



Audio Bootcamp XVI: Approaching and Designing Audio for Interactive VR Applications

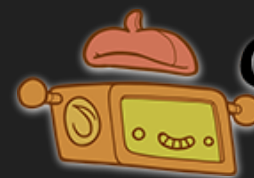
Presented by (your favourite) Sally Kellaway @soundsbysal



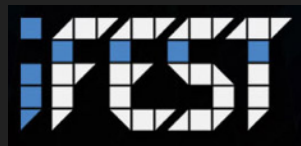
A very formal introduction

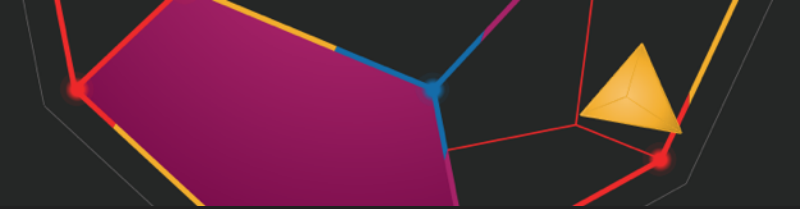
- I do VR Audio Design (oh you don't say)
- I speak about VR Audio, diversity, game audio, etc (evidently)
- I work with these people —————>
- I've spoken at other conferences like

OSSIC



creative coast
festival





This talk will be about VR AUDIO (YAY)

- It's really complex (aka, background)
- But it's kinda ok (aka, pipeline)
- Has a lot of nuance, so it takes a long time (aka, idiosyncrasies of the creative practise)
- But it's the most immersive expression of our craft possible (aka, Why?)





Some questions to start

- Do you know what Binaural means?
- What about HRTF and HRIR?
- Do you understand what Ambisonics means?
- How well do you know your basic acoustics?





Good news!

You're going to learn a lot!

OR

Well done!





Bad news!

You have a lot to learn!

OR

**You understand that there's always
stuff to learn!**





It's really complex (aka, background)





First rule of VR Audio:
This is a dynamically evolving field
that includes academic research
and a rapidly developing
commercial industry.





There is no perfect solution.

But there is 'snake oil' out there.

The snake oil might actually work
for some people.





Everybody is different

- Look at the person's ears to your left
- Look at the person's ears to your right
- Look around at all the ears
- Are any of them the same?

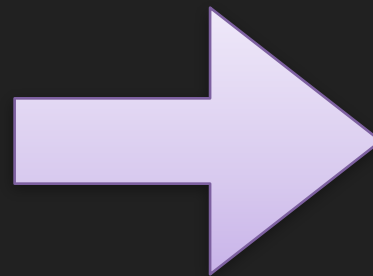




Everybody is different



(Generic babies)
(they have small ears)



(Full-sized VR audio babes)
(their ears are much larger)

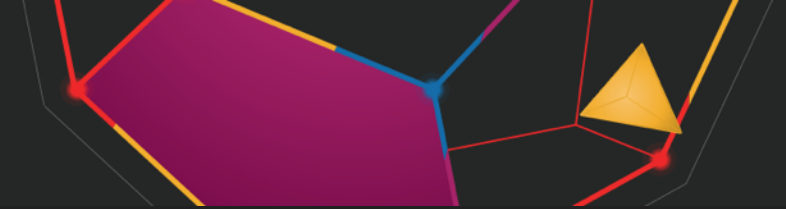




Who cares about ears?

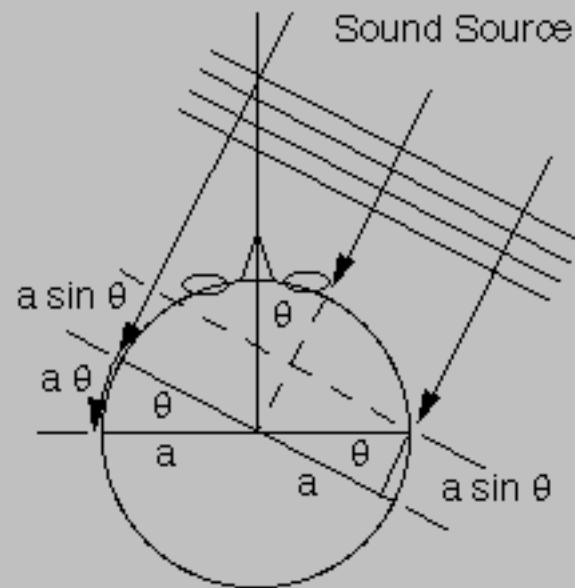
- Your ear (and head, and torso) is actually secret encoding device to make a sound sound like it coming from somewhere
- Your brain knows what the encoding means, and translates that into your ability to localise



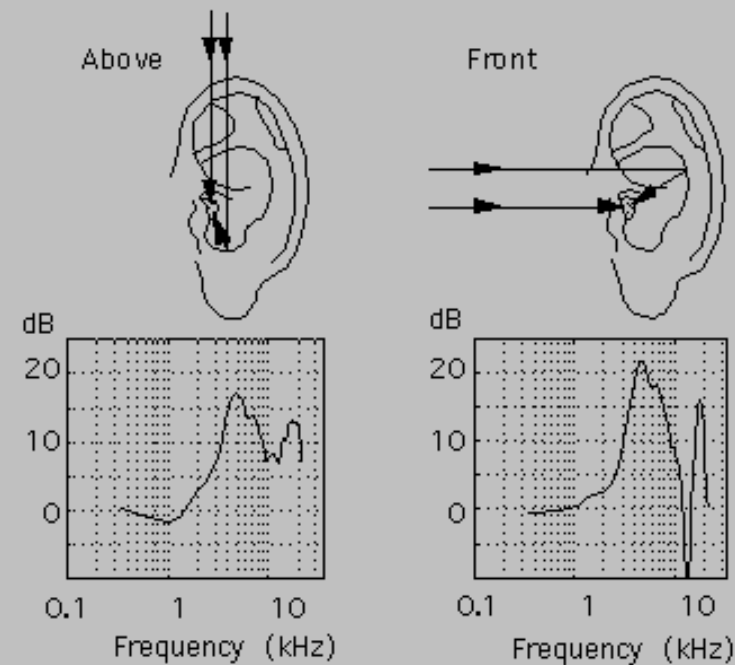


Ok your ear theory sounds plausible

- That system is actually quite complex



ITD/ILD
(Duplex theory)



Spectral/Pinna
("Monaural")



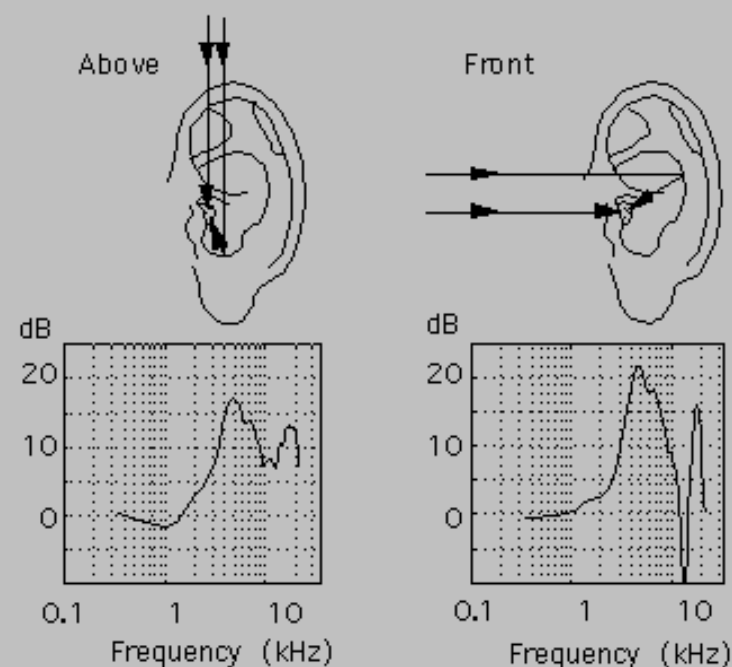
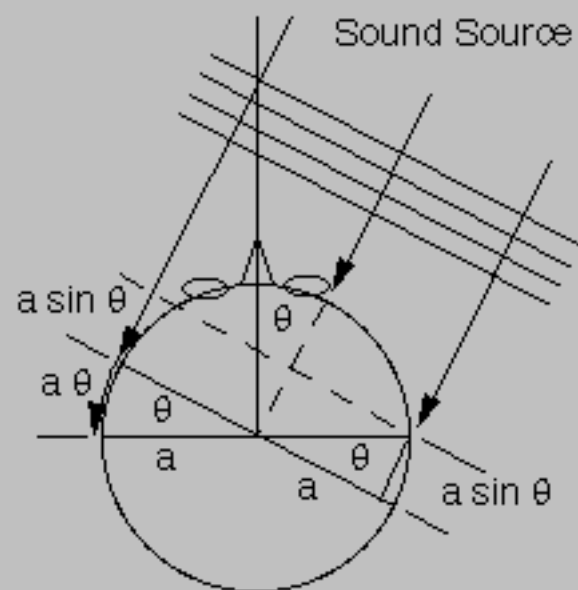
Torso/Shoulder Reflection





Ok your ear theory sounds plausible

- That system is actually hugely complex



ITD/ILD
(Duplex theory)

Head angle

Head Micromovements

Room Reflections

Spectral/Pinna
("Monaural")

Proximity Effect

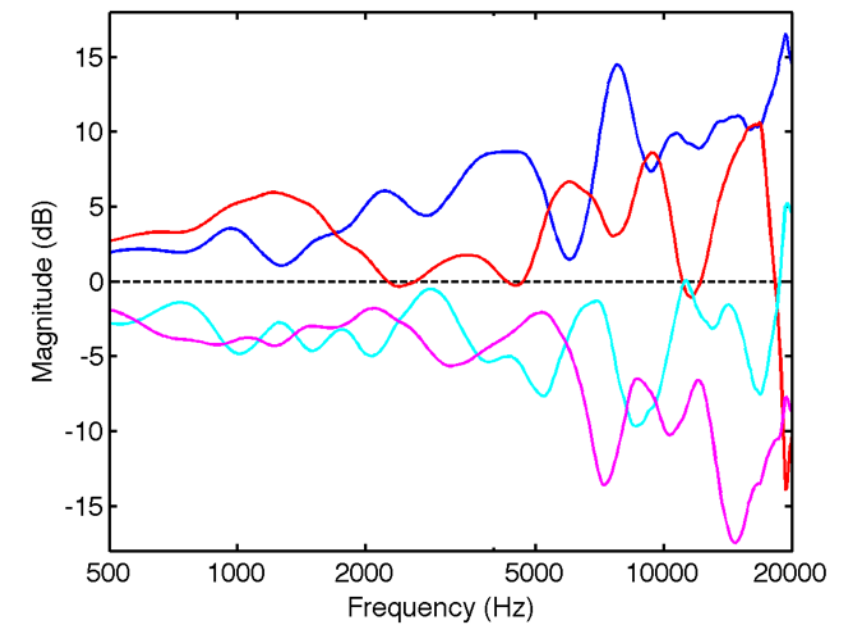
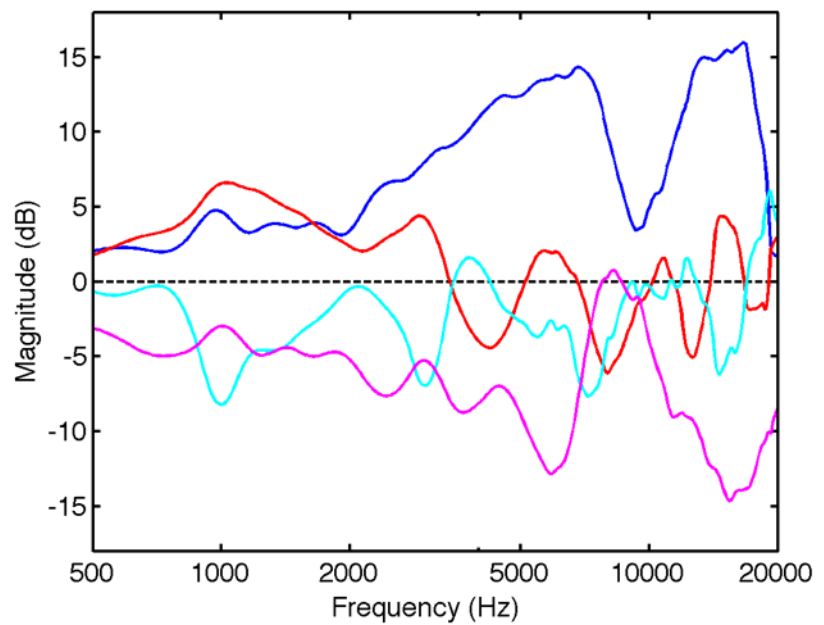
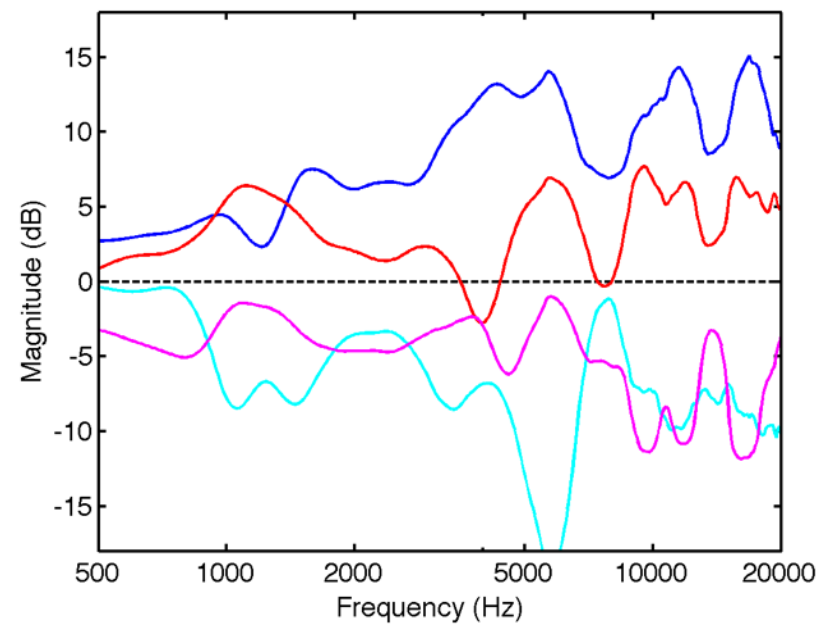
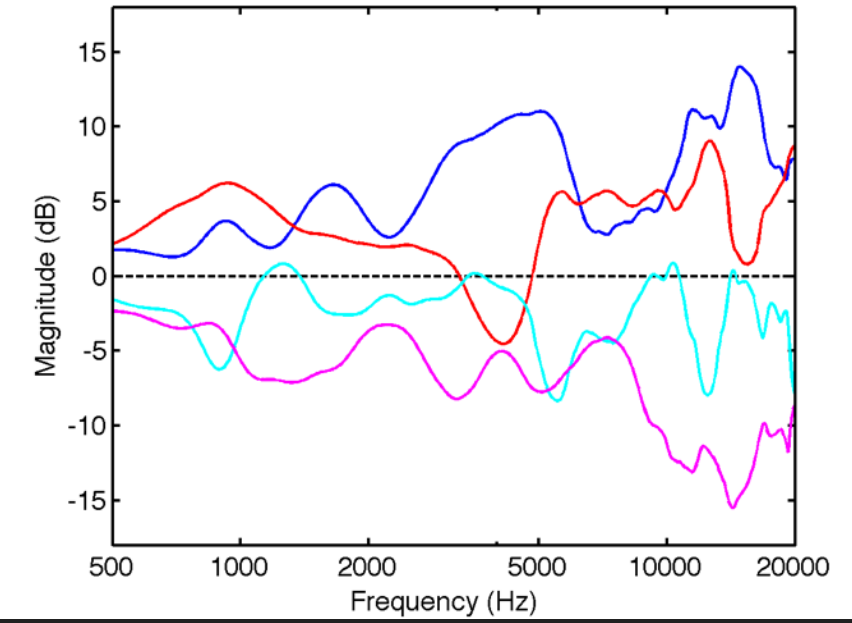
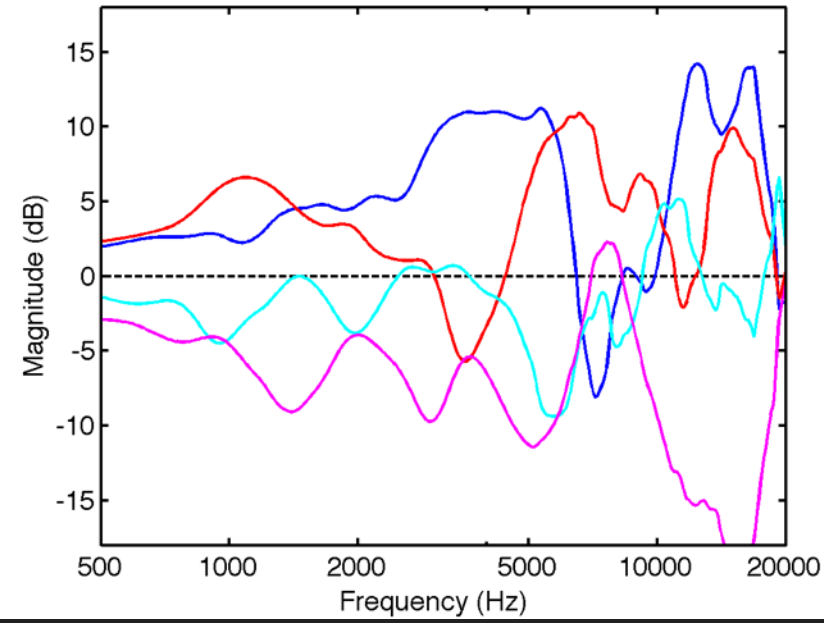
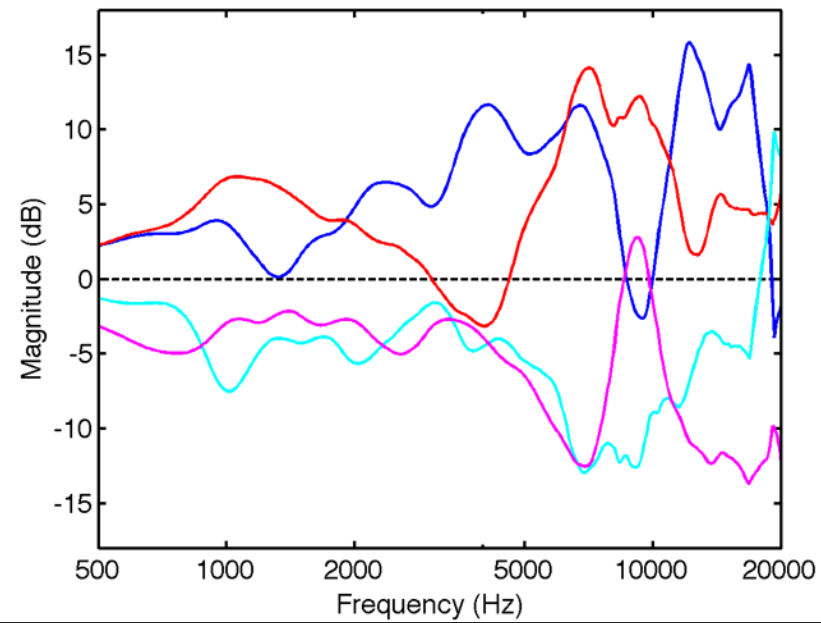
IED

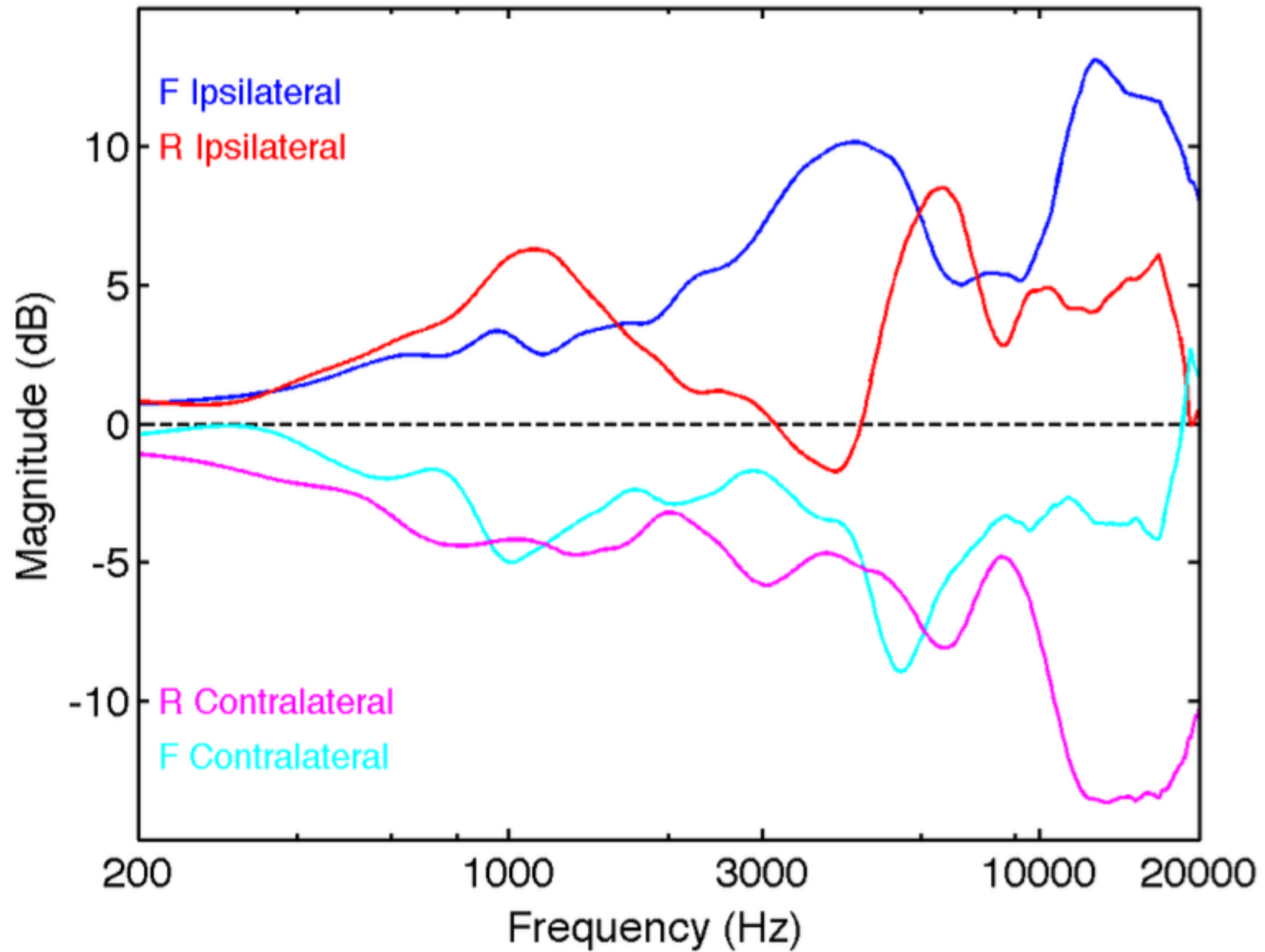
Torso/Shoulder Reflection

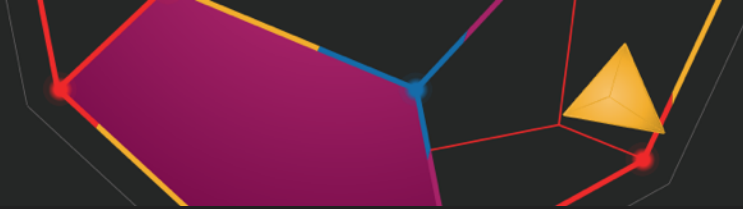
IPD

Motion Parallax

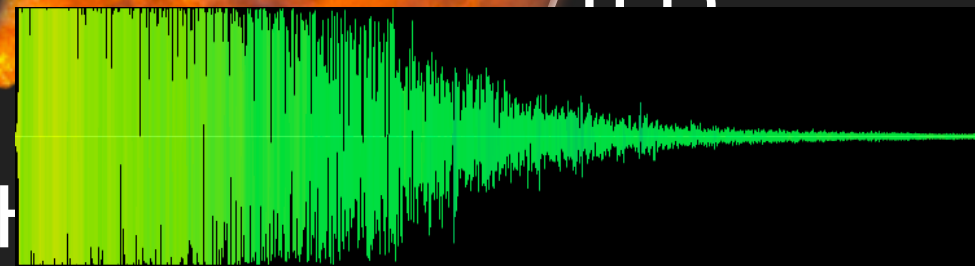








How can there possibly be more?!?

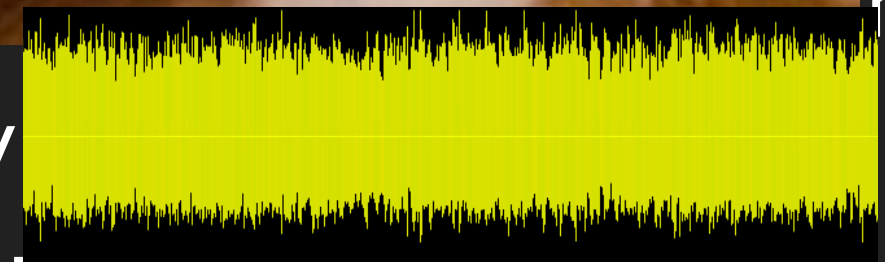


Room Reflect



Proximity

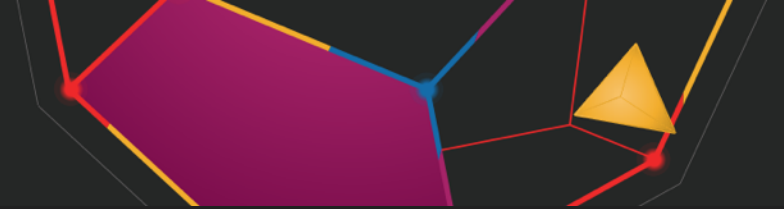
Motion Parallax



Source: Brüel & Kjær <https://www.bksv.com/en/products/transducers/ear-simulators/head-and-torso/hats-type-4128c>

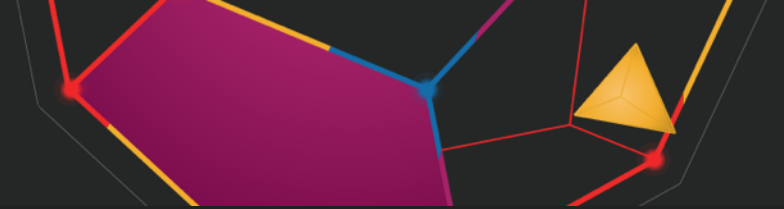
Source: Richard O. Duda <http://interface.cipic.ucdavis.edu/sound/tutorial/psych.html>





**But it's kinda ok
(aka, pipeline)**





What is my pipeline then?



Wwise

fmod®



facebook 360
SPATIAL WORKSTATION

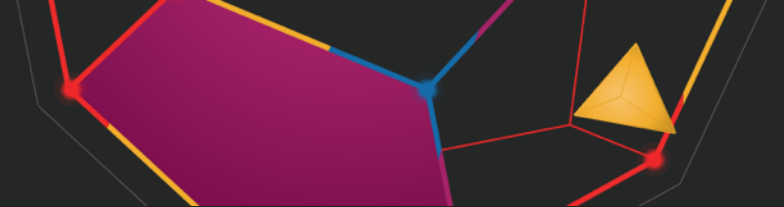


OSSIC



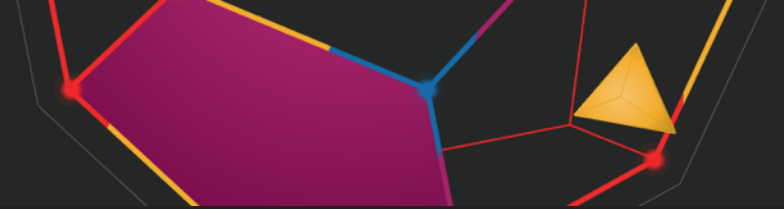
RealSpace3D
Audio





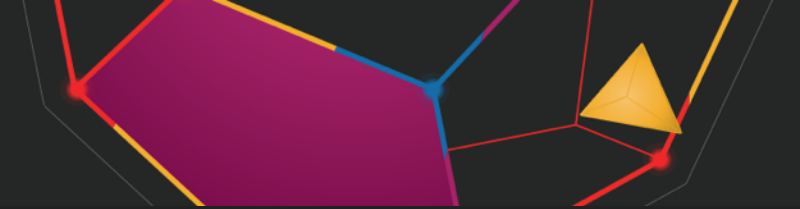
**Has a lot of nuance, so
it takes a long time
(aka, idiosyncrasies of
the creative practise)**





Immersion = Environment = Immersion





What does it MEAN?

- More often than not, the art part of the team might have more restrictions than you do...
- This means that you might only have...
 - Small interact-able environments
 - Small numbers of interactions that can happen
 - Non-AAA numbers/detail of environment assets

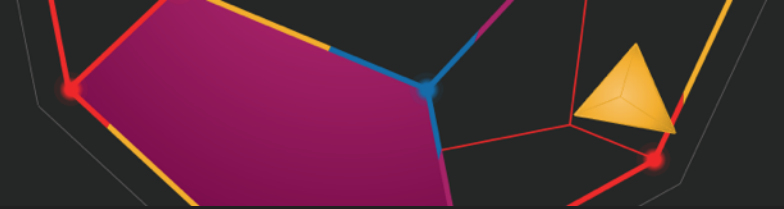
Actually a good thing





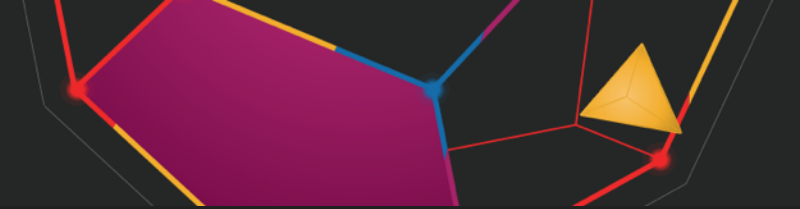
Source: Engineerium, Zero Latency (2016)





Intimate Interaction > Everything Else





Sound Staging in VR

- We all know what sound staging is right?
- Thoughtful Sound Staging.....
 - Ensures non-critical sounds are **non-attention-grabbing**
 - Ensures non-visually represented sounds are non-attention-grabbing
 - Helps the player understand what is happening around them
 - Gives the player more control and power
 - Helps players understand their relationship with the world





Sound Staging in VR

Environment SFX

20m+ / 65 ft +

**Props you get kinda
near to**

10-20m / 32 - 64 ft

5-10m / 16 - 32 ft

**Movement Cues
Intimate SFX**

1-5m / 3-16 ft





Intimate Space

- If you allow the player to interact with objects within arms length, that arm's length zone is really important to prioritise
- There's plenty of things you can do to preserve this range
 - Selected sounds **dB boost**, low end **EQ boost** in I-zone
 - De-prioritised sounds *dB cut*, *EQ cut* in I-zone
 - Side chain compression
 - Same for Direction/Orientation of focus sounds
- This is one of the reasons that you can choose to spatialise **music**...





Environment SFX

Lowest Intensity

Low Intensity

Medium Intensity

High Intensity

Highest Intensity

No music placed here

(remember the rant about intimacy?)

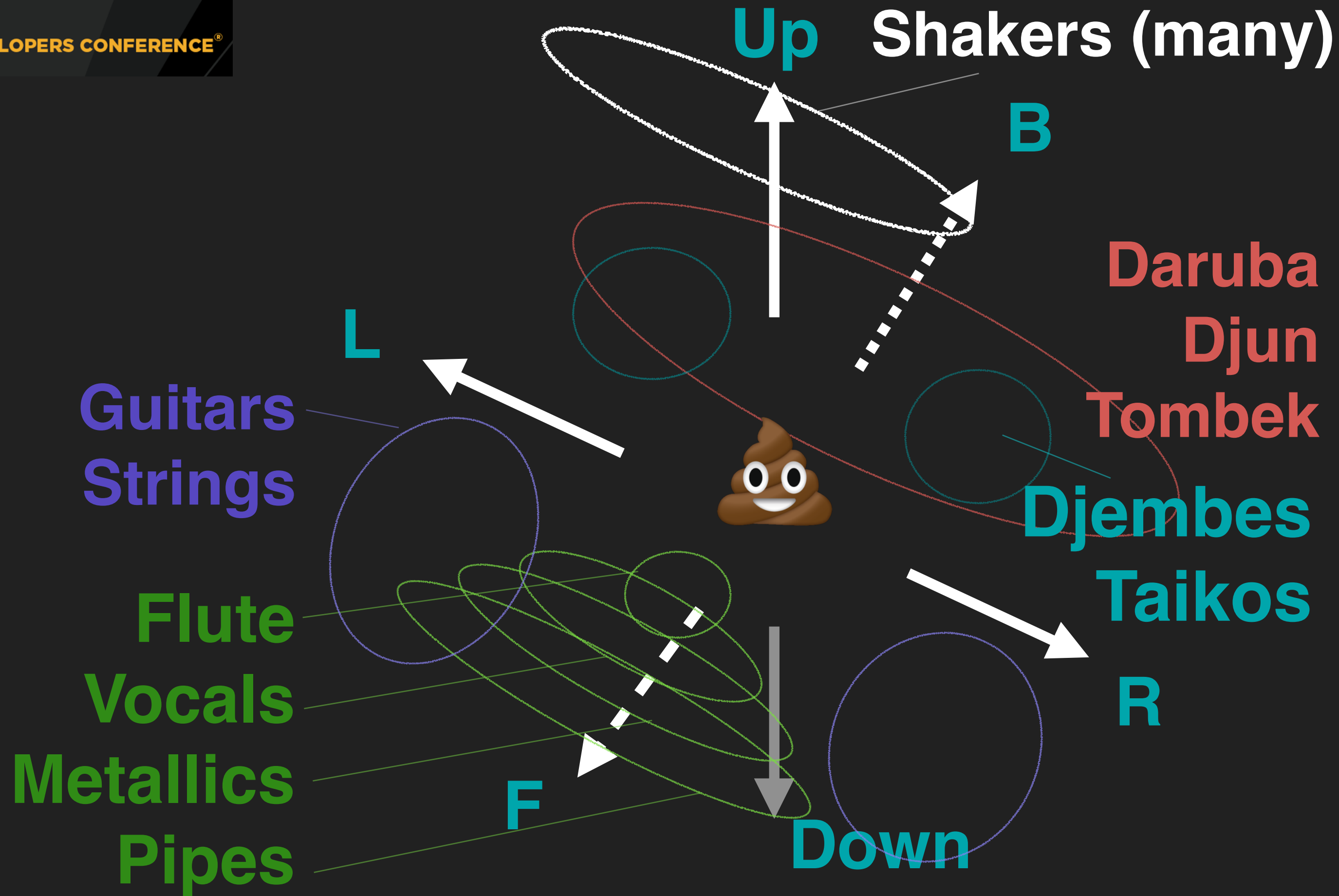
20m+ / 65 ft +

10-20m / 32 - 64 ft

5-10m / 16 - 32 ft

1-5m / 3-16 ft





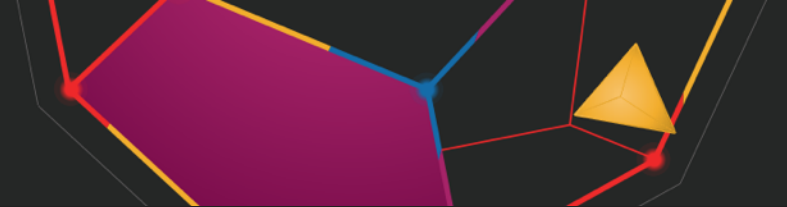




You Cannot Test Your Own Work Properly

- In development, **you** create a *pathway of expectations* through your experience
- In 360/VR environments **overstimulation** and the **temptation of exploration** is strong for non-expert players - you have to expect this and pre-empt your design for this
- Keeping your design priorities straight, a little foresight and good mixing will help you deliver a better experience from the outset





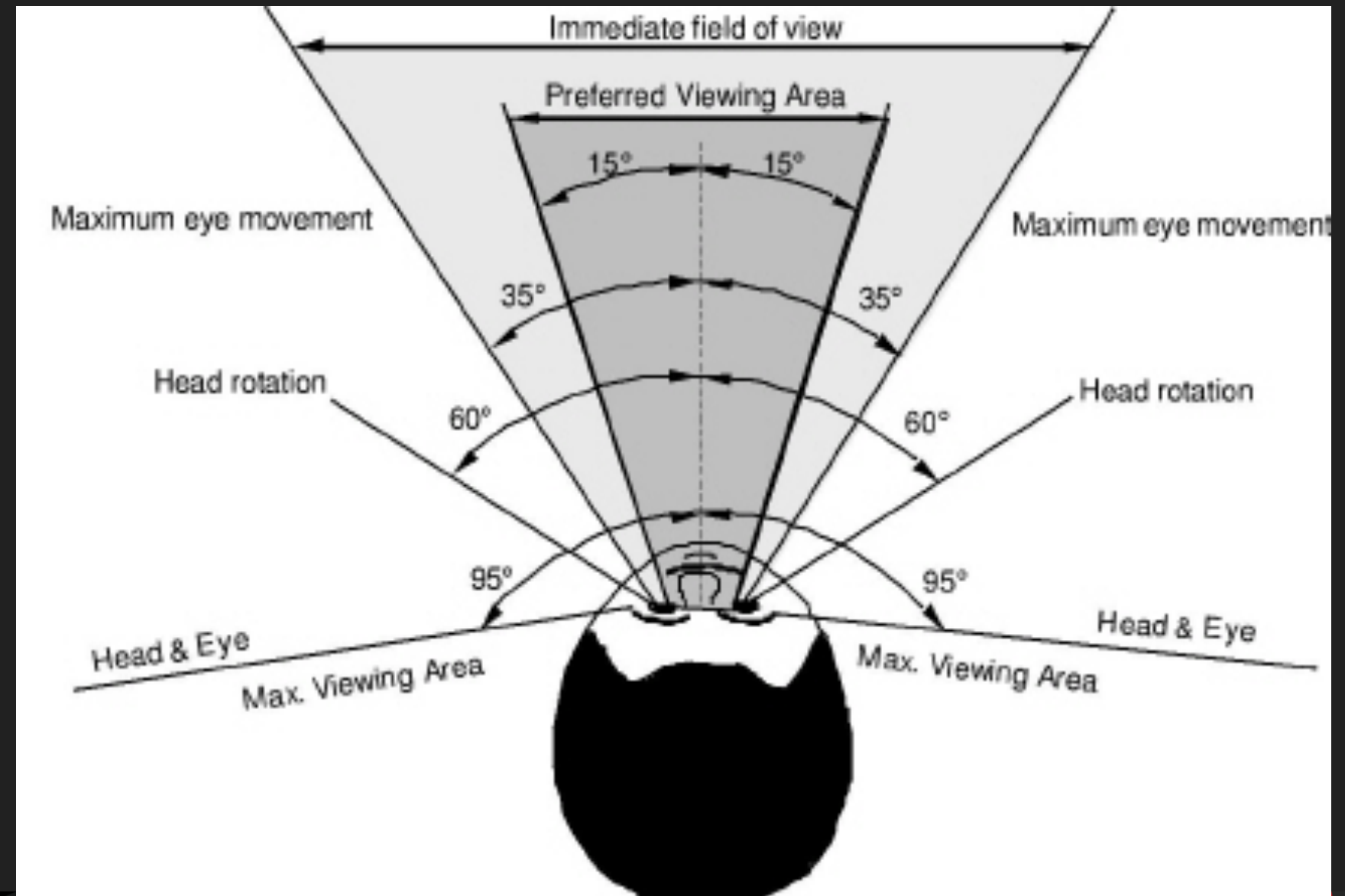
**But it's the most immersive
expression of our craft
possible
(aka, Why all this bother?)**





Why should I go to all this bother?

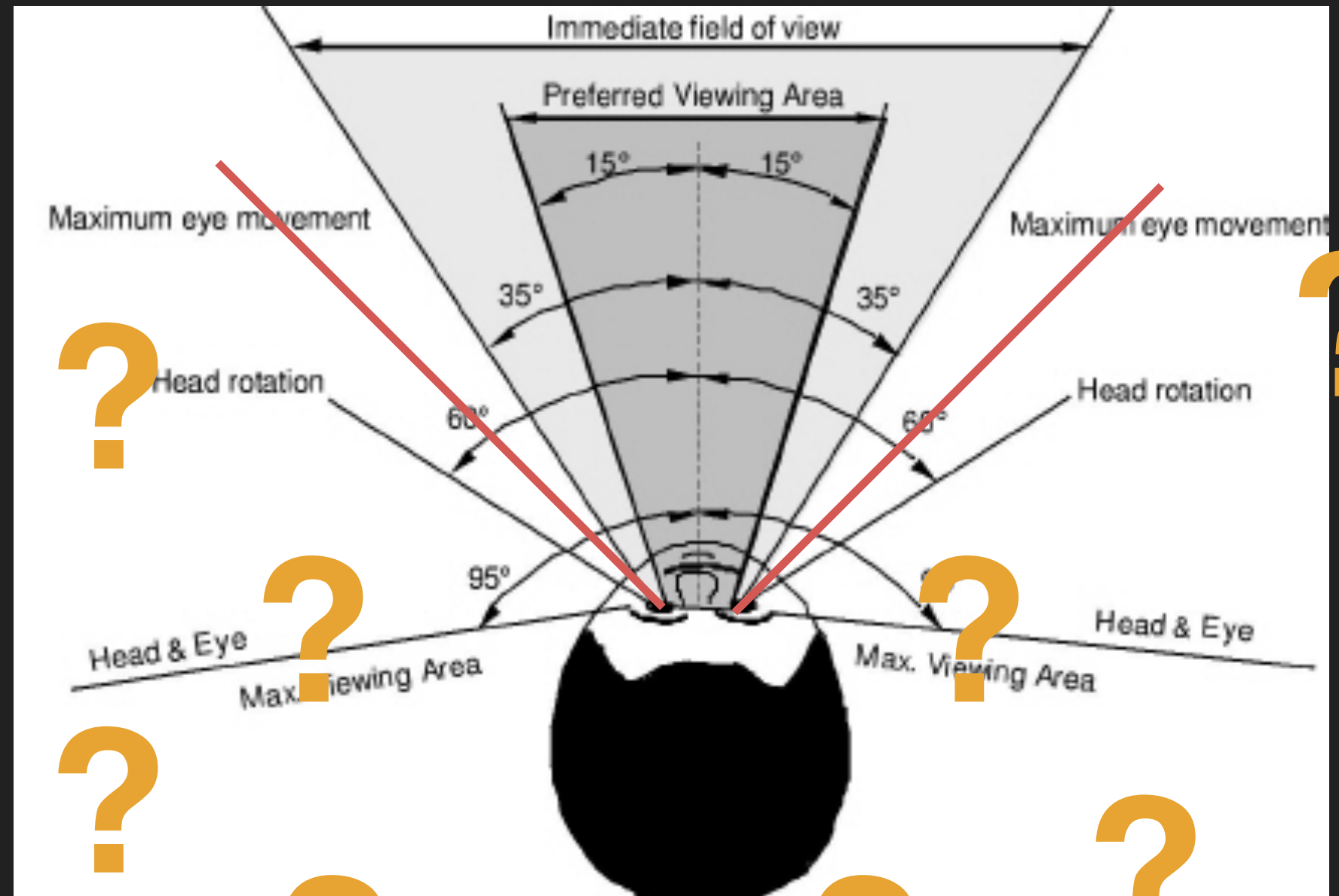
- Last time I checked, humans only have a FOV of about 100 degrees laterally from each eye outwards
- This includes peripheral vision
- Diagram: (from bipplar.com)

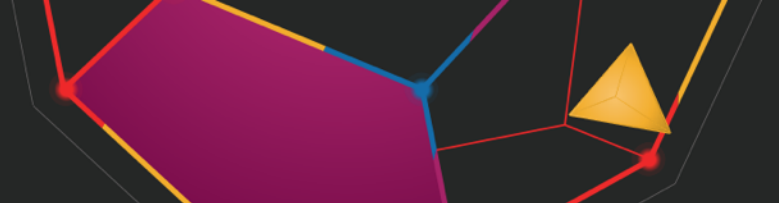




So? Do I look like an optometrist?

- FOV of VR headsets is limited
 - GearVR = 96°
 - Fove = 100°
 - OSVR = 110°
 - Oculus = 110°
 - Vive = 110°
 - StarVR = 210°
- Audio is the easiest way to 'fill' the field that cannot be seen





Biased Testing

Immersive Environment

Theory

Sound Staging

Theory

Adaptive audio

skillz

Psychoacoustics

research

Hardware

Limitations/Liberations

Impacts to

localisation potential

Intimate

Player space

Spatialisation
tools





THANXXXXXXXXXX

 TWITTER! ADD ME NOW!

@soundsbysal

 COME SAY HI I ONLY BITE CAKE!

 If you are a cake and don't want to get bitten, you can email me:

sally@ossic.com

