Codificação binaural em cinema virtual

Binaural coding in virtual cinema

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Sound in cinema *O som em cinema* (1)

- The soundtrack (o conteúdo sonoro):

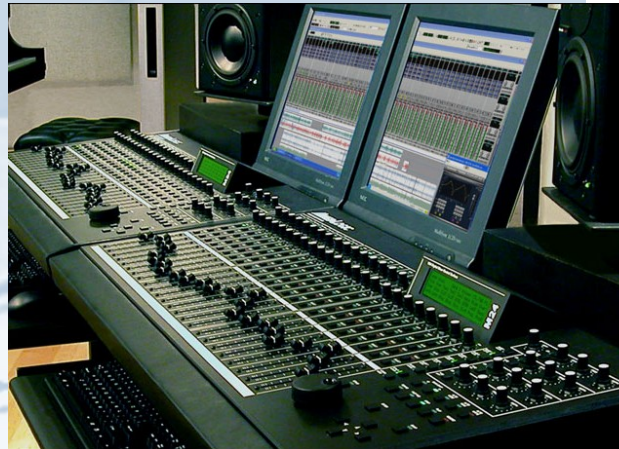 - Sound collection and recording
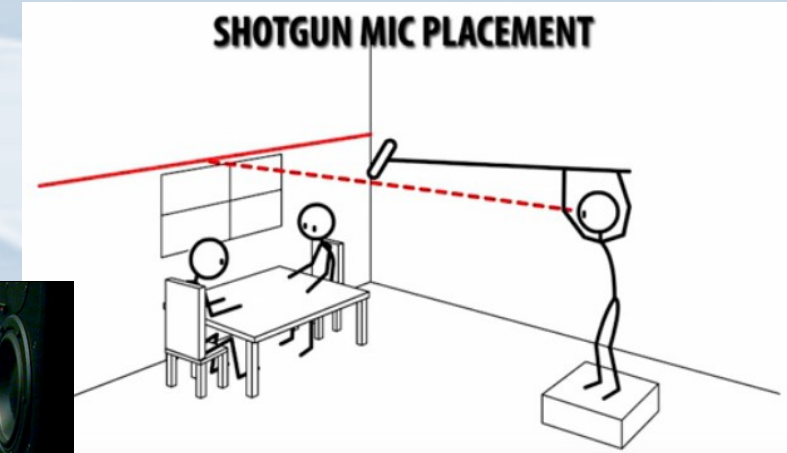
  - Mixing, panning and sound design

    (digital)

  - Soundtrack format selection and reproduction in cinema room

https://www.studiobinder.com/blog/sound-recording/#Recording-Distance

SHOTGUN MIC PLACEMENT

http://www.mixedlogic.com/

(example of screen speaker)

Sound in cinema *O som em cinema* (2)

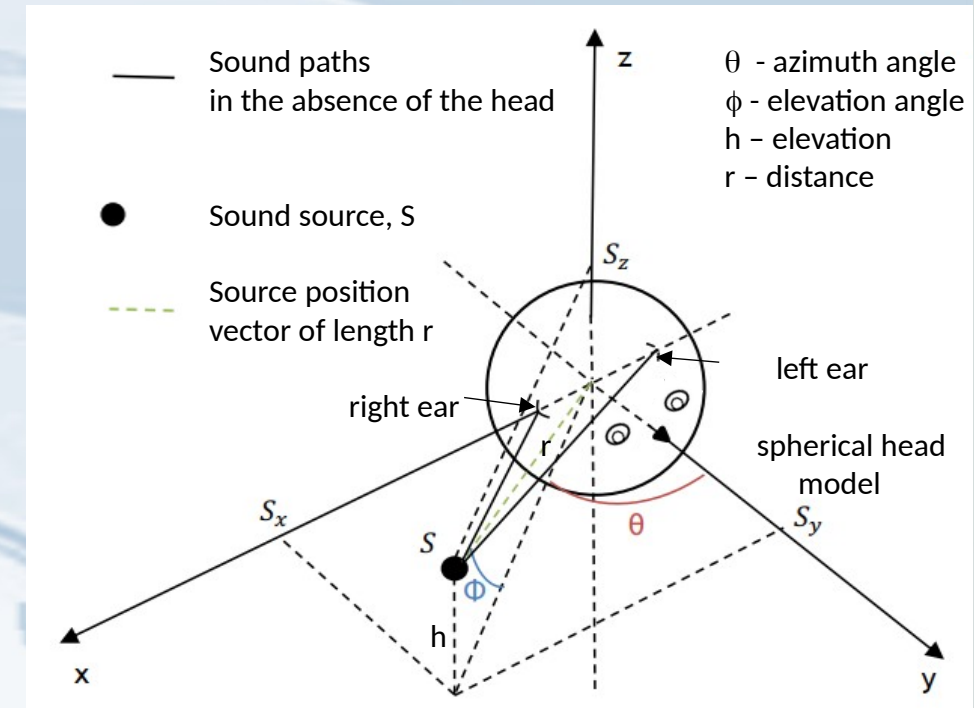- Spatial sound perception by the spectators is demanded:
  - Co-incidence of image and sound objects,
  - Objects localizations in the scenes,
  - Sound field production with an **Immersive**
  approach requires more than:
    - Stereo   (reduced azymuth range)
    - Surround   (reduced elevation range)
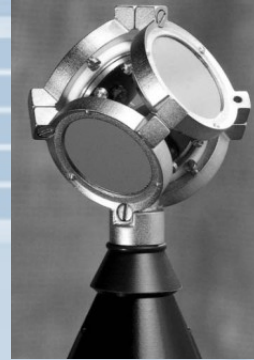 - Requires 3D controlled sound field
- The main technical problem:
  - To produce the required sound field *at ears level* in a cinema room environment for *all* specta-tors (large sweet-spot)
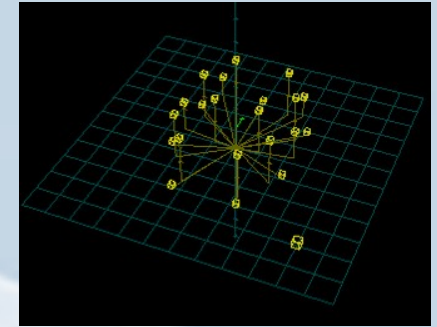

Sound paths in the absence of the head

Sound source, S

Source position vector of length r

θ - azimuth angle
ϕ - elevation angle
h – elevation
r – distance

left ear

right ear

spherical head model

Sound in cinema *O som em cinema* (3)

- Some 3D approaches:
  - Ambisonics – high order
    ~~...~~ne array
    ~~...~~uction with, for ex: stacked-rings or
    ~~...~~ustom layout)

  - Dolby Atmos
  - DTS:X

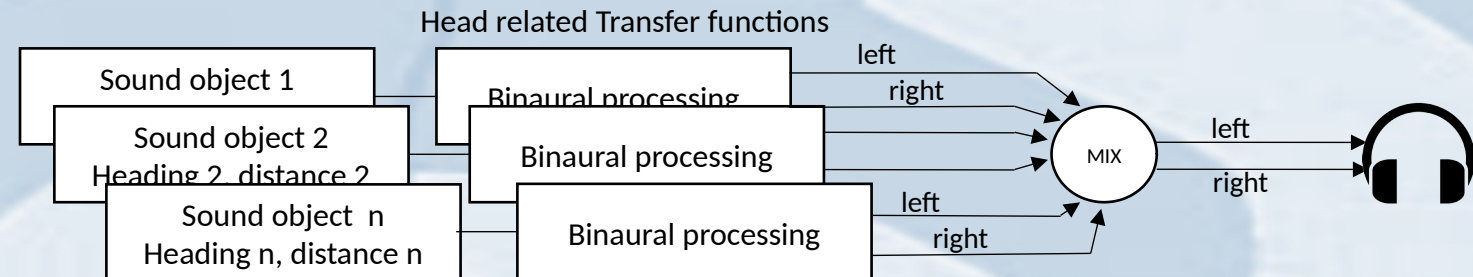http://www.blueripplesound.com/custom

- Sound object concept: dynamic

- PROBLEMS?

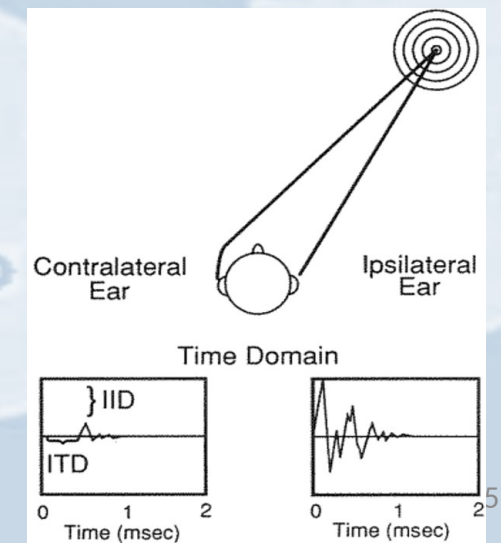# Binaural coding *Codificação binaural* (1)

- What is binaural coding?
  - Many - to – 2 channels processing, for emulation of the human hearing at the ear channels entrance
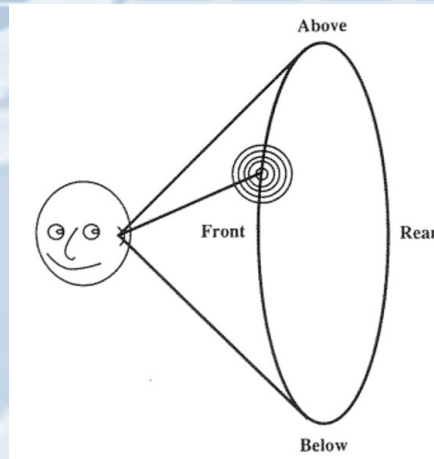
- How does it work?

- Binaural fusion, ITD, ILD

- Human source localization capacities and incapacities
  3 ± 4,7 degrees azymutal at 0 degrees, worse in other directions

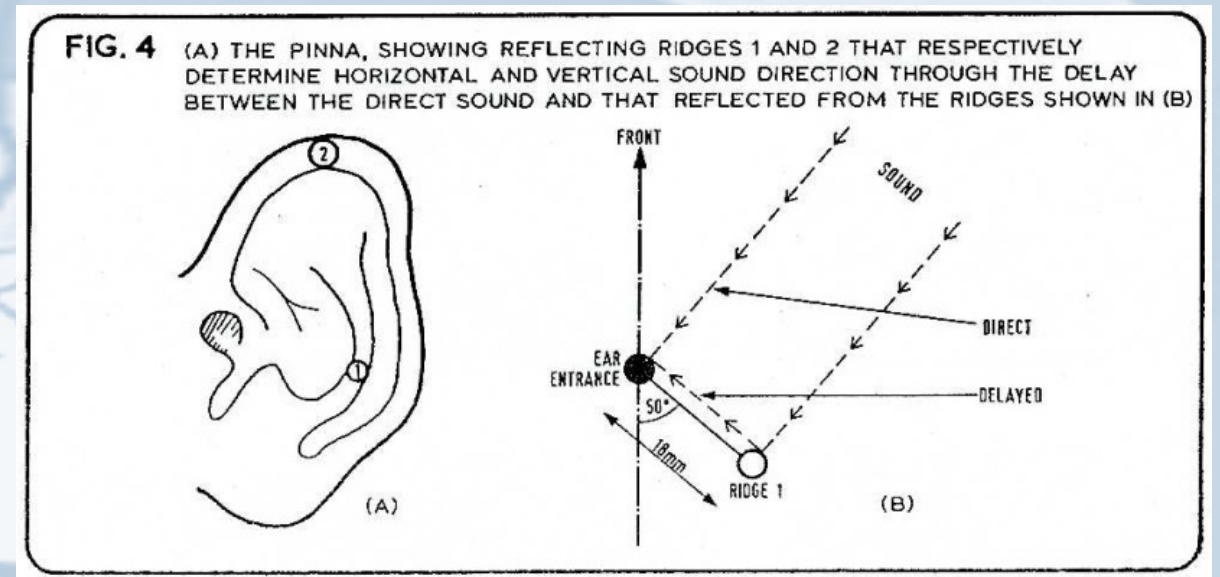# Binaural coding *Codificação binaural* (2)

- Human source localization capacities and incapacities (continued)

Cone of confusion

Front-back confusion – pinna effects

In Dummy head recording, Michael Gerzon

FIG. 4 (A) THE PINNA, SHOWING REFLECTING RIDGES 1 AND 2 THAT RESPECTIVELY DETERMINE HORIZONTAL AND VERTICAL SOUND DIRECTION THROUGH THE DELAY BETWEEN THE DIRECT SOUND AND THAT REFLECTED FROM THE RIDGES SHOWN IN (B)
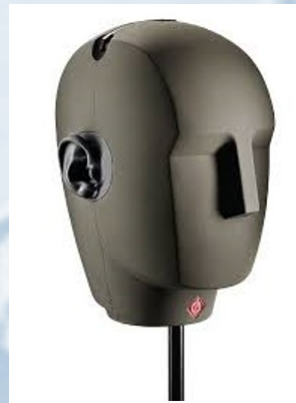
Binaural coding *Codificação binaural* (3)

- Head related transfer functions
- (existing databases: CIPIC, IRCAM; ARI, ATK, Google, LPF-ESI, etc)
- Pick-up or Synthesize source object

left and right ear Signals

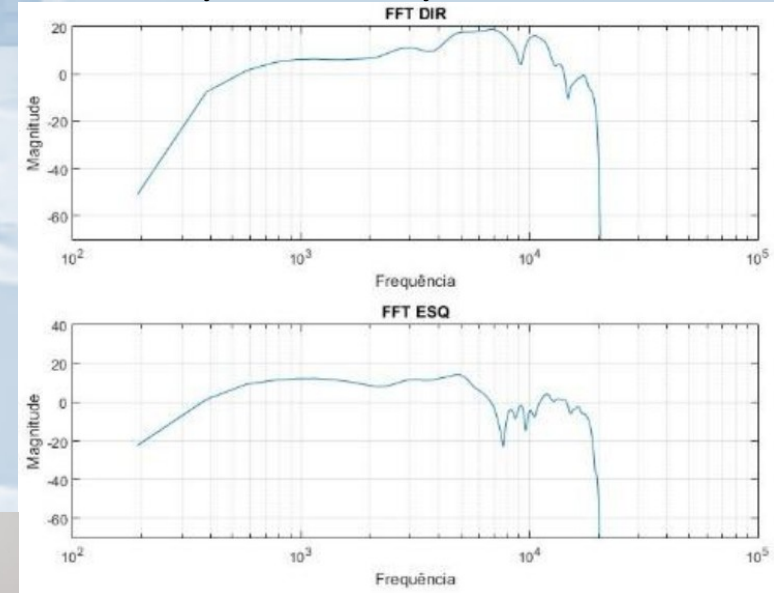In Construção de uma cabeça artificial..., Catarina Cruz

With manequim

B&K HTS   Neumann   LPF-ESI

or use a real head with in-ear microphones

in-ear mic + earphone

- Play with in-ear headphones

Binaural coding in cinema
Codificação binaural em cinema (1)

- Documentary or news – binaural pick-up and reproduce

- Original movie - pick-up, mix and design (3D)

(Works with virtual reality)

https://www.bbc.co.uk/rd/blog/2016-05-virtual-reality-sound-in-the-turning-forest

- 360 degrees video
  - HOAmbisonics pick-up, head orientation processing, binaural rendering and reproducing

Example interactive video (Aachen University)
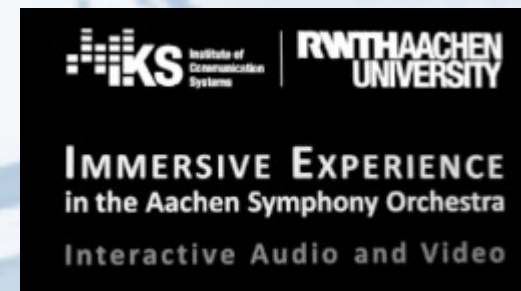
WEARING HEADPHONES is required

https://youtu.be/XZY3nPnDCQw
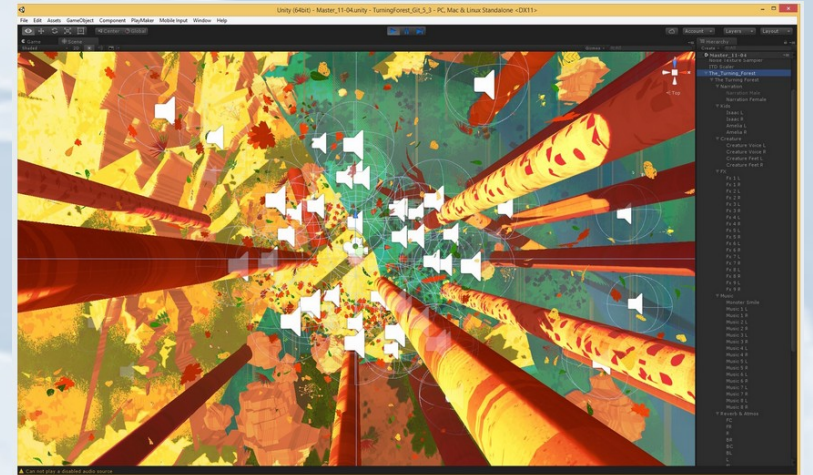
That's it for now. Thanks!

I'm glad to take questions…