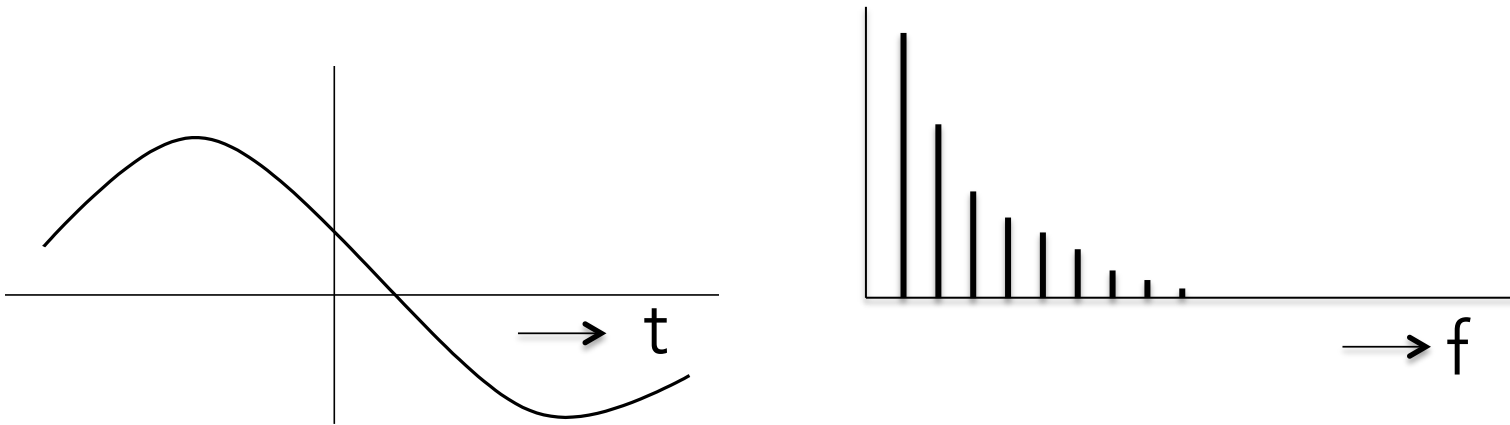


Week 13

MP3 Compression

Time Domain Vs Frequency Domain



Give me one idea to compress the signal by viewing this diagram!

Convert signal into frequency
domain and encode
frequency coefficients!

How do humans
perceive audio?



100



200



500



600

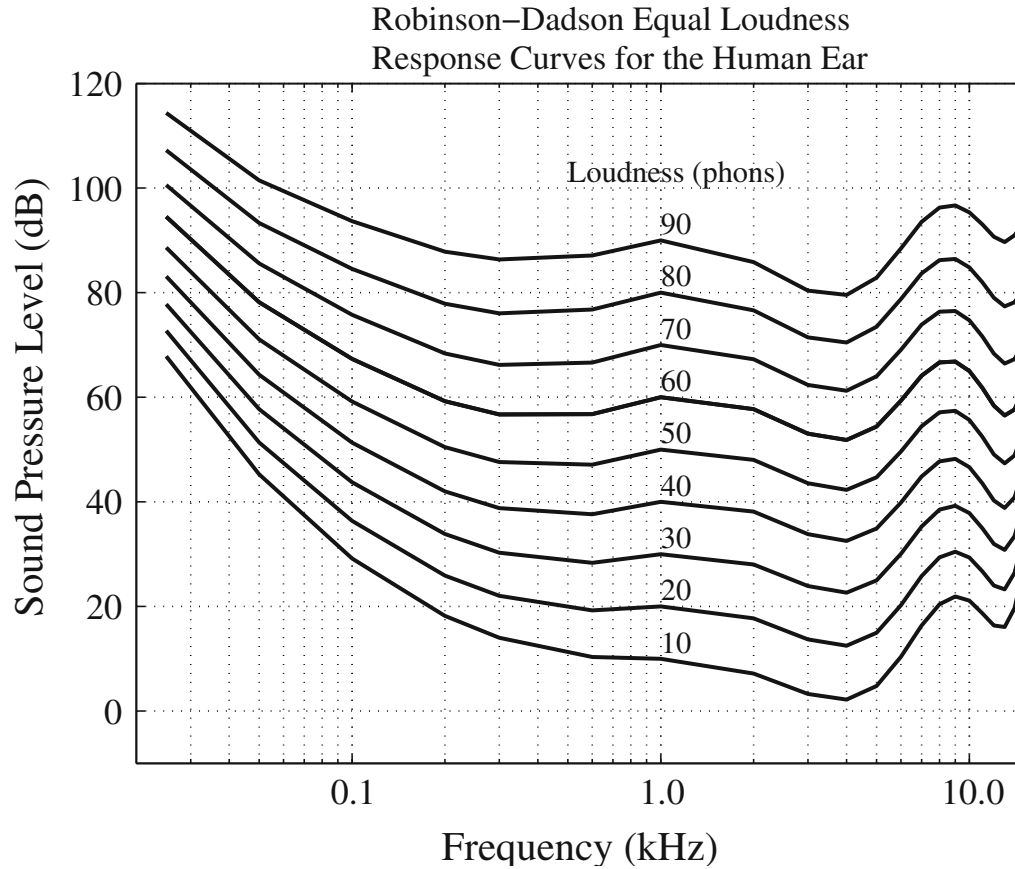


1200

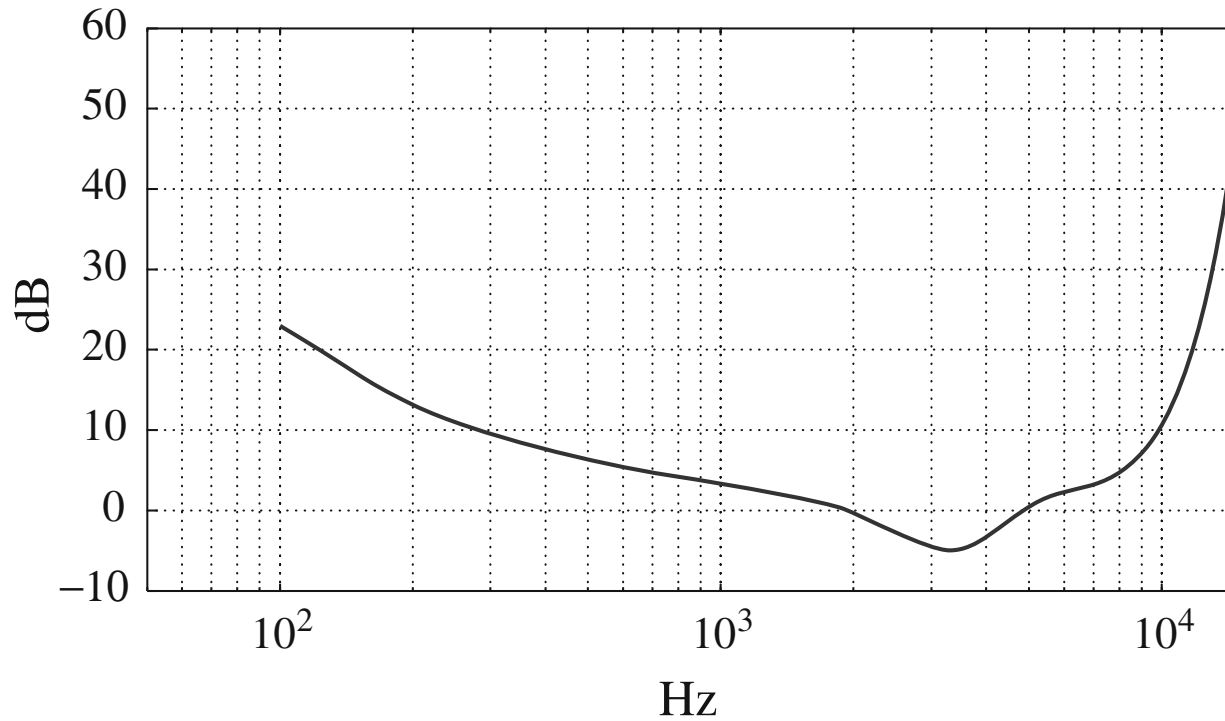


1300

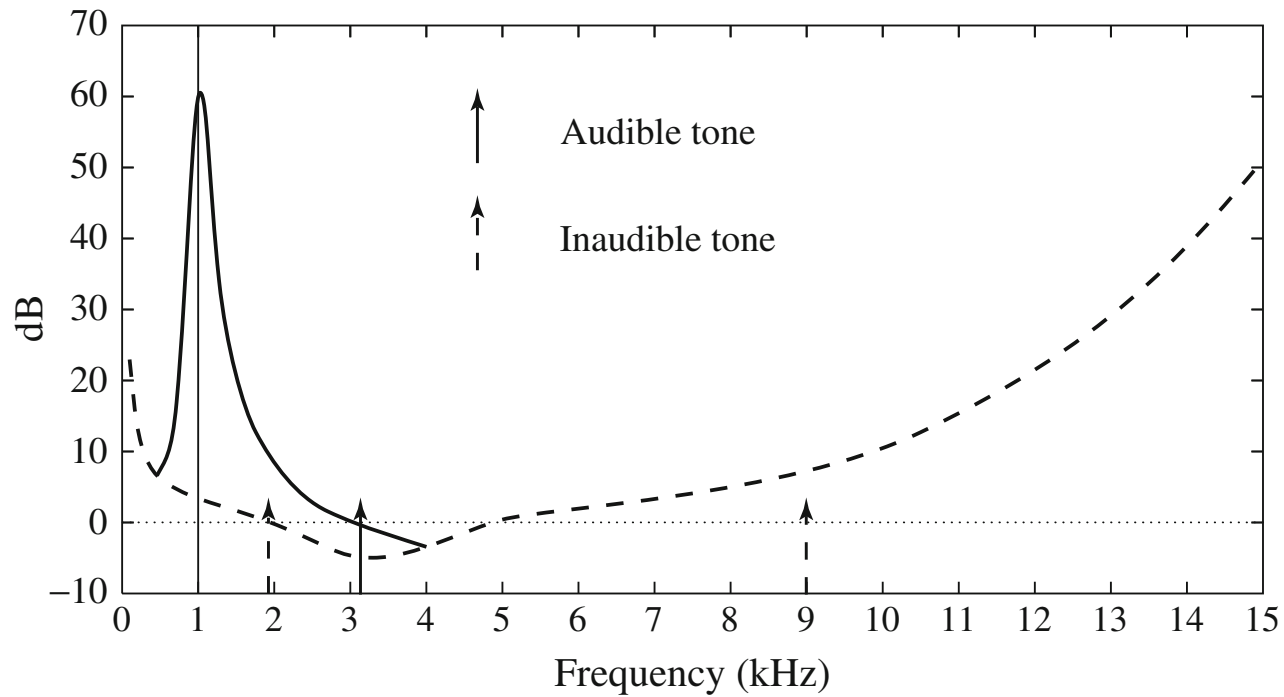
Equal Loudness Curve



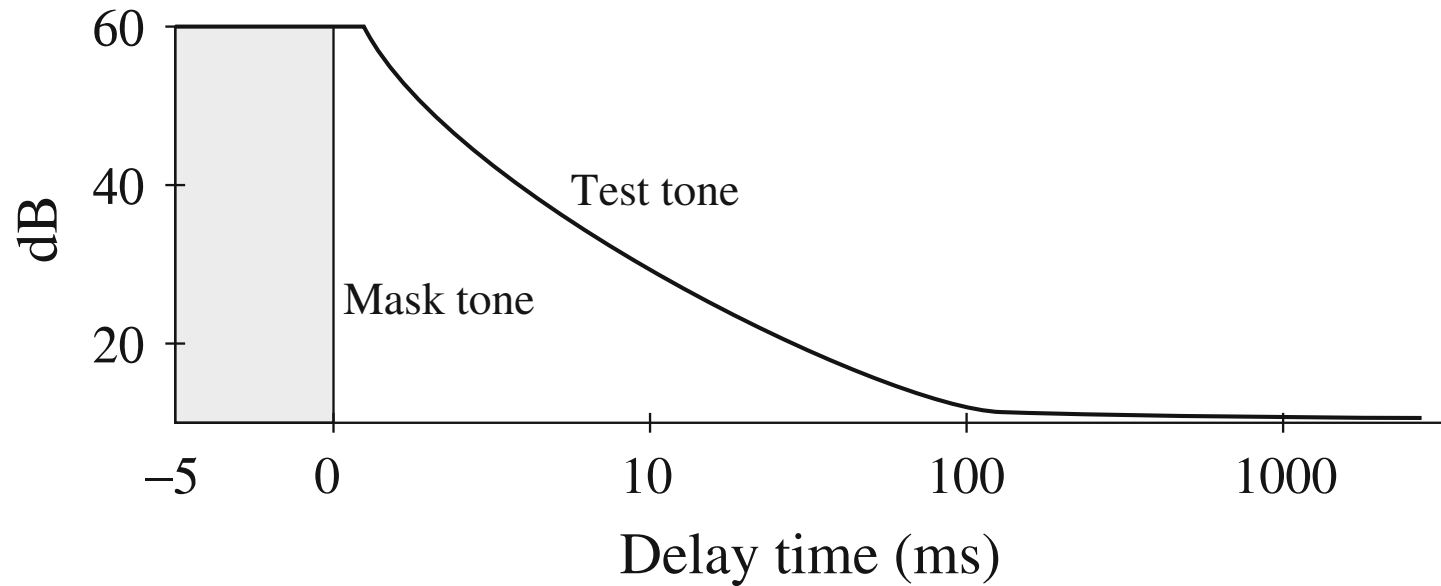
Threshold of Human Hearing



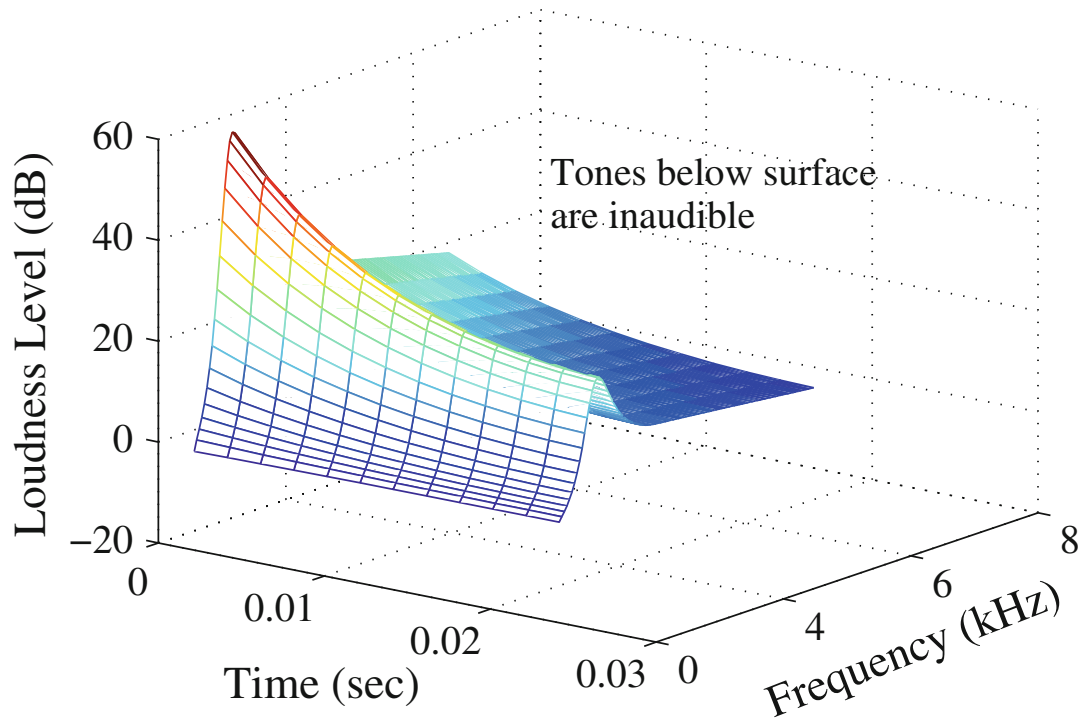
Frequency Masking



Temporal Masking



Total Masking



Psychoacoustic Model

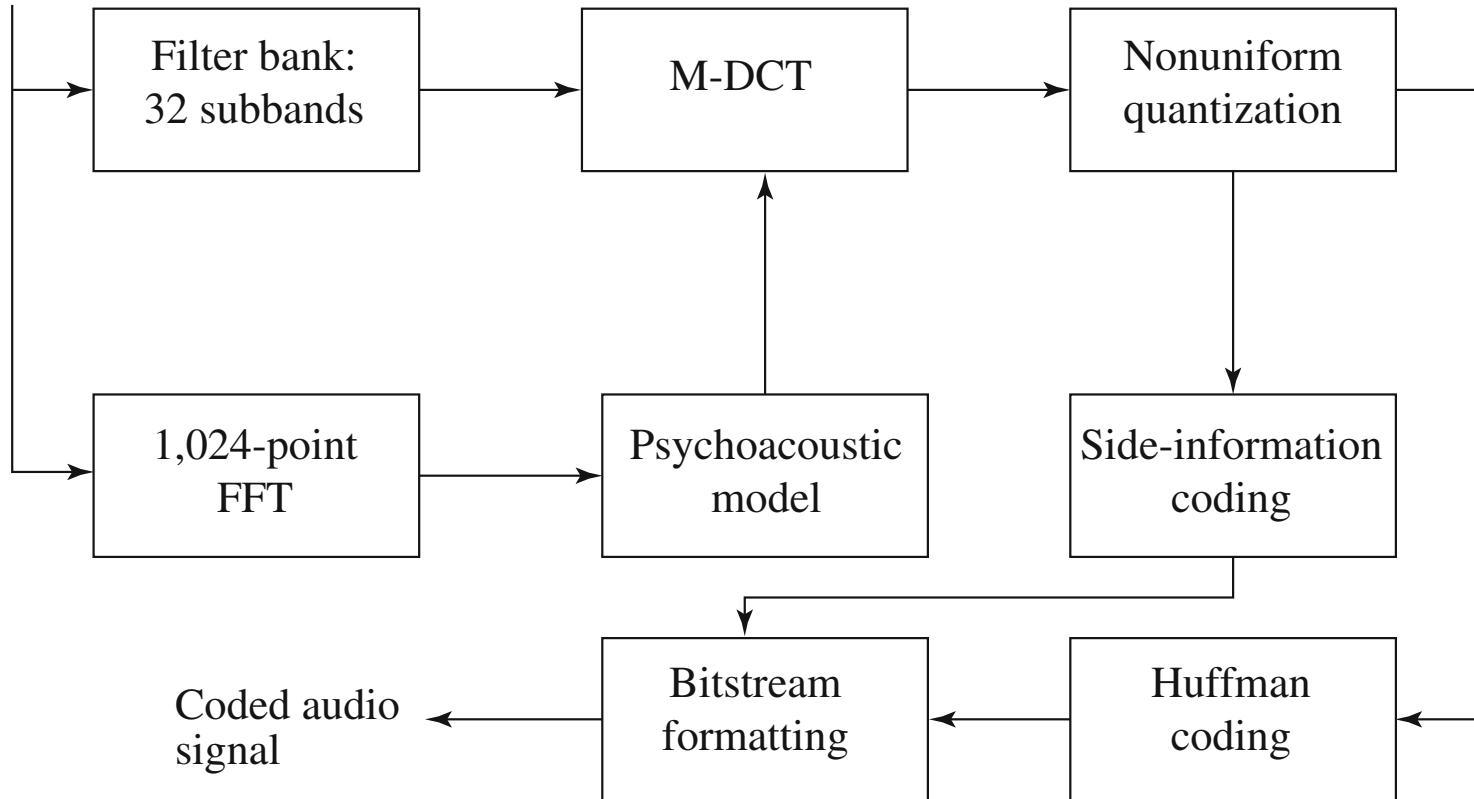
- Threshold of hearing
 - Describes the notion of “quietness”
- Frequency Masking
 - A component (at a particular frequency) masks components at neighboring frequencies. Such masking may be partial.
- Temporal Masking
 - When two tones (samples) are played close together in time, one can mask the other.

MPEG Audio

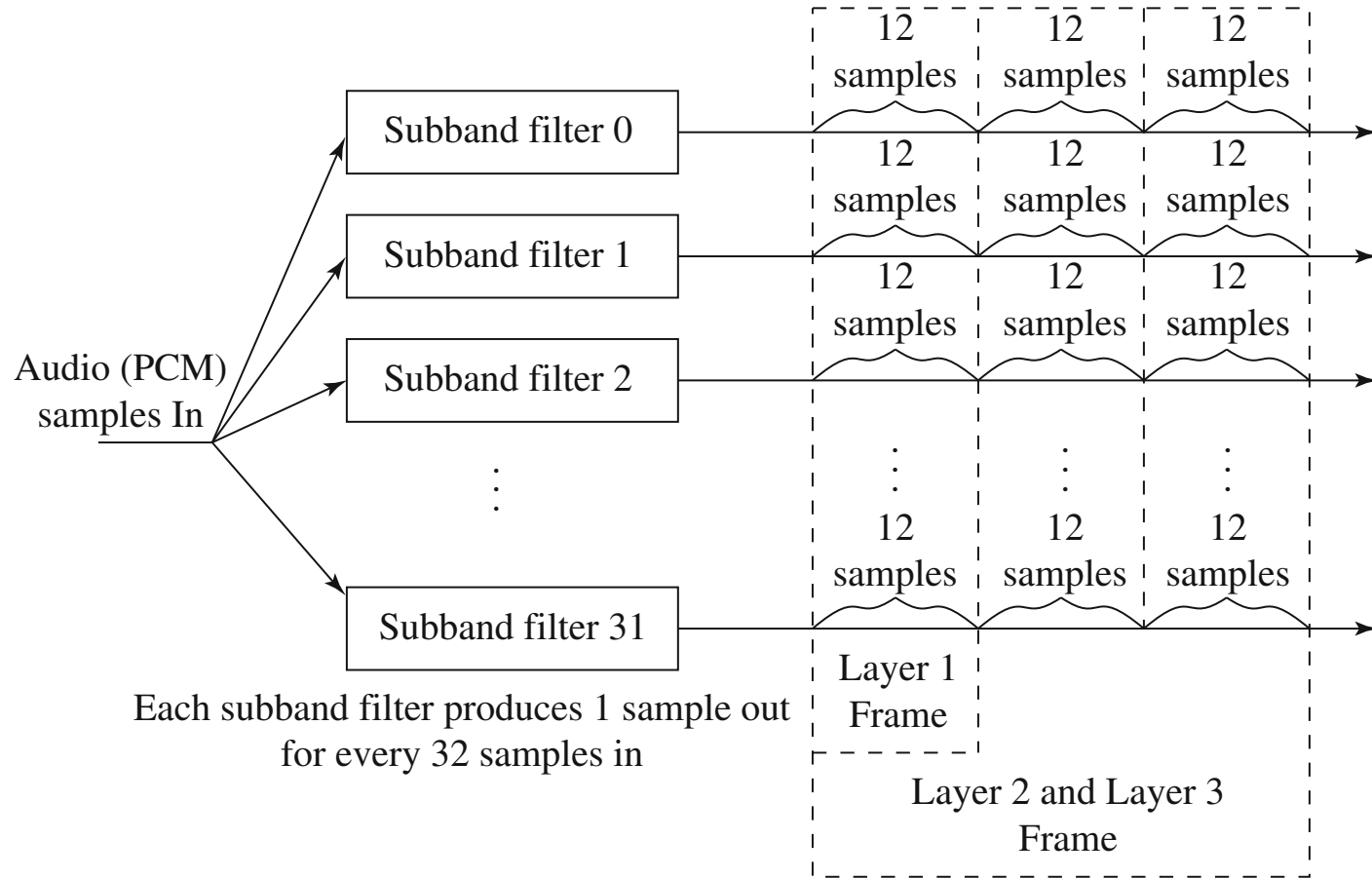
- Layer I: Uses sub-band coding
- Layer II: Uses sub-band coding (longer frames, more compression)
- Layer III: Uses both sub-band coding and transform coding.

MP3

PCM
audio signal



MPEG Audio Frames



Masking and Quantization

Band	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Level	0	8	12	10	6	2	10	60	35	20	15	2	3	5	3	1

- ❑ The 60dB level of the 8th band gives a masking of 12 dB in the 7th band, 15dB in the 9th.
- ❑ Only send amount above masking level

Compression has three stages

1. Transformation
2. Information Loss
3. Coding

Magnitude of common sounds

Rustle of leaves	0
Very quiet room	10
Average room	40
Conversation	60
Busy street	70
Loud radio	80
Train through station	90
Threshold of discomfort	120
Pain in ear	140
Damage to eardrum	160