

HEARING AMONG MUSICIANS AND MUSIC PERFORMANCE

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A Transcript of Ockham's Razor program with Robyn Williams and Donald Woolford, broadcast over ABC Radio National on November 21, 1999.

Robyn Williams: Do you play a musical instrument? If you do I suppose you take it for granted that it helps to hear the noise you make. Some of the audience, on the other hand, especially if the performers are someone else's adorable children, have been known to pray for deafness to escape the ordeal. But frankly, do you need good hearing to be a good musician? That sounds like a daft question, but it isn't. Donald Woolford is an acoustics engineer and found there is a difference between the hearing you need to perform music as opposed to what you rely on for other work. And when you think about it, there are many examples of supreme musicians whose ears worked hardly at all. And Donald Woolford is a musician himself.

Donald Woolford: Many of us know of Scottish born Evelyn Glennie, world famous percussionist, and perhaps seen her perform. Evelyn Glennie, who started to lose her hearing at age 8, was quite deaf from early teens. She has performed widely in the UK, also in Europe, North America, Japan and Australia. Her autobiography, 'Good Vibrations', is a story of great determination. Even though the nature of percussion lends itself to touch, sight and vibration perception as feedback in performance, determination and innate musicianship must have contributed to her magnificent achievements.

One of the attributes of musicianship is the ability to transcend the purely physical aspects and structure of music. Most of us can distinguish between just a technical performance and a truly musical or an even magical one that enters the spirit of the music. Another attribute of musicianship is the ability to play together with others, artistically. But some reliable auditory feedback is necessary for musicians who play pitch producing instruments, to produce and monitor their own music output, as well as listen and adjust to other instruments. Orchestral players of such as strings, woodwind and brass instruments regulate their music with auditory feedback to control pitch, loudness, timbre and ensemble, together with applying acquired technical, musical and cognitive skills. Sight is also a very important factor.

Recent research into musicians in major orchestras has revealed that a larger than expected proportion of players have acquired some sort of hearing changes due to a wide variety of causes, to include presbycusis or ageing of hearing. It may seem surprising that those affected perform well and presumably stress free. Indeed the musical function of hearing in conjunction with all the other elements of music performance among these musicians appears unaltered. One conclusion we may postulate is the robustness of musical hearing. Another, that musicians make the most of residual hearing because of their highly developed auditory skills, and is supported by an investigation into

frequency discrimination of complex sounds by Drs Murray Spiegel and Steve Watson in 1984. Members of the St Louis Symphony Orchestra performed better initially in these tests compared to non-musicians. Nevertheless the non-musicians caught up with and even out-performed the professional players in purely discrimination testing, but only after extensive and directed training over a period. In the book 'Music and the Brain; Studies in the Neurology of Music', J.D. Hood reported that Smetana at the age of 56, totally deaf, performed Chopin's Nocturne in B and his own Polka in A Minor. A contemporary wrote of his performance as towering above all other pianists. Hood also reported Beethoven's attempt to conduct 'Fidelio' in 1822, which has disastrous consequences because of his deafness. But deafness appeared not to inhibit Beethoven's composition. Vaughan Williams was reported as having presbycusis deafness in his later years, but continued to conduct successfully until his 85th year, even though he was unsure of orchestral balance and had to consult with Sir John Barbirolli and Sir Adrian Boult in conducting recordings of his own works, since he could not hear high tones of some instruments.

Dr Barrie Morley, neurologist of Queensland, summarised the main contemporary views. For example, there appears to be a right brain hemisphere dominance for music execution, that music talent involve different brain functions. Dr Oscar Marin of Portland, Oregon, in Diana Deutsch's book 'The Psychology of Music', mentions documented cases of aphasia among professional or amateur musicians in whom musical abilities were not noticeably affected. There thus appear to be diverse brain functions for music faculty. Research into musicians' hearing has foundation in the advent of rock music, and published papers date back to the 1960s. Later work has looked at the hearing of orchestral and other types of musicians and audience to establish the effect of the music upon hearing. For example, in the Swiss Romande Orchestra, Rabinowitz found that 22 out of 110 players had changed hearing levels presumed due to the music alone. Drs Alf Axelsson and Frederik Lindgren of Sweden listed 42% of players in two Swedish orchestras as having pure-tone thresholds worse than expected for age. Although intense music was a suggested diagnosis of 36% of these players, other diagnoses included disease, gunfire, heredity, injury, presbycusis and previous noisy job. Some players had up to three different diagnoses. It is significant that many causes of changed hearing levels from other than intense music were identified. Also apparent from these and other studies, is the wide variation in susceptibility for hearing loss resulting from intense sound exposures.

The medical assessment of hearing is directed to establish type, extent and source of hearing impairment if one exists, and determine remedies and predictions about aural abilities in everyday life. However, measurements were not devised to test aural abilities in music perception, or monitoring sounds created by a musician, or in loudspeaker listening by a sound recorder, where that kind of accuracy is required. Indeed in the cases of musicians from standard measurements, one might predict difficulty to perform efficiently because of hearing losses, even though performance efficiency is already demonstrated.

There is evidence that music may cause less damaging effect upon hearing than industrial noise of the same energy spectrum. For example, Alf Axelsson in Sweden surveyed 53 rock and pop musicians in 1973, and again in 1993, and found that although they had hearing slightly worse than the average populace for age in 1973, presumed due to the music, were collectively within the average populace in 1993. Why? It may be because their music performances are for short periods of a few minutes, even though very high level, with frequent rest periods, that they work a shorter week, or what is called the aural reflex, a middle-ear phenomenon that limits energy through to the cochlea, or inner ear. Axelsson found however, that some players had permanent tinnitus or ringing in the ears, and some hyperacusis, that is, increased sensitivity to loud sounds. In an article about loud music and hearing loss in *'Audio Magazine'*, Dr Mead Killion of Chicago, who developed the Musician's Ear Plug, is quoted as saying, 'God protects musicians, otherwise they'd all be deaf!' Whether or not musicians are thus favoured, there is science that suggests musicians lose less hearing than expected due to the music. Axelsson and Lindgren established that music with the same energy as industrial noise produces less temporary hearing loss. Garry Foster, of Worksafe Australia, said the evidence suggests that although music is a risk to hearing, the risk is much less than the equivalent exposure to industrial noise. In a series of studies in the 1980s, Dr Norm Carter at National Acoustic Laboratory, found that amplified music and recreational noise consistently showed little or no effect on hearing acuity of young people as a group, and young adults up to 30 years. It was concluded that long-term exposure to occupational noise remained the main source of noise-induced hearing loss. Although a person's measured hearing appears normal for age, researchers using comparatively new oto-acoustic emission testing claim a different scenario. It is considered that cochlea hair cells may already be damaged due to noise exposures, which is not apparent from the audiogram.

It is an intriguing question as to how a musician can perform with some-thing less than so-called normal hearing. Audiograms of some musicians who perform well and presumably stress free, exhibit little sensitivity for the higher harmonic structure of music sounds. For example, a tenor in Tennessee needs a hearing aid for everyday life, but takes the aid off for singing. An orchestral pit musician in USA with a high tone hearing loss has problems in discriminating female speech, with its higher frequency content. The second oboist in a famous orchestra cannot discriminate all the sounds of the violin solo in 'Scherzade', at least from where he sits in the orchestra.

Two of these players were older, and it may be their hearing

changes were the result of both ageing and exposures to intense sounds. Whatever, they were still performing music at a professional level, presumably stress free.

As an orchestral player, my observation is that much older players perform well, even though one could expect them to have at least changes in hearing due to age. Indeed, many players in major orchestras in the USA continue well into their seventies. The late A.T. Welford, Professor of Psychology at Adelaide University, said 'Where specific tasks were done under deficiencies due to age, fatigue or injury, the performer compensates to achieve the same objective.' If we can apply this to hearing in music performance, how much hearing deficiency can be tolerated before other performance elements have been stretched to their limits? We do not know, but is probably to include such as the type of instrument and individuality.

To my knowledge, there is little science that relates hearing to the function of music perception in music performance, combining the perception of music and the precise production of musical sounds. Any investigations should involve binaural hearing perception rather than the one-ear-at-a-time health tests. Professor Steven Colburn, Director of the Hearing Research Center at Boston University, has authored papers about binaural perception for various kinds of hearing impairments. In Steven Colburn's Center, I am working on the effects of simulated hearing impairments in the performance of some orchestral instruments. Preliminary results appeared in a recent issue of *'Acoustics Australia'*.

I consider that musicians deserve special attention into the effects of loud music upon their hearing and the possibility of noise induced hearing loss. In particular, to re-examine the criteria for the conservation of their hearing, since the present industrial criteria were derived from industrial noise. Music, with its often fluctuating levels and intermittent nature, is different in character. Even so, sound levels get quite high in an orchestra, more so in an orchestral pit. Secondly, it may be that special measurements can be devised that relate music perception to hearing in the function of production of music. Definitely not to scientifically measure performance quality and competence. In this the final arbiters are listeners, one's peers, and should remain so, considering the nature of music. In my opinion, part of the beauty of music performance is the unexpected and artistic variability.

Since medical interest in hearing is oriented to health and communication, and measurements thereto are not directed to music, special measurements for application by health professionals, in addition to the standard battery of tests, could bring science and music closer. But the final gap may never be bridged, because of the nature of music. Nevertheless the application of special measurements directed to music may be the catalyst to admit a partially deaf person to a music school, or help resolve industrial matters for musicians. It may be inspiration from the Glennie determination will result in a positive advance.

Robyn Williams: Evelyn Glennie, that incredible percussionist, who appears to be completely unrestricted by her deafness. That was Donald Woolford, who used to lead orchestras in Adelaide but now plays in a string quartet in Sydney. He's also an acoustics engineer.