Chapter 3 Lesson 2

Acoustics - sience dealing with the production, effects and transmission of sound waves; the transmission of soundwaves through various mediums, including reflection, refraction, diffraction, absorption and interference; the characteristics of auditoriums, theaters and studios, as well as their design.

Acoustic isolation - this prevents external noise from transmitting into the studio environment through the air, ground, or building structure. It can also prevent feuds that can arise when excessive volumes levels leak out into the surrounding neighborhood.

Frequency balance - the frequency components of a room shouldn't adversely affect the acoustic balance of instruments and/or speakers. Simply stated, the acoustic environment shouldn't alter the sound quality of the original or recorded performance.

Acoustic Separation - the acoustic environment should not interfere with intelligibility and should offer the highest possible degree of acoustic separation within the room (often a requirement ~~[illegible]~~ for ensuring that sounds from one instruments aren't unduly picked up by another instrument's microphone.)

Reverberation - the controll of sonic reflections within a space is an important factor for maximizing the intelligibility of music and speech. No matter how short the early reflection and reverb times are, they will add an important psychoacustics sense of "space" in the sense that they can give our brain subconscious cues as to a room's size, number of reflective boundries, distance between the source and listener, and so forth.

Cost factors - Not the least of all design and construction factors is cost. Multimillion-dollar facilities often employ studio designers and construction teams to create a plush decor that has been acoustically tuned to fit the needs of both the owners and their clients. Owners of project studios and budget-minded productions facilities, however, can also take full advantage of the same basic acoustic principals of construction techniques and apply them in cost effective ways.

Studio Types - Professional music Studio
Audio-for-visual production environments
Project studio
Portable Studio.

Primary factors governing studio and Control Room Acoustics

- Acoustic isolation
- Symmetry in control room and monitoring design
- Frequency Balance
- Absorbtion
- Reflection
- Reverberation

Concrete - this is the best and most solid material, but it is often expensive and it's not always possible to pour cement into an existing design

Bricks (Hollow-form or solid facing) - this excellent material is often easier to place into an existing room than concrete

Gypsum plasterboard - building multiple layers of plasterboard into a double-walled stud frame is often the most cost-effective and design ~~effective~~ efficient approach to reducing resonance and maximizing transmission loss. It's often a good idea to reduced these resonance by filling the walls cavities with rock-wool or fiberglass, while bracing the internal structure to add an extra degree of stiffness.

Floors, Risers, Ceilings, Windows + Doors

Whenever possible, double door designs should be used to form an an acoustical sound lock. This construction technique dramatically reduces leakage because the air trapped between the two solid barriers offers up high TL values

ISO-ROOMS + ISO BOOTHS

Isolation Rooms (ISO ROOMS) - are acoustically isolated or sealed areas that are built into a music studio or just off of a control room

Isolation Booths (ISO BOOTH) - provide the same type of isolation as an iso-room, ~~but~~ are often much smaller. Often called vocal booths, these mini-studios are perfect for isolating vocals and single instruments from the larger studio.

Noise Isolation within the Control Room
Replace fans with quieter ones, ventalation, CPU's.
Creat Iso rooms for the noiser tools

Acoustic Partitions - moveable acoustic portions (also known as flats or gobos) are commonly used in studio to provide on-the-spot barriers to sound leakage. By portioning a musican and/or instrument on one or more sides and then placing the mic inside the temporary enclosure, isolation can greatly improved in a flexible way that can be easily changed as a new situations arise.

Symmetry in control room design

The center and acoustic imaging is best when the listener, speakers, walls and other acoustical boundries are symmetrically centered about the listeners position. Center listener or monitoring position @ 45° symmetrical corner, or symmetricly center

Frequency Balance - room should exhibit a relatively flat response over the entire audio Range without adding its own particular sound coloration

Reflections - One of the most important characteristics of sound as it travels through air is its ability to reflect off a boundry's surface at an angle that's equal to (and opposite of) its original angle of incidence, just like light on a mirror. Through careful control of these reflections, a room can be altered to improve its frequency response and sonic character.

Standing Waves - (room modes) occur when sound is reflected off of parallel surfaces and travels back on its own path, thereby causing phase differences to interfere with a room's amplitude response.

Flutter Echo (slap Echo) is a condition that occurs when parallel boundries are spaced far enough apart that the listener is able to descern a number of discrete echos. It often produces a "BOINGY" hollow sound that greatly affects a room's sound character as well as its frequency response

Absorbtion - of acoustic energy is, effectively, the inverse of reflection. Whenever sound strikes a material, the amount of acoustic energy that's absorbed relative to the amount that's reflected can be expressed as a single ratio known as the material's absorbtion coefficient

High frequency absorbtion - the absorbtion of high frequencies is accomplished through the use of dense porus materials, such as fiberglass, dense fabric and carpeting. ~~which~~ These materials generally exhibit high absorbtion values at higher frequencies, which can be used to control room reflections in a frequency-dependent manner.

Low frequency absorbtion - materials that are absorbtive in the high frequency often provide little resistance to the low-frequency end of the spectrum (+ vise versa). This occurs because low frequencies are best damped by plyable materials, meaning low-frequency energy is absorbed by the materials ability to bend and flex with the incident waveform

~~Bo~~
Bass Trap - used as another low-frequency buildup at specific frequency (and ~~their~~ their multibles) within a room.

- Quater-wavelength trap
- Pressure zone trap
- Functional trap

Room Reflections and Acoustic Reverberation

Reverberation (Reverb) - is the persistance of a signal (in the form of reflective waves within an acoustic space) that continues after the original sound has ceased. The effect of these closely spaced and random multiple echoes gives us perceptible cues as to the size, density and nature of an acoustic space. Reverb also adds to the perceived warmth and spatial depth of recorded sound and plays an extremely important role in the perceived enhancement of music.

3 components = • Direct Sound • Early Reflection • Reverb

Acoustic Echo Chambers - a traditional echo chamber is an isolated room that has highly reflective surfaces into which speakers and mics are placed. The speakers are fed from an effects send, while the mic's reverberant pickup is fed back into the mix via an input strip of effects return. By using one or more directional mics that have been pointed away from the room speakers, the direct sound pickup can be minimized. Moveable partitions also can be used to vary the room's decay time.