

Exploratorium Cookbook III

A Construction Manual for Exploratorium Exhibits

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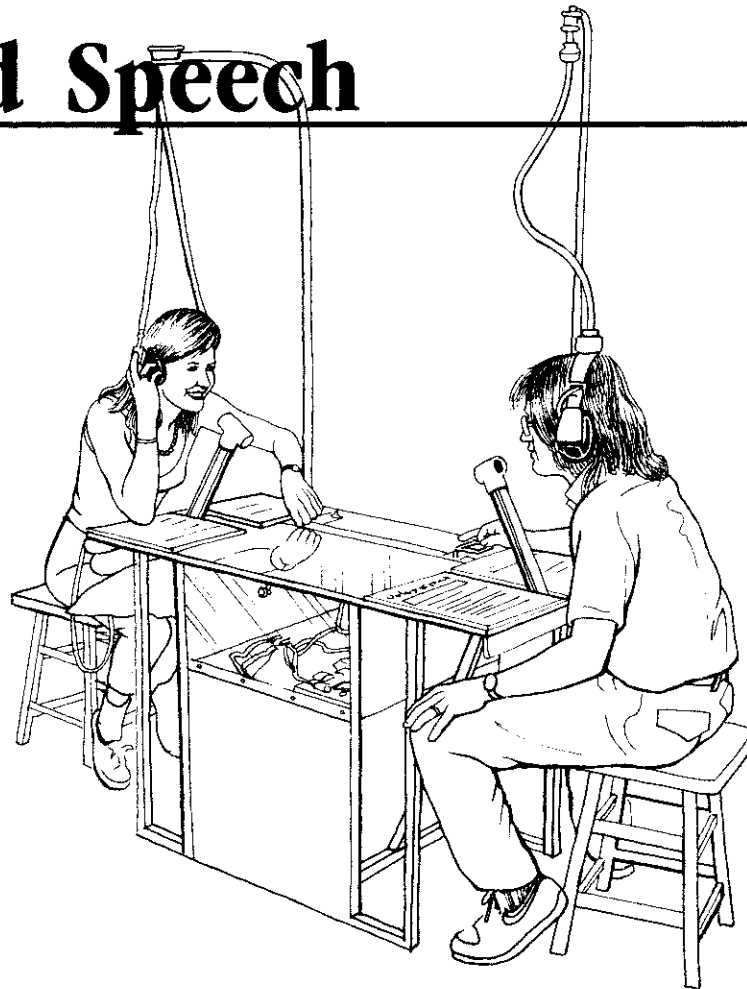
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Delayed Speech



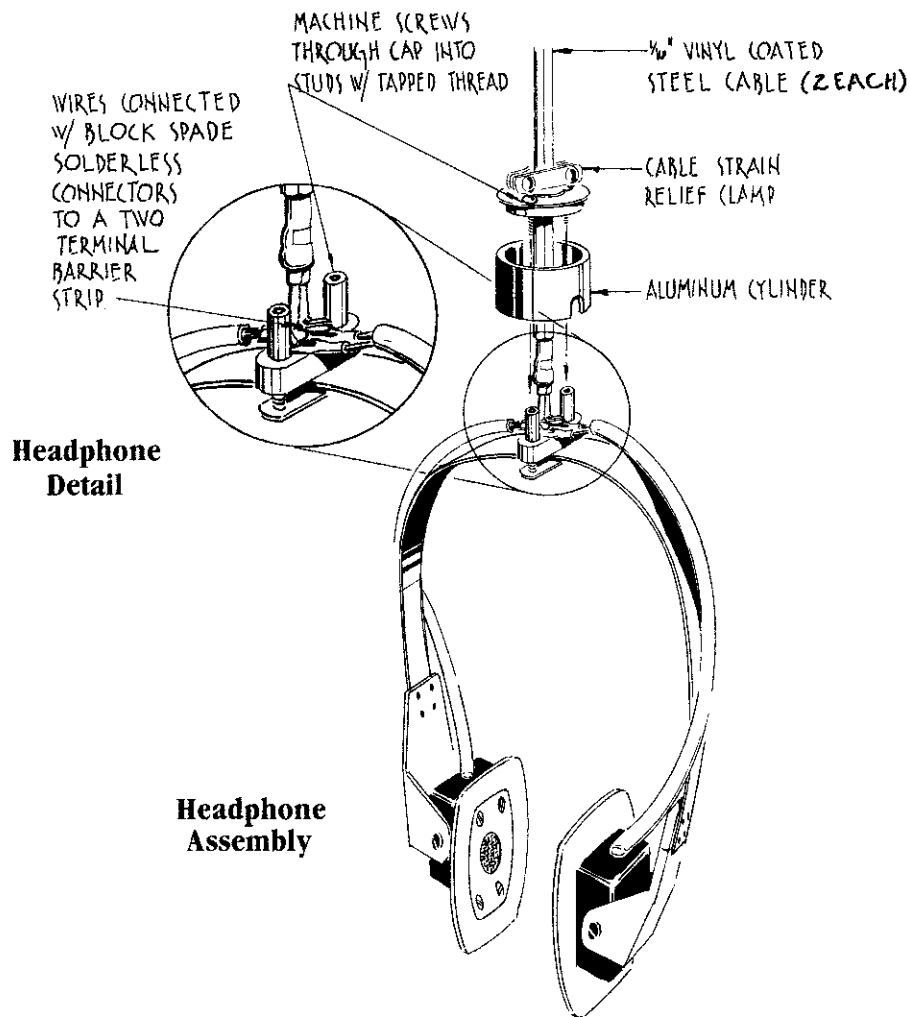
Description

One or two people can talk into microphones and hear themselves in headphones. The playback of their voices is delayed up to 1/5 second (variable). This delay makes it almost impossible for some people to speak intelligibly, since the normal mouth-to-ear feedback mechanism has been tampered with.

Construction

There are several ways that this exhibit can be constructed. We currently use a completely electronic method of delaying the voice. In the past we used a magnetic tape delay system with the record head separated from the subsequent play head. The delay was changed by varying the tape speed. We eventually gave up this system because of tape wear and maintenance.

Our method for electronically delaying the voice is complicated and takes quite a bit of electronic sophistication to build. In recent years complete electronic delay devices, suitable for connection to standard audio systems, have been developed by the musical instrument industry. Not only are these devices already built and ready to use, they are higher fidelity and cheaper than our homebrewed version. These are available in any musical supply store that sells electronic accessories. Ask for an "analog delay line." I have tried one made by Ibanez (model AD9) and have found it eminently satisfactory. These units sell for about \$200.00. I have been told by music store people that a digital delay line, although a little more expensive (around \$275), provides better fidelity and a longer delay time—up to 800ms as opposed to 400ms for the analog delay line. You will have to open the device up to install an external "delay" potentiometer for the public to adjust, but this should present no great problem.



The delay device can be installed on a table. Our headphones are hung from bent steel electrical conduit terminated with "pulling elbows." These pulling elbows are standard electrical conduit fittings that allow a strain relief to be screwed into one end, the pipe fixed in the other, with access for wiring connections. The headphones are hung with two pieces of 1/16" vinyl coated steel cable. These cables not only provide a strong support, but are the "wires" that carry the audio signals to the headphones as well.

We have modified the headphones in order to beef them up. The head size adjustment is fixed in place with rivets, and a cylindrical assembly is attached to the top of the headband for connection to the supporting steel cables (see diagram).

Our exhibit lets two people converse at the same time. This seems to enhance the effect and also makes it more fun, since you can share the experience with a friend. We have seen copies of this exhibit where only one person is allowed to talk and listen, and they just don't have the same impact. A simple mixer should enable two people to use the same device; cheap mixers are available from Radio Shack.

Critique and Speculation

Since we have not actually tried using a commercial analog delay device on our floor, we cannot guarantee its longevity in a museum setting. The devices do seem to be built to last and are apparently available in two styles: floor pedal and rack mount. Choose whichever seems more appropriate to your situation.

Related Exploratorium Exhibits

Perceptual Reinforcement

Reverse Distance; Two Boxes with Rod

Time Effects in Perception

After Image; Benham's Disc; Bird in the Cage; Color Reversal; Light Pistons; Magnetic Tightrope; Persistence of Vision; Professor Pulfrich's Universe; Random Dot Stereograms; Depth Spinner; Squirming Palm; Stereo Sound 1 & 2; Hearing Meaning.

Voice and Speech

Pitch Switch; Variable Speech Control; Voice Mirror; Voice Trace; Pygmalion; Speech Dissector; Vocal Vowels.

Exploratorium Exhibit Graphics

Delayed Speech

You normally hear what you're saying at the same time that you say it. This exhibit delays your words, so that you hear yourself talking a fraction of a second after you've spoken.

To do and notice

Sit down, put on the earphones, and speak directly into the microphone. You will hear yourself speaking, but each word will be delayed by about 1/8 of a second.

If you can't think of anything to say, have a conversation with a friend at the other microphone or read this sign aloud.

Notice that it becomes difficult to talk at a normal speed. You become confused unless you speak very slowly.

You can vary the delay time by turning the knob while holding the button down.

What's going on

Normally, you continually modify what you say, as you say it. You compare the quality of the sounds you make with those you intend to produce, and you adjust your speech accordingly. This feedback loop, as it is called, seems to be important to the ability to speak coherently.

You also rely on other kinds of feedback to control speech production, such as the vibration of the vocal cords conducted through the bones of the jaw or the movement of the lips, tongue, and teeth. Because of this tactile feedback, people who suffer a loss of hearing are still able to talk, although their speech gradually deteriorates over time.

Doctors sometimes use a delayed speech device to test claims of deafness. If the patient is able to hear, delayed feedback will make normal conversation difficult.

Table of Contents for Cookbooks I, II, and III

Cookbook No.-Recipe No.

Mechanics

Balancing Stick	1-75
Bernoulli Blower	2-83
Bicycle Wheel Gyro	2-84
Descartes Diver	3-135
Downhill Race	3-136
Falling Feather	3-137
Gyroscope	3-138
Momentum Machine	1-74

Electricity and Magnetism

Black Sand	2-87
Bulbs and Batteries	2-88
Circles of Magnetism	2-89
Color TV and Magnetism	3-139
Daisy Wheel Dyno	3-140
Earth's Magnetic Field	1-80
Eddy Currents	1-82
Electrical Fleas	3-141
Energy vs. Power	3-142
Finger Tingler	3-143
Generator Effect	1-81
Giant Electroscope	2-90
Giant Meter	3-144
Glow Discharge	3-145
Hand Battery	2-91
Induction	3-146
Jacob's Ladder	2-93
Magnetic Lines of Force	2-92
Magnetic Suction	3-147
Magnetic Tighrope	1-79
Ohm's Law	3-148
Pacific Gas and Leather	3-149
Pedal Generator	3-150
Pluses and Minuses	1-78
Short Circuit	3-151
Son of Transformer	3-152
Suspense	3-153
Transformer	3-154
Very Slow Electrical Oscillations	3-155
Watt's the Difference	3-156
Zero to Sixty	3-157

Eye Physiology

After Image	1-37
Blind Spot	1-36
Blood Cells (Corpuscles of the Eye)	1-34
Blood Vessels	1-33
Eyeballs (Eyeball Machine)	1-31
Macula	1-35
Pupil	1-32

Eye Logic

Fading Dot	1-38
Floating Rings	1-47
Frozen Hand	1-21
Horse's Tail (Gray Step 1)	1-43
Mondrian (Gray Step 3)	1-45
Motion Detection	2-94
Moving Stripes	1-40
Peripheral Vision	1-42
Persistence of Vision	1-46
Rotating Gray Step (Gray Step 2)	1-44
Shimmer	1-39
Sliding Gray Step (Gray Step 4)	3-158
Three Spinners (Benham's, Depth, and Palm)	1-41
Whirling Watcher	3-159

Monocular Vision/Size and Distance

Changing Squares	3-160
Distorted Room	1-56
Far-Out Corners	1-58
Glass Camera (Perspective Window)	1-55
Impossible Triangle	1-57
Multi-Dimensional Shadows	1-60
Reverse Masks	1-59
Size and Distance	3-161
Thread the Needle	1-54
Trapezoidal Window	1-61

Stereoscopic Vision

Binocular Vision (Eyeballs)	1-48
Cheshire Cat	3-162
Delayed Vision	1-52
Lenticular Images (3-D Dots)	1-51
Reach For It	3-163
Reverse Distance	1-53
Stereo Rule	1-49
Three-D Shadows	1-50
Two As One	3-164

Color Vision

Bird in Cage	1-30
Color Reversal	1-29
Color Table	3-165
Green Tomatoes	2-106
Orange Shadows	3-166

Refraction

Chromatic Aberration (Rainbow Edges)	1-27
Critical Angle	1-2
Disappearing Glass Rods	2-104
Glass Bead Rainbow	1-4
Image Quality	3-167
Jewels (The Jewel Box)	1-5
Lens Table	1-11
Optical Bench	1-12
Rainbow Encounters	1-3
Refraction (Bathroom Window Optics)	1-6
Telescope	1-13
Water Sphere Lens	3-168

Reflection

Anti-Gravity Mirror	3-169
Corner Reflector	3-170
Duck Into Kaleidoscope	2-107
Everyone Is You and Me	3-171
Hot Spot	1-18
Look Into Infinity	2-109
Magic Wand	2-110
Mirrorly a Window	2-111
Parabolas	1-15
Shadow Kaleidoscope	1-20
Shake Hands With Yourself	1-17
Spherical Reflections (Christmas Tree Balls)	1-19
Touch the Spring	1-16
Pinhole Images	
Holes in a Wall	2-108
Pinhole Magnifier	1-14
Sophisticated Shadows	2-112

Interference

Bridge Light	1-9
Diffraction	1-7
Long Path Diffraction	1-8
Soap Bubbles	1-10
Soap Film Painting	3-172

Polarization

Blue Sky	2-95
Bone Stress	2-96
Glass Catfish	2-97
K.C.'s Window	1-24
Polarized Light Island	3-173
Polarized Radio Waves	1-26
Polarized Image Mosaic	1-25
Polarized Sunglasses	1-23
Rotating Light	2-98
String Analogy	1-22

Light and Color

Color Removal	3-174
Colored Shadows	1-28
Distilled Light	2-105
Grease Spot Photometer	2-130
Inverse Square Law	3-175
Iron Sparks	3-176
Laser Booth	3-177
Light Island	3-178
Spectra	2-131

Stored Light	2-132
Sun Painting	1-1

Heat and Temperature

Brownian Motion—Real	2-128
Brownian Motion Model	2-127
Cold Metal	3-179
Convection Currents	3-180
Curie Point	3-181
Give and Take	2-125
Heat Pump	2-129
Hot-Cold	3-182
Low Frequency Light	2-126
Skillet	3-183
Water Freezer	3-184

Sound, Waves and Resonance

Bells	1-64
Conversation Piece	3-185
Earpiece	2-113
Echo Tube	2-114
Focused Sound	2-115
Giant Guitar String	3-186
Harmonic Series Wheel	1-66
No Sound Through Empty Space	1-65
Organ Pipe	3-187
Pendulum Table	3-188
Pipes of Pan	3-189
Resonant Pendulum	2-85
Resonant Rings	2-86
Resonator	1-63
Vibrating String	2-116
Visible Effects of the Invisible	3-190
Walking Beats	2-117
Watch Dog	1-67
Wave Machine	1-62

Music

Circular Scales	1-71
Multiplied Glockenspiel	1-73
Piano Strings	1-72

Speech and Hearing

Delayed Speech	3-191
Hearing Meaning	3-192
Hearing Range	3-193
Language Wall	3-195
Selective Hearing	1-70
Stereo Hearing (Stereo Sound 1)	1-69
Tone Memory	1-68
Vocal Vowels	3-194

Animal and Plant Behavior

Brine Shrimp Ballet	2-99
Microscope Projector	2-100
Mimosa House	2-101

Neurophysiology

Crayfish Eye's Response to Light	2-118
E.M.G.	2-119
Garden of Smells	3-196
Grasshopper Leg Twitch	2-120
Heartbeat	2-121
Reaction Time	2-122
Sweat Detector	2-123
Watchful Grasshopper	2-124

Patterns

Harmonograph (Drawing Board)	1-76
Horse and Cowboy	3-197
Moiré Patterns	2-133
Non-Round Rollers	3-198
Relative Motion	1-77
Sun Dial	2-134

Mathematics

Bouncing Ball	3-199
Catenary Arch	2-102
Chaotic Pendulum	3-200
Fading Motion	2-103
Square Wheels	3-201