Example:

An auditorium has dimensions 20×30×10 *m* and an average absorption coefficient $\bar{a} = 0.15$. A speaker standing with his/her back in proximity to a wall of the room, located ~ in the center of this wall radiates $P = 10^{-5}\ Watts$ of power with a directivity factor $Q = 4$. Since $A = S\bar{a}$, then: $\bar{A} = S\bar{a} = 0.15\left[2\times(20\times30)+2\times(20\times10)+2\times(30\times10)\right] = 330\ m^2$ (*n.b.* this *A*-value is a very small absorption for a room $\Rightarrow$ this room will be extremely reverberant/extremely "live").

Directly in front of the speaker, at a distance $r = 5\ m$ away from the speaker, the sound pressure level associated with the ***direct*** + ***reverberant*** sound will be:

$$SPL_{\substack{direct\\+rvb}}(r = 5\ m) = L_p^{direct}(r = 5\ m) = L_{Pwr} + 10\log_{10}\left(\frac{Q}{4\pi r^2} + \frac{4}{A}\right)\ (dB)$$

$$= 10\log_{10}\left(\frac{10^{-5}}{10^{-12}}\right) + 10\log_{10}\left(\frac{4}{4\pi(5)^2} + \frac{4}{330}\right) = 10\log_{10}\left(10^7\right) + 10\log_{10}(0.0261)$$

$$= 70 - 15.84 = 54.16\ dB$$

The ***steady-state reverberant-only*** sound pressure level (*n.b.* independent of location in the room) will be:

$$SPL_{\substack{rvb\\only}} = L_{Pwr} + 10\log_{10}\left(\frac{4}{A}\right) = 10\log_{10}\left(10^7\right) + 10\log_{10}\left(\frac{4}{330}\right) = 70 - 19.16 = 50.84\ dB$$

As long as the noise level in the room is not too large, the speaker can be heard by a listener located 5 *m* away, directly in front of the speaker. However note that the direct *vs*. reverberant-only sound pressure levels as this location in the room differ only by ~ 3.3 *dB*!

If the above calculations are repeated for a listener located 30 *m* away from the speaker, again directly in front of him/her (*e.g*. at the very back of the room), $SPL_{direct}(r = 30\ m) \sim 35\ dB$, which is –16 *dB* below the ***reverberant-only*** sound pressure level – thus the listener at the very back of the room will have an extremely tough time hearing/clearly understanding the speaker due to the (strong) reverberant nature of this "live" room. Thus, electronic reinforcement of sound in this portion of the room/auditorium would significantly improve the quality of the sound listeners hear there...

Percentage Articulation Loss for Consonants (*%ALCONS*):

Speech intelligibility studies carried out in the Netherlands in the early 1970's (please see/read *e.g*. V.M.A. Peutz, "Articulation Loss of Consonants as a Criterion for Speech Transmission in a Room", J. Audio Eng. Soc. 19, *p*. 915, 1971) have enabled us to develop mathematical formulae quantifying the percentage loss of consonants, from direct measurements of the percentage of sounds incorrectly identified *e.g*. by good, average and poor listeners:

$$\%ALCONS\left(r \le D_{crit}\right) = \frac{200r^2T_{60}^2}{QV} + k$$