Proceedings of the Institute of Acoustics

# THE VIEWS OF RECORDING STUDIO CONTROL ROOM USERS

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## 0. ABSTRACT

A study was carried out in order to identify common language, views and preferences of professionals using audio control rooms. This was done as part of current research on the design of Control Rooms for critical listening. The survey took the form of semi-structured interviews that were carried out in London and the North West of England. Preferences and views regarding reverberance, stereo image, envelopment, positioning of monitors and other parameters are discussed. Common problems affecting the perception of sound in control rooms and their effects are identified. A qualitative explanation of the results is given along with some relevant quotations from the interviews.
Preferences and problems in control rooms are discussed and an example is given of how the results could be used to contribute to further work on control room design.

## 1. INTRODUCTION

The design of control rooms is a subject that has been widely discussed [1,2,3]. Since the first monitoring rooms were designed and built there has been great divergence of opinions and design philosophies. Several publications have presented tests on the subjective perception of sound in small rooms. However, as the design of control rooms for music monitoring takes further steps to accommodate new technologies and even new formats it seems of great importance to identify and understand how the professionals who use them describe their experience and views. Furthermore, identification of most common problems found in contemporary studios could give control room designers an indication of where to best aim their efforts in order to further improve control room design.
The present paper concentrates on the dissemination of the results of a survey carried out on control room users and their opinions on how a control room should "sound".

### Method

The collection of information took the form of a semi-structured interview, where 18 professionals were asked their opinions on the sound of control rooms they currently use or have used in the past. 15 of these professionals worked mostly with recording and mastering at professional recording studios, 2 worked in live recording of classical performances and 1 in broadcast for a major British broadcast company. Questions were aimed at acoustic factors that relate to the perceived sound in the control room. These are factors that may affect, hamper or facilitate the task of accurately monitoring the signal. The range of musical styles was varied and included classical, pop, rock and dance. Interviews were recorded and took an average of 30 minutes.
Results are presented in the form of quotes extracted from the interviews and the general trend identified for each parameter asked is indicated.

# 2. RESULTS

## 2.1 Reverberance

Most respondents prefer rooms that have less Reverberance. This induces more confidence when monitoring. It is referred that Reverberance should be set to a minimum before it makes it uncomfortable and unnatural to work.
*"I'd prefer a dry room"*
*"You don't want a room that is counteracting or adding to what you're trying to do..."*
*"...you want the room not to introduce any extra reverb so that you can monitor what's going on..."*
*"I think the room should be neutral in the sense that you shouldn't be aware of it"*

However, almost everyone finds that working in a room that is almost anechoic may become stressful, uncomfortable and the sound in it is unnatural.
*"I find dead rooms very tiring, I think it seems the sound changes quite a lot when you move around"*
*"I think a completely dead room is very claustrophobic"*
*"...obviously if you were put in an anechoic room, no reflections from anywhere, I'm sure that you would probably say, you know, hang on you know, fifteen minutes later you would be saying I want to go back to my living room."*

Some ambience will help to give a better understanding on how the final work will sound at the end users' system. Furthermore, it sounds more natural to our auditory sense to have some ambience when in an enclosed environment.
*"you need a room to be slightly reverberant because the end listener, the person in the living room at home has a reverberant room"*
*"I wish control rooms sounded more like living rooms, like the domestic room where people listen to music and where music seems to sound best, in your own home."*
*"...it's not very helpful to be in a completely dead room like an anechoic chamber, it's not a very helpful environment, it's not very helpful psychologically in that even though in a basic sense you're working and listening to loudspeakers, you are conducting conversations with people and you're kind of living out your normal life in the room so you want the atmosphere of that room acoustically to be conducive to wellbeing I suppose (...) you need to have something that gives you, you need some reflections so that it feels natural but that's about as much as possible, as much as should be allowed. "*

## 2.2 Stereo Image

Optimum stereo image is described as enabling different clear positioning areas within the speakers. Instruments will be easily pinpointed in a whole image. Phantom sources have a defined, narrow (when applicable) and imaginable position.
*"...you need to feel you can hear clearly every single definable point between the two speakers..."*
*"Yes, I think so, defined imagery yes, so that if you've got a series of images in a stereo field then they're clearly defined, discernable."*
*"...having a full image in front of me, kind of pinpoint exactly where things are, I find that very important..."*
*"If it was perfect you'd hear a piece of music in front of you being played by somebody and you'd imagine where they are."*

In a good stereo set-up, pan-pot movements are clearly reflected in the positioning of the sound images between the speakers. In poor systems, panoramic movements have to be extreme for the effect to be noticed.
*"you tend to find or what I find is that badly set up systems before things start moving off that central image you have to be panning hard, and then they are a lot further out yes."*

### Focus/Envelopment

Most respondents prefer sound focused on the speaker field. Reflections or sound arriving from other directions can be distracting and make user feel uncomfortable.
*"if it's a stereo operation then you certainly shouldn't be surrounded by the sound"*
*"I want the depth to start, the front of the depth to be where the speakers are and the rest of the track to go behind it almost."*

If the room is introducing too many reflections the user can find it difficult to predict how it will sound in other environments. He/She would not know if their perception is from the sound being monitored or the particular room-speaker interaction.
*"it would make me worry if I heard things coming from say the sides or the back, I'd wonder what it sounded like outside the room"*
*"...in a stereo situation if the sound appeared to be coming from somewhere else then that would be a problem in the room I think."*

Most respondents state that some controlled reflections or ambience will add to the naturalness of the sound.
*"I think so, however I'm sure that reflections are useful in the you know, (...)they're all necessary for the human experience."*
*"Yes, I suppose well it does depend on what sort of time difference we're talking about you know and how live..."*

Common feeling is that the focus should be on the speakers, allowing also a certain depth of the stereo field behind the speaker plane.
*"I do tend to prefer it, the most obvious sound coming from the speakers yes, it is nice to get a bit of environmental sound."*
*"Yes, it's not natural sound if you don't get anything from around the room. But I like the focus to be the speakers yes."*

## 2.3 Frequency Balance

Most respondents prefer a room which enables them to hear the full audio frequency range without any alterations. This means that the loudness level of reproduced signal should be even at all frequencies.
*"A room that doesn't colour the sound."*
*"basically as flat as possible, some studios, I know some people that have taken treble off but to me the more information you're presented with, the better it is."*
*"Studios aren't necessarily there to flatter music, the music should flatter itself."*
*"A neutral room."*

A great number of people in the panel mention that a good room enables an increase in loudness without added colouration.
*"It doesn't, as you turn the monitors up the room doesn't alter the sound."*

Most of the interviewees mention low frequency problems happening in rooms where they usually work. This takes the form of rooms that either enhance the Bass response or reduce it. Low frequency should be detailed and precise without the effect of room modes (resonances).
*"the main problem I think that we have with this room is the bass response of the room which changes drastically depending on where you sit."*
*"there's something in the walls that causes the bass to boom and reverberate and do strange things"*
Some people mention that the room and system should not introduce any colourations that may affect the correct perception of sound. This would confuse their understanding on how it would sound

elsewhere.
*"I think I'd like a room that's pretty flat and you just then make your records sound as good as you can but I wouldn't want to be deluded into something because then when I take it somewhere else it's not going to be..."*

## 2.5 Sound Area

All respondents have felt that the sound varies as they move to different positions in the room. Problems are described as vast differences in the frequency spectrum, blurry stereo image, a difference in transient sounds and an increased difficulty to hear different components of the signal properly.
All respondents mention that the most common problems are a rise in low frequency sound at the rear of the room, low frequency changes across the mixing desk and low frequency "Hot-Spots" in the room.
*"You must sit in the operating position in the room to do any serious work."*
*"There's always a change in the frequency response, the transient is different depending on where you are you know, obviously that's partly to do with frequency and phase cancellation etc..."*
*"Yes, the worst thing is in the bottom end"*

Because of the difference in the sound field between two positions in the room, two persons will get a different perception. In commercial facilities, this may become a problem as a customer may be getting a wrong idea of the sound because of his/her positioning.
*"It is reasonably important because it gives the people you're working with a wrong impression, because generally they're not sitting at the desk all day"*
*"it has to sound good everywhere in the room because band members aren't going to come up and sit you know and make sure they're sat in the right place"*
*"Again not so much a problem for the actual engineer who is sat at the desk but anybody else who needs to listen in the room is you know, is a problem because you have to swap places you know for the sweet spot."*

Some users also find it extremely difficult to translate their work to other environments because they are not sure if their perception is correct.
Sound is commonly described as not being homogeneous around the room.
*"I guess in general yes, the audio spectrum sort of shifts as you move around."*

Most users prefer a larger homogeneous sound area. *"I think the bigger the neutral space that can be created the better."*
*"...but I usually find most control rooms sound, if you stand at the back of the room there's a lot more bass but there's the reasons for that and that's just something I accept..."*

Middle and High frequencies are described as usually unaffected by this problem.

## 2.6 Monitors

Most respondents generally use near field speakers for monitoring mixes. The reason for this is that these speakers are thought to be more illustrative of end users' systems (generally Hi Fi). It is also more difficult to make something sound "good" on this type of speakers and they are described as being less tiring when used for long hours.
*"At least 80 percent on near fields."*
*"It's just because they're more like hi-fi speakers really"*
*"Virtually all the mixing and the long hours of programming and working are done on the near fields."*

Main Monitors are generally used for recording, when loud levels are required and also when there is a need to check for extended frequency response. Sound on Main Monitors is also more representative of clubs and bars. Most people feel uncomfortable using them because the sound through main monitors is

overly enhanced and makes everything sound good.
*"I find it difficult to make decisions about the balance of instruments on big speakers, it sounds too good"*

Although main monitors will almost invariably give a better detail of sound, near field monitors will show up problems arising from restricted frequency response and give a better view on how it will sound in domestic environments.
Main monitors are the choice when it comes to audition a product to record companies, due to their "bigger, stronger and more exciting" sound.

Four professionals of the interviewed panel always use main monitors, usually on stands, for classical music recording or for radio broadcast.

## 2.7 Learning the Room

Most respondents agree that they get used to how a certain room "sounds" after using it for a while. This learning process can take the form of listening to previously recorded material and hear how it sounds in a particular control room they will be using. Another common procedure is to take some work out into other environments and listen to how it translates. Professionals evaluate if the final work sounds as it was originally intended in the control room, when listened to elsewhere. If there are any major differences, the work is brought back into the control room and the mix is compensated. This procedure will continue until the final work is achieved to a satisfactory level without the need of later readjustments. Finding problems and slowly solving them is also part of this learning process.
*"I'm used to our mix room now and you can be fairly sure you know what you're getting out"*
*"It does take you a while to get used to"*
*"I mean the first thing you do is to play a reference tape, a tape of mixes or music that you're familiar with and you know what it's supposed to sound like or you know what you're familiar with and so immediately you hear something strange like too much treble or a resonance at 1 kHz or too much bass or a fuzziness in the stereo image or something like that"*
*"I guess the example is you go and you do, you mix something to what you think, or you balance something according to your current stored perception of what it should be, you then take it out and listen to it and realise that something's twisted and you have to adjust, you then go back, try again and you get gradually used to the way that sound should be..."*

Some professionals mention that if they were using a well-known mixing console or outboard equipment, they would expect a certain behaviour of the EQ section or gain. If this does not happen they will use this as a clue as to how the acoustics of the room and monitoring system are affecting their perception.
Ultimately, being used to the sound of a specific room is being able and making sure that work that is taken out will sound consistently similar in other environments.
*"that's the main thing is that your work may be different from what you did in another control room but it's still is OK so it's a question of confidence, it's a gradual acceptance of those characteristics."*

## 2.8 Consistency With Other Systems

Most interviewees will take mixes out into other rooms and systems (Hi-Fi, Car, etc) in order to check if it sounds as they intended in the control room. Invariably, these systems will have lower quality sound.
*"Is the best way to go about it and at the end of the day as long as it sounds similar in that control room and then probably the most important thing to do is after you've finished the section or the mix is take it home and listen to it at home, listen to as many different speakers as you can"*

Professionals check for consistency in frequency, balance of instruments, missing notes, masking of important sounds, loss of detail, perspective of stereo image and reverberance and mono compatibility.

*"Well I hear at home, I'm looking to hear that it's as I remember it sounding in the control room."*
*"I listen to, one is the kind of what I'd call the technical frequency bands which is just how much bass, how much treble but then the other more musical aspect is the question of the musical aspect of a mix for example, the balance of the instruments and the perspective of the instruments, reverberation is important as well"*
*"Looking for, yes, just balance, what is the, how is the atmosphere sound now, does it work any more, the little picture we've created, does it sound like I expect it to sound, is the vocal too loud, is the vocal too quiet. Vocal sounded fine in the control room why is it too quiet now?"*

Control rooms that have problems in the frequency response will result in problems in final mixes when heard on other systems.
*"And the subtleties involved and how a little bit in a room can turn into a lot or not enough"*
*"A frequency thing yes, not usually a balance thing, it's usually a frequency thing.*
*Quiet or missing bass notes, or if something sounds excessively bright in a new control room."*

A common comment is that low frequencies do not translate well and there will be either a loss or an increase of low frequency when replayed on other systems.
*"Usually it's slightly different and it's usually the bottom end"*
*"Mostly in the bottom end, I don't think there's any doubt that playing stuff on other systems particularly ones that you know well but are still domestic type systems gives you an idea of how your mix will translate into real rooms, into real situations and obviously is very valuable..."*
These problems may usually be readjusted by remixing or at a later mastering stage.

## 2.9 Optimum Control Room

The panel was asked for a description, in their own words, upon how an optimum control room should be. In terms of acoustic factors, the authors find more appropriate to include transcriptions of some of the comments made in order to convey the full meaning to the reader.

*"Clean, clear, detailed, strong, (...)"have enough separation, have enough, enough depth, (...)you've got to have a dynamic range, you need to hear everything, you want to hear as much detail as possible, all the information possible, as wide a frequency range as possible, flat unless you know the room, and at least two pairs of monitoring sources..."*

*"Yes, balanced across the frequencies sure, you don't want it to be getting excessively bottom endy when you turn the speakers up, (...)you don't want the high frequencies to be reflected."*

*"a neutral environment where you can make informed decisions about the recording you're making, (...)I don't want to be bothered with the control room, (...)I'm making all my decisions, my balance decisions on the sound which comes from those speakers. I should be able to forget about the monitoring environment.*
*I don't want an environment which is fatiguing in terms of being able to listen to any acoustic problems within the room, if they're constantly nagging at you then that is really going to get on your nerves.(...)anechoic environment is not normal you know, it's, so I guess that's one of the reasons why I wouldn't like it."*

*"a room with a flat response that doesn't mislead you, you want a large working area where there is very very little alteration in the sound you hear, (...) there's nothing worse than having one little zone where you can hear it for real then you move over and you do your alteration then you move back to see what it's done ..."*

*"I guess clarity, clarity is a big thing, I suspect a lot of reflections make a confusing space*
*I think you've got to have a real clear, neutral space so that you can really hear what the sound is that's in the speakers as opposed to the sound of the room"*

*"as long as I take a mix out of a control room that you know that I'm happy with then that's when the control room is a good control room, it's not guessing again it's like a control room that stays true to what I'm doing in it*

*so everything that I'm trying to achieve on particular mix will you know happen in other systems..."*

*"I really do like very accurate rooms, a good sounding room should be accurate with regards to image, I don't think a room should have any sort of imposed character...it's not like walk into an anechoic chamber, put a pair of speakers up it probably will sound fantastic you know but turn round and have a conversation with somebody it can be quite bizarre and you shouldn't have to shout, so on and so forth, should be enough reverberation for something to sound natural but it shouldn't affect the character of the room."*

## 3. DISCUSSION

Even though there is some agreement on factors like reverberance, stereo image and focus, there are still problems identified with frequency balance, equalization of the listening area and the use and positioning of monitoring sources.

Low frequency resonances, also referred to as *room modes*, are inherent to any enclosure and produce peaks and dips in the frequency response that depend on source and listener position and to some extent on the shape and acoustic treatment of the room. Studies by Bucklein [4], Olive, Schuck, Toole et al [5] have revealed that low frequency peaks are more noticeable than their equivalent spectral dips. The detection of these resonances is also dependant on their frequency and bandwidth. For practical purposes and in the context of this paper low frequency resonances may enhance or reduce certain groups of frequencies altering the perception of the timbre of the sound, therefore giving the listener a wrong perception. Compensations made to the sound in the control room may prove inadequate when the same sound is listened to elsewhere. The problem escalates due to the fact that low frequencies mask higher frequencies, this effect becoming larger at higher listening levels [6]. Therefore, a certain room mode (resonance) will not only alter the correct perception of that frequency (or bandwidth) but also increase the effect of masking higher frequencies.

One other inherent effect of room modes is the uneven spatial distribution of pressure levels in the room. This leads to the fact that two people in the same room will have a different perception of the signal being played. In the audio industry, it is usual to work by committee, and there may be various people at different positions in the room. A divergence of opinion may arise from the fact that the perception is being altered solely by the acoustics of the room. There is also the need of identifying the best listening position in the room in order to make correct judgements. This may lead to delays and disagreement, making the whole process more laborious. At mid and higher frequencies the stereo image is the first to be affected as the listener steps out of the recommended listening position. In some rooms the redirection of first reflections may also lead to regions where the monitoring accuracy is not optimum, due to a dense concentration of redirected reflections.

Added problems arise with the fact that most sound engineers and producers use a second set of monitoring sources. These are usually a pair of close field loudspeakers (also known as *near* fields) with limited frequency response, which are placed on the meter bridge of the mixing desk. The reasons for using these near field monitors are detailed in Section 2.6.
Bech [7] and Olive, Schuck et al [8] have written on the effects of loudspeaker placement on timbre and listener preferences.
Control rooms should be designed having the listening position (or area) and monitoring sources as the main points. For this reason the whole acoustic control of reverberation, reflections, room modes and stereo imaging are done for what are generally referred to as the *main monitors*. When monitoring through a different set of sources that are not placed where the main monitors are, the response of the room will be altered. Stereo image, first reflections, room modes and to some extent reverberation will be affected. Consequently, the perception of the listener is also altered. Not only by the different frequency response of the near field monitors, which is why they are there in the first place, but also by the whole

speaker/room interaction.
Again, this may lead to problems in the correct judgement of sound that is no longer optimal for the referred room/loudspeaker set-up. Even more, due to the fact stated in Section 2.6, that near field monitors are used for most of the time in the mixing process.

All these factors have lead to procedures and "tricks" in order to learn how the room behaves before undertaking any important work in the control room. Processes where the final work is taken out into other environments and systems to check for consistency are also very important in making sure that the decisions made in the control room translate as desired elsewhere. All this makes the task of recording, mixing and broadcasting of professional sound a laborious one, highly dependant on experience and a good knowledge of the system-room interaction.

# 4. CONCLUSION

Control room users have been surveyed to find their views on the acoustic factors that make a "good" control room. The objective is to inform and further help on the development of guidelines and objectives for the successful design of better control rooms.
Common preferences regarding factors like reverberance, stereo image and focus were identified. However, frequency response, especially at low frequencies and the spatial distribution of sound levels and spectrum in the room are still difficult problems for control room users. Further investigation should concentrate on the equalization of the listening area in such a way that this could be designed to be larger than is usually found in contemporary control rooms. One other factor that has been identified is the extensive use of near field monitoring. The problems arising from this were discussed. Design considerations could include acoustic control for the radiation from near field speakers as well as main monitors.
The authors are currently researching on the attainment of a more even spatial distribution of sound at low frequencies in small rooms.

**With the support of:**
*Programa Praxis XXI, Fundação Para a Ciência e a Tecnologia, Ministério da Ciência, Portugal.*

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