Marco Conceição[1 2] marcoconceicao@gmail.com
Dermot Furlong[2] dfurlong@tcd.ie

1 ESCOLA SUPERIOR DE MÚSICA, ARTES E ESPETÁCULO DO INSTITUTO POLITÉCNICO DO PORTO
2 TRINITY COLLEGE DUBLIN

Sound recording: *an Art*

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RESUMO

As realizações artísticas exigidas no processo de gravação são tão exigentes como as esperadas numa efêmera performance ao vivo, com a diferença que uma gravação irá durar ao longo do tempo. Neste artigo é feita uma discussão sobre como as gravações sonoras têm evoluído no sentido de facilitar mais-e-mais controle sobre os atributos percetuais que permitem aos ouvintes apreciarem melhor o significado e emoção de uma gravação em particular. "Spaciousness" é um atributo de perceção que é considerado e investigado. A procura de um som "perfeito" levará à eterna pergunta "o que pode ser feito para que se obtenha um melhor som".

ABSTRACT

The artistic achievements demanded in the recording process are as demanding as those expected in an ephemeral live performance, with the difference that a recording will last over time. In this paper a discussion is made on how sound recordings have evolved toward facilitating more-and-more control over the perceptual attributes which allow the listeners' to better appreciate the meaning and emotion of a particular recording. Spaciousness is one perceptual attribute which is considered and investigated. The demand of a "perfect" sound will lead to the eternal question "how can it be made to sound better".

INTRODUCTION

From the early days of sound recording – going back to Edison – it is possible to consider the technological achievement of sound field recording and reconstruction as an *art*. During the period of recording using wax cylinders, an effort was made to position the performer in a proper manner, and to control the dynamics of the performance so that the diaphragm and stylus of the gramophone could mechanically register the sound waves in grooves on the wax. Not only did the performer have to accommodate to a "new" performance practice which was completely different from a performance, say, in a concert hall, but also the rooms in which these recordings were made were altered to provide for a dry acoustic that would ultimately help the recording process (Toole, 2008, pp. 13, 14). The adaptation to these new conditions made for changes in the performance of music, thereby contributing to the art of the music itself while at the same time delivering a new form of art (*i.e.* sound recordings) embedded in the medium in which it was delivered. Sterne argues "that sound reproduction is *always already* a kind of studio art" (Sterne, 2003, p. 223). The sound recording efforts made today are not that far removed from those of the early days; it is the "evolution" of the technology and recording techniques that accounts for changes in the aesthetic appreciation of the performance which is associated with the *art* of sound recording.

Sound recording technology has evolved despite the repeated claim that the technological achievements of the equipment needed for capturing and delivering sound was already at the pinnacle of its achievement. If advertisements from some of today's manufacturers of audio equipment are examined it can be noticed that marketing lines such as "hear the truth with great sound" (www.jbl.com), "true-to-the original" (www.bostonacoustics.com), "realistic multichannel surround sound" (www.dolby.com) are not so different from advertisements of the Victor Talking Machine Co. from the 1920's where one could read "the human voice *is* human on the New Orthophonic". It has been the case that audio manufacturers have repeatedly claimed to have reached sound recording perfection, not only by comparing to rival companies, but also compared to their own line of products. This persistent pursuit of sound recording perfection has also been the case for the techniques used for recording sounds. For example, sound engineers often claim that the use of certain microphone techniques will necessarily be better than others (Gerzon, 1971; Griesinger, 1985; Lipshitz, 1986). The research approach indicated in this paper has sought to provide some objective grounds for such claims.

Pursuing the best possible sound in recordings has not just been the *raison d'être* of sound technicians and audio manufacturers, but also that of performers who demanded a "perfect" sound in the recordings they made. The artistic goals involved in the recording process should be as demanding as those of a live performance. It is worth pointing out that music recording has not generally evolved toward more-and-more exactness of physical reconstruction. Rather, it has developed toward facilitating more-and-more control over reconstructed sound field features (Sterne, 2003, p. 242; Swedien, 2009), the pursuit of which leads to the eternal question "how can it be made to sound better?"

FROM "DEAD" TO "LIVE"

In the time of Edison, sound recordings were conducted in very controlled and acoustically "dead" rooms (*i.e.* with reflections reduced as much as possible). Given the fact that the presentation of reverberant sound over monophonic reproduction (Conceição, 2015, pp. 41–64) sounds very muddy (*i.e.* less tolerant to reverberation levels) (Streicher & Everest, 2006), the need to control reverberation was a contributing factor in the choice of recording rooms. Also, the very insensitive recording systems, such as the early phonographs, made it so that the performer needed to be as close as possible to the microphone, resulting in recordings where the direct sound was dominant. Direct sound here is to be understood as the first arriving sound wave from a source to the ears of a listener or a microphone, travelling in a direct path without being reflected from any surface (Everest & Pohlmann, 2009). This technical and artistic approach was the normal practice in the early days of sound recording. Although listeners enjoy listening to music in "good environments" (*i.e.* good acoustics) which contribute to making an uplifting sound for musical performances, it seemed that these acoustically "dead" recordings nevertheless created a pleasant illusion. That this sonic illusion worked can be explained by the fact that the overall recording system was able to reproduce/communicate something of the meaning and emotion of the music. Toole (2008) comments that listeners have at some point felt "that tingling sensation that tells us we are experiencing something special and emotionally moving. What is 'real'? Was it 'reproduction'? Good sound or bad? Does it matter? The fact that these feelings happen confirms that the [overall recording] system works." (p. 5). However, if any sound recording in a spatial environment can contribute towards an emotional reaction, will a more spatially complex sound recording contribute further in evoking a greater depth of feeling? Studies have shown that a performance in an acoustic environment has a more preferred impact than the same music played in a "dry" one (Barron, 1971). Listener preference for sound field presentation has been found to be greater in a lively, spacious sounding performance environment (Ando, 1985). Consequently, there is an argument to be made, (see (Conceição, 2015)), that adding a spacious quality to sound recordings could lead to greater preference for the reconstructed sound fields that result. The audio industry has developed an increasing number of tools, and proposed more and more recording techniques for delivering complex sound field reconstructions which help answer the question "how can it be made to sound better?". Toole (2008) proposes the following explanation of reconstructed sound field impact manipulation as follows: "by understanding the perceptual dimensions and the technical parameters that give control over them [perceptual dimensions], it may be possible to give the artists tools that allow them to move into new creative areas by expanding the artistic palette." (p. 5)

The sound processing tools which exist today are numerous: from controlling dynamics, to filtering and modulating sound, from pure corrective technologies to the creation of new sounds, and from monophonic to stereophonic reconstruction where direction and spatial attributes of the sound field can be controlled and manipulated. Spaciousness is one of the perceptual parameters that can be

controlled and which has been found to contribute to an enhanced appreciation of the *art* of sound recordings (Conceição, 2015). In a similar manner to Toole (2008), Read and Welsh in their book "From Tin Foil to Stereo" (1959) recount the statement written in 1951 by Edward Tatnall Candy:

> "Liveness," the compound effect of multiple room reflections upon played music, is – if you wish – a distortion of "pure" music; but it happens to be a distortion essential to naturalness of sound. Without it, music is most graphically described as "dead." Liveness fertilizes musical performance, seasons and blends and rounds out the sound, assembles the raw materials of overtone and fundamental into that somewhat blurred and softened actuality that is normal, in its varying degrees, for all music. Disastrous experiments in "cleaning up" music by removing the all-essential blur long since proved to most recording engineering that musicians do like their music muddied up with itself, reflected. Today recording companies go to extraordinary lengths to acquire studios, churches and auditoriums (not to mention an assortment of artificial, after-the-recording liveness makers) in order to package that illusively perfect liveness. (p. 378)

This statement helps draw attention to the fact that not all which seems measurably correct will be appreciated as art, or, in the case of the theme here, as a good sounding recording. It is important, therefore, to understand the auditory features which are "missing" in recorded and reproduced sound such as "Liveness", a term that has been extended to the science of auditory spaciousness (Streicher & Everest, 2006, p. 12.1), and to provide the technological means to deliver such features.

CREATING AND RECREATING SONIC "ILLUSIONS"

Since the "birth" of stereo in the 1930's, the spatial experiences which could be conveyed in sound recordings have contributed towards a better sonic experience. Despite the fact that critics of stereo sound claimed that there was no need to have 2 channels since mono was capable of delivering a guaranteed impression of the recorded performance, stereo was enabled to develop by the persistence of but a few audio technicians, researchers and artists who were enthused by the capabilities of the stereo system. Swedien quotes one major recording label executive as saying "stereo is like taking a shower with two shower heads – and *you* wouldn't take a shower with two shower heads, would you? Ha! Ha! Ha!" (Swedien, 2009, p. 39). Such comment demonstrates the lack of vision for the potential that stereo could provide a more uplifting experience similar to that experienced in concert halls and also allow for a "sonic fantasy" where new "stereo spaces" could be created and new emotions experienced. Eighty three years after its introduction, stereo is still one of the most used recording formats, while its potential has not yet been fully exploited (Lipshitz, 1986; Swedien, 2009).

Localisation or placement of sound objects in the stereo field is of great importance for sonic illusions. The fact that sounds can be perceived across apparent left to right locations on a stereo stage is a marked improvement over that of monophonic sound reconstruction. But the sonic illusion is not restricted to accurate localisation. Bruce

Swedien comments "...that really good stereo music reproduction was not merely one sound source coming out of one speaker and a different sound coming out of the other speaker". In fact, for him, music can be reproduced "more emotionally by using stereo recording technique" (Swedien, 2009). It can be appreciated that if perceptually significant features of an acoustical environment, such as spaciousness, are conveyed within the sonic illusion, listeners are likely to enjoy the experience more. Griesinger has stated that spaciousness is as important to sound recording reconstruction as it is in concert halls, and that one of the major duties of a sound recordist should be to create the impression of spaciousness (Griesinger, 1985). In summary, auditory spaciousness (see (Blauert, 1997; Conceição, 2015)) is the perceptual impression of sound in an enclosed space. The addition of early reflected sound to a discrete, direct sound source (*e.g.* a musical instrument) at the ears of a listener will create a sonic impression of a space which will differ according to the strength and details of the reflected sound (Barron, 1971).

In order to create and recreate illusions with sound recordings it is important that the features required for the sonic illusion to take place are fully understood. Accurate imaging, good sense of space, tonal quality and instrumental balance are but a few of the features which are important in a good sounding recording. How can these features be controlled in a recording? Should the recording space and the microphone techniques used during the production provide these features? Is it possible to artificially create these features? These questions and others have emerged since the beginning of the *art* of sound recording, and although over the years some solutions have been presented/suggested, many question remain, with yet more questions/further research following on from the answers provided to date. The research studies carried out have focussed on the perceptual attribute of spaciousness, and on techniques by which the recording engineer and producer can manipulate the listeners' impression of spaciousness. The final section here will consider how recording techniques has been found to contribute to reconstructed sound field spaciousness.

SINGLE POINT "MICING" VS. "MULTI-MICING"

Recording techniques have evolved in more or less two different styles. The first is the single point recording technique which utilizes an array of microphones positioned at a spot in the room and aimed at the sound source. Here the idea is to capture the sonic properties of the performance including the acoustics of the space using a somewhat minimal, or "purist", approach. The second approach is to use a plethora of microphones which might include, or not, a main array and several accent microphones that are aimed at particular instruments or sets of instruments. The feeds from these microphones are then mixed, where either a natural approach to the original sound stage recreation, or a "new" sonic stage definition might be the result. The two approaches discussed here relate to the recording of classical ensembles (*e.g.* orchestras and chamber ensembles) performing scored music. Although these different styles of recording techniques might also be used in the recording of jazz, pop and rock music, "multi-micing" is the preferred technique among sound engineers and producers of these styles of music (Bartlett & Bartlett, 1999).

Throughout the years, recording techniques have been debated and defended by those who prefer the single point technique, and those who prefer "multi-micing". Those who defend the latter approach, as discussed by Gerzon, are more or less "objective", while those who defend single point arrays tend to make their claims on a more "subjective" analysis of the results as being more "realistic " and "pleasant" (1971). The fact is that assessing the results using a purely objective analysis is not entirely satisfactory, since the results from the recordings depend on the desired musical effect. If it is accepted that stereo is incapable of reproducing a realistic (*i.e.* close to the real performance in the acoustic space) sound stage, then it will always be a subjective judgment when judging one technique as being more realistic than the other (Gerzon, 1971). What is important here is that the different perceptual features of a recorded sound are delivered to the listeners' ears so that a required feeling and emotion can be appreciated.

Is it then possible to deliver all perceptually significant aspects of a sound field from a primary room to a secondary listening environment using either recording technique? If the perceptual feature of auditory spaciousness is examined, it is possible to discuss whether a recording is producing an appropriate feeling of spaciousness or not (Furlong, 1989), and this discussion is made without, sometimes, any knowledge of it (*i.e.* the recording) being a single point or a "multi-miced" recording. Some experiments made by Griesinger (1985), Gerzon (1986), and more recently by Conceição (2015) have rediscovered and provided insights into how it is possible to manipulate recordings produced with either technique, previously discussed, so that the perceived auditory spaciousness can be changed.

CONCLUSION

Despite the technical achievements in sound recording, there is still and always will be an artistic dimension involved in capturing sound. Audio equipment and techniques developed for use in the process of sound recording are only relevant if the necessary perceptual features are considered. The persistent question of "how can it be made to sound better" is motivated by the notion that sound recordings can communicate emotions and perceptual impressions. Therefore, it is important that research undertaken in the field of sound recording should also be focused on the control of the perceptual effect of the reconstructed sound field, and not merely on the physical effectiveness of the reconstruction. That is to say, physical sound field reconstruction should be approached using perceptually significant physical features.

REFERENCES

Ando, Y. (1985). *Concert Hall Acoustics.* New York: Springer-Verlag.

Barron, M. (1971). The subjective effects of first reflections in concert halls – the need for lateral reflections. *Journal of Sound and Vibration*, 475–494.

Bartlett, B., & Bartlett, J. (1999). *On-Location Recording Techniques.* Woburn: Focal Press.

Blauert, J. (1997). *Spatial hearing: The Psychophysics of Humann Sound Localization.* Cambridge, Mass.: MIT Press.

Conceição, M. (2015, July). Spaciousness Control for Sound Field Recording and Reconstruction. *A dissertation submitted to the University of Dublin for the degree of Doctor of Philosophy*. Dublin, Ireland: Trinity College Dublin.

Everest, F. A., & Pohlmann, K. C. (2009). *Master Handbook of Acoustics – Fifth Edition.* New York: McGraw-Hill.

Furlong, D. J. (1989). Comparative Study of Effective Soundfiled Reconstruction. *87th AES Convention* (p. 2842). New York: Audio Engineering Society.

Gerzon, M. A. (1986, July). Stereo Shuffling: New Approach – Old Technique. *Studio Sound*.

Gerzon, M. A. (1971, March). Why Coincident Microphones? *Studio Sound, 13*, pp. 117, 119, 140.

Griesinger, D. (1985). Spaciousness and Localization in Listening Rooms – How To Make Coincident Recordings Sound As Spacious As Spaced Microphone Arrays. *79th Convention* (p. 2294). New York: Audio Engineering Society.

Lipshitz, S. P. (1986). Stereo microphone techniques...Are the Purists wrong? *Journal of the Audio Engineering Society, 34* (9), 716–744.

Read, O., & Welsh, W. L. (1959). *From Tin Foil to Stereo.* Indianapolis, Indiana: Howard Sams.

Sterne, J. (2003). *The Audible Past.* Durham & London: Duke University Press.

Streicher, R., & Everest, F. A. (2006). *The New Stereo Soundbook* (3rd ed.). Pasadena, CA: Audio Engineering Associates.

Swedien, B. (2009). *Make Mine Music.* Milwaukee: Hal Leonard Books.

Toole, F. E. (2008). *Sound Reproduction: The Acoustics and Psychoacoustics of Loudspeakers and Rooms.* Burlington: Focal Press.