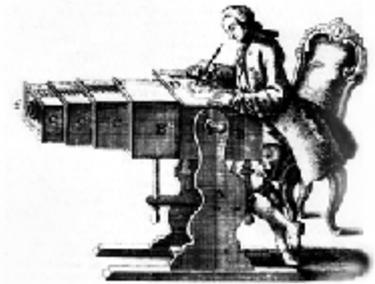


# Creating effective camera obscuras

Firstly buy my [book!](#) (then,,,,,,,,, read on!)



The earliest form of 'photography' and the earliest use of a pinhole was the camera obscura (Latin for 'better than the telly'). From 1500 AD onwards lenses replaced the hole but still formed an inverted image.

In our digital projection world, obscuras are a great way to inflict wonder onto kids of all ages and, like solargraph cameras, should be used in all schools, for all ages, everywhere in the world.

Many instructions for obscuras on the web require: a substantial knowledge of lenses, an ability to build stuff and the reader to own a tower overlooking San Francisco Bay!

Below are several: fast, simple, cheap and wonderfully effective, tried and tested designs to introduce the wonders of light to either a class of students or your own children (or just as a fancy chat up line!).

---

## The Cereal Box

Time required = 20 minutes.

Materials and tools required :  
Empty cereal packet, tape, scissors, pin.

A pinhole obscura. An excellent project to give to students for homework. The final image is quite dark so the obscura needs to be held close to a lightbulb to show the inverted image.



Empty packet and bag(screen)



Cut out large aperture on box and tape the 'screen' over the gap.



Use a pin to make a pinhole on the face opposite the screen



Hold close to a light source to view image (inverted light bulb).

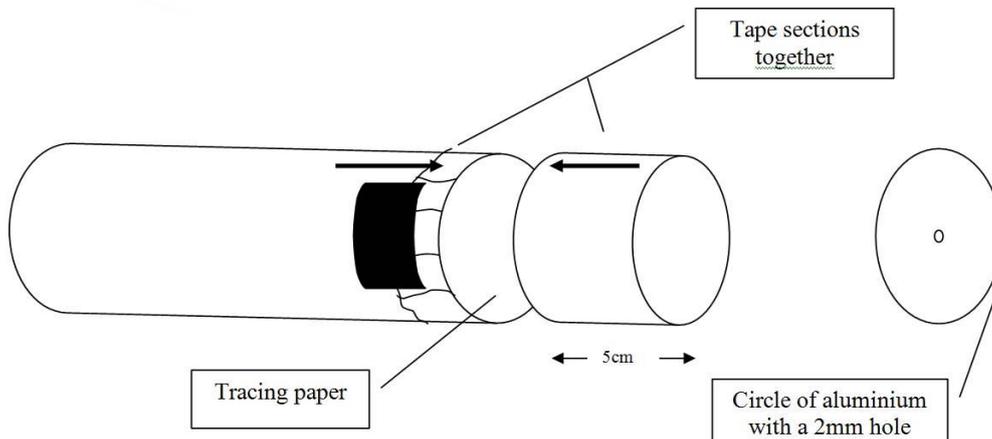
An improvement on the design can be made by cutting a slot into the box, inserting the screen and making the hole in the base. The image can then be viewed with the box acting as a shade to allow outside viewing.



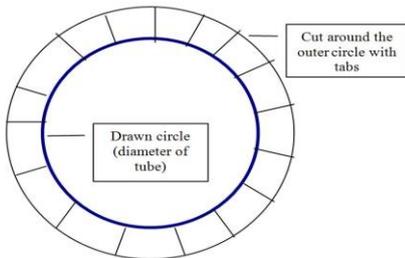
## The Tube Obscura

Time required = 25 minutes.

Materials and tools required :  
Empty tube, tape, tracing paper, breadknife-hacksaw, scissors, pin.



Cut the end off a cardboard tube (using a breadknife or small hacksaw) then tape some tracing paper tightly over the cut end of the tube. Re-assemble the tube with the tracing paper inside. Use the same tube to trace a circle on a thin sheet of aluminium. (A flattened out drink can works well although thin black card will also work). Make a pinhole (the size of a drawing pin) in the centre of this circle. Cut the circle out with the hole in the centre and tape over the end of the tube. Look through with one eye whilst blocking the excess light with your hands.



Tracing paper outline



Tracing paper inside tube



Using the tube obscura

The tube obscura also has a great 'pirate' feel about it!

## Lens based obscuras

The next three designs incorporate a single element lens rather than a pinhole. The increased brightness of a lens means these obscuras can be used in most light conditions. The disadvantage is lenses require focussing, so slightly more time is required to make them. You may also need to get the hang of the high tech device that is a ruler!

Lenses come in all shapes, sizes and most importantly, costs. The designs below use lenses which can be found in any high street 'pound shop'.

**Magnifying glasses** - for use in the Shoe box obscura.

These should focus infinity at around 10cm. Check this by holding the magnifying lens towards a light or a window of the shop and judging or measuring where the light - window is focussed.



Most magnifying glasses will work fine although cheap plastic magnifying glasses can give a fuzzy image (as I have learned to my cost!)

**Reading glasses** - for use in I-scura and Room obscuras.

Cheap reading glasses can be bought for a few pounds in similar 'pound' shops. They come in various strengths, measured in 'diopters' shown as: +1, +1.5, +2, +2.5, +3, or +4

Knowing these strengths is handy as we can buy the lenses which are appropriate to the obscura we are building.

+1 focusses at 90cm (used in the room obscura)

+4 focusses at 26cm (used in the I-scura)

The other strengths of diopter lenses focus on a sliding scale between these.

**Projection sheets** - for use in both.

Traditionally people try to project the image onto a wall. Not only will this require specific optics, but by the time the light reaches the wall, the image will be too dim to view.

The most effective way is the view 'through' a semi transparent material.

After scouring cheap shops the best items I have found, and a healthy balance between transparent and opaque, are thin dust sheets and plain white shower curtains, both of which can be found in the same pound shop you got your lenses from (sorry, should have told you earlier!).

These are then placed into the obscura or hung from the ceiling. With care they can also be laminated to make a flat screen (although the shower curtain material sometimes melts!)

---

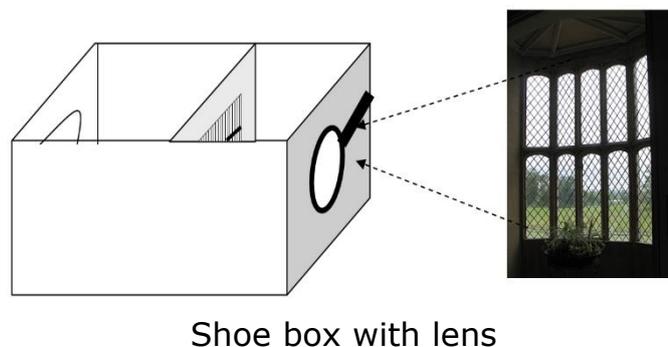
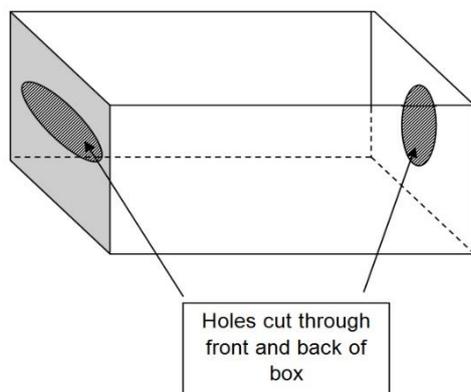
## The Shoe Box Obscura

Time required = 30 minutes.

Materials and tools required :  
Shoe box, tracing paper, small magnifying glass, adhesive tape.

This is an excellent hand held obscura for passing around the class, or for each student to make on their own. It creates a bright image so works well in overcast conditions and even indoors.

Take the lid off a shoebox and cut two holes at each end, one oval or rectangular (wide enough for both eyes to see through), the other circular and the size of your magnifying glass. (It sometimes takes quite a bit of scissor work to cut through the card!)



Laminate a sheet of tracing paper or cheap shower curtain.

The laminating isn't essential but allows the image to be focussed on a flat plane and will make the screen stronger.

This sheet is then moved back and forth until an image of a window appears in focus.

Tape the screen in position. (The distance will vary according to the distance of the window).

Replace the lid of the box and view through the large aperture.



The final camera obscura.

If you can find two boxes that fit neatly inside each other you can create a 'focussing' obscura.



Another option to entertain the class would be to make 11 cameras, strap them onto the school football team and watch them try and play football against a group of Y7s whilst viewing the world upside down.

Probably get done on health and safety grounds but worth a giggle!

These obscuras can also be part of a cross curriculum projects incorporating art, design and technology, recycling, science, (even PE!) Below are some examples from the very wonderful [Trinity Catholic High School](http://Trinity Catholic High School) in Essex.



Crocodile



Penguin



Pig



Spongebob

# How to transform your shoe box obscura into a digital projector!

(fairly rubbish)



Point the obscura 2 foot from a window then use card to view the 'focal length' inside the box where the window is focussed.



Fix your phone to the card with two rubber bands (to hold your phone) and tape this inside the box at the focussing point.

Wait for a dark spooky night and go camping. When you are bored of scaring each other with ghost stories, go to 'settings', disable the 'auto-rotate screen', set up your phone to 'video' or photos on 'slide show' mode and fix the phone under the rubber bands upside down (the image is inverted). Initiate the slide show and point the projector a few feet away from the flysheet of your tent till you get a 'sharp' image.



(Absurdly simulated image!)

Whilst it may not cope with family games of Grand Theft Auto, it's a fun way to merge 2500 years of technology whilst whiling away rainy nights under canvas, far from an electrical socket!

---

## The I-scura

Time required = 2 evenings.

Materials and tools required :  
Laundry basket, waste bin, white shower curtain, 3 diopter lens, gaffer tape. scissors.



As well as a way of viewing natural wonder, it can also act as a handy inconspicuous disguise for anyone on the run from the CIA.

This approach can be adapted to whatever situation you desire.

Below is the creation of my TV obscura in the permaculture area of the Shambala festival this year.



Entrance



TV



TV image



The Original live TV!

## The Room Obscura

Time required = 30 minutes.

Materials and tools required :  
Blacked out room, (Use cardboard or rubble sacks), +1 diopter lens, white dust sheet or shower curtain, A4 sheet of black card, adhesive tape.

Instant wonder for a whole class achieved by blacking out a window and using a +1 diopter close up filter to project an image of the outside world onto a hanging sheet.

Find a room that can be blacked out. Ideally with a view to the North (in the Northern hemisphere) so the window doesn't look into the sun.

Measure the window then cut out, (or stick together) some light tight material (cardboard or black plastic) to a size a bit larger than the window.

I'm a gaffer tape man myself but those of you who don't want to ruin your paintwork may want to make use of Velcro, magnetic tape, or some other high tech stuff.

However you fix it, make sure it is **100% light tight**.



Image projected on to a sheet (which needed ironing!)



Lens positioned on window blackout

A+1 diopter close up lens (easy to find in pound shops) will focus at around 90cm. If a thin white dustsheet- shower curtain (pound shops again!) is then hung from this point the projected image can be viewed 'through' the sheet, enabling a whole class to view the image. You can then get someone to jump around outside or write 'This is upside down' on a board.(so it appears the right way up).

### Using a Pinhole.

A hole positioned a few cm above the lens the size of a hole punch (with the lens obscured) can also be fun, allowing you to skew the projection of the outside world etc.

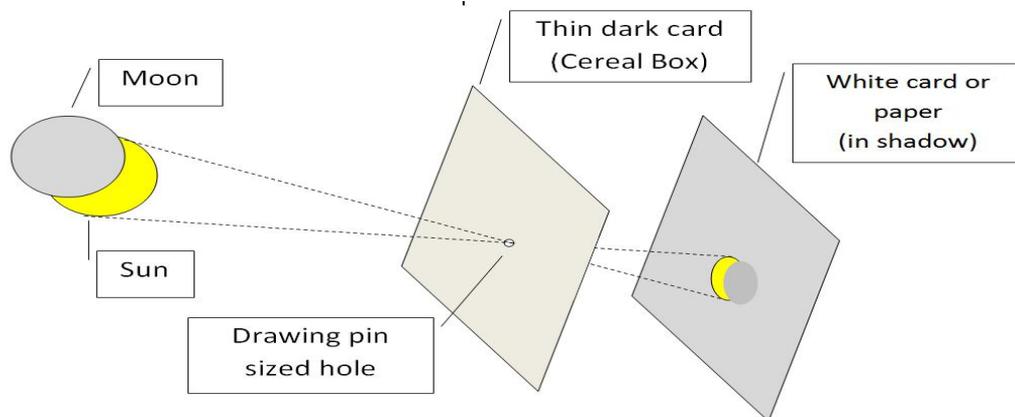
Cut out a 3cm area in the blind and replace it with a square of aluminium with a hole punched through using a paper hole punch. Not so good on cloudy days for mass viewing but good for various experiments, ie why is the sun still round through a square hole? Good old Aristotle!

### Creating a scenario.

Choose a bright day to show off your new gizmo. It takes a while for ones eyes to get used to the dark so, before someone comes round, roll the blind down, stick a piece of insulation tape (shutter) over the lens and dimly light the room to allow peoples eyes to get used to the dark.

Invite them in and whilst their eyes are adjusting tell them all about, Mo ti, Aristotle, Al-Habn, Isaac Newton etc. Then take the 'shutter' off the lens and 'voila' something to chat about in the pub!

### 'Instant' eclipse viewer for safe viewing of eclipses.



### Links.

<http://www.marjapirila.com/now.html>

The best obscure artist this side of the sun!

<http://www.brightbytes.com/cosite/collection.html>

More information on camera obscurers



The Clifton Observatory in my home town of Bristol. A marvellous place. Should be given to me to make into an international centre of pinhole photography!