Institute of Acoustics

THE DESIGN OF A RADIO DRAMA STUDIO

A. R. Woolf

Radio Operations and Engineering, British Broadcasting Corporation

BACKGROUND

This paper describes the conversion of an existing hall into a drama recording centre for the BBC's South and West Region.

Christchurch Hall, Clifton, Bristol, was originally built in the last century as a warehouse. In 1893, it was converted to religious assembly rooms, and a boys' club. In 1961, the BBC acquired it for an orchestral music studio, and about ten years later, it was modified, at minimal cost, as a drama and light entertainment studio. As drama recording techniques developed, the studio was increasingly found inadequate, and in particular, the control room was far too small. In 1986, it was decided to convert the studio into a modern drama recording facility, which would also cater for the secondary use of light music recording.

It had been some time since the BBC had designed a drama studio, and the opportunity was taken to reconsider the requirements. The operational staff and producers who were to use the area made a considerable contribution to the design, and the result is different in some ways from our other radio drama studios.

GENERAL REQUIREMENTS OF A RADIO DRAMA STUDIO

There are stringent backgound noise and sound insulation requirements, covered elsewhere [1,2], but this paper concentrates on the internal acoustic requirements and other general needs.

In radio plays, the illusion of the performers being in a variety of different places (a living room, a courtroom, a telephone box, an open moor, to name a very few frequently required) must be provided aurally. Sound effects (sea wash, birdsong, traffic) are used where possible to establish a scene, but it helps the illusion if the reverberation simulates the required space reasonably convincingly, or at least does not blatantly conflict with it.

Why can we not simply use a very dead room, and process the outputs of the microphones with artificial reverberation devices? In fact, some organisations work this way, but we have found that it has limitations. One problem is getting realistic perspectives when people move towards and away from the microphones - in a real room the proportion of direct to reverberant sound changes. The psychology of the performers is also important - it is difficult to use the right tone of voice for a courtroom, when in a very dead acoustic. Both these problems can be overcome with the right equipment, but it can take a lot of time and effort to set up. Of course, a studio can provide only a limited number of basic acoustics, that are then modified with electronic reverberation devices.

As well as the right acoustics, there must be a variety of floor surfaces, stairs, doors, and other practical effects.

Finally, the production technique of building up a scene from a mix of sounds demands a large control room, to house the many tape players, grams, and compact disc players, often looked after by an operator with a separate sub-mixer.

Earlier BBC designs

For some years, BBC drama studio design followed a fairly standard pattern. Typically, a large rectangular room is divided into two or three parts by double sets of heavy curtains (fig.1)[3]. The acoustic treatment is varied to give a gradation from live to relatively dead. Both canvas and velour curtains are used for their different absorption, and by opening and closing them, various acoustics, and effective sizes of area are possible.

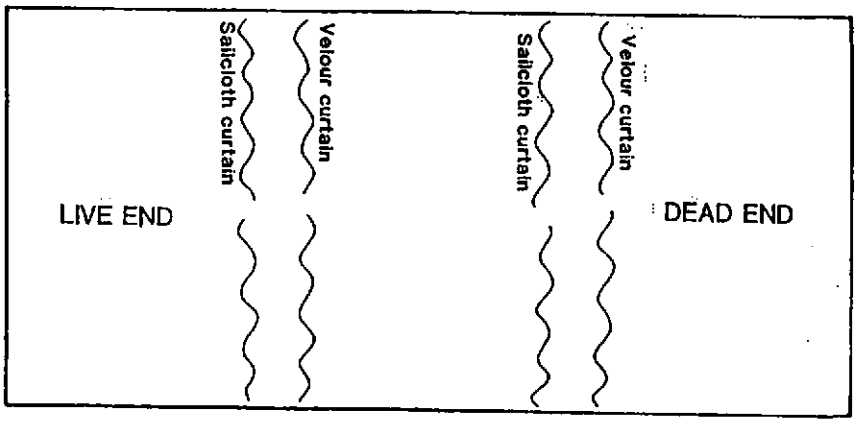
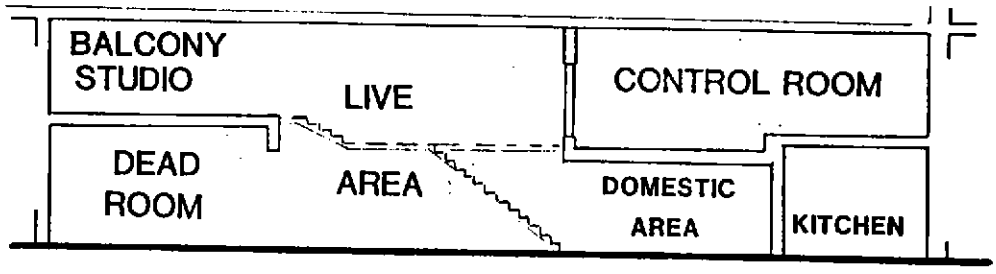


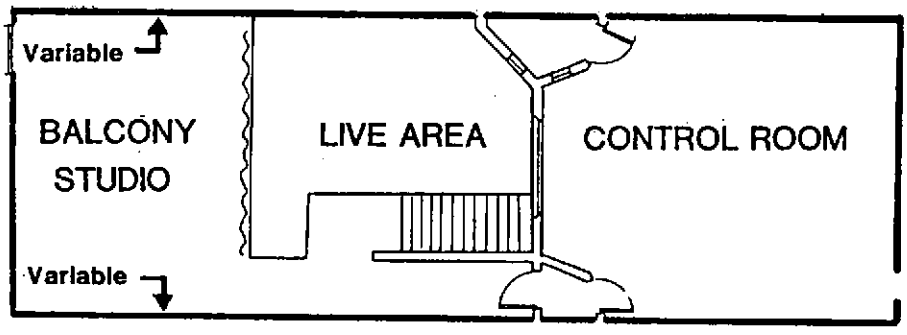
Figure 1. Generalised BBC Radio Drama Studio Design

Larger studios also have a "dead room". This is treated on walls and ceiling with wideband absorbers. The absence of obvious reflections gives a sound which is conventionally acceptable as "outdoors", although a direct comparison shows that it is not really similar to any outdoor environment. The illusion is helped by bass cut on the recording, and by playing appropriate outdoor background sound effects. Electronically adding discrete echoes such as come from trees, buildings, and hills, can also help.

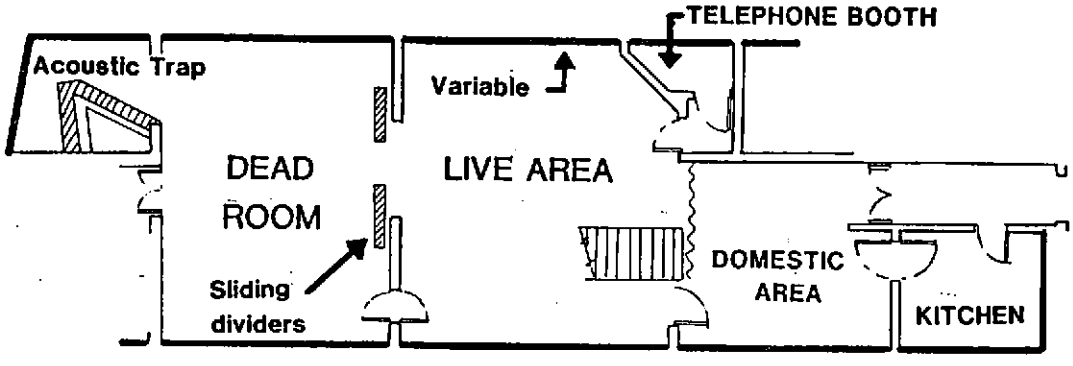
With this repertoire of spaces, together with reflecting and absorbing acoustic screens, a reasonable variety of dramatic requirements can be met. However, in recent years, studio users have asked for a more convincing simulation of domestic rooms, e.g., bathrooms and kitchens, and for rooms which have a more definite acoustic character.



Section



Plan: Upper Level



Plan: Lower Level

5m (approx.)

Figure 2: Christchurch Hall Bristol: Studio and Control Room Areas

CHRISTCHURCH HALL

The Building

Originally there were four storeys, but before the BBC acquired it, parts of intermediate floors had been removed to make two halls, the lower of which forms the studio. There are extensive cellars, some of which can be used to simulate the acoustics of vaults and prison cells.

Basic Plan

It is difficult to simulate the sound of a large room in a small one, so one space of reasonably large volume was required. (This was also needed for the secondary use for music recording.) We decided that, rather than have a single space divided by curtains, we would make a slightly smaller but undivided main area, with some simple variable acoustic treatment for flexibility of use. This would release space for other ancillary areas, which could be given more distinctive acoustics, described below. A section and plans of the upper and lower levels are shown in fig. 2. Space was made for the large control room by placing it on the upper level, over part of the studio, kitchen, and "green room" (performers' waiting area).

The various areas are described separately below, but the relationship between them is also important. This was carefully thought out to provide, so far as possible, useful transitions between different acoustics.

The Live Area

The main studio is known, by analogy with earlier designs, as the live area. BBC designed modular sound absorbers [4,5,6] are used for the main acoustic treatment. The variable treatment, which covers a large part of one wall, was designed using a version of the standard BBC acoustic screen (fig. 4). This is based on two different densities of mineral wool; a high density layer over a low density layer, on a hard backing. The upper layer acts to some degree as a membrane absorber, and is effective to lower frequencies than a single density of mineral wool of the same overall thickness. The variable treatment is made using hinged panels similar to the screens, which can swing to cover wideband modular absorbers. In the open position the absorbing faces are exposed, while when closed only hard surfaces are exposed.

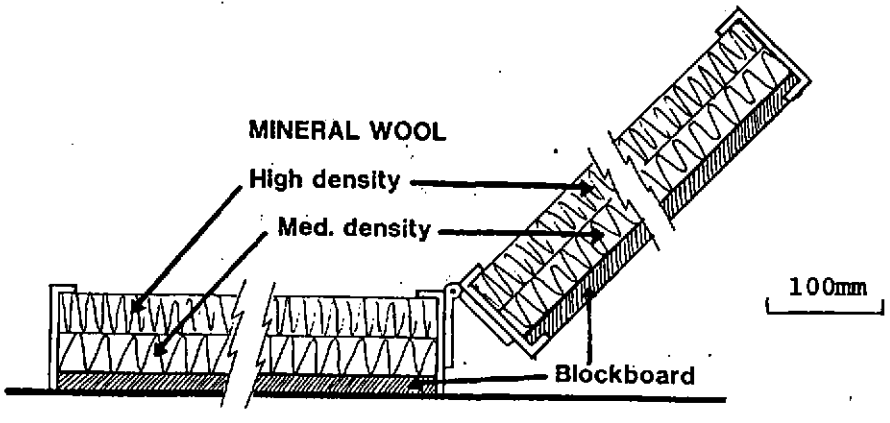


Figure 3. Variable Acoustic Treatment

The reverberation time is variable, using both the hinged panels and the carpet, between about 0.4 and 0.25 seconds, so the area is not really very live; however in the more live condition it is sufficient to provide some feedback to the performers, and more reverberant rooms are simulated using artificial reverberation. Like most simple schemes of variable acoustic treatment this gives little change at low frequencies, and although a change is measurable at 125Hz the lowest frequency at which it is effectively variable is about 300Hz. The change in local acoustic near the variable wall is of course much greater than the average figure shows.

The Dead Room

A space at one end of the studio was set aside to form a dead room. There were a number of conflicting requirements for this important area. It had to be dead down to a reasonably low frequency, but also large enough for crowd scenes, so the possible depth for acoustic treatment was limited. It had to be usable as an extension of the main studio, so a large opening between the two was wanted for good communication; but when used as a separate dead room, moderately good sound isolation was required. This is to avoid "spill" of sound on to microphones that may be simultaneously in use in the live area, and also to avoid sound from the dead room setting off reverberation in the live area which can return to the dead room itself and affect the quality.

A self imposed problem was the decision to use the space above the dead room as part of the studio, which enabled us to provide another identifiably different acoustic. The Balcony Studio, as it is known, has proved popular with producers, but it limited the height of the dead room below, to 3m from floor to ceiling slab.

The ideal treatment for a drama dead room would possibly be absorbing wedges, as used in free field "anechoic" rooms. However, to be effective down to a sufficiently low frequency, these would need to be about 750mm long, and would take up an unacceptable amount of space. BBC designed wideband modular absorbers, which incorporate membrane absorption, are effective to below 100Hz in a total depth of 200mm, and so it was decided to treat the entire room, including the ceiling, with BBC type A8 wideband absorbers [5].

The opening to the live area was made 2.5m wide, allowing good communication between the two areas. However this can be completely closed off by a pair of sliding "walls" (fig.2). These are constructed using a commercial shelving storage system, which runs on a steel track. These sliding dividers are completely covered with modular absorbers, so that when shut, almost all wall areas of the dead room have wideband absorption.

Glazed sliding doors are also fitted, for use when the dead room is used as an isolation booth for music recording.

The Acoustic Trap

This is to enable an individual performer to enter, or exit from an "outdoor" scene by moving in relation to the microphone. It is impossible to move far enough away in a normal room to make an effective exit, so a small annexe to the dead room was constructed, enabling a performer to exit around a heavily

acoustically treated corner. Obviously as the sound source disappears around the corner, high frequencies are attenuated more than low ones, but the effect is still useful.

The Kitchen

This is a dual-purpose area: it provides both refreshments for the artistes, and a kitchen acoustic. Acoustically, it is a normal kitchen apart from the specification of an absorbing tile ceiling and lined curtains, which provide almost the only absorption. It has a normal domestic door to the adjoining studio, for dramatic use as an "effects" door, but this can be covered by an acoustic door when sound isolation is needed.

The Domestic Area

This low-ceilinged area, beneath the control room, provides an acoustic typical of many found in homes. It has a hard ceiling, and some mid and high frequency absorption, but little at low frequencies.

The Balcony Studio

This area can be used in a number of ways. The two end walls have variable acoustic treatment, using a combination of fixed and hinged acoustic screens, similar to that described for the live area. The long wall has wideband treatment. The ceiling has acoustic tiles, and a heavy curtain can separate the balcony studio from the live area. The result is that when the end walls are made reflecting, a very obvious flutter echo can be set up between them, controllable by slightly angling the hinged elements if desired. This can give some distinctive acoustics, including unnatural sounding ones which are sometimes needed. When the end walls are made absorbing, it is more like a very heavily furnished living room or bedroom. With the curtain open it can be used in conjunction with the live area to give distant perspectives. This flexibility has made it one of the most used areas of the studio.

The Telephone Booth

Telephone conversations are common in radio plays. The "far" actor's microphone is electronically treated to simulate telephone quality, and to maintain the illusion he must be acoustically isolated from the normal quality "near" microphone. This small booth provides the isolation - the size of the room is not noticed on the distorted speech. A second use is to simulate a telephone box, i.e., a very small space with hard walls. The acoustic treatment is therefore variable, with swinging panels to give either hard or soft surfaces on all sides.

Practical Effects

The sound of a door is often needed. Freestanding doors in frames are commonly used, but a door fitted in a wall sounds more convincing, so a number of doors are fitted in strategic places (it is not necessary to be able to walk through them). Both domestic area and kitchen also have sash windows, but so that sound isolation is not compromised, they open on to blank walls.

The staircase is a dual-purpose: it both gives access to the upper levels, and is an effects stair. Each tread is divided into three sections of carpet covered wood, bare wood and stone.

There is a variety of floor surfaces. The gravel tray is naturally in the "outside" acoustic of the dead room, as are stone flags (coverable by carpet). Wood, carpet, and tiled floors are provided in other areas.

THE STUDIO IN USE

It would be nice to be able to say that the studio went into use with no problems whatever, but this was not quite the case; however, some problems that arose are illuminating. The only area that presented real difficulty was the dead room. An audible coloration appeared to be associated with the wire mesh fronts on the absorbers, that were not fully damped by the mineral wool with which they should have been firmly in contact. A large number of wire mesh fronts were removed, with a noticeable improvement. The steel guide track of the sliding dividers also gave an audible ring, and had to be damped. The plastic diffusers on the fluorescent lights resonated, and had to be removed. These resonances would have been completely inaudible in a normal room, or even in a talks studio with reverberation time of about 0.2 second, but in the dead room, the absence of other masking reverberation made them obvious. The hollow steel supports of the staircase also rang; it was found that the sand with which they should have been filled had inadvertantly been omitted, and this had to be laboriously poured in using a funnel and a length of tubing.

CONCLUSION

Generally, the variety of acoustics available has been appreciated by the users of the studio. Although it is difficult to make comparisons, it seems that the new facility gives a greater variety of useful acoustics than previous designs, at least for the drama recording techniques currently used.

REFERENCES

1. Meares, D.J., & Lansdowne, K.F.L. 1980. Revised background noise criteria for broadcasting studios. BBC Research Department Report No. 1980/8.

2. Walker, R. 1981. Revision of the sound insulation requirements in broadcasting studio centres. BBC Research Department Report No. 1981/1.

3. Gilford, C.L.S. 1972. Acoustics for Radio and Television Studios (IEE monograph series II). Peter Peregrinus Ltd., London.

4. Burd, P.M., Gilford, C.L.S., & Spring, N.F. 1966. Data for the acoustic design of studios. BBC Engineering Division Monograph No. 64.

5. Walker, R. 1982. The design of a new wideband modular sound absorber. BBC Research Department Report no. 1982/8.

6. 1980 BBC Guide to Acoustic Practice. British Broadcasting Corporation.