An Optical Science Encouragement Kit for School and Community Outreach

3M Visiting Wizards

THE BAKKEN MUSEUM

A Little Bit About 3M Visiting Wizards and its Partnership with The Bakken

3M Visiting Wizards

3M sponsored science outreach program since 1985 wherein trained "Wizards" check out and present kits in classrooms

Science is Fun

29 self-contained kits that demonstrate that "Science is Fun"

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The Bakken partnership began in 2010 in order to:

- *Bring educators and scientists together*
- *Apply education principles to kit design*
- *Simplify lessons*
- *Develop uniform kit design and documentation*

The Strengths of the Partnership

3M Visiting Wizards

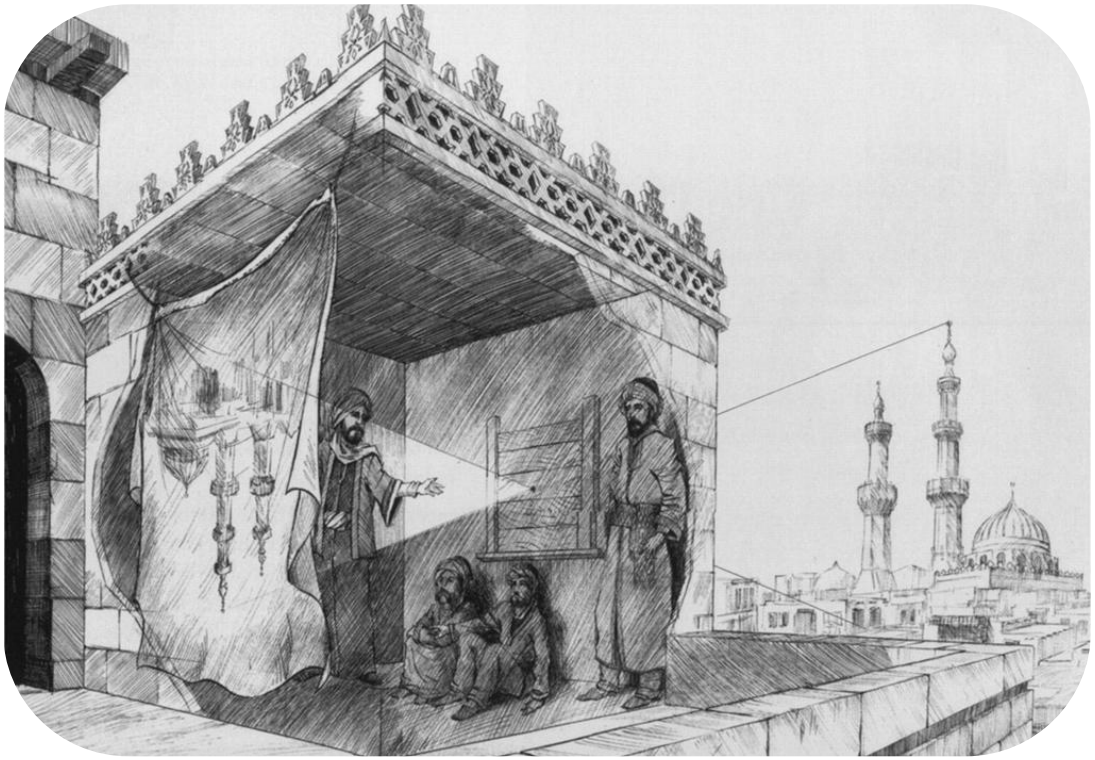
- Science and Engineering Expertise
- Science Outreach Programs
- Pool of Volunteer Scientists
- Cutting Edge Technology

THE BAKKEN MUSEUM

- Pedagogy Expertise
- Understanding of Teacher Needs
- Knowledge of Standards
- Internal Education Programs

Camera Obscura as a Visiting Wizards Kit

Optical device used by philosophers, artists, and scientists since Alhazen (ca. 1000 CE)



Illustrates image inversion, projection, and aperture effects

Canaletto

Return of the Bucentoro to the Molo on Ascension Day, 1732

Overcoming Challenges of the Original Kit

Area of Concern	Challenge	Desired Changes
Overall Design	Bulky, heavy, complicated Rarely checked out by Wizards	Simple, robust Portable, easy to set up and use
Lighting	Big, heavy, halogen work lights which get very hot	Cool, compact, efficient, low-power light source
Illuminating Objects	Reflecting enough light to produce a viewable image	Bright image on the screen
Aperture and Lens Assembly	Manual aperture changes	Turret aperture holder for easy aperture changes
Ancillary Learning Tools	Difficulty explaining image inversion	Provide a more concrete understanding of why the image is inverted

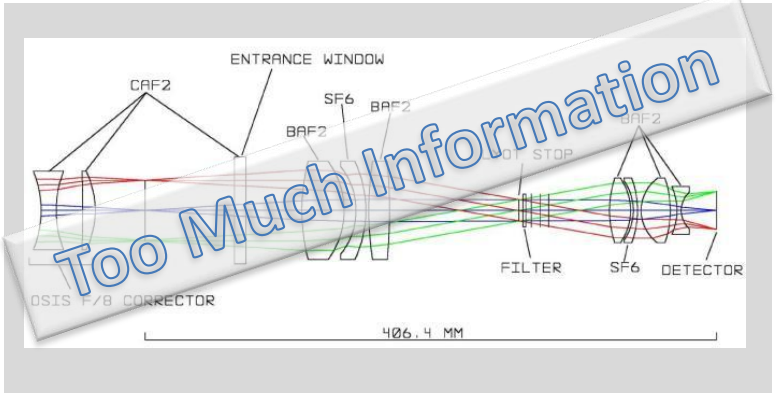
Conclusions

- 3M and The Bakken Museum collaborated on revisions to a science encouragement kit
- The two parties brought together complementary aspects of science, education, and design
- The kit was completely reengineered
- The new kit is:
  - more portable
  - built for a flow-through environment
  - limited to a few concepts (aperture effects, image inversion, focus)
  - fun!

Develop Uniform Kit Design and Documentation

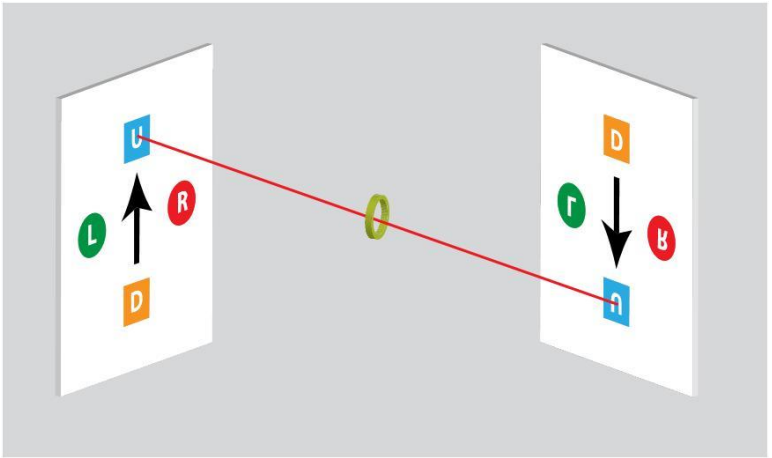
Lesson Plan

- Limit to three concepts
- Eliminate extraneous information
- Avoid “lesson creep”



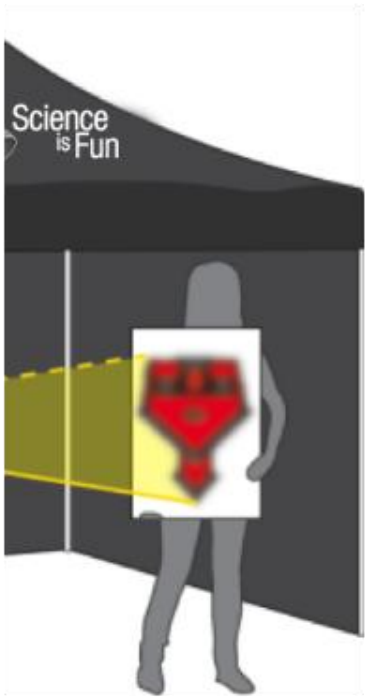
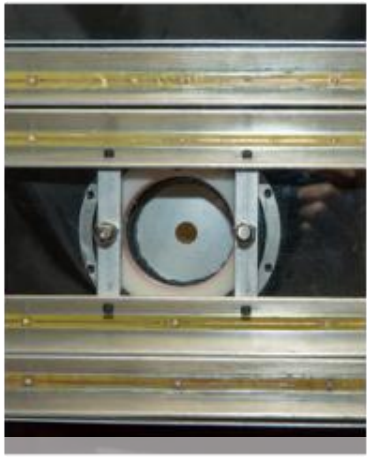
Documentation

- Standardized
- Organized
- Clean
- Simple







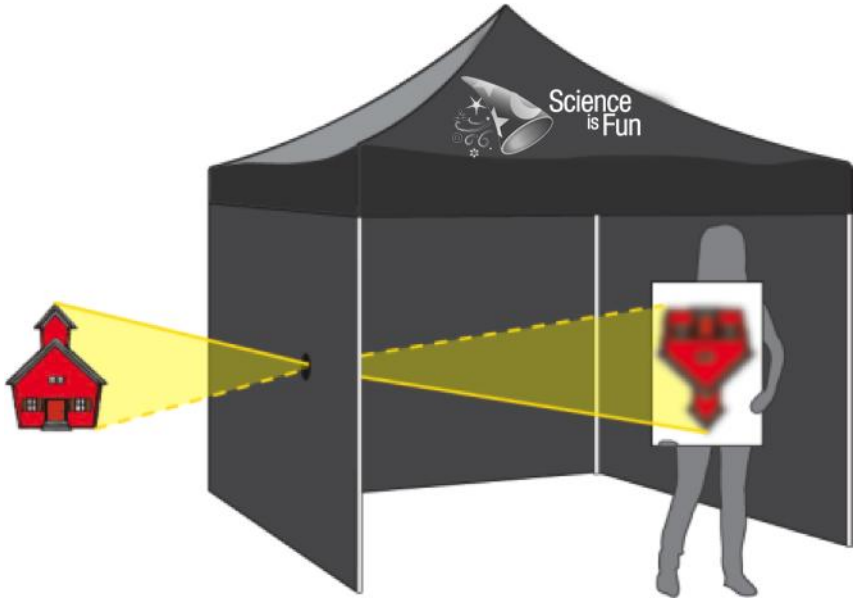

Science
is Fun







SO, WHAT'S IN THE KIT?

From Concept to Reality



Artist's Sketch

Pop-up Tent Version
(only aperture wall shown)

A Look at the Overall Design

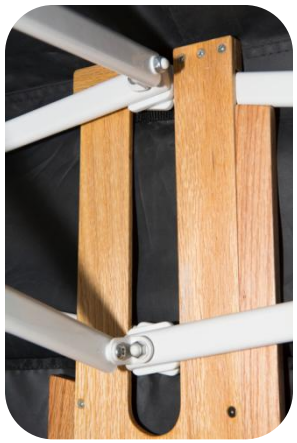
Complete Packed Kit

Unpacked Kit

Tent Set Up

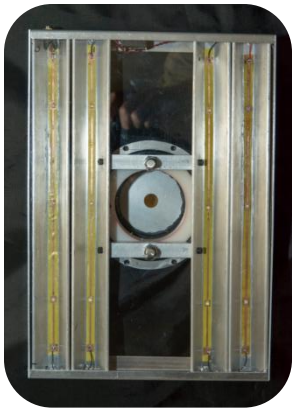
Aperture, Lens, and Lighting

Aperture Assembly



Snap Mount for Aperture Assembly

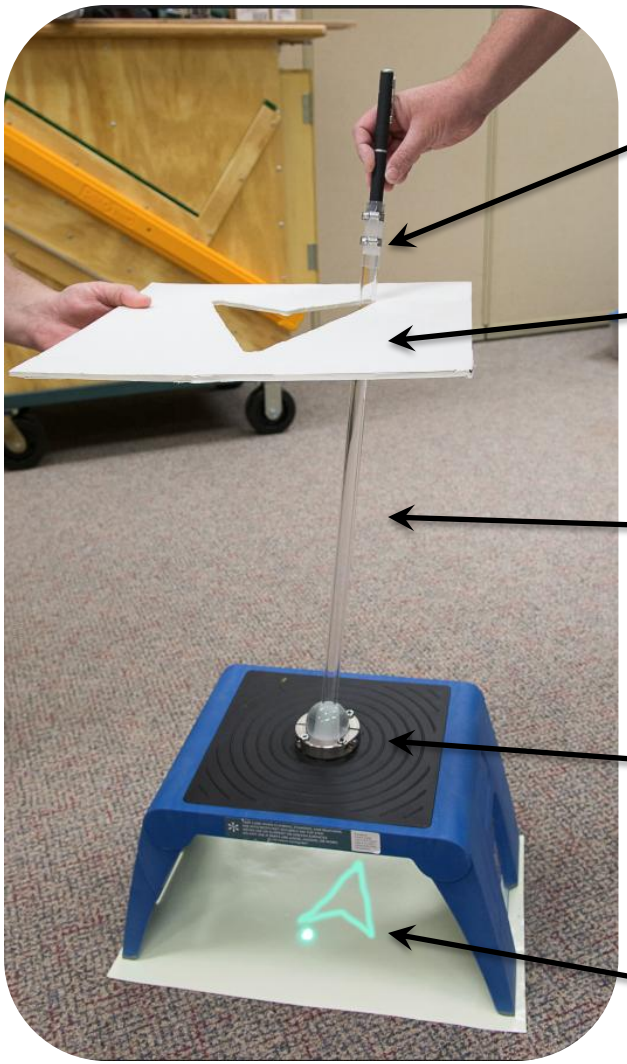
Three Apertures + Lens



Collimated LED Lighting Mounted on Aperture

Retroreflective Gear

Demonstrating Image Inversion – Hands On



Blue Green Laser Pointer

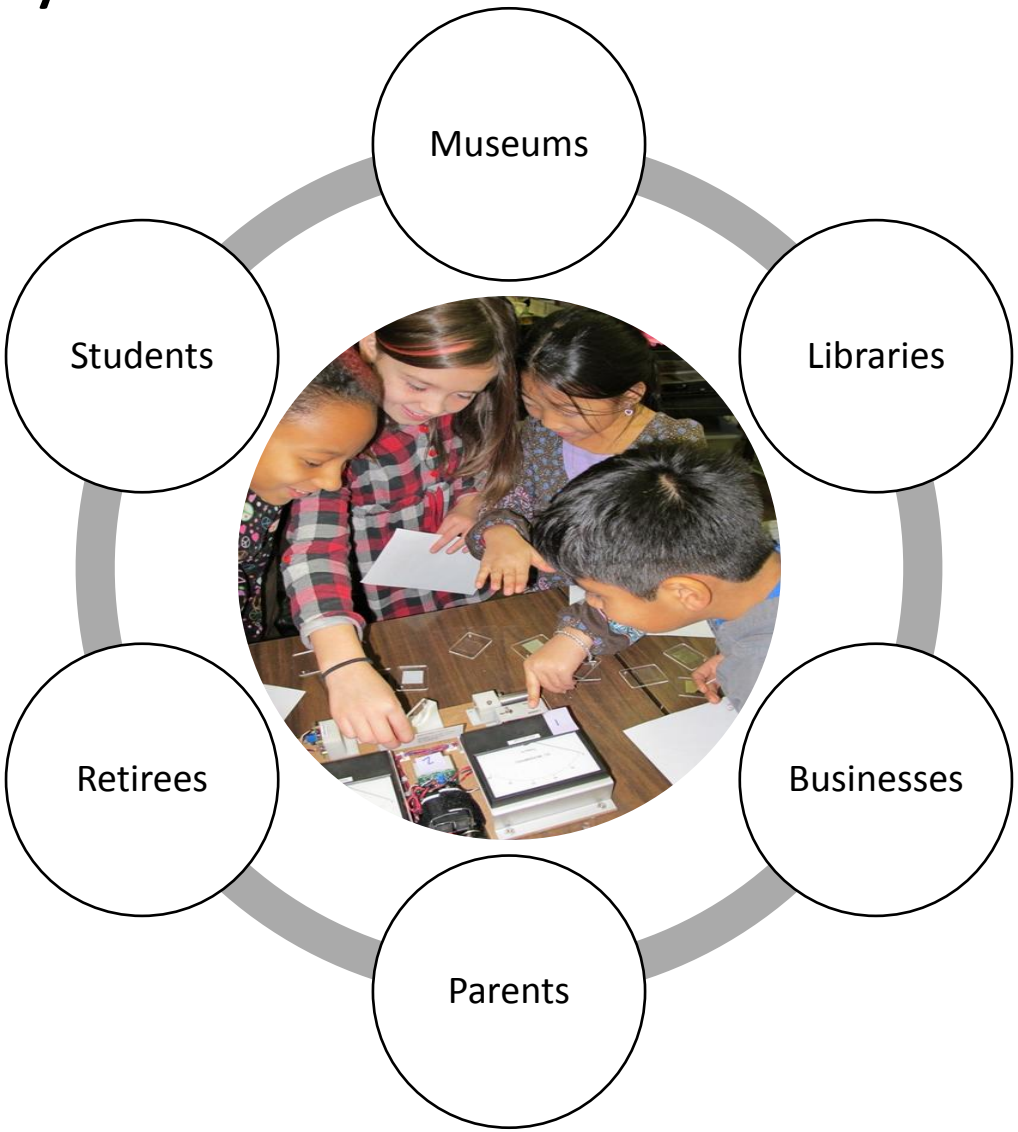
Arrow Stencil

Plexiglas Beam Tube

Gimbal

Phosphorescent Paper

Who Could You Collaborate with in Your Community?



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3M

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Questions?

3M Visiting Wizards

If you think of something later…

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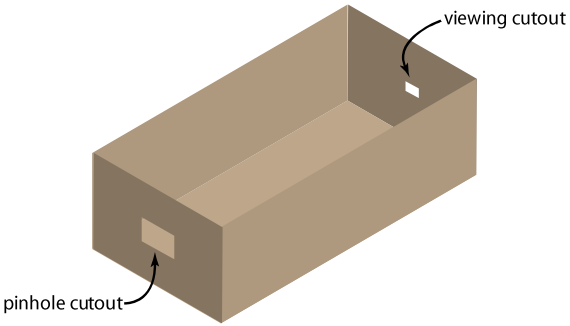
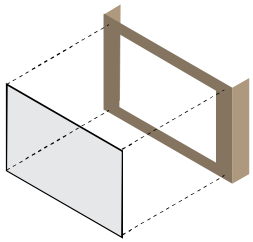
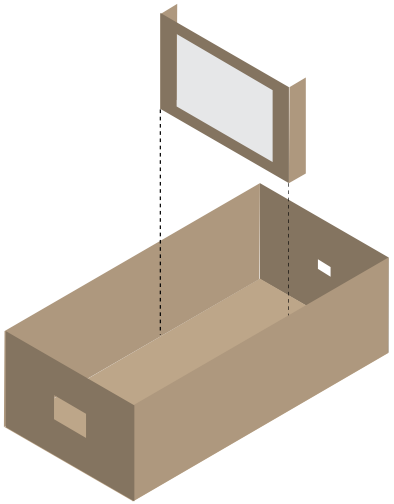
How to Make a Pinhole Viewer



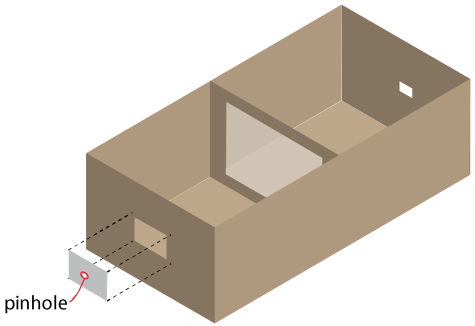
Step 1. Make pinhole and viewing cutouts in opposite end panels of a shoe box



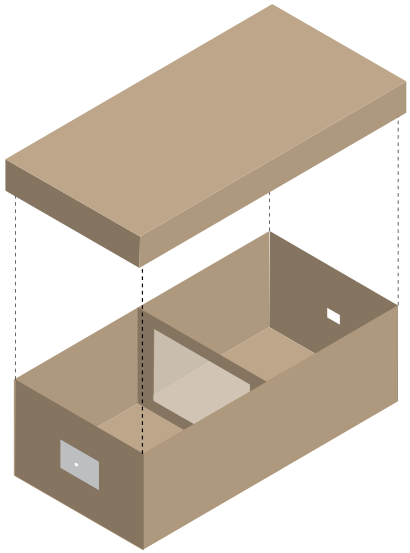
Step 2. Make translucent screen with tracing paper and cardboard frame



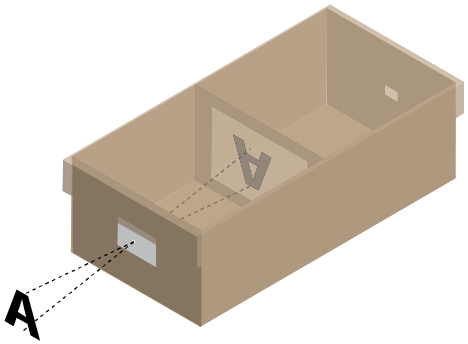
Step 3. Glue screen to box at midpoint



Step 4. Glue aluminum foil to pinhole cutout and then make pinhole with a small nail



Step 5. Place cover on box



Step 6. View scene in bright sunlight and observe inverted image on screen

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