

## Psychoacoustics

*The study of subjective human perception of sounds.*

*Both the ear and the brain are involved in a person's listening experience.*

## How Much Louder Does That Seem?

- *Relative loudness perception*
- *Not linear due to how the inner ear works.*
- *It is however more like a log scale. Therefore we use decibels (dB)*

## Factoids

- *People standing watch in the dark can perceive sounds that are not really there.*
- *A common form of sound masking in offices, is pink noise. It also works for sleepers in noisy motels.*

## Tuning Out Noises

- *We can tune out details. A person listens to scratchy records eventually stops noticing the background noise, and simply perceives the music. S/he might not even remember hearing scratches.*
- *You probably don't notice the background noises much in this room until we record a narration in here.*

## Loudness vs. Amplitude

*Amplitude and loudness are related but not the same...*

*Something **sounds louder**, even if the amplitude is the same, **if**:*

- *its frequency is around 1000–2000 Hz.*
- *other sounds are now quieter*
- *the amplitude never drops (as in commercials).*

- *Something **sounds louder** even if the amplitude is the same, **if**:*

- *more frequency overtone elements, or an EQ boost in the 800–2000 Hz range, are added.*
- *If it is moved away from other sounds in a sound field (like stereo or 5.1 surround)*

- Something **sounds louder** even if the amplitude is the same, also **if**:
  - *No other sounds in the mix occupy the same frequency range.*

## Loud Lows?

*True low frequencies are hard to reproduce over computer and many home audio systems, even with subwoofers. Some theaters can do it.*

## Loud Lows

But we usually **cheat** by putting in a little of the very low fundamental we want (say 25 Hz) and add a **lot of the next octave** (50 Hz in this case).

If we get the balance between the frequencies right, people imagine they are hearing more of the 25 Hz note and we save money on heavy duty speakers and amplifier power.