BINAURAL HEARING IN MUSIC PERFORMANCE

The perception of music is binaural, two ears working together, and most of the research thereto uses binaural hearing, unlike the monaural assessment process for the health of hearing. Also music perception research generally stops at music perception and does not venture into the production of music sounds.

But the primary element of music performance function is the production of sounds by voice or musical instrument, solo or in relation to other instruments and voices. This within certain variable limits if the music is to obey the need for such as form, pitch, intonation, harmony, ensemble, rhythm and timing.

The possibility of noise-induced hearing from music exposures remains the principal object in looking at musician's hearing levels. Research has shown musicians often exhibit less than so-called normal hearing resulting from many different etiologies, beside the effects of aging, called presbyacusis. For practising professional musicians, particularly older persons, monaural pure tone audiometry often exhibits little sensitivity for frequencies above 3 or 4 kHz. Also the audible frequencies are sometimes depressed in one or even both ears. Although the harmonic structure of most orchestral instruments can extend as high as 15 kHz, fundamental pitch ranges lie below about 1.6 kHz, perhaps a redeeming feature.

The range of hearing levels for musicians can vary from the most unusual case of Evelyn Glennie, world famous percussionist, completely deaf from early teens, to young persons whose hearing extends as high as 20 kHz at audiometric zero. What then are hearing criteria to establish performance abilities ?

Details of measured hearing levels of many musicians suggests it is difficult if not impossible to make predictions about a person's ability to perform music on the basis of the information derived from pure-tone audiometry or otoacoustic emission testing to determine residual hearing. Indeed the assessment by a musician's peers, listeners, sound recordist and music critic appear to remain the final arbiters of the integrity of music performance. Additionally, attempts to quantify music performance by measurement presents difficulties in application thereto, since variability and inconsistencies exist even though the musical and cognitive aspects may satisfy all concerned.

Preliminary research at Boston University Hearing Research Center during June 1997 was directed to estimate the degree of hearing changes musicians may sustain, from any etiology, before performance appears affected, or the degree of hearing impairment where performance becomes stressful to the player. Experiments may determine such an estimate essentially individual, or an estimate that is true only for a class of instruments or voice, or an estimate of general application.

Practising musicians of wide age range in and around Boston, some from Berklee College of Music, were enlisted to take part in music performance experiments. Conductive hearing losses were induced using ear muffs over one and both ears. Noise masking of higher frequencies above 4 kHz were also used to simulate sensorineural losses. All sessions were recorded and assessments and comments made by players.

Audiograms of each player indicated a variety of hearing levels, but this information gave no indication of performing expertise for non-experimental conditions. In fact added hearing impediments, although stressful to players, did not appear to materially impair performance. It was significant that players of wind instruments found increased stress by the presence of the earmuffs, which inhibited skull vibrations. Also there was a handedness among players, some of whom relied on one ear more than the other. Thus unobservable changes to performance quality with practically no increase in player stress occurred when the ear less important to performance was covered. But covering the most useful ear caused increased stress for players even though playing changes appeared imperceptible. This is not surprising, since some players during performance often use one or two ear plugs, or the musician's Earplug ER 15, by Etymotic Research in Chicago. Good evidence to support the robustness of musical hearing and player adaptability.

A very interesting fact about musicians' hearing is that even though a person may have a compensable noise induced binaural hearing loss derived from monaural measurements, and have difficulties in discriminating speech and the sounds of everyday life, that same person may be unstressed in performance with no observed impediments. Why? One explanation is the over-learned elements of music performance and cognitive skills can somehow make up for depressed hearing levels, that is providing a degree of residual hearing is present.

Boston University Biomedical Engineering Hearing Research Center is one of international recognition with emphasis on binaural hearing. Headed by Professor Steve Colburn, a close liaison is maintained with laboratories at MIT and Northeastern University. Symposia are presented regularly by in house, out of state and overseas researchers on a wide range of topics in psychological acoustics and the neural system. This laboratory is thus an ideal venue for continuance of the work.

Donald Woolford
Visiting Scholar, Hearing Research Center, Boston University.

Books...

Attenuation and Use of Hearing Protectors - 8th Edition

National Acoustic Laboratory

National Acoustic Laboratories, Chatswood 1998 ISBN 0 64 09114 2, 80 pp, soft-cover. Available from: NAL, 126 Greville St, Chatswood, NSW 2067, tel. (02) 9412 6800, fax (02) 9411 8273. Price A$25.00

This is the latest edition of the reference document listing the performance of the hearing protectors that have been tested at the National Acoustics Laboratory in Australia. The stated aim of this publication, in the Introduction by Warwick Williams, is to present information on the 'selection, fitting, use and maintenance of hearing protectors' in addition to the performance data. From the slender document of around 30 pages for the former editions, this 8th edition comprises 80 pages of which less than 20 are devoted to the data on hearing protectors.

The first parts of the considerably expanded information sections include descriptions of the rating and measurement procedures. Theses are followed by the practical guide to the selection, fitting and use of protectors. There are descriptions of the various types of muffs, plugs and comments on the use of combinations. A table clearly lists the advantages and disadvantages of muffs and plugs. The appendices include glossary of terms, typical noise levels, use of a sound level meter as well as contact details for the