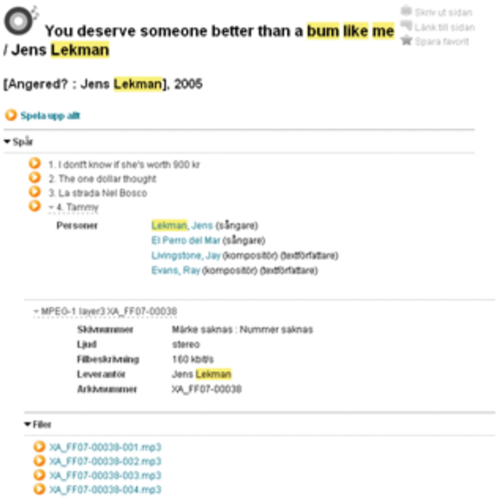
publications. While waiting for the new law, we learn how to work with the material and also save some productions for the afterwards.

Example: Record for digital sound files downloaded from the web



The digital files are described in the carrier record and the actual sound files are linked to the part records. The prefix X stands for files made from external material, XA is an archive file, and XS is a browse file. In cases like this, the archive files are also browse files since the files imported to our system are already in a browse format.

SMDB – the Swedish Media Database

SMDB, the Swedish Media Database is available at the Swedish National Library home page: www.kb.se > Sök i SMDB KB:s Audiovisuella medier or directly at: smdb.kb.se

Please note that no digital files are available on the web, for copyright reasons.

ARCHIVING ACOUSTICS

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Abstract

We are all aware of how rapidly cultural and musical traditions can change, or disappear altogether. And we can see how traditions struggle to adapt to new social conditions and new technological means. There are failures, but many success stories as well. One of the threats to any performance tradition are the changes in the acoustic conditions under which it is performed. Whether it is a cave or a theatre or a temple in the middle of a city traditions struggle to adapt. Very often, the technologies used to make this adaptation (microphones and PA systems) effect the traditions in unexpected and not very satisfactory ways. Worldwide, there are efforts to document performance traditions under threat. But there has been no similar effort to document the acoustic conditions under which these performances take place. The author in this paper will describe the examples of acoustic conditions that have changed, and as a result have changed major performance traditions. He will describe the technologies that are currently available to document acoustic properties of performance spaces; how they can be recorded and archived. The author will describe a low cost system he has been using for such measurements in archaeological sites. He proposes an international effort at collecting and preserving such measurements in sound archives worldwide and will describe some of the ways in which these measurements can help reconstruct at least some elements of vanishing traditions.

A repository of Impulse Responses

This paper is in the nature of an appeal; to collect Impulse Response recordings – as closely adhering to ISO 3382 standards as possible, of many sites that are linked to performance. Theatres and auditoria of course, but temples, ancient souks and market stalls as well. These IR files are very small – need not be larger than 100 Kb each. But they will preserve a heritage that is daily deteriorating.

I will begin with a little history; in 1995, Dr Thomas Ault, theatre historian, asked me if I could measure the acoustic properties of a second century BC structure in Orissa, because he wanted to establish that this space was a very early theatre.

So off we went, packing a full size 486 computer with Windows 3.1 and 640 MB of hard disc, Nakamichi CM 300 omni and a CM 300 cardioid microphones and a small mixer. We rented a monitor for the computer in Bhubaneswar, and hired a loudspeaker and amplifier, along with an electrician who hooked up the computer to an overhead power cable.

Our first visit to the site convinced me of two things: the site indeed had extraordinary acoustics, and any kind of measurement could only be done well after midnight. There was a teashop, and two temples, all producing music through their loudspeakers, and there was a highway less than a kilometre away, with truck noise, very loud horns, and music too. And hundreds of tourists, many of them school children.

Using an early version of Cool Edit software, I played various kinds of tones and recorded them back as the site interacted with the sound. Among the tests I did was to play a sweep tone, from low frequencies to high. The site appeared to produce very long-delayed echoes at some low frequencies, and it certainly had a surprisingly long Reverberation Time for an outdoor space.

Among the possible ways of studying this space was to build an acoustic model (I used CATT acoustic) so one can take the various elements apart, and see what contributions they make to the acoustic properties of the site. Around this time I got in touch with Prof Angelo Farina at the University of Parma, who pointed me to ISO3382 specifications for acoustic measurements of built spaces. He also provided me with the Aurora set of plug-ins for Cool Edit, which produce a full set of results meeting ISO3382 from processed Log Sine Sweep measurements.

This early work led to several papers, at the Acoustical Society of America's special sessions on Archaeological Acoustics and at two meetings of the International Federation of Theatre Technology.[1]

I made several more trips to Ranigumpha over the years, with improved technology. On one trip I used Omni microphones inserted in my ears and made dummy head measurements! All the while, conditions at the site were very visibly deteriorating

The structure, very elaborately carved out of a mountainside, is limestone and very crumbly. It is a popular local tourist spot, poorly supervised, with children (and monkeys) scampering all over. Every visit, one sees more broken off little pieces of the carved surfaces. This does not effect the acoustics very much, but some years ago the Archaeological Survey has started beautifying the place, which I am afraid does.

Ranigumpha near Bhubaneswar, Orissa (C.T. Ault)

Vulnerable acoustics

On my last brief visit to the site, I noticed that they had dug up the flat ground in front of the structure. They were planting bushes and trees where two thousand years ago people probably sat on improvised wooden benches to watch ritual theatre. I had not been there since, but I could see it will break up the view of a very beautiful façade of the structure. It must change the acoustics too, but in what way I have not measured.

Michael Gerzon the Oxford mathematician and 'founder' of ambisonics initially proposed the collection of sonic behavior of ancient theatres and auditoria.[2]

There are several important reasons for this.

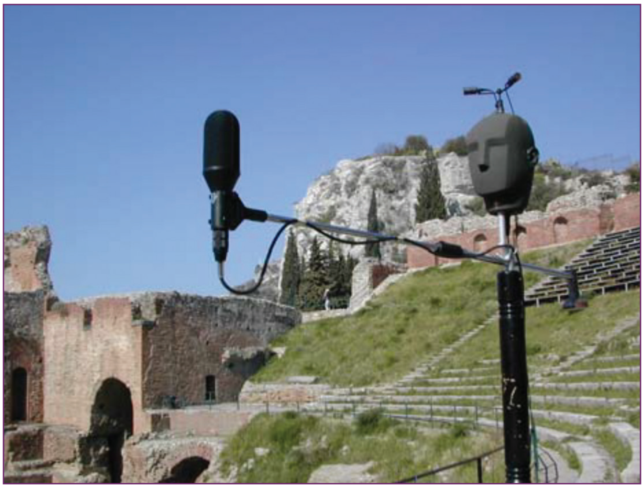
First is to identify and preserve the acoustic properties of archaeologically valuable sites, as currently no such effort is being made. This in itself will be a valuable resource, as the measurements enable the recreation of virtual acoustic environments even if the original environments have been disrupted or destroyed.

Second, a study of these acoustic properties will lead to an understanding of the acoustic sensitivity of the people who built them, and will go some way in explaining the function of some of the more obscure structures from early India. For example, it should help in identifying sites that were definitely intended for performances of various kinds, including theatres.

The third is to create a repository of these measurements (as standardized Impulse Responses) for future study and perhaps use. There are already small commercial collections of this kind ("Waves" comes to mind). There have been some discussions about the rights to these IRs – evidence perhaps they are important to preserve.

There have been some attempts in this direction already.[3]

With software based measurement systems, it is possible to extract sufficient information on the acoustics of a given space – in the form of impulse responses – to recreate these acoustics.



Three measurement systems Soundfield microphone, dummy head and a pair of cardioids – Angelo Farina.

While great attention is being paid to the preservation of physical spaces of cultural importance - whether ancient archaeological sites or medieval performance spaces - no attention at all has been paid to preserving the acoustics of the spaces.

In many cases, preserving the pristine acoustics of these spaces is impossible. Cities have grown around what were at one time remote temple sites. The amount of man-made noise has increased phenomenally - it has always been worsening, but this increase has become exponential in the modern era. And sometimes, the very efforts of preservation or protection of a site led to the destruction of its acoustics.

There are other activities that affect the acoustics of these spaces. A multilane highway is obvious and audible. But not so obviously, a new high-rise building, a large hotel, excavations on a nearby mountain, for marble or limestone or just plain rock, will also affect the acoustics of some of these spaces.

The acoustics of all ancient spaces may not be equally significant. But we do not know which ones are significant, which are not, and they all are being destroyed.

What we do know is that the acoustic environment played a far greater role in the construction and use of many early sites than has so far been acknowledged. From sites of cave paintings to ball courts of the Aztecs, significant acoustics have been observed at many sites.

Steven J Waller et al have established that acoustics played a significant part in the selection of caves for painting by early man (around 20, 25 thousand years ago). There is currently a move in some countries to prevent any development in the mountains around these caves that would modify their acoustic properties. Recent archaeological work in the Velpumadugu in Andhra Pradesh for instance has established links between Neolithic petro glyphs and 'singing stones' in that area.

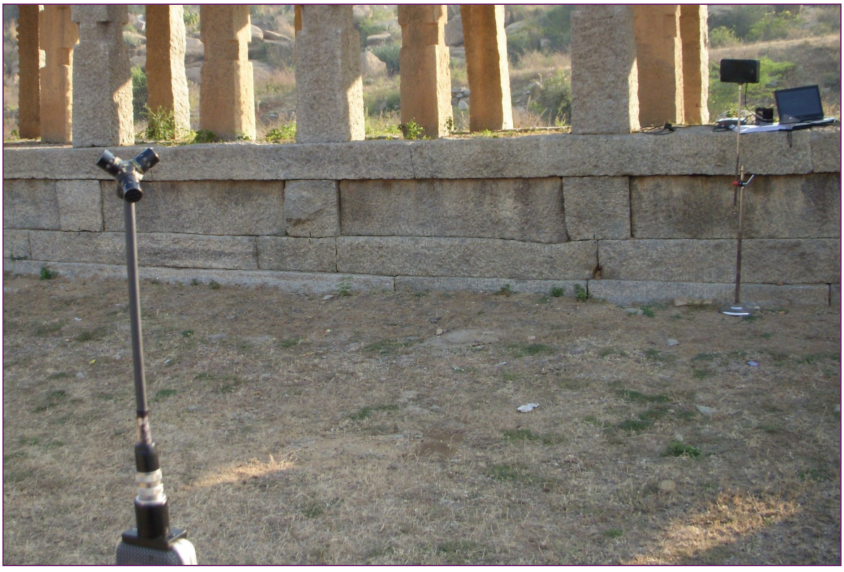
There are other sites that are perhaps not of archaeological interest, but are of importance nevertheless. Some years ago I visited the home of Kumar Gandharva, and recorded some music in his practice room. It is a large, low ceilinged room with a hard wooden floor. I recorded some wonderful Tanpura sound in that space, and I know that Kumarji took the sound of tanpura very seriously. It is one of those spaces that I would like to have documented.

In many parts of India, ritual performances are linked closely to specific locations. What are the acoustical properties of these spaces? They too are candidates for documenting and preserving.

Folk theatre in India is now presented with a forest of microphones, sometimes suspended like fruit from overhead. In a few performances of Yakshakagana that I have seen, you can hear the percussion, and the main singers. The actors, who dance and say their lines, are not audible. A veena performance without contact mikes, what does it sound like. As amplification takes over the concert stage, a sitar concert reaches rock music volumes.

What did it sound like in a Kerala Koothambalam, when the singer did not have a microphone, but was audible over the percussion? We do not know, but I do not think their relative volumes have changed; what changed was the threshold noise against which the performance takes place.

When I went to measure acoustics of several locations in Hampi, Karnataka, I was not looking for auditoria, but Other spaces of acoustic interest. The ruined market stalls, a space that was used for public announcements, etc.



Ruins of Hampi market stalls – with the modified Zoom H2 recording impulse responses.

State of the Art

In the last decade, many people have been at work, all over the world, documenting the acoustics of a great variety of spaces. Many methods are being employed, from starter pistols to bursting balloons; DAT recordings of the resulting sound to sound level meters and stop watches.

Computer based methods – in particular MLS signals and Log Sine Sweep signals as source signals, and Impulse Response recording as the required measurement - are available, but have generally tended to be expensive and cumbersome.

I have been, for ten years now, trying to simplify and make inexpensive a system for this use. The requirement is: a loudspeaker (a small full range speaker can be used, but the ideal is an omnidirectional dodecahedron.

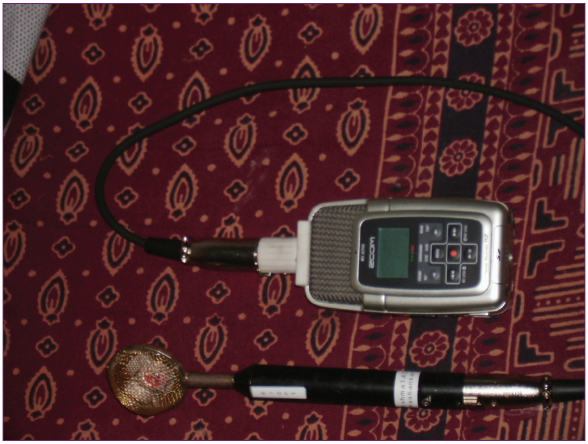
An amplifier and a signal source. Small automobile amplifiers powered with rechargeable lithium battery packs are ideal. I used a laptop as my signal source, but switched to an MP3 player with a recording of the log sine sweep signal.

The microphone: at the minimum a calibrated (or calibratable) omni microphone. A mono IR will give repeatable results, but the ISO specifications call for a two channel recording. To be future proof, my own recommendation is to use a soundfield or equivalent microphone. This is also the recommendation of Prof Angelo Farina "a Soundfield microphone could be the optimal transducer for performing 3D impulse response measurements: the W channels is good for the monoaural parameters (omnidirectional), the Y channel provides the figure-of-8 signal required for computation of LF, and other two directive channels (X and Z) can be used for recreating the whole 3D soundscape inside a playback environment…"[4]

The problem of cost and complexity still remains. High quality ambisonic microphones are expensive. They require a good quality multichannel A-D convertor and a laptop or a multichannel recorder. Multichannel recorders are now getting affordable, however.

Several years ago, I realized the Zoom H2 recorder could be modified to be a very reliable and inexpensive 4-channel recorder. A recorder like the Sound Devices 744 is preferable, but this costs only a fraction. I had documented the modification. [5]

Building Tetrahedral microphones too has become simpler with advent of 3d printing, and I routinely get capsule assemblies printed at Shapeways.[6]



One of the versions of home built Tetrahedral Microphones, with the modified Zoom H2.

My last site measurement visit was almost two years ago, to Hampi in Karnataka. It was the first time I had measured IRs in ambisonic format, using my system built out of a modified Zoom H2 and home built tetrahedral microphone using six mm cardioids capsules.

For my Hampi visit, I used a small RadioShack loudspeaker, which at one time was recommended for measurement use, a small 40-Watts amplifier that can be powered with a 12volt battery. A laptop to generate the Log sine sweep signal, and the Zoom H2 and my Tetrahedral microphone (Brahma !) to record.

I have simplified the process since then – I now record the Log Sine Sweep signal onto an MP3 player. (Many of them will play wave format sound) and glue this to the amplifier. The laptop can stay in my hotel room.

I will also replace my Radio Shack loudspeaker with an omnidirectional dodecahedron. There are published files for printing the parts needed for this. I just have to get my 3d printer going.[7]

(Endnotes)

1 ASA special session on Archeological Acoustics, Columbus, OH, 1-5 Nov, 1999; Cancun, Mexico 2-6 December, 2002. "Theatre and Cultural Memory", IFTR World Congress, Amsterdam June 30 to July 6, 2002.

2 Recording Concert Hall Acoustics for Posterity" M.Gerzon – JAES Vol 23, Number 7, pages 569-571 (1975)

3 http://www.acoustics.net/

4 "Recording Concert Hall Acoustics for Posterity", Angelo Farina, Regev Ayalon AES 24th International Conference on Multichannel Audio

5 http://www.flickr.com/photos/ms_static/sets/72157625446503232/detail/

6 http://www.shapeways.com/shops/umashankar

7 http://www.thingiverse.com/thing:24308

SOCIAL SCIENTISTS AS USERS: SEARCHING FOR RECORDED SOUND IN ITS ENVIRONMENT

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Abstract

For social scientists, it is crucial to access complex information on sound production and the recoring environment. They need data derived from professional recordings that help to support conventional observations.

Media distributors have long-held the role of environment sounds as disturbing nuisance that had to be eliminated or suppressed. In the best / worst case, side sounds were left unchanged to create a "lively" atmosphere for an anthropological sound recording or a sound recording for a special audience to which the place of the performance is of particular interest. The coughing in a live concert or the dog barking in the background of a village ensemble became then part of the marketed item.

In an archive, sound reductions hopefully not take place. Nevertheless, environmental sound inclusions, in certain recordings, are considered to be side effects of the main recording project undertaken by collectors of different disciplines who did not purposely intended to record those noises. Ideally, they were searching for equipment that avoids it best.

Unlike this approach, the project at our institution tries to purposely include all possible environment sounds produced during the primary sound production. These sounds come from various distances and or directions. The paper will focus on the scientific potential and the resonance of these recordings among users in order to achieve more reliable research outcomes. Though small in number, researchers of very different social sciences areas might become a strong and supportive group of future users.

Introduction

For social scientists, it is crucial to access complex information on sound production and the recoring environment . They need data derived from professional recordings that help to support conventional observations. In times of new methodologies in humanities and amoung network researches, environmental sound as well as sound environment becomes an important subject of study for the benefit of holistic views on human development.

Sound recording engineers and archivists, however, did and do not focus much on the role of the environment as an acoustic and thus complex sound of life that delivers a huge amount of extra information[1]. These Media distributors perceive it as "noise" that should be separated from the audio essence; a disturbing nuisance that had to be eliminated or suppressed to serve the expectations of the consumers and the researchers. The problem of getting to this kind of complex sound and later on to its preservation starts with the way the recordings are done. In the following paper we present some examples of recording methods followed by a discussion of its use by social scientists in our small scale archive at Universiti Putra Malaysia.

The research on our recording and preservation methods revolves sound recordings of select local string instruments in their rural environment. For example the sape native to different ethnic groups of Orang Ulu (Chan & Musib, 2011), and the Bidayuh tube zither *pratuokng* in its local context (Jähnichen, 2011c; Musib, 2011).

The second part of experiment is done in terms of observing the further use of these recordings as scientific tools and as accessible items in our Archive. Each sound embedding depends on spatial and time parameters. These parameters are evident in the musical performance of these selected local string instruments therefore we do not limit our observa-