On the record

– your meetings will echo though history!

Recordings of meetings are now easy to distribute digitally to those who couldn't be there, explains Conrad Taylor

MEETINGS AND CONFERENCES are great opportunities to acquire knowledge and advance our thinking, but inevitably many people can't attend. If proceedings can be published, many more will benefit. Even those who were present may be grateful to have their memories jogged!

Academic and professional societies have long made sure this happens. Soon after the Royal Society was founded in 1660 as a London club for the advancement of science, it started to publish accounts of its meetings in the *Philosophical Transactions*. Today, millions of scholarly lectures are published each year. The system relies on lecturers' willingness to produce a written paper at their own expense, because of the fame and academic credibility it will give them.

In many other contexts, especially in business, it doesn't work like that. For example, I help to organise one-day conferences for the Electronic Publishing Specialist Group (EPSG) of the British Computer Society. We have a small budget and can't afford to pay fees to speakers. We're grateful that these busy people can spare us the time. We can hardly ask them for a written paper as well! If we want to produce a more thorough report of a meeting, we have to do that ourselves.

Because it is hard to take an active part in a meeting and at the same time make accurate notes, I long ago decided to make audio recordings of meetings and write them up afterwards. Last year, EPSG started to publish audio recordings of lectures directly on the Web. I'd like to share with you some of the techniques we have learned for using audio recording to make our meetings 'go further'.

The mechanical notebook

Is your primary reason for recording to help produce a written account afterwards? In that case your main concern is to capture the essence of the event with the least amount of difficulty, and make it as easy as possible to transcribe. Technical recording quality is not so important.

For small meetings and interviews, a pocket microcassette recorder or digital recorder might do the job. Some digital recorders can be linked to a PC to transfer the sound files. Many 'dictaphone' type digital recorders have limited capacity, but Belkin makes a microphone for the Apple iPod that transforms it into a handy digital audio recorder with many hours of storage capacity. (For longer meetings, anything that saves you from having to change recording media is a blessing.)

There are occasions when a video recording makes a better 'notebook' than audio (see left sidebar), but it is audio I'm concentrating on in this article. Still, it's worth remembering that a small camcorder can serve as a convenient audio recorder. I've recorded many evening meetings with a

Video notebook?

Would a amateur videotape of a meeting be a better aide-memoire for writing it up than plain audio? It depends on the subject matter. Last year I videotaped a two-day conference on the design of transport information systems – a very visual subject. Most of the speakers showed photos, videos and diagrams to make their points.

After the conference, the organisers distributed VHS copies of my recordings to the volunteers who had offered to write up the talks for publication. Thanks to the video record, they will be able to weave into their written accounts a faithful description of the visuals as they were shown to the audience.

small Hi-8 camcorder, with lens cap on and powered from the mains: just pop in a ninety-minute cassette, set the machine on Long Play, and you can record three hours or so without having to change the tape, which is a real convenience.

The MiniDisc advantage

In 1992, when I increasingly needed to record and transcribe meetings for the Information Design Association newsletter, I decided to try MiniDisc – then a newly-launched digital-quality audio disk format. MiniDisc is essentially a random-access medium, and the laser head that reads the audio signals never makes contact with the surface of the spinning disk. I reckoned this would be advantageous for transcribing audio recordings, a process which involves a lot of pausing and rewinding that might wear out a tape mechanism.

Also, while a MiniDisc is being recorded, you can press a button that puts an index mark to indicate the start of a new 'track'. Indeed, index marks can be added retrospectively. You can use this capability to mark a change of speaker or topic within an interview or round-table discussion. This is very useful when you are reviewing a recording afterwards.

Since 1992, when it was a rather exotic medium, MiniDisc has become a popular consumer audio format: the recorders are less expensive and so are the disks. A palm-sized MiniDisc recorder, equipped for example with Sony's ECM-MS907 microphone, is a handy recording tool for meetings and interviews. In 2002 the Museum of Childhood in East London gave volunteers this kind of kit to conduct oral history interviews with elderly

As a digital recording medium on a random-access disc, the MiniDisc format has a lot to offer interviewers and people recording meetings

Ready to roll

My current recording kit is based around the Marantz PMD-650, a MiniDisc recorder designed for journalistic use.

A – The recorder itself is quite large, but this means that the buttons and controls are easy to use. The recording levels for the left and right channels can be set independently with the concentric knobs.

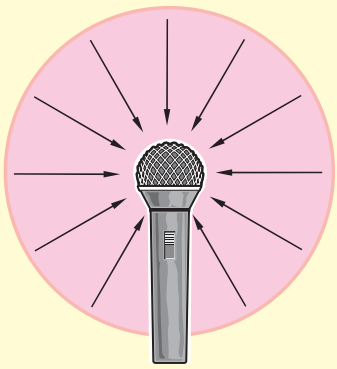
B – Microphone connections are of the locking XLR type (explained in the article) and provide 48 volts of power to the microphones.

C – The microphone I mainly rely on is a Røde NT1 directional diaphragm condenser microphone: a bit delicate, but with good sensitivity and excellent reproduction. It draws power from the recorder.

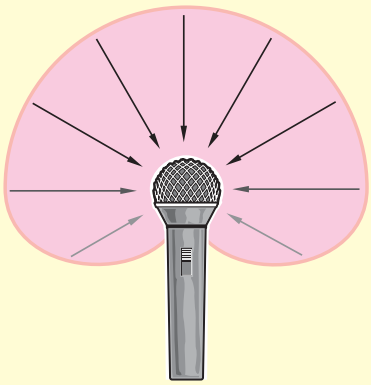
D – Whatever kind of microphone stand I use (this one is for the desktop), I always place the mic in the shockmount cradle to protect it against noises transmitted through the floor and furniture.

E – I also use a highly directional Sennheiser ME66 shotgun microphone to catch questions from the audience, and as a back-up if the speaker walks away from my main mic. It can be powered either from the recorder or an internal battery, and also serves as an excellent camcorder microphone.

F – The pistol-grip mount was designed for use with a hairy wind-jacket for outdoors interviewing, and incorporates a shockmount for shotgun microphones. For meetings, I attach a folding mini-tripod and it can sit safely on the floor until I need to pick it up and point it in the direction where questions are coming from!

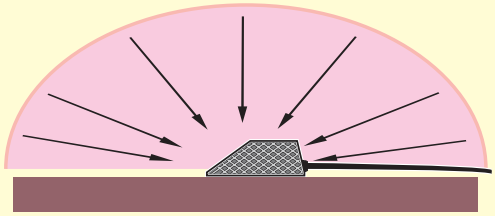


Omnidirectional mic



Cardioid mic

Boundary effect mic – uses an adjacent surface to focus the pressure from sound waves.



Some MiniDisc disadvantages

1 Unless you use one of the long-play modes offered by later models of MiniDisc recorder – and this itself introduces compatibility problems – you will be limited to 80 minutes per disk.

2 Changing disks between recordings is not fast. When you press the Stop button, the machine first updates the 'TOC' file (disk directory); then you can change disks. There's a pause while the machine searches to see if the new disk has a TOC; only then are you ready to record. You can lose from twenty to thirty seconds!

3 Digital audio fanatics say that MiniDisc's ATRAC audio compression compromises quality, especially for very high and very low frequencies (if you can hear that, you've got better ears than I have – or maybe you're a dog…)

4 More seriously: very occasionally, MiniDisc recordings fail completely and mysteriously because the machine doesn't write the TOC correctly, or it becomes corrupted afterwards. Instant dismay!

Alternative digital recording media

DAT: For the ultimate in portable recording quality, look at Digital Audio Tape recorders, which are the standard in the film industry. (The Tascam DA-P1 is a typical portable DAT machine.)

Recordable CD: Most CD-recorders are not exactly portable, but there are exceptions. I know of some meeting venues that have built a CD recorder into the sound systems of their meeting rooms.

Record to hard disk: You could record straight onto the hard disk of a computer – a laptop, for example. Essentially this is what many music studios do these days. You'll need audio recording software, and for good results, a better way of attaching microphones than the built-in computer microphone port provides. The Tascam US-122 interface box, for example, takes input from two professional microphones, with a pre-amplifier and gain control for each.

local people about their memories of childhood in the pre-war years. The recording quality was a bit rough in places, but this was mostly because of background noise, poor microphone placement and similar factors.

As MiniDisc recorders have become more consumer-oriented (and smaller) the user interface has become too fiddly for comfortable use in transcription, and some useful features such as cue-and-review *within* a track have been dropped. Perhaps it's significant that the Museum's interviewers shied away from the task of doing the transcriptions – they paid me to do some of them instead. By that time, I'd graduated to a professional MiniDisc recorder with a very comfortable interface (see photo on preceding page). I had much cause to bless the magic one-touch Instant Replay which causes the playing head to jump 8 seconds back…

You wouldn't use a beerglass as your camera lens…

Let's assume that your audio recording aspirations are more ambitious than just capturing 'good enough quality' as an *aide-memoire* for a written report of a meeting. Maybe you want to run off Audio CDs or cassettes of a lecture, incorporate the recording into a multimedia production, or distribute it on the Web as streaming audio or a downloadable MP3 file…

Quality recording starts with the microphone, which is to an audio recorder what a lens is to a camera. Would you use a dirty beerglass as a camera lens? No – and not only would you want a decent lens, you'd want the right lens for the job. That's how it is for microphones, too.

Directional or omnidirectional microphones?

Where people speaking in a meeting are sat all around a table, an omni-directional microphone may be the simplest choice. One design of low-profile omnidirectional microphone called a '**boundary effect** mic exploits the fact that sound-pressure increases near a hard flat surface like that of a table, and is very useful in these situations.

Most of the time, you'll prefer a directional microphone, the recording capsule of which is designed to reject sound coming from behind. These are usually called '**cardioid**' microphones because the pick-up pattern, represented by lines to indicate the strength of signal received, looks in cross section like a heart. Microphones with a more emphatic orientation towards the front are called '**hypercardioid**'.

For extreme directionality, film-makers and news reporters prefer a **shotgun** microphone. Often the thin tubular mic is suspended in a shock-proof cage, wrapped in a furry windshield similar to the one I'm carrying on page XX, and carried on a pole, looking like a hairy guinea-pig speared on a stick.

What kind of pick-up system?

A **dynamic** microphone is so called because a magnet moving inside a coil directly produces the electrical signal that represents the sound. These mics don't need external power, are quite robust and tend to be reasonably priced. They don't 'overload' (distort sound) much at high volumes, but they are prone to generating their own background hum.

Inside a studio you're more likely to find a **diaphragm condenser** mic. The diaphragm which captures the sound waves modifies the electrical resistance of the mic, which must be powered externally (either by a battery or with 'phantom power' through the mic cable). Delicate and expensive, they are prized for their excellent signal-to-noise ratio and fidelity of response across the whole range of audible frequencies.

Other specialist microphones use some variety of condenser pick-up. A **Lavalier** microphone is so small that it can be clipped inconspicuously to clothing, and is sometimes used as the pickup of a radio microphone.

Cables, plugs and power issues

A consumer microphonesusually has a thin, unshielded cable ending in a jack plug. It will also be short, because a longer unshielded cable could pick up radio signals (you don't want to find yourself recording the local taxi company!); and the small jack plugs are often a source of crackling.

Professional microphones usually connect via a locking three-pin XLR socket to a shielded co-axial cable. Shielded cable runs can be quite long – I place my microphone by the speaker's podium, with 15 metres of cable between there and where I'm sitting in the hall.

To exploit this system, your recording apparatus will also have to have XLR connectors like the Marantz deck on page XX. Most professional recorders will also send 48 volts of 'phantom power' through the cable to drive condenser-style microphones.

XLR adaptors are available for consumer MiniDisc recorders, too. The **Pass MD-Report Mark 4** 'wraps around' a range of Sony and Sharp MiniDisc recorders and gives them dual XLR sockets with phantom power and much easier-to-handle controls. Similarly, the Tascam US-122 interface for direct-to-computer recording provides a two-channel pre-amplifier with XLR sockets and phantom power.

Getting your microphones in position and in trim

The typical meeting which I record is one in which there is a speaker on stage and an audience who will be given the opportunity to ask questions or make comments afterwards. Experience has taught me to be realistic in how I set up my microphones and equipment.

My first recommendation is – never rely on Automatic Gain Control. This common feature of recording devices monitors the input from your microphones and set amplification automatically to suit. As soon as there is a pause in discussion, the AGC loses its nerve and boosts the amplification. Background noises and machine hisses get louder and louder, until speaking starts again and AGC retreats to a more reasonable level. No! Take manual control – monitor volume with headphones, and if your recorder has a visual display of gain levels, use that. If you use two mics, you should be able to control the gain for each independently of the other.

Ideally, you would place a directional microphone some 25 cm from the speaker's mouth, and slightly off-axis. (This 'off-axis' trick is to avoid the shock-waves from the plosive consonants such as 'p' and 'b' and 't' from

Dynamic microphone

Relatively inexpensive and robust, these are popular for recording speech and for use with public address systems. (Model: Sennheiser Evolution e85)

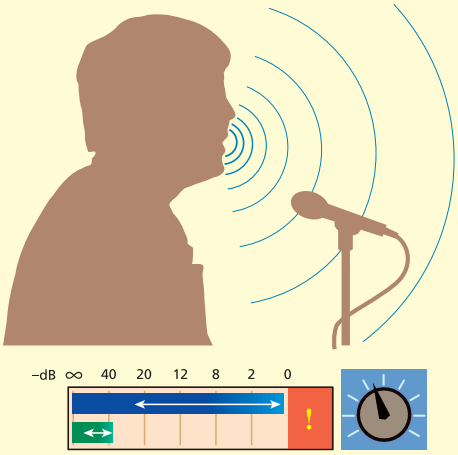
Using a pro mic with a camcorder

When I videotape a meeting, I am every bit as concerned to use the best possible microphones – arguably, sound is more important than vision in video recordings of meetings! I use a Sennheiser ME66 shotgun mic that requires an XLR connector. This plugs into a BeechTek adapter under my Sony VX-1000 camcorder: it has two XLR connectors, independent volume control for each source, and transfers the signal to my camcorder's 3.5mm external microphone jack plug.

A simple Beyer shockmount holds the shotgun microphone between elastic cords and prevents camera motor noise from being transmitted to the microphone.

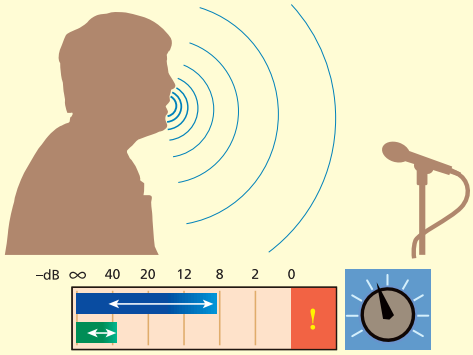
Introducing the Magic Audio Meter

To explain the compromises we must make in setting up microphones, I have invented this fictitious audio recording device, which is magically able to discriminate between the speaker's voice (blue bar) and background noise (green bar). Ideally we want to place the microphone and trim the pre-amplification using the dial so that the green bar is a short as possible and the blue bar peaks just under the 'danger zone' where distortion occurs.



The ideal set-up (for the ideal speaker)

It's wonderful if the speaker can be counted on to maintain a constant distance of 25cm from the microphone. The close, strong soundwave energy from the speaker's voice 'drowns out' the background noise, and the gain control knob is adjusted downwards so the signal does not overwhelm the recording apparatus.



The risks of close microphone placement

Sound energy obeys the inverse square law: if the speaker doubles her distance from the mic to 50cm, the energy received by the mic falls to one quarter; if she approaches to 12.5 cm from the mic, the energy increases fourfold.

In the diagram above, the speaker has strayed away from the microphone and the recording level has been much reduced.

Very few speakers without performing experience are comfortable with a microphone and can be relied upon to maintain a constant distance from it.

hitting the microphone with a bang. A foam shield over the microphone can also help, but it muffles the sound a little.)

The reason why the placement described above is (in theory) 'ideal' is that if you can set the gain control fairly low on your recorder, and rely on a good strong signal coming from the speaker, you won't pick up much background noise. But this works only with experienced microphone users who can maintain a proper distance from the microphone as if it were second nature. Less experienced speakers are likely to get too close and bellow into the microphone, or wander off into the middle distance and fade away (see diagrams, left).

Experience has taught me to use a sensitive directional microphone about a metre away from the speaker, and be more generous with the gain setting, as shown in the diagram on the opposite page. That way it doesn't cause so much variation in the volume if the speaker leans 20cm closer to the mic or wanders another metre or so further away. I do pick up more background noise with this set-up – but it's a reasonable trade. This trick is easier to do with a good-quality mic the circuits of which don't generate much electronic 'hum' inernally.

I often rig a shotgun mic as a back-up on the other channel, and most of the time I keep its gain control turned down. If the speaker really wanders too far from the primary mic I turn up the gain on the shotgun mic and follow the action. The shotgun mic also comes into its own when it's the audience's turn to ask questions – without it, I'd be able to capture only half of the dialogue.

I always try to cradle a microphone in a shock mount. This isolates it from vibrations that come through the floor or stage and up through the microphone stand. If you must place a mic on a table and you don't have a shockmount, do at least place a felt mat or foam rubber underneath. (In a pinch, a thick mouse-mat will do.)

Taking audio into the computer

OK, let's assume you managed to capture your speakers' words of wisdom on tape or disk. Now, by taking the recordinginto the digital environment of your computer you can transform it for use in multimedia or Internet distribution.

Your computer may already have a sound input socket, designed for line-level input, to which you can connect the Line Out ports of your audio recorder. You need audio recording software on your computer to convert the stream of audio input into a digital audio computer file. I use BIAS Peak LE on my Macintosh. On Windows, Sound Forge and Cool Edit have long been popular audio recording and editing applications.

Many MiniDisc and other digital audio recorders have a digital audio port, which is a better way to transfer your recordings than via analogue connections. My Edirol UA-1D interface plugs into the USB port to do this, using either an electrical S/PDIF cable a TOSlink optical cable.

Clean and tight

If your audio is intended for wider distribution, your next job is to edit it. Without a moving picture to give the game away, you can remove all sorts of snippets and chunks from an audio recording, and no-one will be the wiser! (Radio editors do this all the time.) Sometimes it is politic to remove from the public record a contentious statement…but usually the intent of the editing is simply to tighten up the recording, reducing the play time and file size.

It is amazing how much can be removed from the average talk without loss, and with some improvement. 'Ums' and 'ahs' and false starts can be clipped out, hissing intakes of breath suppressed, and each pause can have a fraction of a second sliced from it. Often a thirty-minute talk can lose five minutes of this stuff, without removing any real content.

Web distribution? Compress 'til it hurts

After the Electronic Publishing Specialist Group conference in September 2003 about copyright and the Internet – 'Fair Play and Fair Pay' – we had a fine collection of recorded talks which worked well as a purely audio experience. Why not publish these directly to the Web?

We don't have access to a streaming media server, but we reasoned that we could and should place the talks as downloadable MP3 files on our Web site (having gained permission from our speakers, of course). Unlike media giants like the BBC, we have no reason to prevent audiences from saving these files to disk – one reason why the media companies like streaming media. Indeed, to really study an audio-recorded lecture, you would want to be able to pause and replay it, and MP3 is great for that.

A typical talk from that event, as a 16-bit stereo file with a sampling frequency of 44.1 kHz, was about 480 megabytes of data: not something you'd want to download. Reducing it to mono and halving the sampling frequency to 22.05 kHz reduced the filesize to a quarter, with only a small loss of quality. Finally we experimented with increasingly severe levels of MP3 compression. At the stronger levels the recording definitely becomes more 'swooshy' and hollow-sounding, but one could still make out every word. Setting an upper average data limit of about 6 kilobits per second, and using iTunes, I produced a series of files with an average size of 3 Mb.

Other multimedia possibilities

Many of the MiniDisc recordings I have made have been incorporated in the soundtrack of multimedia productions or videos. I am constantly exploring new ideas for how to use audio as an information tool.

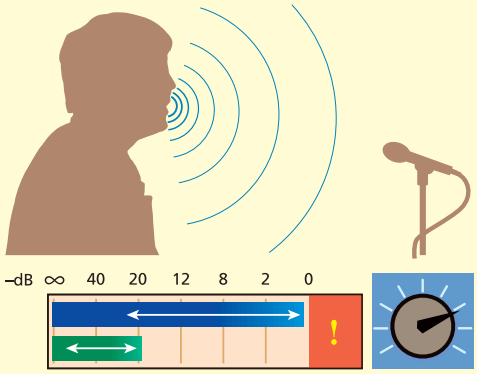
One could add value to audio recordings of talks by synchronising them with still images taken from the speaker's slides. For example, the engineers at Fujitsu UK have run a series of lunchtime technical briefing lectures. They share these with colleagues across the company by placing slide-and-audio presentations on their Intranet, prepared in the Windows Media format.

At present I am investigating the possibility of doing similar things using Flash and QuickTime, trying to get audio and the informative still image to work effectively together while keeping file sizes under the overwhelming bandwidth requirements of video. I hope I'll be able to report back to you later on how we have fared with our experiments.

Recordings from EPSG conference: 'Fair Play and Fair Pay' – www.epsg.org.uk/meetings/copyright2003/

Most recorded lectures can be improved by editing out the 'ums' and 'ahs' and pauses – typically you can cut a 30 minute talk to 25 minutes without losing any content.

'Safe' microphone placement and trim



I have found that to get consistent recordings, it's wise to place a sensitive directional microphone about a metre away from the speaker. This has the added advantage that they aren't tempted to hit my expensive microphone to see if it's working!

That way, slight movement by the speaker doesn't produce such variation in the strength of the signal.

Note that I have had to adjust the gain knob to increase the effective volume, and this has the effect of increasing the interference from background room noise, and the electronic noise which the recording circuits and mic themselves generate; but I judge this the lesser of two evils.

(The background noise won't be too bad if the microphone and pre-amp circuits are of good quality, and the microphone is a directional type and protected against shocks. Much also depends on the accoustics of the room.)