# Sound Sound Guidelines

**by JM Nelson**

Ballroom dance is a healthy, enjoyable activity. Dance is perhaps the most beneficial sport; it burns calories and requires continuous, full body participation. Unfortunately there is accompanying danger, often ignored and emerging well past the opportunity for prevention. The music we so much enjoy can be silently damaging, "silently" because the damage is not felt. It is also cumulative and irreversible.

At a social dance, there are two, predominant sound categories, music and conversation. The interaction of these is critical to our comfort and enjoyment, but their interaction is also critical to healthy hearing. Two factors that influence the impact of sound on human hearing are reverberation and sound pressure.

**Staying Healthy -** One does not need to carry a dB Meter to stay healthy. The following provide a basis for estimating sound levels and can be used for maintaining a healthy environment.

65 - 70 dB Speaking softly near the ear
70 - 75 dB Normal conversation
75 - 85 dB Speaking normally near the ear
85 - 95 dB Speaking loudly near the ear
95 - 105 dB Shouting near the ear

Considering music as background, conversation must exceed the music level by at least 3 dB, and likely a bit more for anyone over 30. If the music is at a reasonable level, conversation can be comfortable, but in many venues we must shout when conversing. If you can't have a conversation with your dance partner without shouting, then you are in a damaging environment, and the background noise is likely greater than 90 dB. If you must shout near their ear, then the level is likely above 95 dB, and, since sound fluctuates, the peak sound level might exceed 100 dB and could easily approach 110 dB. If you must shout to be heard, then you are accumulating hearing damage, and you should consider leaving or using ear plugs. If you feel occasional discomfort, then there could be peaks approaching 120 dB, and it is time either to acquire ear protection or leave.

**Reverberation -** The most critical factor for intelligibility is reverberation time. Excess reverberation results in echo at a level sufficient to conflict with the initial sound, and the associated wave interaction can also cause uneven sound distribution. Though a completely "dead" room might not be desirable, a reverberation time above 0.6 seconds will inhibit intelligibility. (Examples of different reverberation times can be heard at http://www.mcsquared.com/reverb.htm) Anyone who has been at a gathering wherein conversation was difficult, even in the absence of any other sound, has probably experienced excess reverberation. In dance venues, difficulty in hearing the beat is generally a sign of excess reverberation. Higher volume is often used to compensate for poor intelligibility, but any perceived improvement is likely an illusion.

**Sound Pressure -**

Sound is a pressure wave that impinges on the eardrum. One measure of our hearing is the threshold below which no sound is detected. There is an upper threshold at which pain is felt. Unfortunately, there are intermediate sound levels at which damage is cumulative and permanent, but not felt. The standard measure of sound pressure is the *decibel*, abbreviated as dB, "d" for "deci," and "B" for Bel, a unit devised by Bell Labs for measuring sound. One decibel is approximately the smallest change in sound that humans can detect. Since perception of change is a function of the initial measure, the unit of measure is logarithmic; an increase of 3 dB indicates a doubling of the sound pressure. Damage to hearing can begin at 85 - 90 dB, and it is generally irreversible. OSHA requires that hearing protection be made available to factory workers at 85 dB, and mandatory at 90 dB.

**Recommendations -**

**I**f the music sounds "mushy," has too much echo, or if it is difficult to hear the beat, then there are likely reverberation problems. The only solution is to change the room acoustics, usually by adding sound absorbing material to the walls and ceiling. Intelligibility cannot be improved significantly by increased volume.

If you must speak loudly or shout to converse, then the sound level is likely unhealthy, and you are probably accumulating irreversible hearing damage, even if the ringing or hissing goes away later. Over time, exposure to high sound levels will impair hearing, and the noise will not go away, though it could be years later. Prevention is paramount, when damage is detected, it is too late to take corrective action. There is no rational argument for dance music to be above 90 dB, and there is good reason to maintain sound, even for entertainment purposes, below that level. In a properly designed room, one can have danceable music, enjoyable conversation, and healthy sound levels.

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