Direct field D (Free field) and Reverberant field R (Diffuse field)

... marks the acoustic properties and is room dependent.

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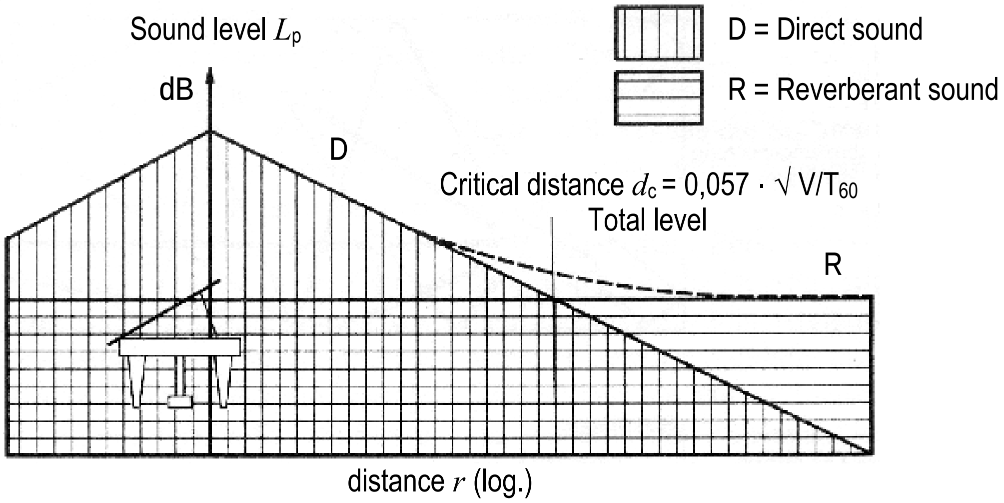
German version: Direktfeld D (Freifeld) - Raumfeld R (Diffusfeld) http://www.sengpielaudio.com/DirektfeldUndRaumfeld.pdf

As sound engineers we should consider the environmental conditions of an ideal sound source with a spherical pattern within a room. The direct sound D of a source will reach the listener's ear or microphone first, followed by the room reflections which form the reverberant sound R. The direct sound decreases with increasing distance, ie the sound pressure p decreases after 1/r law. The reverberant sound is approximately evenly distributed throughout the room.

Thus, the D/R ratio varies with the distance to the sound source and as such is an important criteria for the microphone placement. At the point of "critical distance" d_c the direct sound D and reverberant sound R are of equal size. D = R.

This information is useful to sound engineers. Figure from: Dickreiter, "Mikrofon-Aufnahmetechnik", 3rd edition, page 8.



Spatial distribution of direct sound and reverberant sound

Near field N and Far field F

... looks only at the sound source and is not room dependent.

Each sound source has a far field and near field, which is only sound source-dependent. When considering the far field and the near field, acousticians consider the sound field which "noisemakers" are generating. The acoustics of the room does not matter. Really! Sound engineers would not be concerned with this.

Most clearly the boundary between the two fields is illustrated in using the example of a "radiator of zero order" terms (breathing sphere or pulsating sphere). The near-field of such a radiator is characterized by the condition: $k \cdot r << 1$ and the far-field is characterized by the condition: $k \cdot r >> 1$

Where: k = circular wave number, and r = distance from the measurement point to the sound source.

The sound terms far-field and near-field can be confused with the terms reverberant field or diffuse field and direct or free field. So keep both pairs of words strictly separated.

Specifying an exact boundary between the near field and far field of a sound source is not always possible and depends on what residual phase angle φ is valid between sound pressure and particle velocity. There is also no consensus between acousticians. An opinion is that the near field of a sound source is at $r < 2 \cdot \lambda$ and the far field is at $r > 2 \cdot \lambda$ - also we are told that the far filed is at $r > \lambda$.

Between sound pressure p and the sound velocity v, there is a phase angle φ, which has the size $k \cdot r$ and the following relationship:

$$cos\varphi = \sqrt{\frac{1}{1+\left(\frac{1}{k \cdot r}\right)^2}}$$

For sound we use:

$$k = \frac{2 \cdot \pi}{\lambda} = \frac{\omega}{c} \qquad \omega = 2 \cdot \pi \cdot f$$

According to this relationship we get for the remaining phase angle φ at a distance of $r = 2 \cdot \lambda$ a value of cos φ = 0.997, corresponding to φ = 4.44°, that is valid at a distance $r > 2 \cdot \lambda$ in the far field of the radiator of zero order.

The sound pressure of a spherical wave in the near field drops with $1/r$ and the sound pressure of a plane wave drops in the far field with $1/r$. In the near field of the sound source, the particle velocity v increases sharply. Therefore we get the $1/r^2$ law for the frequency-dependent sound particle velocity. The word near field is commonly used by sound engineers only if the proximity effect is explained, that is the strong increase of the low frequencies affected by near-mic'ing of pressure gradient microphones, see: "Decrease of sound with distance": http://www.sengpielaudio.com/calculator-distance.htm

Note: Near and Far field characterize the sound source itself (not the room), while Direct field (free field) and Reverberant field (diffuse field) are determined by the acoustic properties of the surrounding room area.

"Direct field and reverberant field" have nothing to do with "near field and far field".

This figure with D/R and N/F together is not correct: http://www.sengpielaudio.com/D-F_and_R-D-Field.pdf