But, What About The Audio?

Sound Solutions for Musical Videoteleconferences

Brian K. Shepard, DMA

Associate Professor of Pedagogical Technology

Flora L. Thornton School of Music

University of Southern California

Janet/Royal College of Music • Arts and Humanities Streaming Event • London, UK • 19 September 2012

This presentation available at: www.briankshepard.com/pdf/Janet_RCM_2012.pdf

Audio

vs.

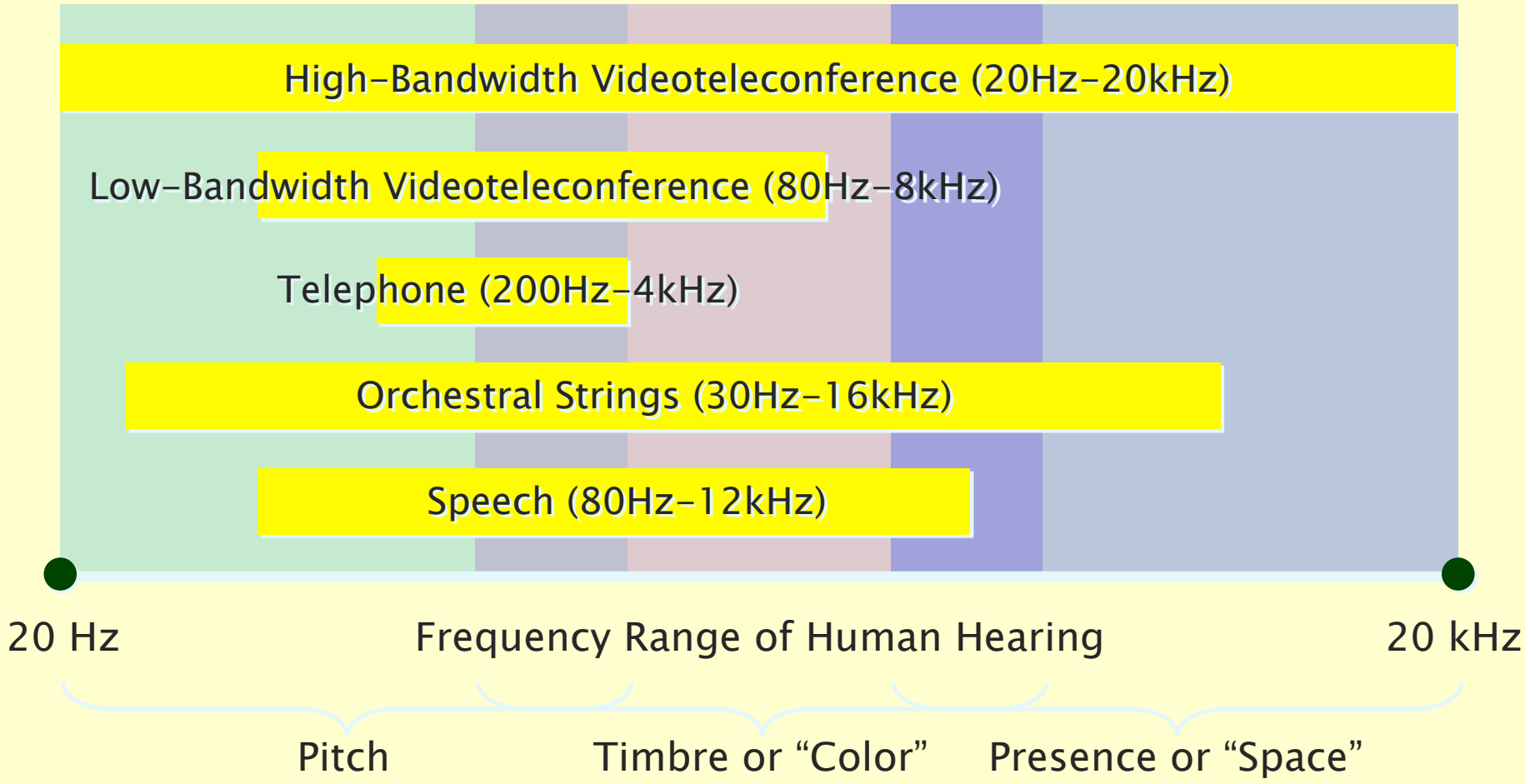
Video

Where's the Information?

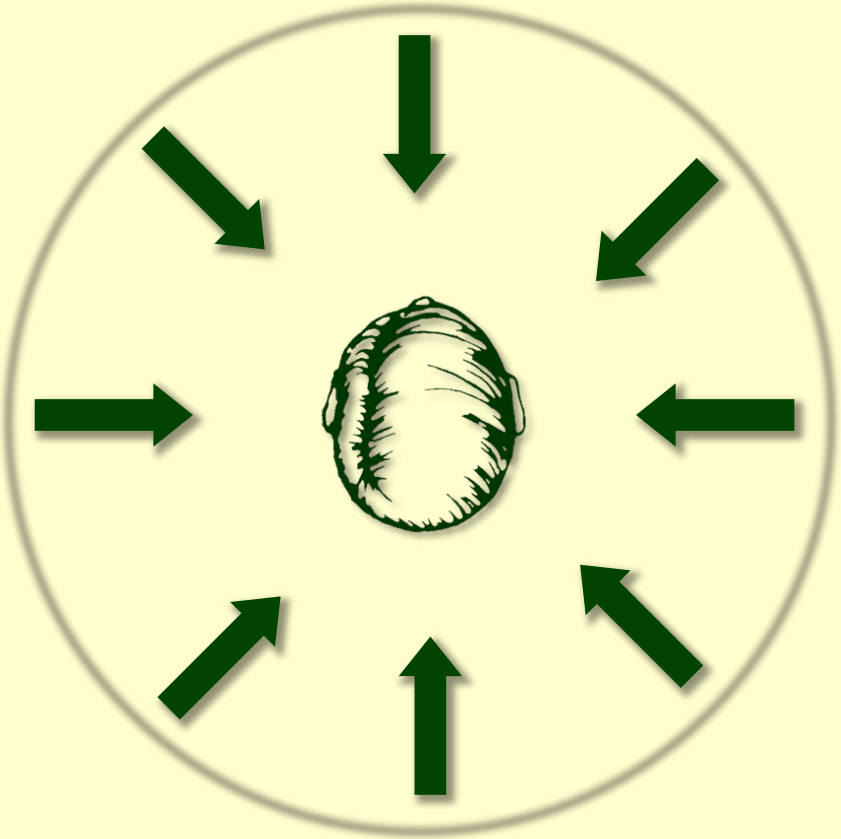
Musicians and Sound

- They use the eyes to confirm what the ears have already told them
- They care about sound, not audio—there is a difference!
- They care about things like tone quality, pitch accuracy, phrasing; not frequency response and decibels
- They need to trust the accuracy of what they hear

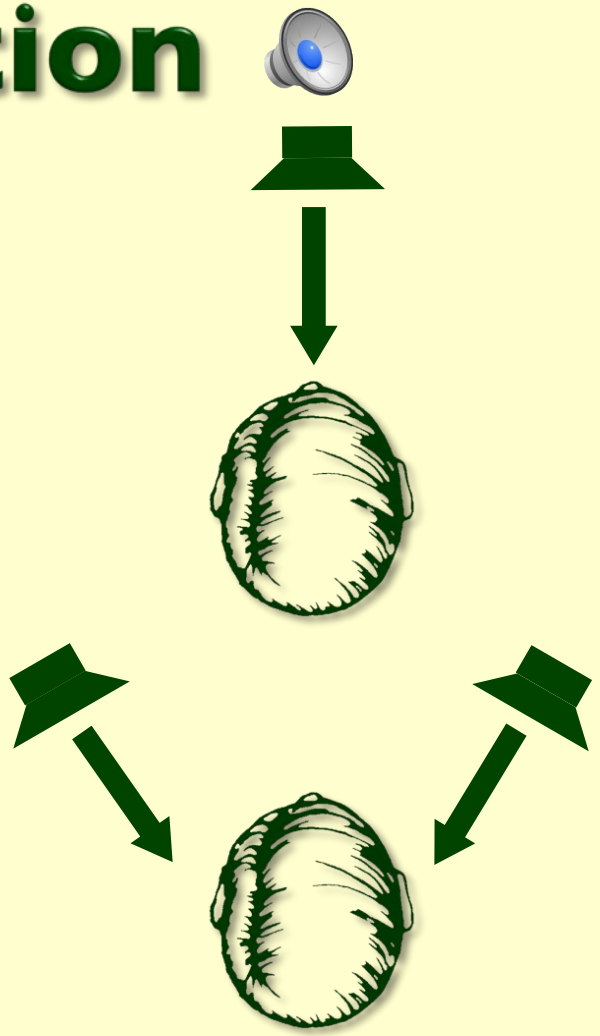
What We Hear


High-Bandwidth Videoteleconference (20Hz-20kHz)
Low-Bandwidth Videoteleconference (80Hz-8kHz)
Telephone (200Hz-4kHz)
Orchestral Strings (30Hz-16kHz)
Speech (80Hz-12kHz)
20 Hz
Frequency Range of Human Hearing
20 kHz
Pitch
Timbre or "Color"
Presence or "Space"

Spatial Localization



3-Dimensional Audio World



Monaural Audio vs.
Stereo and Multi-Channel
Audio

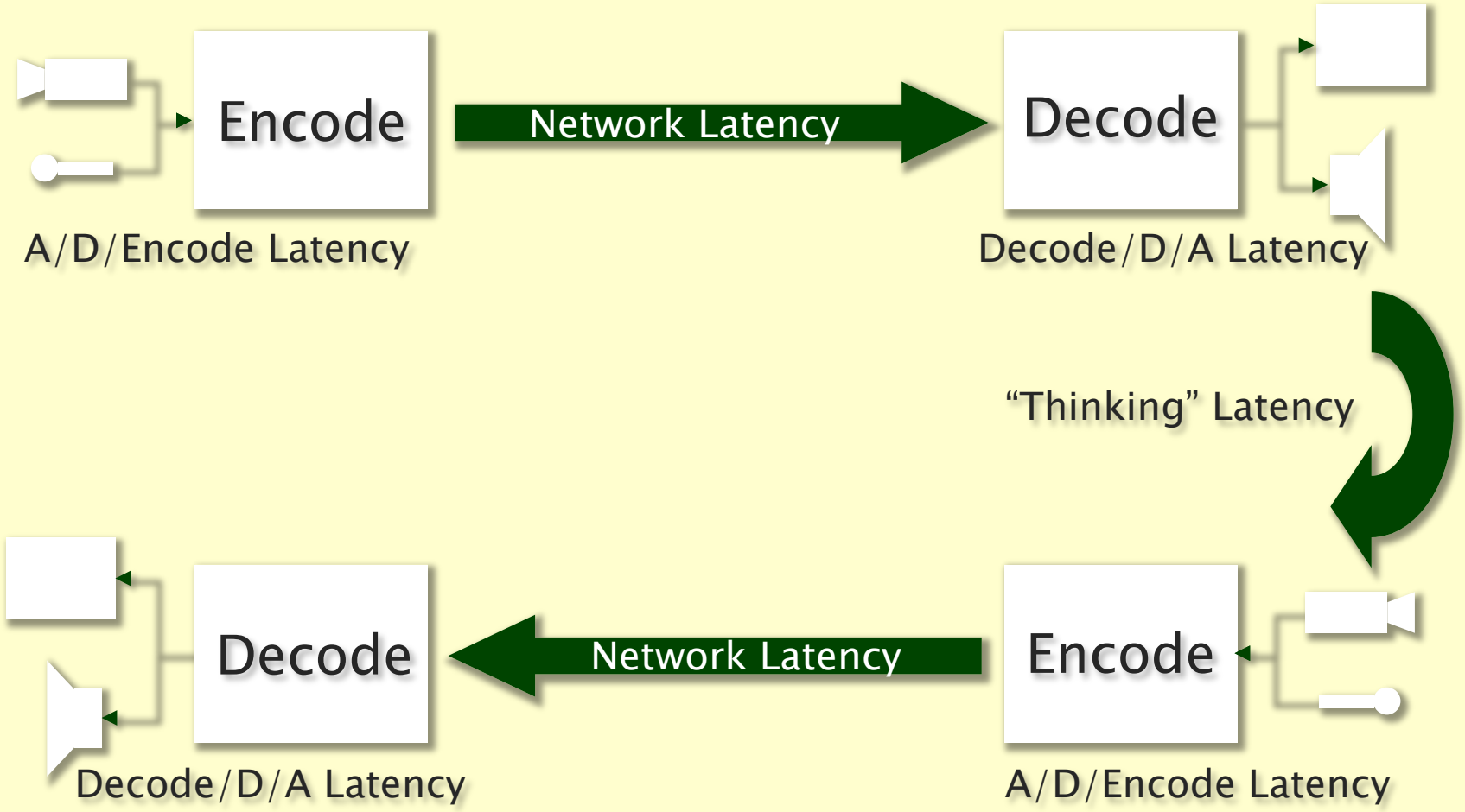
Sound Quality

≠

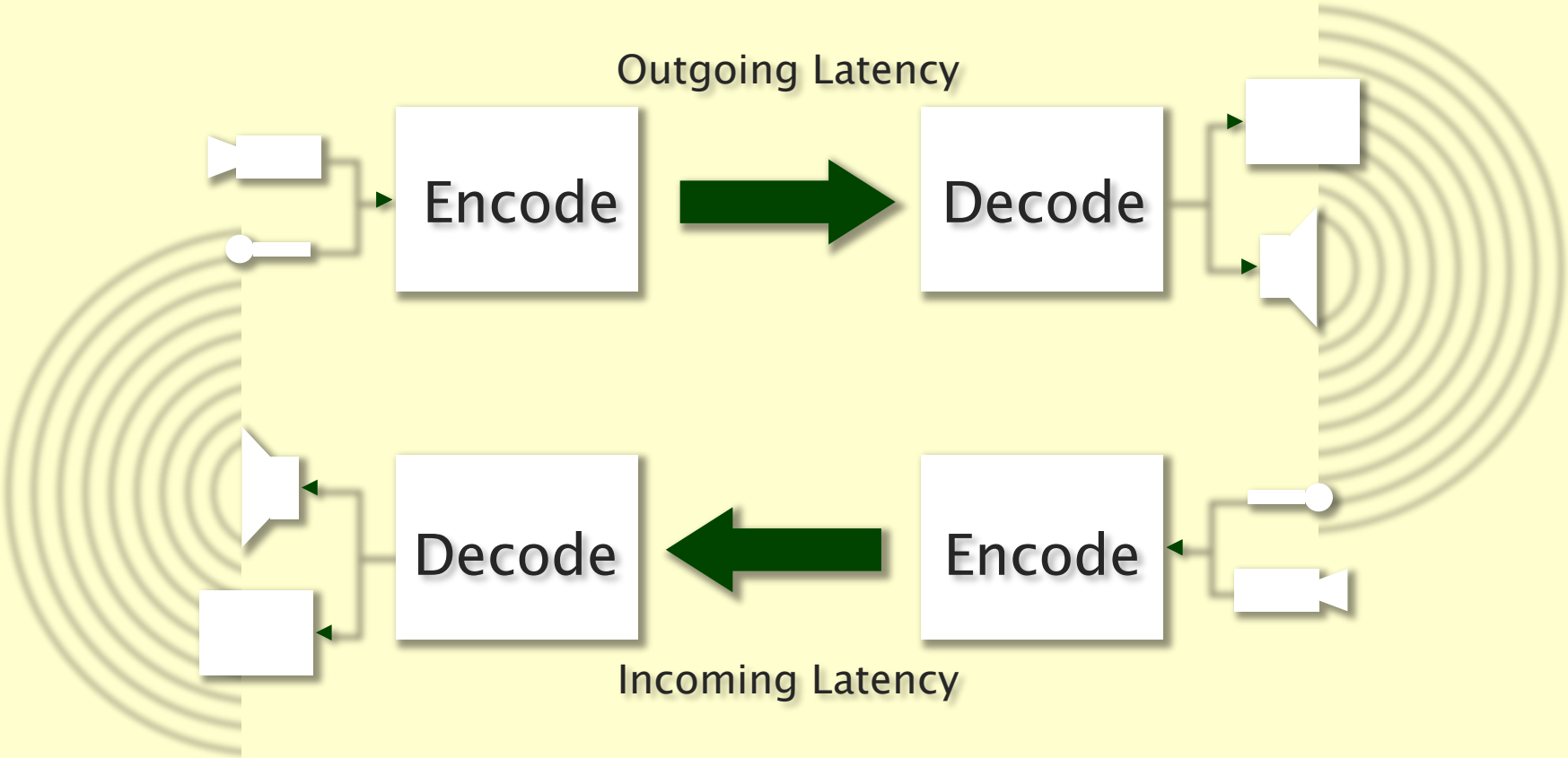
Compression

- Audio Compression
  - Reduces the dynamic (loudness) range of the audio. Often used in recording, but not as frequently in streaming audio
- Data Compression
  - Reduces the size of the data stream by either removing information or reconfiguring information
    - Lossless: rebuilds the audio at the decode end to the original quality – high latency
    - Lossy: permanently reduces the audio quality by removing elements the codec "thinks" we won't notice (perceptual encoding) – moderate latency

VTC Latency


Encode
Network Latency
Decode
A/D/Encode Latency
Decode/D/A Latency
"Thinking" Latency
Decode
Network Latency
Encode
Decode/D/A Latency
A/D/Encode Latency

VTC Echo


Outgoing Latency
Encode
Decode
Decode
Encode
Incoming Latency

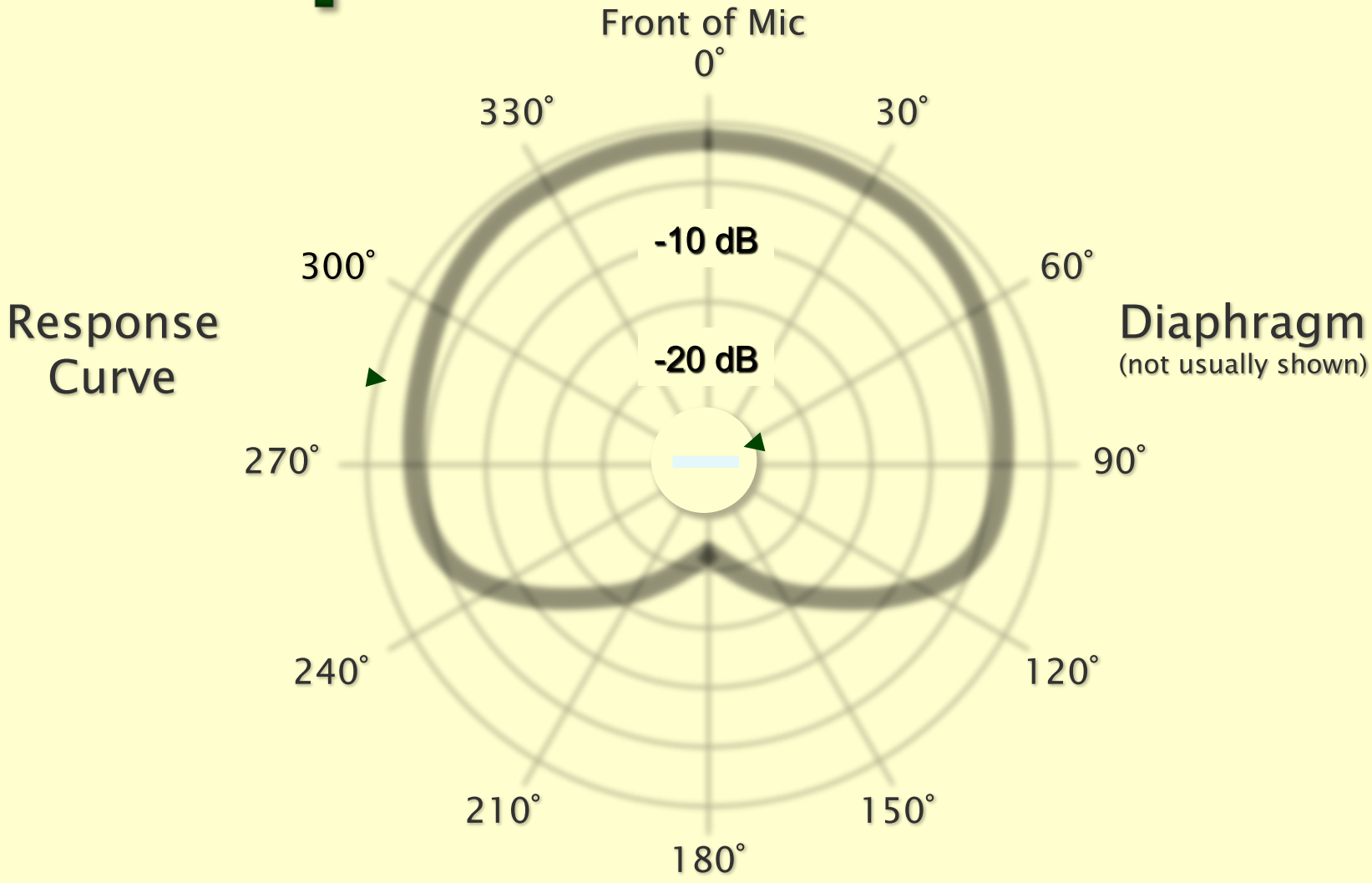
3 Secrets of Audio Success

- Location
  of participant(s) inside the room
- Location
  of proper microphones in relation to the participant(s)
- Location
  of microphones in relation to the loudspeakers

Microphone Type

- Dynamic (Moving Coil)
  - Rugged, warm sounding, requires higher sound levels, good echo rejection
- Ribbon
  - Rather fragile, warm sounding, works with fairly low sound levels, moderate echo rejection
- Condenser
  - Fairly sturdy, bright and crisp sounding (accurate), will work with extremely low sound levels, poor echo rejection

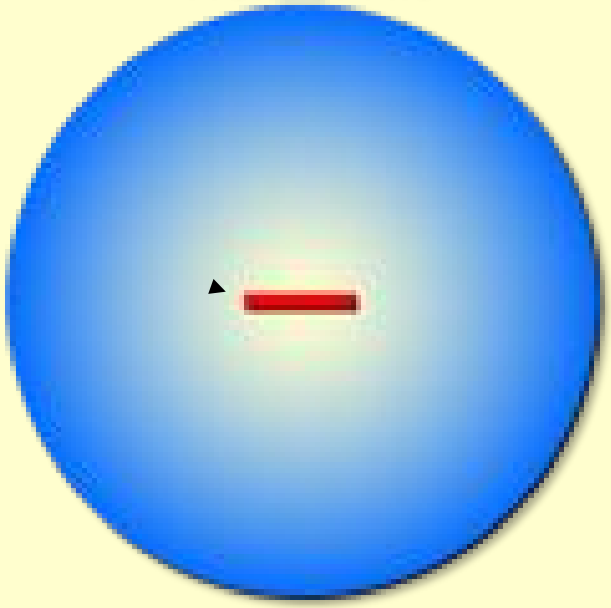
Microphone Polar Pattern



Omnidirectional Mic

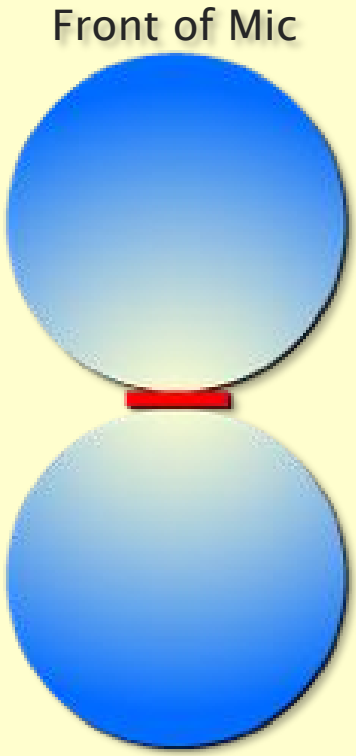
Front of Mic

Diaphragm



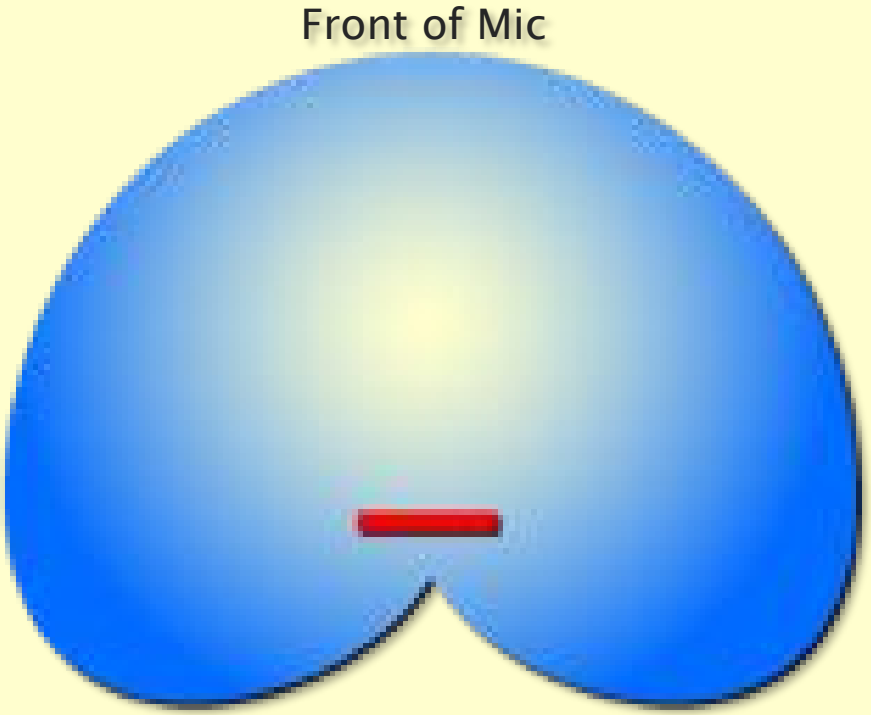
The Omnidirectional Microphone hears in a 360° sphere around the diaphragm.

Figure-8 Mic



The “Figure-8” or Bidirectional Microphone hears in front of and behind the diaphragm.

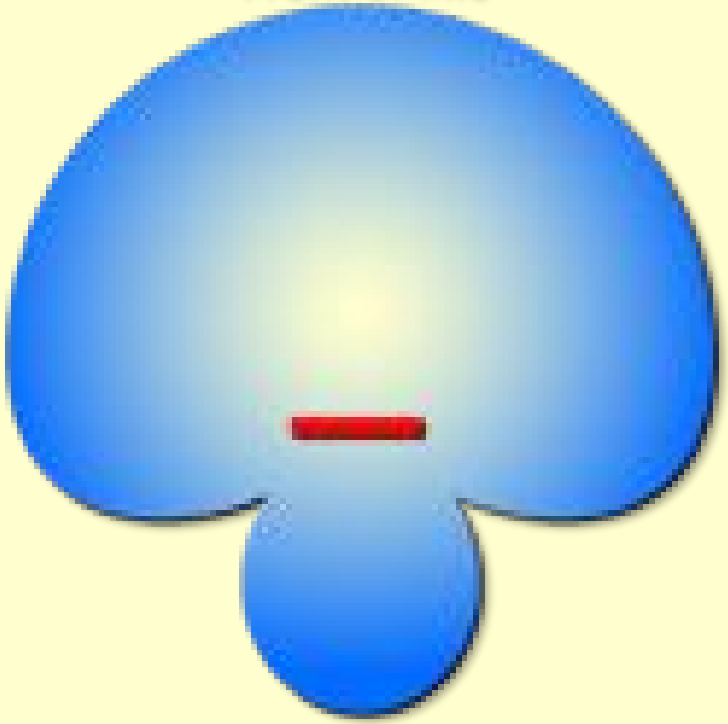
Cardioid Mic



The Cardioid Pattern Microphone hears predominantly in front of the diaphragm

Supercardioid Mic

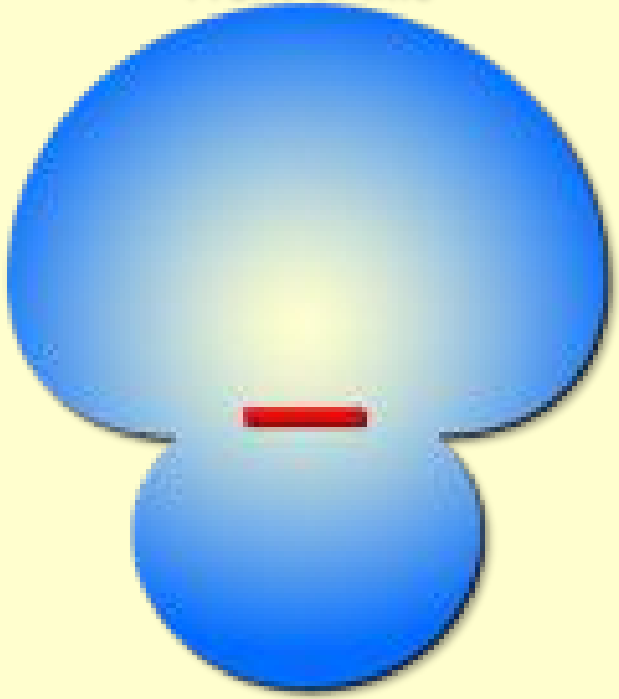
Front of Mic



The Supercardioid Pattern Microphone hears mostly in front of the diaphragm, a little less to the side, and a small pickup area to the rear.

Hypercardioid Mic

Front of Mic



The Hypercardioid Pattern Microphone hears mostly in front of the diaphragm, with very little side pickup and a slightly larger pickup pattern to the rear.

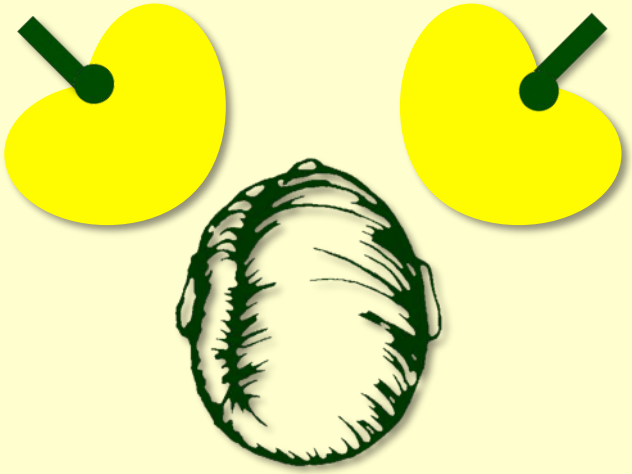
Boundary Mic

The Boundary Microphone is placed on a flat surface. Thus, it hears above and beside the diaphragm in a half-spherical pattern.

Physical Echo Rejection

Speakers positioned
behind, or off-axis
to the Microphones

Dynamic, Cardioid
Pattern Microphones
placed close to the
Participant(s)



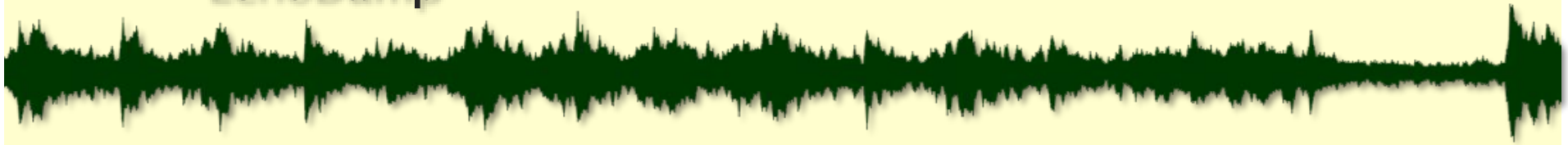
Non-Reflective or Diffusive Surface behind the Participant(s)

Electronic Echo Control

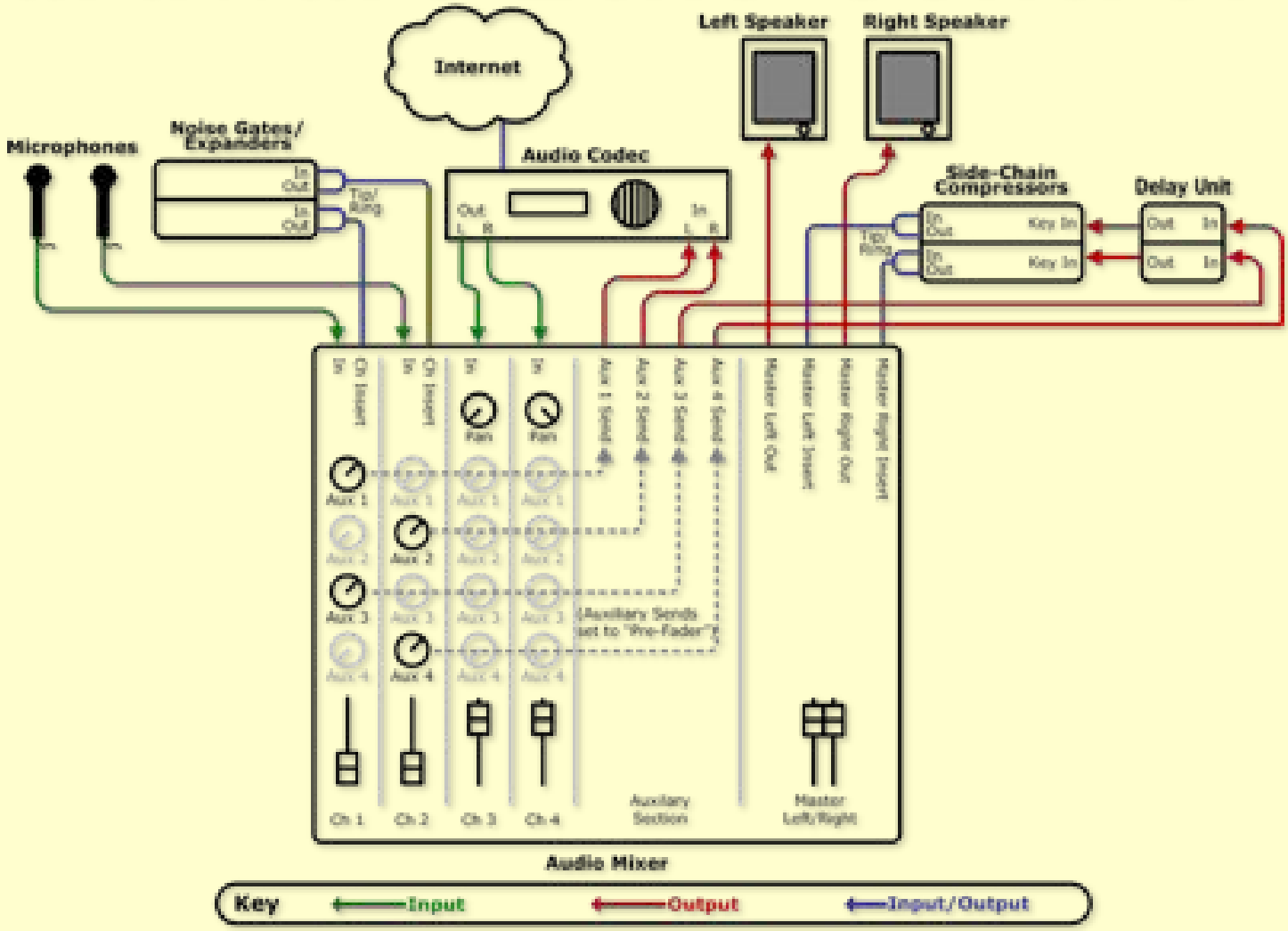
Only after completing all the Physical Echo Rejection Techniques

- Acoustic Echo Cancellation (AEC)
  - Found on most commercial codecs
  - Good for most speaking situations, but not for music

- Dynamic Echo Control
  - Works well for music, but requires fine-tuning
  - Can be done with hardware, but quite complex
  - **EchoDamp**



Hardware Echo Control



EchoDamp

- Audio Mixer and Full-Frequency Echo Controller for the High-Bandwidth Musical Videoteleconference
- Free to non-profit, educational and artistic institutions
- EchoDamp.com

EchoDamp

- Intuitive and easy-to-use audio mixing and echo cancellation in one software package
- Uses a dynamics-based algorithm rather than a frequency-based one (like *Acoustic Echo Cancellation*) to preserve the full frequency range of your audio
- Runs on both Macintosh and Windows computers
- Compatible with any 4X4 (or larger) hardware audio interface that supports *CoreAudio* on the Macintosh or *MME*, *DirectSound*, or *ASIO* on the Windows platform

EchoDamp


HI PASS
EXPANDER
SIDECHAIN
CLIP
64L
64R
SOLO
MUTE
© 2009 University of Southern California
CODEC IN
SIDECHAIN DELAY
AUDIO ON/OFF
635ms
BYPASS
DUCKER
A/B MIX
0.00 dB
-inf dB
1
2
3
4
5
6
7
8
CODEC OUT
SPEAKERS

Downward Expander

Downward Expanders open the microphone channels when the local musicians are performing, and smoothly close the channels when they are not playing

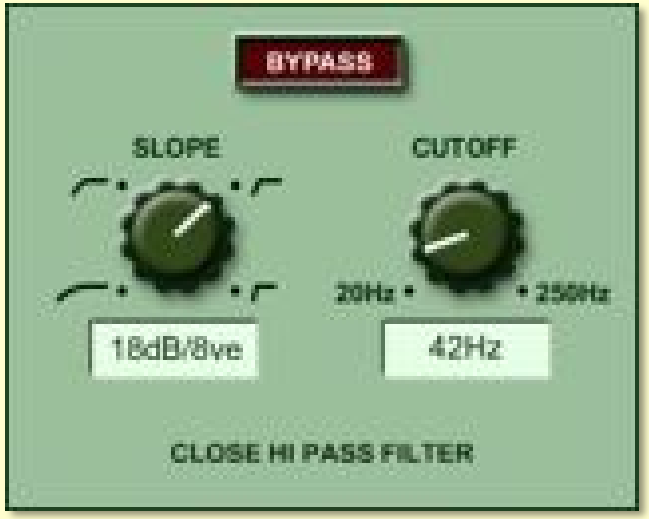
2-Channel Ducker

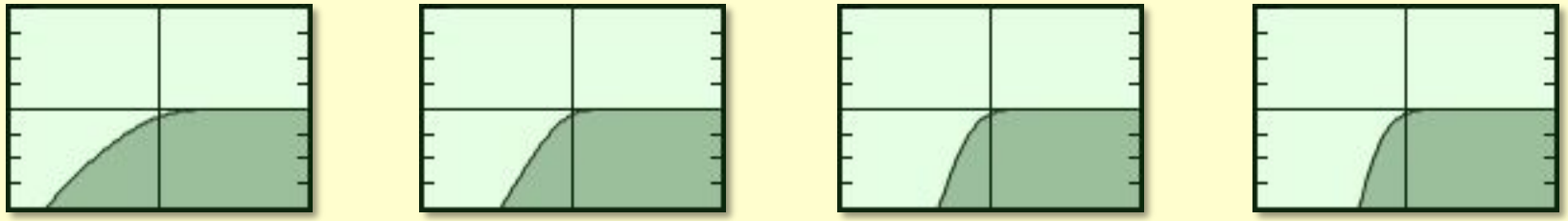
The 2-Channel Ducker, along with the Sidechain Delay, helps prevent your own echo returning from the remote site by gently turning your loudspeakers down as the echo is about to happen

Alternate Mixes

In addition to the mix for the performers, you can create alternate mixes for the control room a live audience

Hi Pass Filter





Hi Pass Filters not only remove rumble and noise, they also help prevent false triggers on the Downward Expanders

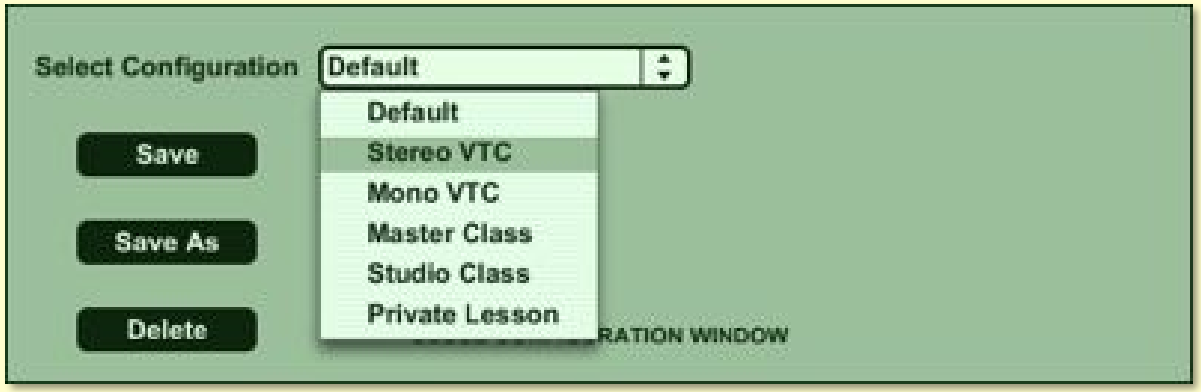
Calibration Tools

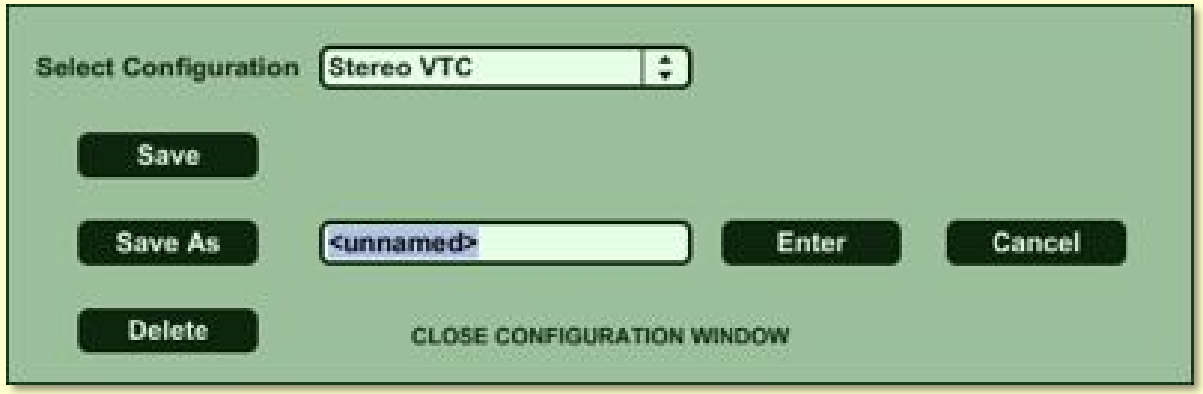
- Audio Calibration Tool
  - Allows you to set common levels between the two sites
- Latency Detector Tool
  - Calculates round-trip latency through all codec and audio components, as well as through the network, to automatically set the Sidechain Delay for the 2-Channel Ducker

Fine-Tune Audio Settings

Customize Audio Settings for Optimal Efficiency with your Computer and Audio Hardware

Save and Load Presets





Save and load presets for the individual Expanders and the 2-Channel Ducker, as well as for the entire Mixer

EchoDamp™

www.echodamp.com

Free to non-profit, educational and artistic institutions

Tips for Best Results

- Do physical Echo Rejection first!
- Remember, do physical Echo Rejection first!
- Do expansion at each end before doing any ducking.
- Do a little echo control at each end rather than a lot at just one end.
- Did I mention that you should do physical Echo Rejection first?

For More Information

Dr. Brian K. Shepard

Associate Professor of Pedagogical Technology

Flora L. Thornton School of Music

University of Southern California

840 West 34th Street, MUS 308

Los Angeles, CA 90089-0851

213.821.4152

brian.shepard@usc.edu

www.briankshepard.com

www.echodamp.com

This presentation available at: www.briankshepard.com/pdf/Janet_RCM_2012.pdf