Diffusion:

When phase and energy becomes more important than directivity to the perception of “space”

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Acoustics vs. Psycho- Acoustics

Physicality is NOT the same as perception

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Measuring Psycho-Acoustic Effects

Many times this is not possible since the effect combines binaural hearing and the brain


ISO 17497-1 Test facility

Scattering Measurements

ISO17497-1 is based on “free field” research. This measurement cannot be used to measure geometric devices. There was an assumption that since you can measure phase differences in free field that their cancelling effects would carry over to a reverberant field. This is NOT the case since the definition of a true reverberant field is to be mixed phase and magnitude information.

Scattering Measurements

The scattering measurement in 17497-1 is based on subtracting specular energy from random energy. In a reverberant room these two energies are mixed randomly and cannot be separated. As the room becomes larger the energies are mixed even more and the measurement becomes random as well.

Proposed ASTM Test Facility

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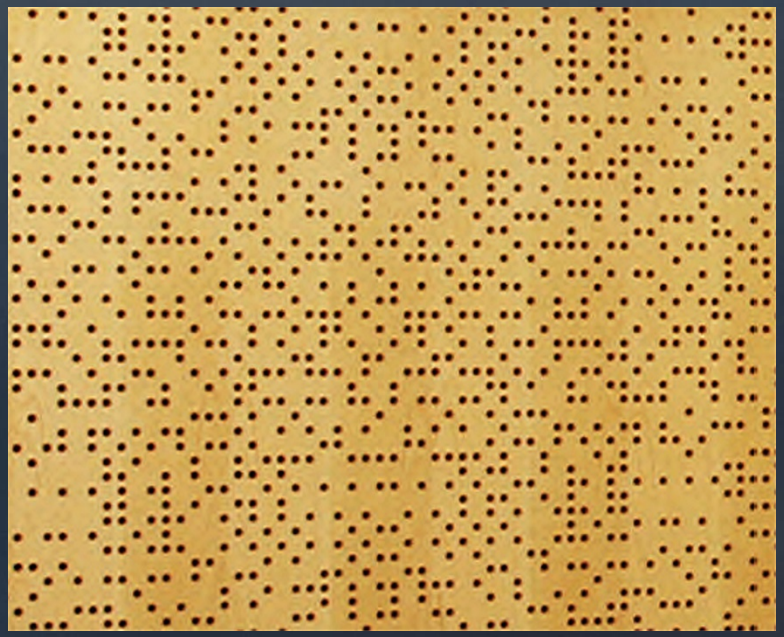
Surface Reflectivity Measurements

Surface Reflectivity measures energy reflected from ANY surface, NOT just “scattering” surfaces. This includes geometrical reflectors as well as diffractive units. This measuring system measures in a free field environment so that phase is also included. The system in the last slide is the same as is used to measure directivity balloons in sound producing units. The difference is that we are measuring 1st order reflections.

A Perforated Diffuser



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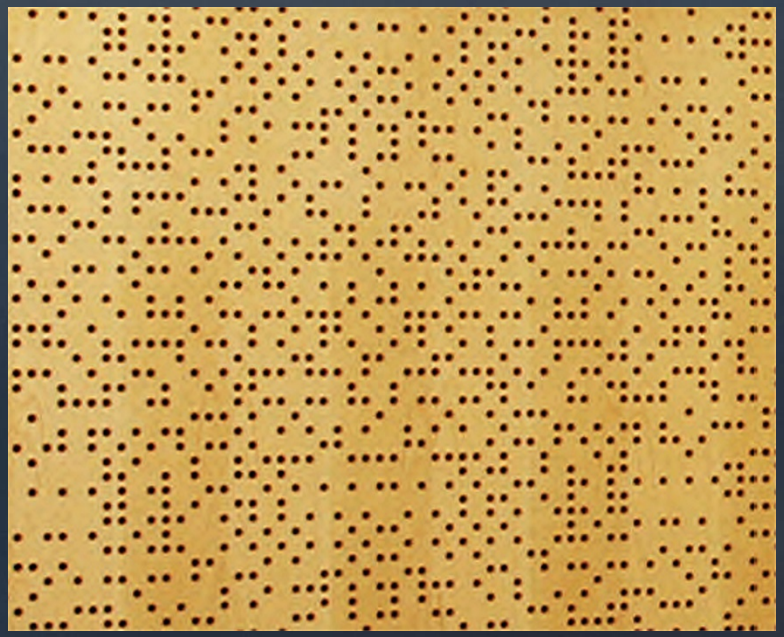
A Flat Plate

(Wood minuus the holes)



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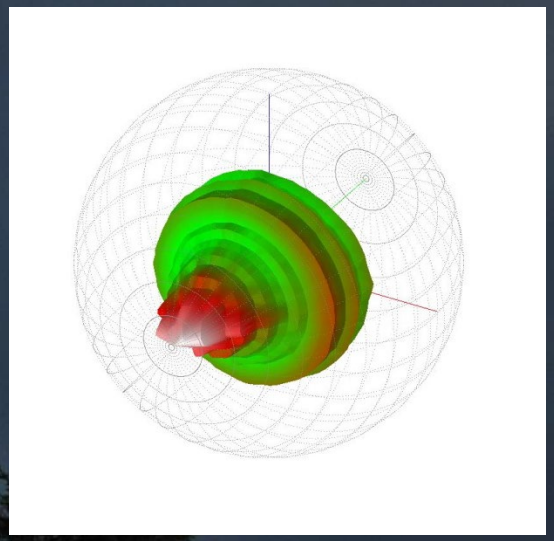
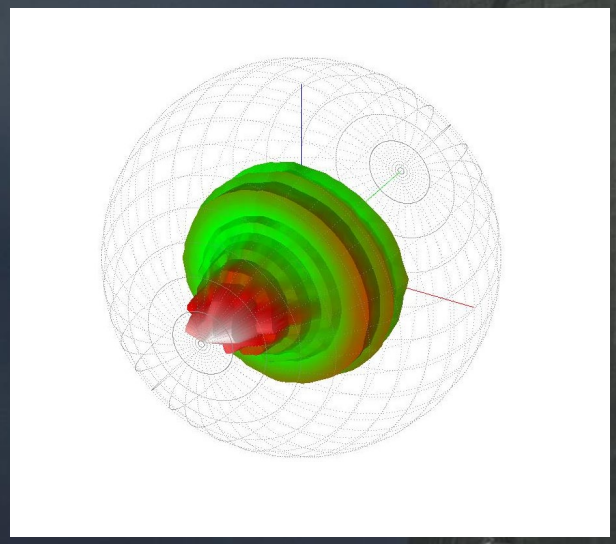
Magnitude and Directivity

Perforated Panel
4K Hz



Flat Panel
4KHz



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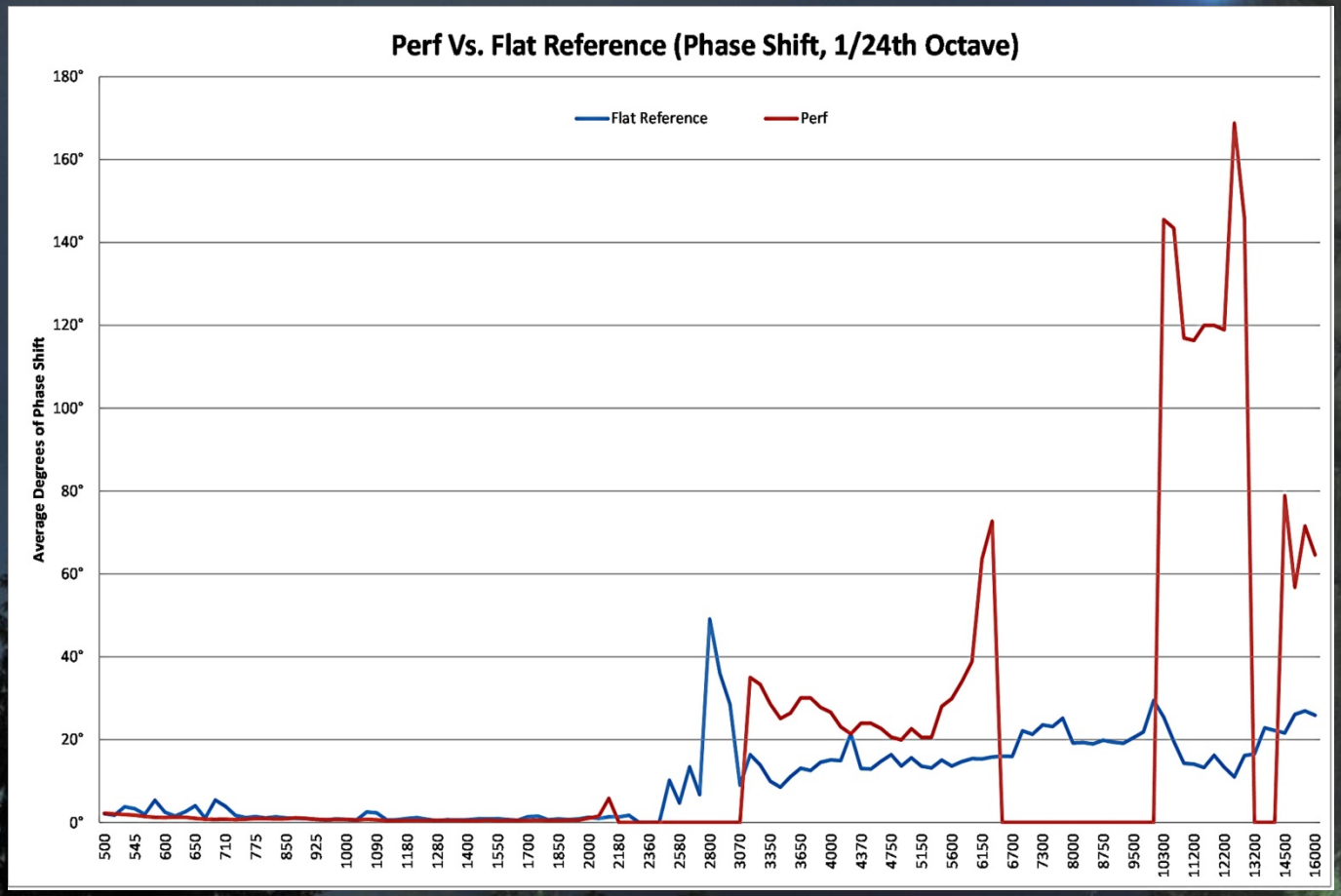
Magnitude and Directivity

As can be seen in the last slide, the directivity balloon indicates there is not a measureable directivity difference between a perforated panel and a flat panel. So why can you hear a difference when these panels are used in a small room? Why does the room seem to “open up”?

Phase Graph



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Phase

As can be seen in the last slide, the phase of the energy reaching your ears is different. One ear hears a certain phase and the other hears a different phase and the brain interprets this as “space” The larger the differences, the larger the apparent space.

Presence: What is it?

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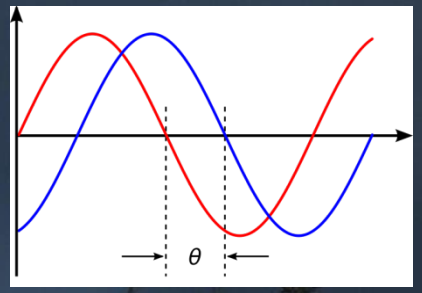
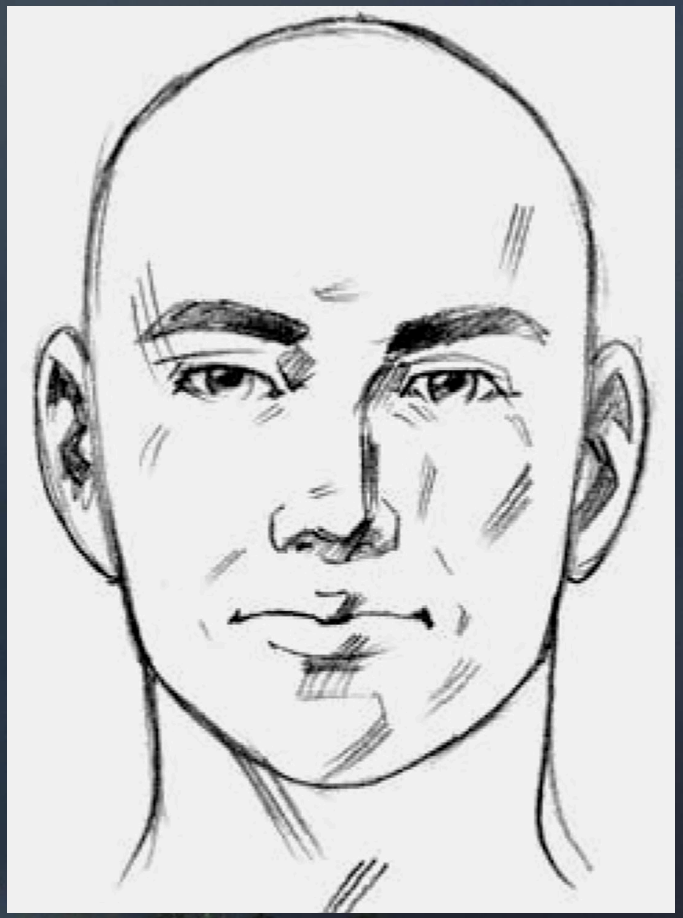
Presence

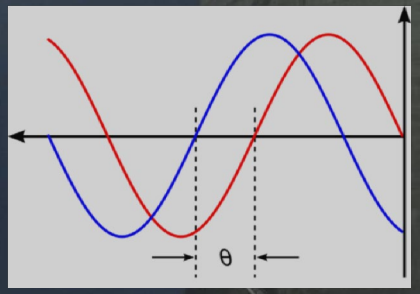
The presence control on certain amps was used to give the effect of increasing the space of a certain sound. This was done by increasing the level of high frequency components at around 16KHz. This was also accomplished in PA work by the use of an “air” control.

Presence Perception



One ear hears the Blue direct sound And then the red Reflection.





The other ear hears The Blue direct sound And then the red Reflection with a different timing or “phase”.

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Presence Perception

A small phase difference at high frequencies translates into the feeling of being in a small room

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Presence Perception

A larger phase difference at high frequencies translates into the perception of being in a larger room.

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Presence

The perception of high frequency phase differences in the brain has been confirmed by experiments done by the student and faculty of The University of Washington Applied Physics Department.

Acknowledgements

I want to thank certain people without whose help this paper would not have been possible.

Jim DeGrandis of Acoustics First Corporation

His animations are without parallel and always help explain how this whole system will help in simulations. He has helped solidify what formats data can be distributed. If we can see, we can do!


Thank you for your attention.
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