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'Multi Channel Mixing Methods'

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1. Introduction.

The title of this paper being 'multi-channel mixing methods', it seems to me that the first question to ask is 'why multi channel?

If the aim is to accurately record the sound in say a concert hall, then all that is required is to locate a microphone or microphone system in the "Ideal" position in the auditorium and feed the signals from this microphone into the best available recording machine. Since we have only two ears apeace, what possible advantage is to be gained from multiple recording channels?

This approach is of course the historic one, and apart from the improvements made in tranducers over the years is the same as that employed by Edison and the other early pioneers.

To bring this up to date, a good stereo pair microphone system, well placed, will yield results which when listened to on modern stereo headphones appear to transport the listener directly to the location of the microphone withimpressive realism.

Again the question presses - why multi channel. Why this fearsome array of equipment, when the end product may well be heard on a teenager's transistor radio?

The answer is simply that in the world of commercial recording the aim is not accurate reproduction at all - but to make a profit, and to make a profit it is necessary to generate a product having the widest possible appeal to the public. A public we may note, that is not very familiar with live performance but which increasingly possesses equipment capable of producing exciting sound provided that the right signals are available.

This then leads to the translated aim of modern recording methods - to make a product that will give the customer satisfying or exciting sound, and this will hold whether it be classical music or any of the other forms that pass for music today.
To this end the 'Ideal listening position' becomes an idealised position probably unattainable in the concert hall or indeed anywhere at a live performance.

The purists may mutter as they will, but economic factors dictate this conclusion, and today economic factors are supreme.

Having thus stated the principles that lie behind the modern approach, it is convenient to consider in detail the impact of this philosophy on equipment and methods. The developments in

this field are of an evolutionary nature, and I therefore propose to cover the ground more or less historically.

2. Multiple Microphones.

It is a common place observation that at a live performance of say Violin Concerto, the majority of listeners will not be able to hear every detail of the soloist's performance either by reason of distance or the masking effect of the far greater sound level from the full orchestra.

By using many microphones, each fed through its own amplifier and provided with separate level controls an engineer may adjust the relative balance of the parts of an orchestra as he pleases without moving either performers or microphones.

No detail of a composers intentions need be lost in the welter of sound, even a guitar may compete with a full orchestra - unnatural, but often vastly effective.

The basic equipment required is a mixing console, which is an array of amplifiers and level controls enabling the operator to blend the signals from a large number of microphones into two or perhaps four outputs for recording.

Much classical recording is still performed with such equipment as this, in a situation where from the engineers point of view, optimum balance can be achieved during rehearsals, since in classical music there is little opportunity for improvisation or desire for experiment, rather a steady progress toward perfection as take succeeds take.

3. The Console Described

The modern recording console is a tool of considerable power and sophistication.

and it is worth a brief examination of its salient features at this stage.

"Channel Amplifiers" are provided to amplify the small signals from the microphones lifting them to the equipment working level with the minimum addition of noise, and also to provide powerful and flexible control of frequency response.

The units illustrated are of the "3 frequency" type enabling indepedant control in three sections of the audible range, in addition a steep slope high pass filter is also available. Such an amplifier provides control going far beyond any needs of correction, being in fact a device in the hands of the engineer for the manipulation of instrumental timbre and even the creation of special sound forms.

Having amplified the signal, faders provide a smooth, silent control of level from each channel thus enabling, blending to take place easily.

Signal routing is accomplished by switching units such as these.

In which an array of push buttons enables the operator to select to which of the console outputs that particular signal will be routed.

Any or all of the buttons may be selected at one time, without change of level or interaction, and in a well made console, without transient disturbance. A special feature is the 'pan' facility, whereby the relative proportion of signal fed to either of two chosen outputs may be varied by a single 'panoramic' control, thus enabling the operator effectively to 'place' a signal anywhere within the stereo sound field.

In addition to the control of timbre, by frequency response, the modern recording studio is normally equipped with devices for artificial control of reverbration, either in the form of a small highly reverberant room, or the electromechanical analogue of a room. The operation of such devices conveniently requires provision of independants outputs from the console for this purpose. Selectors for four such reverberation channels may be seen on the switch units illustrated, these being the black push buttons.

The return signal from reverberation devices must be routed in exactly the same way as any other signal and a group of 'Rev Return' modules are shown here.

Above them are a set of controls and their associated indicators for control of the damping of a steel plate type reverberation simmulator, and thus of its effective reverberation time. Used with care, such devices can deceive all but the most experienced observer and can simmulate almost any type of hall or environment.

A further control in the typical modern console is the compressor or limiter-compressor, which enables Automatic control of the total dynamic range of the programme.

The imaginative operator may use such instruments either singly, or in groups with linked control circuits, to achieve a wide variety of effects, for instance enabling a relatively weak instrument such as a flute to 'ride over' clashing cymbols or loud brass. Unnatural of course, but remarkably few of todays 'pop' sounds are natural.

4. Multitrack Recording.

I have described briefly what might be called the 'obvious' form of mixing console - a tool designed to enable balance to be achieved directly during reheasal and performance.

The development of the multitrack tape recorder has now revolutionised the situation. Now that the capability of recording 16, 24 or even 32 tracks simmultaneously is available, an entirely new recording method may be employed.

The essence of the method is to treat the recording stage as simply an information gathering process, concentrating purely on attaining a good signal to noise ratio on each tape track, and not considering balance at all.

If of course 32 microphones signals are to be condensed to a 16 track tape, some mixing and blending will be involved, but the extent of such mixing will be minimal.

Certain economic and practical advantages follow:

4.1 Since obtaining a good or effective balance may be time consuming, deferring this action to separate 'mix down' sessions will be cheaper, since the musicians then do not have to be paid for repeated replays.

4.2 A further prospect opens, that is the technique of 'overdubbing' in which some parts of the music are recorded separately - that is at separate sessions, the musicians being fed with the already recorded sound on headphones.

This enables the orchestral backing to be recorded in London for a soloist to record in Los Angeles or Toronto.
It may mean that the brass section never see the strings, and neither meet the drummer!

What impact does this have on equipment design?

In the first instance, it is essential that sound be monitored during recording, and whereas in mixing to 4 tracks, 4 loudspeakers could be employed, for 16 or more tracks other measures are necessary.

Page 10

An independant mixer must be provided, having as many inputs as there are tracks to be recorded with as many outputs as there are loudspeakers. Part of such a matrix is illustrated here. It will be seen that during the recording, that is the information gathering operation, a trial balance may be achieved on the monitor, and for this reason stepped level controls are commonly provided to faciliate logging.

Where the 'overdub' technique is employed, the inputs to the monitor matrix will consist partly of existing recording, and partly of console output. Of course the tape recorder outputs must be in 'sync' mode using the record heads for playback so as to ensure time-synchronisation with those signals still being recorded.

Since the multi track technique pre-supposes a substantial degree of separation between musicians a further essential provision is the "foldback mixer" or "cue mixer" to provide performers with a

headphone signal enabling them to keep in time.
This mix must also operate from existing recorded material and from the new tracks during 'overdub' and in the example illustrated.

Up to four independant cue channels are provided mixed from 24 input tracks.
This particular cue mixer also provides for up to 4 of the reverbration devices available to be deployed in the cue mix to satisfy those artists who need or prefer the "singing in the bath" effect.

This then is a typical modern studio mixer with upwards of 32 inputs, each with comprehensive equalisation, 24 outputs, 8 reverberation lines and a comprehensive cue mix. 24 track monitor feeding 4 speakers with provision for reverberation on monitor as well as on cue, independantly of the main mix.

5. Mix Down

The multitrack story does not end here of course, it is now necessary to 'mix down' the signals from the master tape, a process which may be performed with the same console, or in busy studios in a special tape mixing room having a specially designed console adapted to this purpose.

The work of building up a good 'mix', especially of 'Pop' music which is essentially unscored, is lengthy and tedious, being a process of trial and error depending to a large extent on the engineers memory and endurance.

For this reason, attempts are being made currently to provide more sophisticated tools to faciliate this operation.
The 'Automated Mix Down' process is simply one in which the controls on the console are converted into voltage controlled devices, and provision is made for the logging of the settings of these controls in real time in digitally coded form.
The digital code may be recorded on one of the tracks of the multi track master tape, thus ensuring an accurate preservation of the relationship of control operations to the programme.

By rerunning the recording, individual operations may be successively modified, using an update provision.

In essence the same work has still to be done, but the operator has been provided with an accurate electronic memory to relieve his own.

Most current systems will only remember the last stage achieved so that it is difficult to retrace if at the end of a long session the feeling dawns that the fist attempt was the best of all !

Some engineers will find the system just what they wanted, but others will I suspect find it of little use, preferring to approach the final product by an intuitive process seemingly

haphazard in its method but born of artistic ability and experience.

Conclusions.

The console evolved as a result of multi track methods has become a very large and expensive piece of equipment, thus in the nature of things pressure exists to find cheaper ways. One is to take advantage of the very large number of tracks now possible on tape to eliminate mixing altogether at the first recording stage - that is to allocate one track to each microphone channel. The console may then be reduced to a mix down form with perhaps only 4 outputs which at this stage are used for monitoring purposes.

Perhaps two strands of development may now be seen one in the direction of economy, sacrificing some functional flexibility, the other in the direction of greater and greater sophistication complete with mini computer control and costing upwards of £70,000!

Whatever the future, we may be sure that multitrack with its flexibility and potential for the generation of more than one product is here to stay, and that console manufacturers will be at continuous pains to meet the demands of the varied sections of the recording industry and indeed to anticipate them.