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The engineer as stylist

By digitising our first century of recorded music we are on the way, it is hoped, to arresting its incipient decomposition. However faltering the process, the imperative is no longer in question. We hope this body of work, by which I mean recordings, will be available in perpetuity for musicological study. Our understanding of the mechanical, technical and historical aspects of these recordings is growing all the time, which by contrast makes the dearth of information concerning the underlying ideology of sound recording practice throughout this period all the more shocking. Such writing as does exist invariably concerns either the most overt technical aspects of production or simple historical anecdote, revealing little or nothing of the motivations ideals and objectives of recording practitioners either past or present. The nature and character of recorded sound is rarely even discussed; when it is - usually in record reviews - some generous or occasionally disparaging adjective is aimed squarely, if not fairly at the record producer; hardly ever is specific reference made to the craftiness of the recording engineer.

But engineers, like musicians, are responsible for the formulation and propagation of ideals and standards and for helping to establish the public's conception - and perhaps entrenching its pre-conceptions - of what constitutes not only *hi-fidelity* sound but the established notions of how performing musicians actually sound and how they ought to sound. Moreover, through the practice of their craft engineers determine the way musicians hear themselves thereby influencing and reinforcing performer's ideals and objectives. Yet while the influences that affect musicians are increasingly subject to musicological investigation those of the engineer are not.

Outside the German Tonmeister tradition the classical music record producer is seldom expert in sound engineering and rarely pretends to be so. His or her control of the sound balance is therefore limited to their choice of engineer and to their ability to express their preferences in the combined metaphoric languages of musicians and technicians. This they do hopefully while placing themselves at the mercy of the engineer. Even the most renowned producers have always relied on expert engineers to interpret and execute their wishes. Yet few of us even know who these interpreters were; whether they are alive of dead, least of all the extent to which their experience and ingenuity influenced the outcome of recording sessions.

We live in an ostensible society where our evaluations and judgments are determined largely by what we see. It is not surprising then that the engineer is typecast as a simple technician. So much of his work involves the plugging-in of cables, the erection of stands, the calibration, measurement, and adjustment of machines that the recording studio seems more like a factory or laboratory than an artist's studio or musician's performance space.

Engineers themselves have done little to overturn this stereotype and even though they no longer sport the white smock coat they continue to act in ways that reinforce the common view. Give the location-recording engineer half a day and he'll transform any concert hall, town hall or church into his own familiar technological den. Put two engineers together and they'll happily pass the time of day discussing the minutiae of all things technical giving credence (in their own minds as much as the minds of others) to the belief that the equipment, instead of being just the tools of their trade, is itself the heart and soul of their craft. By assuming the cunning guise of the simple technician whose sole duty it is to facilitate the artistic objectives of the musicians and their producer they weave a magnificent subterfuge; no one thinks to question just how they go about their business or what their aims and ideals are.

Apparently, the accepted remit of the classical music recording engineer is to *capture* the true sound of a musical performance, or, in other words, literally to *record*, or *document*. I say this is the accepted remit because it is never made explicit. Never has a musician or producer ever specified to me as an engineer, precisely what it is they expect me to achieve. I am the recording engineer; *ergo* it is my job to record: period. Certain qualifications, in the form of vague, unqualified metaphors are likely to be introduced in responding to an initial balance but I've no reason to suppose that I've been granted an unusual privilege in being accorded the freedom to do my own thing. There was for a time a tacit understanding that the engineer's objective should properly be ***to capture the sound perspective that one might perceive from the best seat in a concert hall.*** But if that were once the goal I doubt that it is any longer. Nevertheless, the presupposition somehow persists that the proper objective must be to *capture* a performance with minimal intervention. And it is this more than anything else that distinguishes classical music recording engineers (who from now on I will refer to as balance engineers) from their popular music counterparts. Where the latter is hired specifically for their acknowledged ability to alter and characterise the source sound in their own unique way, the balance engineer neatly skirts the issue, tacitly perpetuating the belief that there is something inherently natural and unaffected about classical music recording so long as it is done carefully and skilfully. Even those who believe that we should regard live performances differently to recordings, rarely consider precisely how the engineer transforms the experiential sound world of the one into the idealised sound world of the other.

My work on recording sessions enables me to move freely between the performance space and the control room; a comparatively unusual privilege that affords the best chance of making a direct comparison between the real live sound and the balance engineer’s reproduction. I always take full advantage of such opportunities and I wish more engineers did the same because for me, the two experiences are wholly different. In fact, the differences are often much more striking than any similarities, which by comparison seem almost superficial.

When sitting in a concert hall my hearing seems at once more directional than the most directional, hyper-cardioid microphone while at the same time more receptive to reflected sound than any omnidirectional mic. I find that I can attend to any instrument in any section of the orchestra that I choose with pinpoint accuracy or to any aspect of the soundscape without having to discriminate or subjugate my perception of the surrounding ambient space. It’s as if my ears can reach out to apprehend the clarity of a soloist’s voice in an opera house in a way that a single pair of microphones could never do without sacrificing either the underlying orchestral texture or the ambient reverberation. I don’t imagine that this is an unusual experience.

It must be clear to anyone familiar with acoustic music performance that an ideal listening position is not prerequisite to a fulfilling concert experience. The reason why we experience *live* and reproduced sound so differently can be partly explained by the ear’s ability to discern intelligibility in complex reverberant environments. The ear manages this, as the audio expert John Watkinson explains,

> *“…by averaging all received energy over a period of about 30ms. Reflected sound which arrives within this time is integrated to produce a louder sensation, whereas reflected sound which arrives after that time can be temporarily discriminated and is perceived as an echo. Our simple*

microphones have no such ability which is why we often need to have acoustic treatment in areas where microphones are used." [1]

Our ability to listen in this expansive, multi-dimensional way is what distinguishes our ears from microphones. But it is not our ears alone that are responsible; it's the entire apparatus of the human auditory system and the conscious mind to which it is linked. The human ear, like a microphone, is able to detect any sound that is loud enough to be heard but unlike a microphone the unconscious mind decides on which sound to confer its attention. To extend Eisenberg's analogy; in a live performance it is possible to be the director of one's own experience.

The elaborate mechanism that facilitates this ability was first noted by Cherry in 1953 when, in an oddly titled paper, 'Some experiments on the recognition of speech, with one and with two ears' he coined the phrase 'Cocktail Party Effect'[2]. The phenomenon, now also referred to as *Attentional Selectivity,* concerns the unconscious facility of focusing one's attention on one among many competing sounds or noises. Although the subject of ongoing research in the fields of psychology, physiology and neuroscience it isn't yet fully understood. Barry Owens of the Speech Research Group at the Massachusetts Institute of Technology explains,

"From a listener's point of view, the task is intuitive and simple. From a psychological or physiological perspective there is a vast and complex array of evidence that has been pieced together to explain the effect - there are many interactions between the signal, the auditory system, and the central nervous system. Acoustically, the problem is akin to separating out a single talker's speech from a spectrogram containing signals from several speakers under noisy conditions. Even an expert spectrogram reader would find this task impossible."[3]

So far as I can tell, none of the research that has been carried out so far pertains to the perception of music. Dichotic* experiments concentrate almost exclusively on distinguishing speech by referring to relatively simple stimuli such as pure tones, noise, or speech itself. Somewhat ironically most experiments fail to distinguish acoustic sound from recorded sound as though subjects would necessarily respond identically to both even though, as Rick Altman explains,

"*the process of selective auditory attention is far more difficult when we are listening to recorded material. Whereas live sound provides an extraordinary number of variables, each permitting and promoting selective attention, recorded sound folds most of those variables into a single, undifferentiated source. In a live situation, we easily differentiate among the various sound sources surrounding us, but with recorded sound no such clear distinctions are possible."* [4]

In fact, electronically reproduced sound, whether recorded or amplified impedes *attentional selectivity* to the extent that it is rendered virtually inoperative. Microphones can hear, but they cannot listen. When all sound is amplified equally, without discrimination it becomes all but impossible to distinguish any particular sound from the general mêlée. It is for this reason that people who use hearing aids find noisy environments intolerable; not only are they subjected to indiscriminate noise; they are deprived of the ability to discriminate or to direct their aural attention. Imagine Cherry's cocktail party where no matter how hard you try, the voice of the one interesting person to whom you're trying to listen is buried impenetrably beneath the background chatter, laughter, music and the clinking of crystal glasses.

Listening to recordings would be similarly cacophonous if the recording engineer positioned the microphones half a dozen rows back in the auditorium where it would register an unconscionable melange of reflections and extraneous noise. The primary problem then is not that the most truthfully objective sound perspective is illusive, nor even as the Nominalists fear, that there are as many truthful sound perspectives as there are listeners, but that in perceiving recorded sound via a mediating system we necessarily cede to the balance engineer our ability to direct our attention selectively.

The engineer's only recourse is to deploy his or her craft to direct the listener's attention in much the same way as a filmmaker decides where to focus his viewer's attention. Or to put it another way, the auditor relinquishes their attentional choices and admits in their place those of the balance engineer. This means, as Altman explains, that

> *"Far from simply recording a specific story of a specific sound event, the sound engineer actually has the power to create, deform, or reformulate that event."* [5]

With this power to create, deform and reformulate comes clear responsibilities. It is not enough for the balance engineer simply to try and replicate or document the real event. His or her proper purpose must be to re-model the concert-going experience to compensate the listener for the impairment to their selective attention. This is not a simple matter though because as Ribot explained at the end of the 19th century**,**

> *"Without motor elements perception is impossible… If the eye be kept fixed upon a given object without moving, perception after a while grows dim, and then disappears. Rest the tips of the fingers upon a table without pressing, and the contact at the end of a few minutes will no longer be felt... Consciousness is only possible through change: change is not possible save through movement."* [6]

Some 50 years later Aldous Huxley neatly differentiates the operation of visual and auditory perception.

> *"The clearest images are recorded in the macular area in the centre of the retina, and particularly at the minute fovea centralis. The mind, as it selects part after part of the object for perception, causes its eyes to move in such a way that each successive part of the object is seen in turn by that portion of the eye which records the clearest image. Ears have nothing corresponding to the fovea centralis. Consequently the indispensable shifting of attention within the auditory field does not involve any parallel shifting of the bodily organ. The discriminating and selecting of auditory sensa can be done by the mind alone, and do not require corresponding movement of the ears."* [7]

Yet as we have seen, the very intervention of the recording process impedes the mind's ability to discriminate: a fixed pair of microphones affords an immutable balance that thwarts the mind's persistent attempts to re-deploy its attention in ways that are entirely possible and natural in a concert hall.

This poses a singular task for the balance engineer: one, which runs tangentially to the presumed quest for fidelity. For in order to afford the movement on which active, participatory listening depends the engineer must in some way simulate movement to engage the consciousness. For this reason recording a number of spaced microphones straight to stereo has a distinct advantage over multitrack recording with subsequent mixing. Although this latter method - where each microphone is recorded discretely on a separate track - permits the apparently advantageous iterative honing of the recording, this ostensible freedom inevitably urges the engineer towards the creation a perfected balance devoid of anticipatory tension that is much less demanding and engaging and which promotes a passive listening experience. Balancing directly to stereo on the other hand demands of the balance engineer a high degree of concentration and something akin to a performance that reflects the evolution of the music, developing, enhancing and transmitting the tensions expressed by the musicians. At its best, this practice alludes to the shifting of the consciousness during active listening.

Although microphones operate differently to the human auditory system they are, in isolation, quite similar to the human ear: both are pressure transducers sensitive to frequency and amplitude. Furthermore, when deployed in pairs, microphones afford the additional benefit of being able to contrive the illusion of stereophony (at least they do in a couple of quite specific circumstances). From this one can quite reasonably deduce that microphones are extremely well suited to the job of capturing musical sound. But, in order to ensure that the microphone attends only to those sounds that we choose to hear, or those that we regard as musical, and excludes those we do not, it needs to be situated relatively closely to the intended sound source. Part of what constitutes sonic realism or what we call fidelity is in fact the exclusion of extraneous sound that the listener would ignore automatically in the natural environment.

Microphones are available in various directivity patterns so it is possible when using cardioid or directional mics, to angle them in such a way that the unreceptive area tends to exclude unwanted sound. However, overlaying this is the consideration that there are only two methods of recording true stereophony: the first uses a coincident pair of cardiod mics and the second, two omnidirectional mics (that are receptive throughout 360 degrees) in a binaural dummy head or Jecklin disc arrangement. Unfortunately the integrity of both systems is depleted if additional microphones are incorporated into the mix. Moreover, the binaural technique can only be reproduced properly on headphones. As neither technique is especially versatile or adaptable most engineers tend to take a more pragmatic approach. It’s generally agreed that omnidirectional mics sound intrinsically more natural or pleasing than cardioids and as they don’t exclude the surrounding acoustic resonance which is integral to classical music recording the main array in classical music productions usually comprises spaced omnidirectional mics, even though as John Watkinson points out,

> *“Spaced microphones may be used to record stereo, but there is no theory to explain how a virtual image is produced, and the result is more often an effect than a reproduction.”* [8]

When engineers discuss the perceptual qualities and relative merits of each type of microphone they are usually quite unequivocal. Although this isn’t necessarily bad (decisiveness being a useful trait in an engineer), it does foster the formation of a somewhat immutable body of opinion that is rarely tested. The printed frequency response charts that accompany new microphones result from tests in a highly controlled, often anechoic space and as such give only a clue as to the mic's likely response in a diffuse acoustic field. As a result, an engineer's choice of microphones is informed as much by his or her highly subjective preferences as by the mic's qualitative specifications. Those mics chosen for the main array will obviously be those whose sound the engineer judges the most pleasing although he or she will seldom have the opportunity to re-evaluate the mic’s suitability in each situation. Other microphones used to supplement the main array are also chosen for their recognised qualities in highlighting the required aspects of the sound at which they are directed. Ribbon mics for example are now favoured for use on orchestral brass - not necessarily because they represent the brass sound most accurately but because many engineers enjoy the slightly retro sound quality they yield.

The point is that engineers have developed as a community, and continue to develop as individuals, a body of experiential wisdom formed not exclusively of factual knowledge, but of insubstantial, intuitive experience. The hugely variable complexity of each situation makes a purely objective assessment of all contributory factors all but impossible. Besides, there is seldom time for experimentation once the session begins. The engineer is usually expected to achieve a satisfactory sound balance very soon after, or even before the musicians begin playing. When time does permit and musicians show willing it is sometimes possible to adopt an exploratory, adaptive approach. However, not all engineers seek such an approach, preferring instead to trust their tried and tested technique; their preferred method being the one with which they are most familiar or the one which featured most strongly in their training. Until comparatively recently the major record companies were responsible for training new classical music recording engineers. And as each company had an established *house style* the apprentice system naturally fostered and perpetuated the company's established techniques.

I haven't time in this current paper to discuss in detail all the tools and techniques at the balance engineer's disposal in his efforts to contrive a balance. But while these most obviously include a comparatively subtle use of standard studio craft - that's to say, equalisation and dynamic compression, (which is usually manual in the form of fader *riding*) the intervention that probably has the greatest impact both on recording and on the development of a recording style is the incorporation into sound recordings of artificial reverberation.

Although the earliest forms of artificial reverb (such as resonating plates, springs and ancillary chambers) were in use long before recording technology had reached half it's present age their implementation in classical music recording would have been exceptional rather than routine. Reverberation is used for a number of reasons but most obviously its function is to augment the spaciousness of recordings made in acoustics that are less resonant than would be ideal, or to mask unpleasant colouration.

Traditionally, classical music recording venues were specifically chosen for the excellence of their acoustics. All the major recording companies knew which were the finest and these became home from home to the production teams who returned to them time and time again. But even before the heyday of classical recording was over the exorbitant cost of recording in Amsterdam's Concertgebouw or Vienna's Musikverein became unacceptably costly for all but the most prestigious artists. Furthermore, the exceptionally low noise floor of digital recording rendered some of the finest acoustics of the day too noisy for the new CD format while others just closed down or otherwise ceased to be available for recording. London's Kingsway Hall is just one notable local example.

As engineers found themselves working in less inspiring acoustics they sought to compensate for the lack of spacious grandeur by tailoring the imponderably complex variables of the latest digital reverb to enhance the natural acoustic. But as I've already described, engineers have a propensity, for myriad reasons, of sticking to what they know and to what has been proven to work effectively. As the Lexicon 480 became the benchmark to which all other less expensive digital reverbs aspired, its most effective and pleasing settings were stored on removable memory cards, which were often circulated among studios and engineers like trade in illicit contraband. Even without the uniformity of application that inevitably ensued, each digital reverberation device, like all forms of synthetic electronic sound, produces a characteristic sound of its own which becomes increasingly noticeable with familiarity. Anyone in doubt need look no further than the most recent types of artificial reverb which commonly include a Lexicon 480 simulation setting for those who want to recreate that particular type of retro 80's/ 90's sound.

One could quite reasonably assert that the preponderance of orchestral recordings made during the CD boom years bear the stamp of the Lexicon 480, but the undesirability of conformity is less pertinent to us here than the impact that this stylisation subsequently has had on engineer's, musician's and the public's ideals. Artificial reverb is intrinsic to many - perhaps most modern recordings regardless of musical genre. Its incorporation into studio craft has been so extensive and its manifestations so diverse, that it is frequently employed in popular music forms not as a spatial signifier, but as pure effect. It may be used to evoke nostalgia or as a key to introspection for example; a development that perhaps finds its parallel in the slow motion film sequence that seems to intensify the viewer's sensitivity by immersing them in an indulgent hyper-reality.

While to be assailed by some manifestation of stylised reverb with each and every experience of recorded sound is commonplace, to witness an acoustic performance is becoming a comparative rarity. A generation now equates acoustic, with 'un-plugged', which perversely is anything but acoustic. As the dominance of the *virtual* world increases we should perhaps expect the authority and attraction of the experiential to wane in inverse proportion. And as contemporary popular music recordings and performances continue to urge us towards the brighter, punchier sounds of the hyper-real we might expect the paler subtleties of acoustic reality to fall further into abeyance.

In this light it would be altogether implausible to imagine that the evolution of a balance engineer's ideals might somehow remain untouched by the mundane influences to which none of us are immune. It may be useful for sound engineers to cultivate the impression that they're obliging documentary makers but in truth they are beguiling stylists who, however unwittingly are the conduits through which the benignly expansive influence of electronically enhanced popular music infiltrates all other musical genres.

The earliest recording engineers had a tough enough job getting their recording machines to register sound at all. The pragmatic avoidance of malign characteristics in the sound balance would then have seemed far more pressing than the idealistic fashioning of beautifying characterisations. But the development of the microphone and electrical recording soon revealed a more extensive domain. With perspective, ambience, tone colour and dynamics heaving into view, and with the commercial imperative urging them along, engineers launched forth on a quest - ostensibly for perfect fidelity.

We read with amusement, bemusement and incredulity how Edison's tone tests were claimed to be indistinguishable from the live performer but as each subsequent generation makes similar claims we really ought to wonder whether technological developments really bring us so much closer to reality or whether they are merely the continual refinements of a flexile code in which each generation steeps itself.

Without at least recognising the ongoing stylistic evolution in sound recording and without acknowledging its concomitant influence on musical performance we risk misattributing - or missing altogether some of the subtler modulations in western art music.

Endnotes

[1] John Watkinson, The Art of Sound Reproduction. 3.6 *Critical Band* pp 81
[2] E.C. Cherry Some experiments on the recognition of speech, with one and with two ears. *Journal of Acoustical Society of America* 25(5), 975-979 (1953)
[3] Barry Arons A Review of The Cocktail Party Effect. *Journal of the American Voice I/O Society* (1992)
[4] Rick Altman, *Sound Theory Sound Practice - The Material Heterogeneity of Recorded Sound*, pp 29
[5] ibid. pp 25
[6] T.H. Ribot, *The Psychology of Attention*. Open Court Publishing Company, Chicago 1890 pp. 52
[7] Aldous Huxley. *The Art of Seeing* pp 32 Chatto & Windus 1943
[8] John Watkinson, Mics and Hearing. Resolution. Slaying Dragons Jan/Feb 2008

* Dichotic listening is a procedure commonly used to investigate selective attention in the auditory system where two different auditory stimuli (usually speech) are presented to the participant simultaneously, one to each ear, normally using a set of headphones. Participants are asked to attend to one or (in a divided-attention experiment) both of the messages. They may later be asked about the content of either message.

Bibliography

• Altman, Rick (Edited), Sound Theory Sound Practice - The Material Heterogeneity of Recorded Sound
• Arons Barry, A Review of The Cocktail Party Effect. Massachusetts Institute of Technology’s Media Laboratory. Journal of the American Voice I/O Society. (1992)
• Broadbent. D.E. The Role of Auditory Localization in Attention and Memory Span. Journal of Experimental Psychology Vol 47, No. 3 (1954)
• Cherry, E.C, Some experiments on the recognition of speech, with one and with two ears Journal of Acoustical Society of America 25(5), 975—979 (1953)
• Eisenburg E, The Recording Angel: Music Records and Culture form Aristotle to Zappa. Yale University Press 2nd Ed. June 2005
• Gelatt, Roland, The Fabulous Phonograph – From Tin Foil to High Fidelity. J.B. Lippincott Company Philadelphia & New York 1954
• Huron, David, Lost in Music. Science & Music. Nature Vol 453 May 2008
• Huxley, Aldous, The Art of Seeing, Chatto & Windus, 1943
• Knudsen, Eric, I, Fundamental Components of Attention. Annual Review of Neuroscience 2007 30: 57-58
• Moore Brian CJ - An Introduction to the Psychology of Hearing. Fifth ed. Academic Press Jan 2003
• Patmore David & Clarke Eric, Making and Hearing Virtual Worlds; John Culshaw and the art of record production. Musicae Sceintiae 2007; Vol 11 No.2 pp 269-294
• Patmore, D, John Culshaw and the Recording as a Work of Art. Journal of the Association of Recorded Sound Collections 39/1 (Spring 2008), 19-40

- Ribot, T.H, The Psychology of Attention. Open Court Publishing Company, Chicago 1890 <http://hdl.handle.net/2186/ksl:ribpsy00/ribpsy00.pdf >
- Thompson, Emily, Machines, Music and the Quest for Fidelity: Marketing the Edison Phonograph in America 1877-1925. The Musical Quarterly. Oxford University Press. Vol 79 No.1 Spring 1995 pp 131-171
- Watkinson, John The Art of Sound Reproduction. Focal Press Apr 1998
- Watkinson John, Mics and Hearing. Resolution: Audio for Post, Broadcast, Recording and Multimedia Production Slaying Dragons V7.1 Jan/Feb 2008
- Wedge, Donald, Scott, US Patent 7260231 - Multi-channel audio panel. Application No. 09320349 filed 26.v.1999. Issued Aug 21 2007
- Williams Alan, Is Sound Recording Like a Language? Yale French Studies, No. 60, Cinema/Sound, (1980), pp. 51-66 Published by: Yale University Press
- Wrigley Stuart N, A Model of Auditory Attention. Technical Report CS-00-07 June 2000, Speech and Hearing Research Group Dept Computer Science University of Sheffield

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