

Exploratorium Cookbook III

A Construction Manual for Exploratorium Exhibits

by Ron Hipschman

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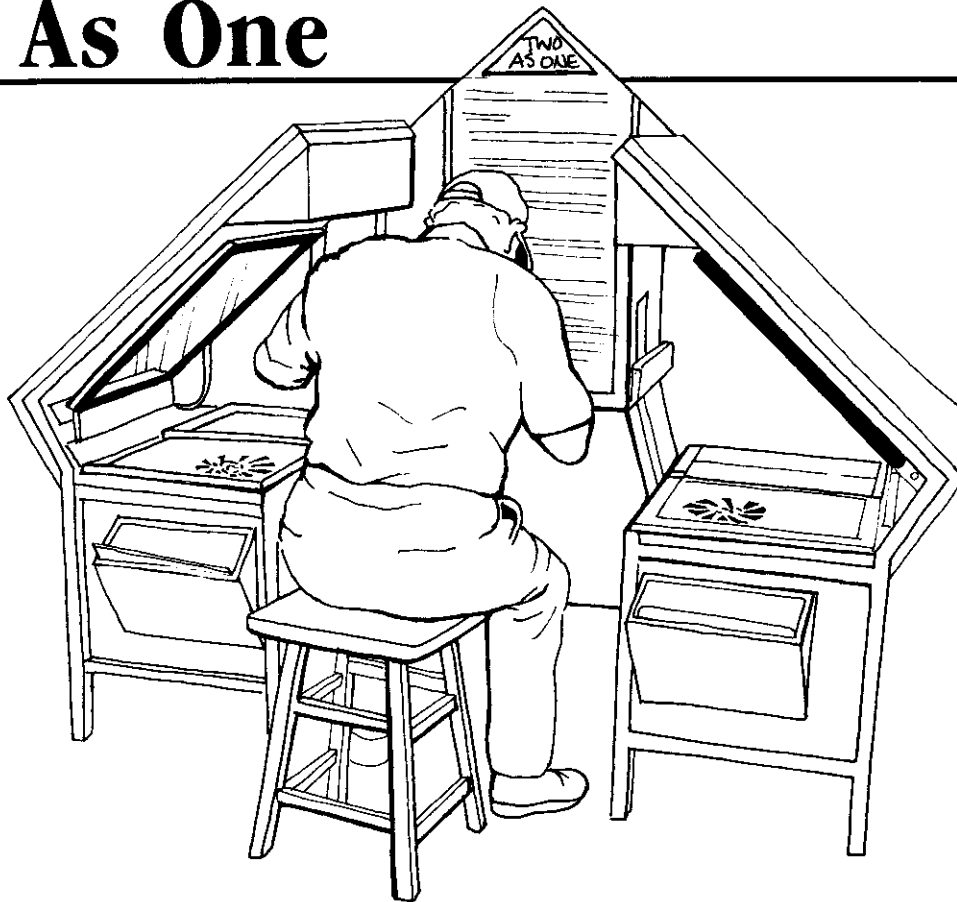
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Two As One



Description

Having two eyes enables us to assemble three dimensional scenes in our brain. Each eye receives a slightly different view; the two views are fused by the brain into the stereo scenes we are so familiar with. Two As One lets you to experiment with binocular stereo vision.

The visitor looks into a prism assembly which splits his/her vision so that each eye views a separate table top. Various laminated pictures and diagrams can be placed on the two table tops, where they can be viewed and fused into stereo images. The viewer can experiment with moving the pictures or switching them right for left.

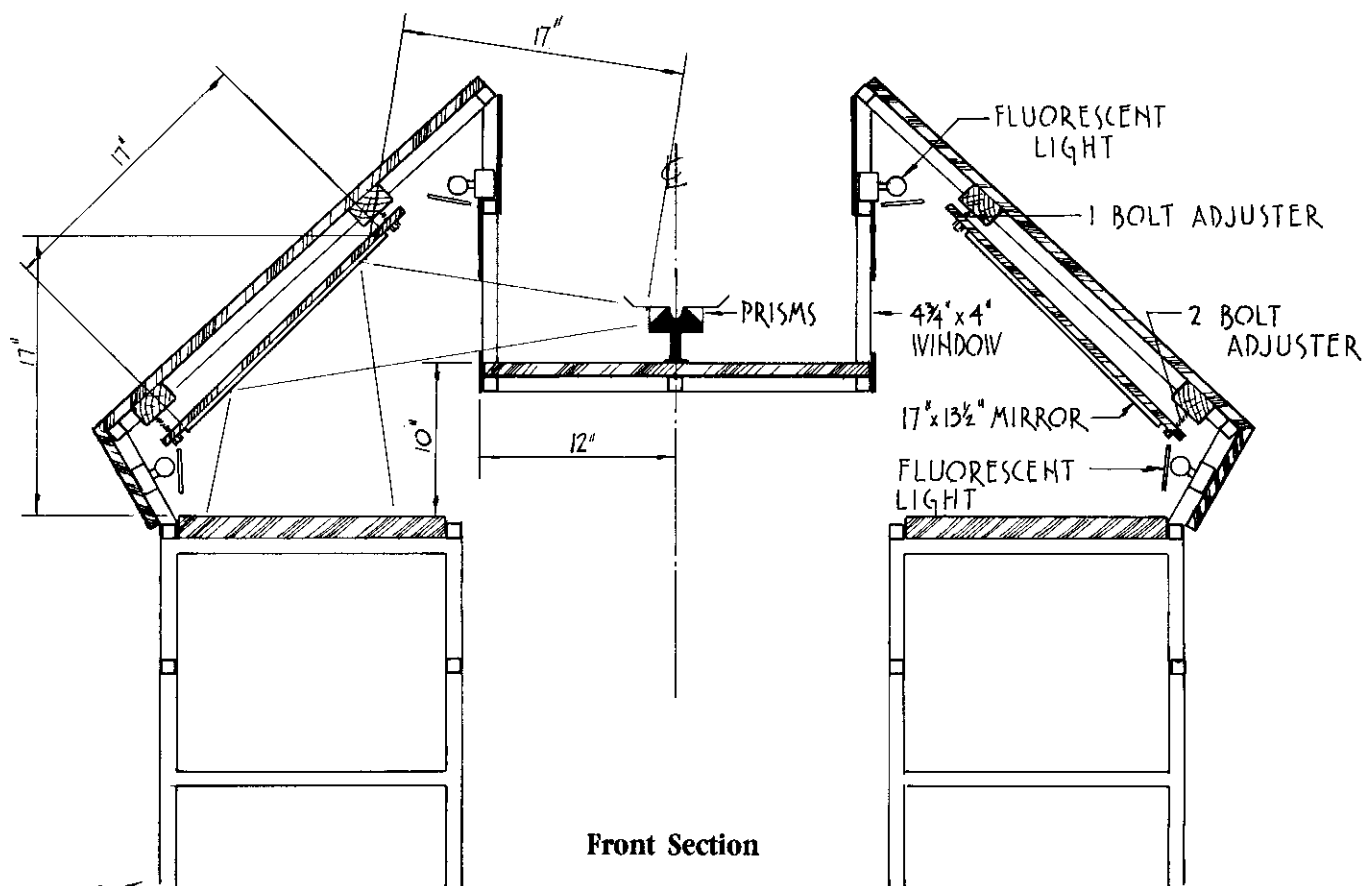
Construction

Mirrors (17" tall and 13-1/2" wide) are placed at 45 degree angles to each of the two table tops, so that the images of objects on the tables are reflected towards the prism assembly. The prisms, one for each eye, are 45 degree-45 degree-90 degree prisms, 1-1/4" square (used as right angle viewing prisms for telescopes). They are placed below the sheet metal viewing plate, which is curved up at the sides and has eye holes 2-1/2" apart (be sure to leave room for peoples' noses!). Our prisms and face plate are fixed to a machined aluminum block held above the table on a 1" square steel stalk. To get rid of reflections from the front surface of the 45 degree mirrors, we have placed polarizing filters in the prism holder and aligned them to cancel these unwanted ghosts.

Black sheet metal windows (4" wide and 4-3/4" high), placed between each of the prisms and its 45 degree mirror, block out all extraneous objects and present the visitor with a view of the table tops only. The windows are about 10" from their respective prisms.

The 45 degree mirrors are mounted on plywood and are held to the exhibit frame with two bolts at the bottom corners and one bolt top center of the mirror mount. With this three-point suspension system the mirror can be adjusted by moving it along the bolts; it is held in place on the bolts with locknuts.

Each of the table tops is illuminated with two 8" fluorescent lamps



behind white translucent plexiglas. One lamp is above the 45 degree mirror and points down, while the other is at the bottom of the mirror and points sideways. This combination gives fairly uniform illumination.

Below each table top is a box to hold the graphic images. We have provided 4 images in addition to the permanent stripes mounted under plexiglas on the table tops. They are:

- 1) A pair of stripes, red and green, with slightly different spacing to give a stereo effect;
- 2) A 3-D image (a graphic of a cone);
- 3) An image of letters which when fused in the brain spells out "TWO EYES," but says nothing when viewed separately. The letters on the two cards are different colors;
- 4) Two different faces, one male and one female, which can be fused into one. It is important to make the faces the same scale (eyes same distance apart) so that the brain can fuse them.

All graphics are plastic laminated. They last quite a while this way, though they would do better mounted on lexan. We've had no trouble with theft.

All components are mounted on a welded 1" square steel tube structure. See the diagram for the placement and distances of the optics.

Critique and Speculation

If welding is a problem for you, the frame of the exhibit can be made of wood—it might even turn out nicer that way.

If you can't find prisms, 45 degree mirrors can be used instead. Second surface mirrors should do fine and are easy and safe to clean.

Related Exploratorium Exhibits

Depth Perception

Depth Spinners; Reach for It; Inferno.

Binocular Vision

Cardboard Tube Syllabus; Cheshire Cat; Cross Eyes/Wall Eyes; DEWA Hologram; Eyeballs; Lightweight Phantoms; Moon Rocks; Professor Pulfrich's Universe; Random Dot Stereograms; Stereo Paintings; Stereo Rule; Stereo Viewers Old & New; 3-D Shadows.

Eye Rivalry

Eye Rivalry I; Cardboard Tube Syllabus.

Dominant Cues

Far Out Corners; Floating Rings; Horse and Cowboy; Impossible Triangle; Reverse Masks; Cheshire Cat; Cardboard Tube Syllabus.

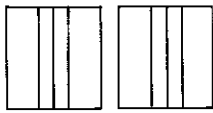
Exploratorium Exhibit Graphics

Two as One

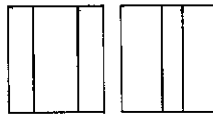
You can use this exhibit to create an artificial perception of depth and also to see what happens when your brain tries to combine two very different views.

To do and notice

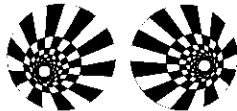
Artificial Depth Perception



There are colored stripes painted on the left and right table tops of this exhibit. Remove any loose cards that may be covering the stripes. With both eyes open, look through the viewer at the red stripe, then look at the yellow stripe which appears further away. Notice that the blue stripe appears even further away.



Find the two cards with red and green stripes. Place one card on each table top, with the red stripe on the right side of each card. While looking through the viewer, slowly slide one card sideways until you see only one red and one green stripe. Notice which stripe appears further away. Exchange the cards (switch the left with the right) and notice that the stripes are now reversed in depth.

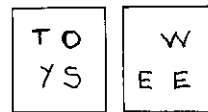


Place one of these cards on each table top. Stare at the center circle and adjust the cards until you see only one circle. Notice the shape of the three-dimensional image. Exchange the cards (switch the left with the right) and notice that the new three-dimensional image is now quite different.

Related Exhibits:

Stereo Rule
Stereo Viewers—Old and New
Reverse Distance
Cheshire Cat
Eyeballs

Eye Rivalry



Place a lettered card on each table top. While looking through the viewer, adjust the letters so that the combined image you see is the phrase "TWO EYES." Notice how the letters tend to overlap with each other.



Place one photograph on the left side and one photograph on the right. Look through the viewer and adjust the faces until you overlap the eyes of each of the faces. Notice the new face you see when your brain fuses these two very different images. Keep looking at the faces and you will see new combinations as you pay attention to different details. Sweep your hand across one of the faces and you will see mostly that face. You can also replace one of the faces with the window card.

What is going on

We use many cues to determine how far away things are. One of the strongest cues arises from the fact that your two eyes see slightly different views of the world. The brain combines these views into a three-dimensional or stereoscopic image.

When you look at the red and green stripes, your two eyes see different pictures. If the two stripes seen by the right eye are closer together than the stripes seen by the left eye, the stripe on the right will look closer to you or above the other stripe. Conversely, if the stripes are closer together for the left eye than for the right, the stripe on the left will appear to be closer.

When your two eyes see totally different views, as with the faces and the window, you can't fuse the two pictures, and so you combine and recombine parts of each eye's view.

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 Tingles)	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
Skillets	3-183
Water Freezer	3-184

Sound, Waves and Resonance

Bells	1-64
Conversation Piece	3-185
Farpiece	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