AUDIO & ACOUSTICS THEORY

Week 7

Psychoacoustics
Localisation, The Haas Effect
IID, ITD & Effect of the Pinna

AUD202: Audio & Acoustics Theory
Audio Engineering & Sound Production
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JMC ACADEMY

Unit Assessments

16th April - Sound Observations Report
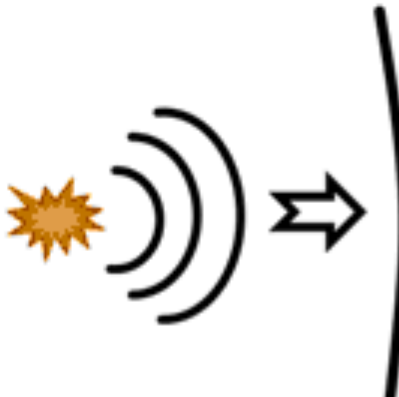
Week 12 – Final Exam

Last Week >

The Decibel,
Inverse Square Law
SPL Meters

THE DECIBEL

A LOGARITHMIC VALUE THAT EXPRESSES THE RATIO BETWEEN TWO QUANTITIES

Change of Level	Loudness Perception	Sound Pressure Effect	Sound Intensity Cause
Decibels	Loudness Gain Factor	Voltage Gain Factor	Power Gain Factor
+ 20 dB	4.000	10.000	100.000
+ 10 dB	2.000 •	3.160	10.000
+ 6 dB	1.520	2.000 •	4.000
+ 3 dB	1.230	1.414	2.000 •
± 0 dB	1.000	1.000	1.000
− 3 dB	0.816	0.707	0.500 •
− 6 dB	0.660	0.500 •	0.250
− 10 dB	0.500 •	0.316	0.100
− 20 dB	0.250	0.100	0.010

PSYCHOACOUSTICS

Psychoacoustics

The study of the perception of sound

- How we hear

- How we can separate different sounds

- Our psychological responses

- The physiological impact of sound/music

Binaural beats are the result of playing two tones of closely spaced frequency in opposite ears

Delta	1 - 3 Hz	Deep sleep, lucid dreaming, increased immune functions
Theta	4 - 7 Hz	Deep relaxation, meditation, increased memory, focus
Alpha	8 - 12 Hz	Light relaxation, "superlearning", positive thinking
Beta	13 - 25 Hz	Normal state of alertness, stress, anxiety

The cocktail party effect is the ability to focus listening on a particular sound whilst filtering out unwanted sounds

Frequency Masking

Sounds can become inaudible in the presence of louder sounds of the same frequency

Psychoacoustic Effects

Binaural Beats

The Cocktail Party Effect

Frequency Masking (aka Auditory Masking)

McGurk Effect

Phantom Words

LOCALISATION

The Illusion of Stereo

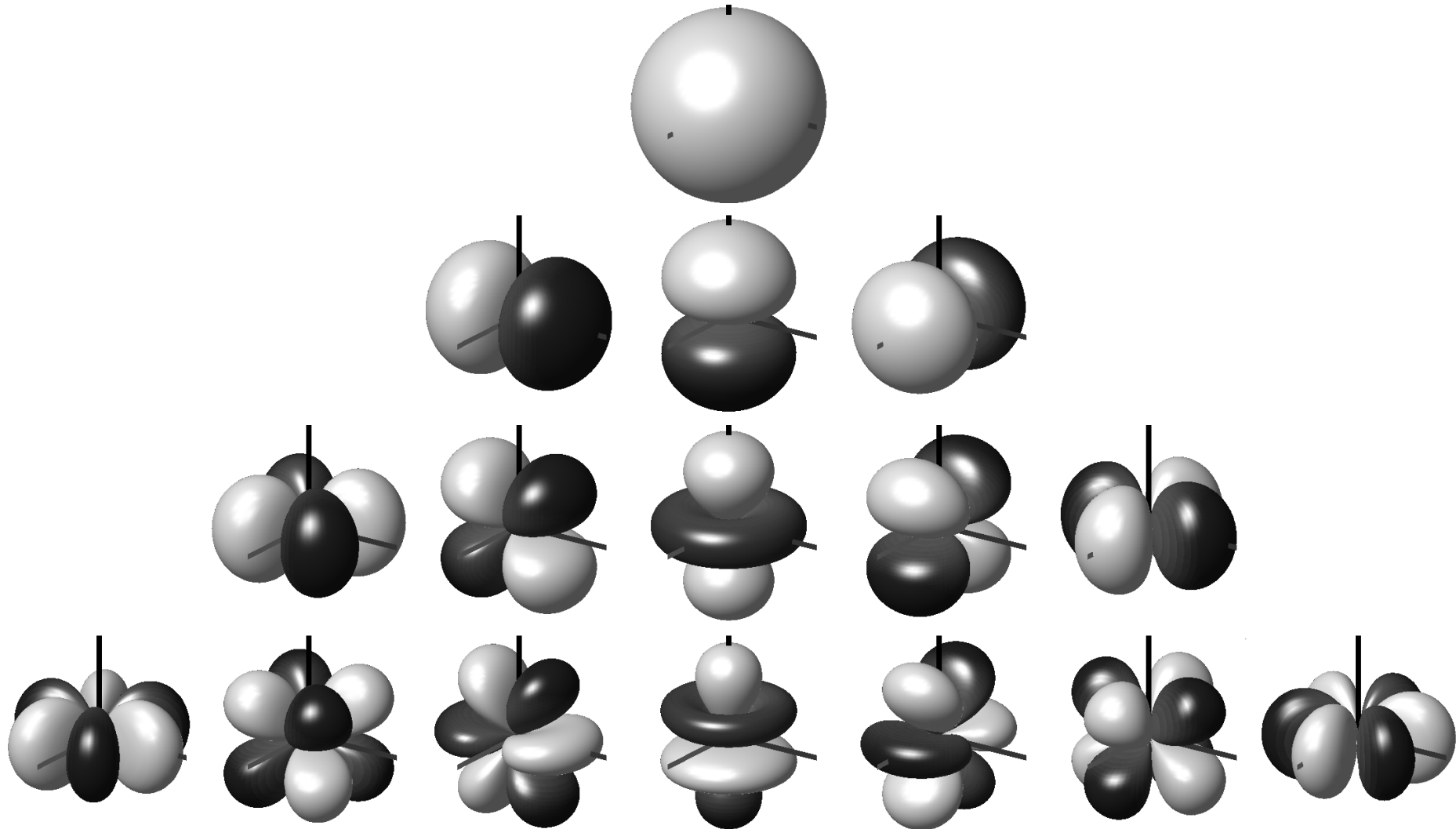With one speaker, we only hear the direction of one sound point

With two speakers we hear a soundstage

What about surround systems?

Surround Sound Technology

- Ambisonics
- Quad
- Dolby Surround
- Dolby Atmos
- Auro 3D

Ambisonics Polar Patterns

The Haas Effect (aka Precedence effect)

We localise sound based on the direction of the first arriving sound.

We fuse the direction of subsequent reflections with that of the original sound despite the real direction of the reflected sound.

Localisation

Using both ears to localise a sound source is called *spatial* or *binaural localisation*. This is based on three acoustic cues received by the ears:

1. Interaural intensity differences
2. Interaural time differences
3. The effects of the pinnae

Localisation

Wavelengths of 17cm or less will not diffract around the head allowing localisation using: **interaural intensity differences (IID)**

Wavelengths of 17cm or longer diffract around the head allowing for localisation using: **interaural time differences (ITD)**

LOCALISATION

Interaural Intensity Differences (IID)

for perceiving direction of high frequencies

Interaural Time Differences (ITD)

for perceiving direction of low frequencies

LOCALISATION

The pinna creates a delay used to determine **'front to back'** and vertical panning due to the shape of the pinna.