Two other statistics are the Echo Criterion for ***speech*** $EK_s(t,\tau_s)$ where $\tau_s = 9\ msec$ and the Echo Criterion for ***music*** $EK_m(\tau_m)$ where $\tau_m = 14\ msec$. Defining the time-dependent statistic:

$$T_n(t) \equiv \frac{\int_{t'=0}^{t'=t} t' \cdot |p(t')|^n\, dt'}{\int_{t'=0}^{t'=t} |p(t')|^n\, dt'} \quad \text{where } n = 2/3\ (1) \text{ for speech (music)}$$

Then the Echo Criterion for Speech $EK_s(t,\tau_s)$ and the Echo Criterion for Music $EK_m(t,\tau_m)$ are respectively defined as:

$$EK_s(t,\tau_s = 9\ msec) \equiv \frac{\Delta T_s(t,\tau_s)}{\tau_s} = \frac{T_s(t+\tau_s) - T_s(t)}{\tau_s} = \frac{T_s(t+9\ msec) - T_s(t)}{9\ msec}$$

$$EK_m(t,\tau_m = 14\ msec) \equiv \frac{\Delta T_m(t,\tau_m)}{\tau_m} = \frac{T_m(t+\tau_m) - T_m(t)}{\tau_m} = \frac{T_m(t+14\ msec) - T_m(t)}{14\ msec}$$

An echo occurs when $\max\{EK_s(t,\tau_s)\} > 1.0$ and/or $\max\{EK_m(t,\tau_m)\} > 1.8$, respectively. A ***flutter echo*** can exist (*e.g.* due to an impulsive-type sound bouncing rapidly back and forth between two parallel reflecting surfaces – *i.e.* axial modes), when $\max\{EK_s(t,\tau_s)\} > 1.0$ and/or $\max\{EK_m(t,\tau_m)\} > 1.8$ occurs ***periodically***, *e.g.* at intervals of ~ 50 *msec* for speech, and at intervals of ~ 80-100 *msec* for music.

The clarity associated with the ***direct*** sound level in a large listening room/auditorium can be characterized by the C_7 statistic, defined as:

$$C_7 \equiv 10\log_{10}\left(\frac{\int_{t=0}^{t=7ms} p^2(t)dt}{\int_{t=0}^{t=\infty} p^2(t)dt - \int_{t=0}^{t=7ms} p^2(t)dt}\right) \quad (dB)$$

The direct sound level clarity statistic C_7 should be well-correlated with the sound source-listener separation distance, and hence should not fall below a range of $C_7 \sim -10\ dB$ to $-15\ dB$.

Numerous other, often more complicated, frequency-dependent room acoustics measurement statistics have also been developed over the years by sound engineers, such as the Speech Transmission Index (STI), Room Acoustics Speech Transmission Index (RaSTI) , Clarity for music C_{80}, Inter-Aural Cross Correlation (IACC), Strength Measure (G), Early Decay Time (EDT), Reverberance (R) – a measure of the acoustic "liveliness" of a reverberant room, an Echo Criterion for music ($\langle EK_m(\tau)\rangle$), Lateral Efficiency (LE) and Lateral Fraction (LF), Bass Ratio (BR), Warmth (W), Brilliance (B), … The speech intelligibility statistic, %ALCONs – per cent Articulation Loss of Consonants in Physics 406 Lecture Notes 10, *p.* 4-6, will be discussed after first discussing various aspects of the nature of a sound field in a listening room.