyday sounds suddenly seemed as interesting to me as the sounds of any music I could hear inside the concert hall. They just seemed so rich that I wanted to document moments of listening. I came to regard the act of listening as a way of making music. I regarded it as a creative activity – finding music in the environment around me."

Bill Fontana, Pascal Wyse interview, Guardian 15th April 2010

There are many different ways recordings can be presented. Some can be heard as pieces in their own right, others are processed electronically (or even physically and re-recorded) or extra instruments are added. Recordings can be mixed and edited together to create collages of sounds (for more information on the history of this practice see musique concrète).

Reproduction of recordings can have different effects- for example, Chris Watson's *Whispering in the Leaves* uses recordings spread over 80 speakers spaced throughout an area to re-create many localised sounds to create an entire sonic environment, taking the sounds of the Amazonian rainforest into a different place.

Others can be used to subvert existing environments, creating sonic surroundings which would not usually be expected within that particular space.

Equipment

Input devices

In order to record sound, some kind of device which can measure vibration and turn it into an electrical signal is required:

Microphones

Microphones consist of a diaphragm which moves along with incoming vibrations through the air. This movement is in turn turned into an electrical signal, which usually needs to be amplified to maintain a suitable recording level.

Different types of microphones have different properties. The most accurate results can be achieved with condenser microphones, which require their own power source.

Directivity is also important for selecting a microphone- this is the pattern in which microphones pick up sound. With a more directional microphone (for example a 'shotgun' microphone), sounds from one direction are picked up more strongly than others- however they are susceptible to the proximity effect which alters low frequencies depending on how far a source is from the microphone.

Microphone directivity can be even further increased, effectively letting the recordist 'zoom in' on a source using parabolic reflectors. It's quite easy to make (or find) a parabola, objects such as old satellite dishes will do, although professional solutions will probably be lighter and more reflective.

Directional microphones in pairs can also be used to create stereo recordings, in order to create a realistic image across two loudspeakers or headphones. The most straightforward technique is probably 'XY' stereo where two 'cardioid' (see directivity link) microphones are placed at 90 degrees to one another, as close together as possible. The stereo effect is achieved by each microphone picking up the same signal, however, due to their directivity pattern- they will be pick up a sound source on one microphone more than the other depending its location. The DPA site has more information on other stereo techniques .

Binaural recording is a way of making spatially realistic recordings for headphone listening. Omnidirectional microphones (which pick up sound equally from all directions) are mounted at either side of the recordist's (or alternatively a dummy) head. This means the sound waves will reflect off and around the recordist's head, just as they would for the listener, creating an effect as if they are actually there. It does, however mean that the reproduction sources (speakers or headphones) would also need to be in the same place. Binaural microphones can be made quite easily and cheaply and give good results. For more links see here.

Surround sound can also be produced with more complex microphone arrangements. A particularly interesting way of recording surround sound is ambisonic recording, where 4 microphone capsules are places in a tetrahedral formation, allowing sound to be picked up from all directions. By altering the levels of each of these signals, different directivity patterns may be produced (even after the recording) and mixed down to any number of channels. Here's a more detailed description [PDF]

Other input devices

Piezoelectric elements

Commonly referred to as 'contact microphones', they are piezoelectric sensors which turn mechanical stress into an electrical signal. They can provide interesting results attaching them to vibrating surfaces, so you can hear what is going on within the structure. They can be bought very cheaply (search for 'piezo ceramic elements') and only really need a cable soldering to them for them to work [guide].

Accelerometers use one of these piezoelectric elements attached to a damped mass on a spring. This allows them to measure the acceleration of the object they are attached to, rather than pressure. This can provide a more detailed result than with contact microphone. Accelerometers can now be found in a number of consumer goods, such as game controllers, mobile phones and other devices.

Hydrophones: Microphones specifically adapted for underwater use. The most effective way of picking up sound in this way is with piezoelectric elements, however they need to be in a sealed enclosure (water and electricity don't mix!). There are various ways of doing this, and you can make them yourself, from just dipping them in wax to more robust enclosures[PDF]. We also have a guide online, written by Leafcutter John.

Laser Vibrometers

Although rarely used in sound recording (mainly due to poor audio quality), laser vibrometers measure vibration at a precise point without the need for physical contact. They work by reflecting a laser off a surface and measuring the Doppler Effect caused by the movement of that surface with a light sensor. However some interesting recordings can be made. There are quite a few DIY videos online showing how to make one for little money, however professionally made models are expensive industrial measurement tools.

Electromagnetic sensors

Although they don't actually pick up sound, the electrical current generated from magnetic fields can have interesting sonic properties. A really easy and cheap way of detecting this is to get 'telephone pickup coil', they're usually the cheapest telephone recording device. They're essentially just a magnetic coil with an audio plug on the end and designed to pick up telephone conversations, however you get some interesting results by putting the coil in magnetic fields (camera flashes and televisions are good).

Recorders

Whilst out in the field, recordists often experience more severe environmental conditions than computers are designed for and require something lighter and more compact.

There is a wide array of machines available which will record high quality audio at many different price ranges, from under £100 to thousands of pounds. Quite passable results can be achieved with digital dictaphones, even. Most currently in production use solid state memory cards, which are cheap and durable or a hard disk drive, which can provide long periods of recording. However, good results can be achieved from Minidisc, DAT, or even older professional quality cassette tape recorders. Some have their own build-in microphones, which can be quite high quality.

The most important thing you need to consider are which external microphones you plan to use: Some small electret microphones (such as binaural mics) will work on 'plug-in power', usually on a TRS mini-jack plug. However if you want to use condenser microphones, you will need 48V 'phantom power', most commonly provided over XLR connectors. If you already own a recorder which does not have capabilities to run condenser microphones, it still may be possible to use them by using a battery powered external microphone preamp (search for 'microphone preamp battery').

When using a recorder, ensure that you set the recording level is set so that it is going to be able to handle the loudest sound in that environment without distorting (when the peak level meter hits 0dB), whilst ensuring that the level is not so low that there will be a low signal to noise ratio. -12dB is often a good peak level to aim for when recording onto digital formats

Monitoring

In order to hear what you are recording, you need to be able to listen to the signal coming into your recorder, isolating this as much as possible. Look for 'closed back' headphones, which go over your ears. These will block out more sound from outside the headphones and 'leak' less sound into your environment. Headphones which incorporate active noise cancelling will not help with accurate monitoring, as they will apply signal processing the sound outside the headphones, which you are likely to be recording. Low impedance (under 100 ohms) headphones will work better with equipment with less powerful headphone amplifiers. 'In Ear Monitors' are also very small, light and accurate, however may leave you susceptible to hearing damage if recording unpredictable sources. This is due to the headphones being positioned in your ear canal.

Editing and Analysis

Once you've made a recording, you'll probably need to edit it. In order to do this you will need a wave editor (most commonly employed as computer software). Here you can alter levels, digitally cut and paste waveforms and add effects. There's a free, cross platform open source wave editor: Audacity.

If you require extra functionality there are other packages available

Another interesting package (especially useful when using more unusual transducers and recording signals outside audible frequencies) is Baudline, a free and powerful piece of signal analysis software.

Bill Fontana Case Study

Bill Fontana's way of looking at the world is to pick out sounds which are hidden, often within structures or underwater. He uses accelerometers and hydrophones, often mixing the signals of both together, to show multiple internal and external 'views' of the same sound.

We asked Bill about some of the equipment he typically uses for field recording:

Sound Devices 744T HDD Recorder

Brüel & Kjær 4384 accelerometers

DPA 8011 Hydrophone

Sanken C8 lavelier microphones (current production COS11D)

Sennheiser HD25 Headphones

Further Information

Chris Watson's guide to wildlife recording (BBC)

Vermont Folk Life Centre

Tapers Section (forum focused on mobile concert recording, relevant for looking up suitable equipment)

Phonography.org

Nature Recordists group (yahoo)

Lab Blog

Richard Thomas, Sound and Music. May 2010