INSTRUCTIONS

SECOND EDITION

for

THE
CELEBRATED ORIGINAL

PHOTONBOX™

PINHOLE CAMERA
MODEL B

"CURIOUSLY CURVED"
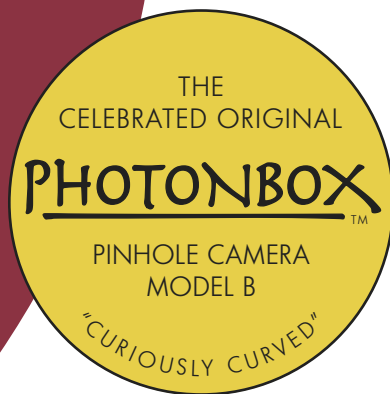
Handmade by Bryan Dahlberg

PHOTONBOX ™

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Introduction

If you're new to photography and/or darkroom work, always remember the two most important words on the cover of the *Hitchhhiker's Guide to the Galaxy*: Don't Panic. This instruction book may look intimidating, but it's much simpler than you think. Most of this is common sense; I've included much of the information as a kind of reference manual for people just getting started. Footnote numbers in the text refer to sections in the Appendix.

You don't need to be an Ansel Adams to get immense satisfaction from the process and to produce impressive pictures. The following three sections give you all the basics. You'll find that after a little practice, they'll actually take longer to read than to carry out.

1. Exposing the negative
2. Developing the negative
3. Making a print from the negative

The supplies listed below are all you'll need, besides the camera and a tripod. Please see the Appendix for details and suggestions about where to buy them.

Red light bulb

Three developing trays

Two or three developing tongs

Photographic enlarging paper or film

Developer

Fixer

Changing bag (for reloading; see picture on page 5)

Timer (a watch that indicates seconds)

Everything necessary for a day's shooting expedition can be carried in a small backpack. If I had collapsed this antique tripod further, it could easily have been strapped to the pack.

Here's what I carry in my pack:
camera and case
tripod
paper (or film)
changing bag
light meter (not shown)
timer (not shown; on wrist)
*beverage of choice (not shown)*

1. Exposing the negative

Loading the camera

You can do this in a totally dark room, with or without a safelight, even in a closet. Be sure no light comes in at the bottom of the door (lay a towel or rug at the gap).

Place a towel or other soft cloth on your work surface to prevent scratching the back of the cover.

Remove the front cover of the camera by opening the latches and pulling the top edge of the cover away from the camera body. As soon as it clears the body, slide it upwards.
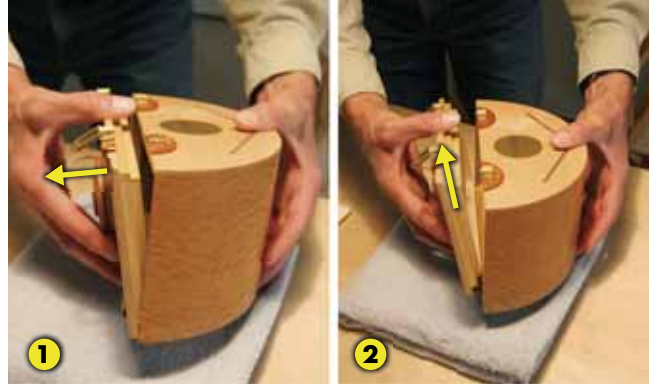

Interior of this camera has been left unpainted to better show details.

Cut a piece of 8x10" paper in half lengthwise (4x10"). Twist it slightly, keeping the emulsion side (usually the smoother and brighter side) up, and insert in camera back between retaining strips. The tension of the curved paper will hold it in place.

You'll notice two very small strips mounted beside the retaining strips. These hold the paper out slightly from the back and allow you to slip a fingernail under the edge of the paper for easy removal.

I find it easiest to slide the paper sideways until one edge of the paper slips into position against a retaining strip, indicated here. The paper (or film) will then fall naturally into place against the other retaining strip. ▶
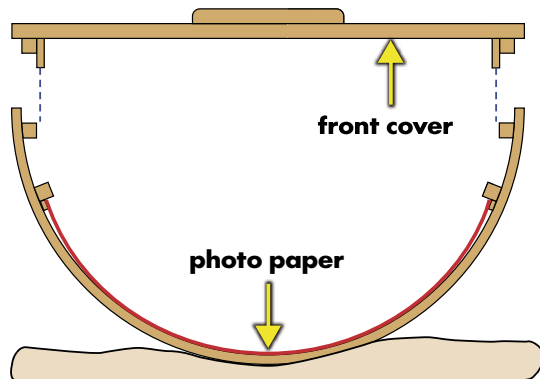
◀ *Cross section view of camera showing proper position of paper/film. Notice how the photo material rests on top of the small strips beside the retaining strips.*

Using a changing bag. This is essential if you don't want to run back to a darkroom between shots. It's basically a black, double-layered cloth bag with two elastic arm holes and zippers.

Aiming the camera

Mount the camera on a tripod. By sighting along the inlaid lines on the top, you can see the left and right edges of the composition. But it's best to err on the side of including too much. You can always crop later. You'll have to estimate the vertical coverage (55 degrees).

Tip:

Cameras with a curved film back exhibit an interesting phenomenon of distortion: horizontal lines above and below the center line of the frame will bow outwards. So the key to shooting a landscape that includes a horizon is to level the camera (with the built-in bubble level), placing the horizon in the center of the frame. Here are two examples of what happens when shooting objects with straight lines:

This wall, photographed straight-on, shows extreme distortion. Interestingly, if you curve an image like this into a semicircle and place one eye at the center (replicating the positions of the aperture and paper/film when in the camera), the distortion disappears.

A flat wall photographed at an angle shows moderate rectilinear distortion.

Far from being a disadvantage, this kind of distortion can be used to create unique images unobtainable with a "normal" camera.

Exposure

In the Olde Days, cameras had no shutters. The photographer removed the lens cap, counted out the seconds, and replaced the lens cap. That's how you do it with a Photonbox pinhole camera. With exposure times of anywhere from 5 seconds to more than three minutes, any slight error in timing will have a negligible effect on exposure.

Basic exposure charts

The following exposure times work well for me. I arrived at them after a few test exposures. Your times will probably vary, depending on the factors listed in the following *Section 2: Developing the Negative.* But they should serve as a starting point. I've left the last column blank for you to use if you want to record readings from your light meter for reference.

Timing an exposure.

An incurable bargain hunter, I found this $2 kitchen timer at my local Goodwill store. It's perfect for timing exposures as well as developing.

	CONDITIONS	TIME	LIGHT METER READING
ENLARGING PAPER	Bright sunlight	40 seconds	
	Hazy sun (soft shadows)	60 seconds	
	Overcast (no shadows)	90 seconds	
	Heavy overcast (no shadows)	$2^1/_2$ minutes	
	Dark overcast, rain	$3^1/_2$ minutes	

When shooting with enlarging paper, you will get best results when shooting in indirect light — cloudy or overcast. The reason is that photographic paper is not capable of recording the wide range of brightness rendered by direct sunlight; it can blow out the highlights and make the shadows excessively dense. Cloudy conditions and twilight produce a very good tonal range. Shooting with film will avoid this problem.

Remember that standard photographic paper does not record red or orange light. (That's why you can use a safelight.) So if you shoot, say, a red building with black lettering, the whole thing will register as black, and the lettering will disappear. You should also consider this when photographing things like old rusty metal (something I encounter often with locomotives and old mine buildings). Do a test by increasing your exposure by perhaps 50% or more.

	CONDITIONS	TIME	LIGHT METER READING
FILM, 100 ASA	Bright sunlight	6 seconds	
	Partly cloudy	16 seconds	
	Overcast (no shadows)	1 mins 30 secs	
	Dawn/dusk	3 mins 45 secs	

Exposure Tips:

Free exposure calculator! Whether you want to design and build your own pinhole camera, calculate exposures for changing light conditions, or even change the pinhole diameter on your Photonbox camera to produce shorter (or longer) exposures, be sure to get a free pinhole calculator for your computer, courtesy of Lenox Laser. It's available for both Macintosh and Windows, and you can download it free from their website: www.lenoxlaser.com. That's the source for the film exposure times above, and they have worked perfectly for me so far.

Time exposure magic! Because the exposure times with a pinhole camera are so long, you'll soon find that you can easily produce a minor miracle: you can make people (and cars and other moving objects) disappear. With a three-minute exposure on a street scene, for instance, anything moving past your camera will either be extremely blurred or will simply not appear in the image at all.

2. Developing the paper negative
(For film developing, see page 10)

Besides the length of time your lens cap is removed, your exposures will depend on such things as

- type of enlarging paper
- type of developer
- dilution of developer
- your agitation technique in the developer
- length of time in the developer

But don't worry. Concentrate on remembering just three things:

1. Use the exposure guide chart above to establish a starting point for your own working methods.
2. Mix and use your chemicals according to the instructions on the packages.
3. Adjust your exposure times to produce a good negative and take notes as to what works for you.

You should place the negative into the developer face down and agitate it slightly (rock the tray) to make sure no air bubbles are trapped. Then you can turn it over and inspect the image as it develops. It should take no more than about 2 minutes.

Then pick it up with your developer tongs, let it drip, and drop it face down into the water tray (or stop bath if you choose to use it). Don't put your developer tongs into the water/stop bath. Agitate for a few seconds, and use your second tongs to pick it up and place it into the fixer.

After about a minute you can turn on your regular room lights. Leave the negative in the fixer for a few more minutes and then rinse with clean water for another couple of minutes (either in another tray, a sink, or just hold it under the faucet).

You can dry it with paper towels, hang it on a clothesline or blow dry it with a hair dryer. In any case, RC paper takes just a few minutes to dry.

See Appendix for more details.

3. Making a print

At this point you will have a negative image on paper. (It is commonly thought that a "negative" is a piece of clear film, but the word actually just means that the tones are the opposite of normal.)

There are two ways of doing this. The traditional way, dating from the very early days of photography, is to make a "contact print" from this paper negative. In the darkroom, place a fresh piece of enlarging paper (same size as the negative you just developed) and place it in emulsion-to-emulsion contact with the negative on top. Lay a piece of glass on top to keep them in contact. Then turn on an overhead light briefly. This will expose the image from the negative onto the new sheet of paper. (You'll have to make tests to establish an esposure time.) Process as usual and you will now have a positive print with which to impress your friends.

But computers now give us another option. Just scan in the negative, turn it into a postive (For instance, in Photoshop: *Image Menu > Adjustments > Invert*), adjust the levels, brightness and contrast to your taste and print out as normal. Oh yes, you will also have to flip the image horizontally to make it "read" the same direction as the original scene. (See Apendix for details.)

Print the picture from your computer as you would any other image.

Appendix

Darkroom Supplies

Just a few years ago, all these supplies were readily available in camera shops everywhere. That's no longer the case, unfortunately, although they can still be found in a surprising number of places. However, a simple phone call or mail order via the Web can bring these right to your door.

I have used two mail order retail companies, both of which have excellent websites, product range and service. One is Freestyle Photo Supply (www.freestylephoto.biz) in Hollywood, California. They have a huge selection of traditional (i.e., chemical) photographic supplies. When ordering your paper, buy *RC ("resin coated") paper for convenient processing, and it must be satin finish, matte finish or semi-matte finish* paper to avoid reflections inside the camera during exposure. J and C Photo (www.jandcphoto.com) in Overland Park, Kansas is entirely dedicated to traditional photography. They have an amazing selection of film and processing chemicals that you probably can't find anywhere else. In fact, they even sell sheet film already cut to size (4x10") for my cameras.

A cheap, portable safelight

Cutting the paper

The easiest (and safest) way to cut the paper to size in the darkroom is to use a small paper cutter available at hobby, craft and scrapbooking stores.

Darkroom set-up and procedure

I've set up temporary darkrooms in hotel bathrooms in a matter of minutes. Replace one of the regular light bulbs in the bathroom with your red bulb, lay out the three trays, pour in your chemicals and you're ready. As far as a safelight is concerned, a simple red nightlight bulb ($7\frac{1}{2}$ watts) is easy, cheap and available at all hardware and home improvement stores. You don't need one of the standard photographic darkroom safelights, although they will produce a

brighter light. (Many bathrooms have only fluorescent tube fixtures, so you may want to invest a couple of dollars in a "clamp light" fixture.) Keep the light at least five feet away from your paper.

Mixing the developer

Developer (it will probably say "print developer" on the package, as opposed to "film developer") is never used full strength from the package. The mixing and dilution ratios will be printed on the package. You'll find that about 16 ounces (or 500 ml) will give you sufficient liquid for an 8x10" tray.

LIQUID DEVELOPER   Developer that comes as a concentrated liquid is the easiest to mix (just dilute enough for a trayfull at a time.) Discard when finished. You'll know it's exhausted because it will turn yellow. The disadvantage of liquid developers is that once the bottle is opened, the concentrate tends to go bad in a few months.

POWDER DEVELOPER   If you buy powder developer (Kodak's Dektol is the most common) it will keep for a very long time in its powdered form. But the instructions on the package will just tell you how to mix up the whole batch at once. I extrapolated the mixing instructions for a single tray of Dektol like this: 23 grams of powder dissolved in 475 ml of warm (approximately 90–100°F water. Let cool to room temperature. I use a small postage scale to measure that weight, but you can also figure that it comes out to about 5 rounded teaspoons full. ***But don't use that spoon for food again!***

You will need to be careful when using the tongs. (By the way, many old time photographers didn't even bother with tongs. You could always spot them by their fingers stained dark brown.) I use just two tongs – the first one (color coded with red handle) never touches anything except the developer. The second tongs (color coded with blue handle) goes between the water bath (or stop bath if you use one) and the fixer. So when your negative is fully developed, pull it out with the first tongs, hold it briefly over the developer to drain most of the liquid, and then drop it face down into the water bath without allowing the tongs to touch the water. Then use the second tongs to handle the negative from then on. The purpose of this is to prevent the developer from becoming contaminated with fixer.

Developer   *Water or stop bath*   *Fixer*
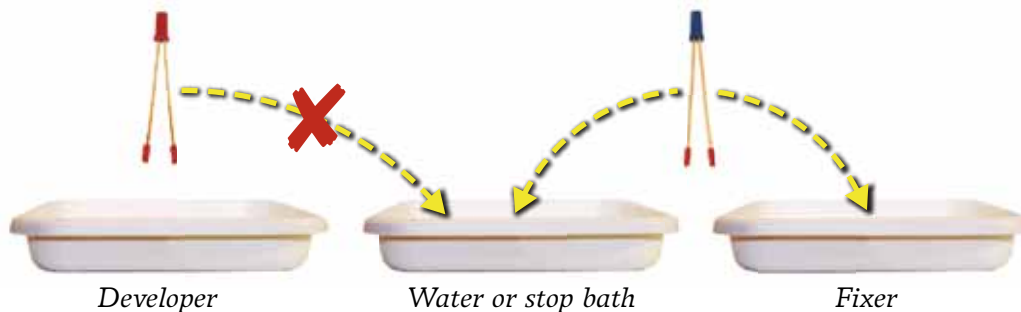
Although you will discard your tray of developer at the end of the day (or earlier, if it turns dark yellow from processing many sheets), the fixer will keep almost indefinitely. At the end of the session, pour it back into its storage bottle. Eventually it will become exhausted. The only way to positively tell when this happens is to use a chemical called Hypo-Chek. From its tiny squeeze bottle, put one drop of the liquid into your tray of fixer. If the drop just disappears, your fixer is still good. If the drop of Hypo-Chek turns milky white, discard the fixer.

Using film instead of enlarging paper

Enlarging paper is cheap, convenient to work with and easy to find, but when used to photograph a subject in sunlight, it will give you a very contrasty image. You can shoot sheet film in your camera as easily as paper, and it will give you a full-tone image as well as considerable increase in emulsion speed. You can use **orthochromatic lith film**, which will allow you to use a red safelight, just as with enlarging paper. Lith film, when used with its own developer, normally yields an extremely high contrast image. Unless you are intentionally going after this effect, use paper developer instead, e.g., Dektol.) Lith film will give you a traditional negative — black image on clear film, which you can easily contact-print or scan into your computer if your scanner has a large enough transparency adapter.

The best option is to use conventional camera film. It gives you a full tonal range and "sees" red, unlike enlarging paper and lith film, so your scenes appear normal. It's available from several sources. (See "Darkroom Supplies" on page 7.) I've gotten excellent results from Jand C's 100asa film. The major drawback is that it must be handled in total darkness. Loading and unloading the camera is easy, but processing is something else.

It can be done in a series of trays, just like enlarging paper, but this is quite difficult and downright sloppy. It's better to use a processing drum or tube. I found a perfect 8x10" drum (originally intended for processing color prints) for $1 in the bargain bin of my local camera store. It can obviously develop two negatives at a time. You can also buy one from J and C, although you can't fill and empty theirs in room light.

Processing film

I've been using Kodak D-76 developer, with a modified mixing technique, similar to how I handle the Dektol in small quantities. (D-76 is also a powder.) I don't shoot enough to make it worthwhile to mix up a gallon of stock solution as described on the package. So I estimate how much I'll need for a day or a weekend of shooting and mix just that amount of working solution from the powder.

My developing drum takes 125ml of liquid per load. I dissolve 9 grams of D-76 powder in 125ml of 120 degree water for each drumload of negatives. (Cool to 68° before using.) I use a small postal scale (available from stationery and office supply stores), but if you don't have one, a rough volume measurement is two rounded teaspoons. My development time is 14 minutes with moderate agitation.

A *small postal scale is ideal for measuring developer. Just remember to allow for the weight of the paper or plastic cup that will be holding the powder (hanging from the clip).*

Whatever, the size of your drum or tray, using that same ratio of powder to water will give you a good starting point. (This dilution is for single use only; discard after using. If you're really picky, you can use Kodak's D-76 Replenisher to re-use the developer, but I don't think it's worth the effort.)

For the small quantities of developer that most of us will be using, it would probably be easier to use liquid developer. I haven't pursued this yet, but when I do I will probably try my old favorite, Agfa Rodinal (although with Agfa's recent bankruptcy, availability may be a problem). Another popular alternative is Kodak's HC-110.

Image adjustments in the computer

I always use Adobe Photoshop for image adjustments, although other software programs will also allow you to do this. For the sake of demonstration, here are the basic steps to follow in Photoshop. Most other software will have similar controls. Photoshop allows you to make an infinite number of fine adjustments; the controls shown here are just the beginning.

◄
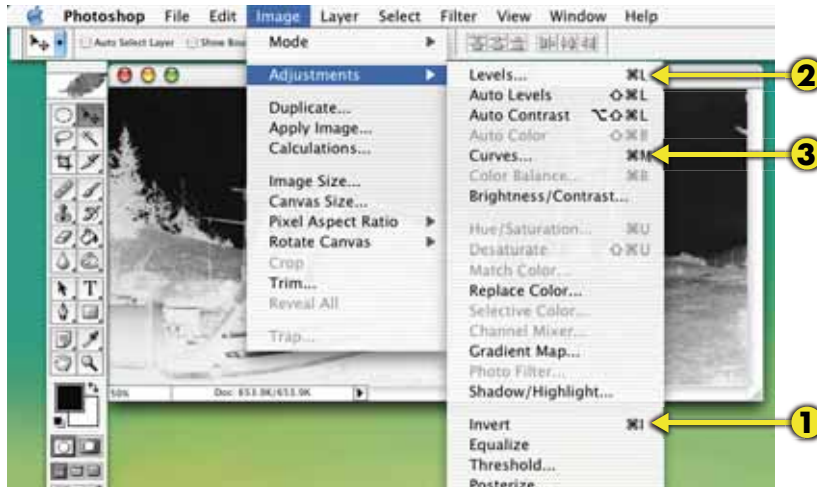
After scanning your negative into your computer and opening it in Photoshop, pull down the Image menu to Adjustments. The three basic controls you'll need are Invert, Levels and Curves, used in that order.
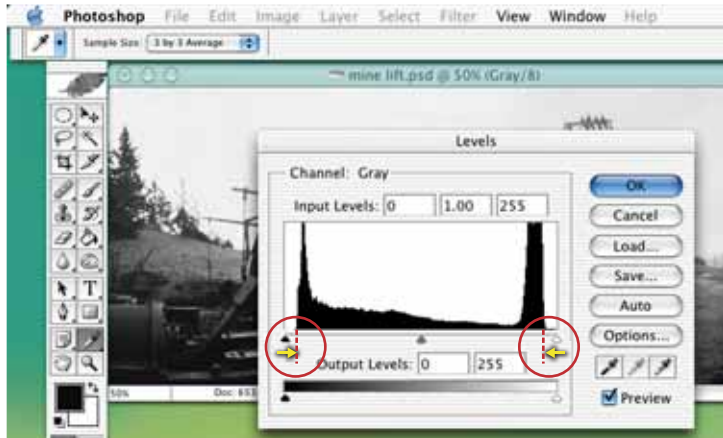
►

First, invert the negative image to make a positive. This will make it easier to judge the next steps.

◄

Now you have a positive image. You could print this as is, but chances are your tonal range leaves something to be desired.

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Next, go to the Levels adjustments. ▶

◀ *This histogram window will open. The graph will look different, depending on your image. Move the small black triangle until it is directly beneath the left-most end of the graph. Move the white triangle directly beneath the right end of the graph. This sets the black and white points of the image. If you have checked "Preview," you'll see the changes immediately.*

▶

Pull down the Image>Adjustments menu again to the Curves window. The curve at first will be a straight diagonal line.

◀
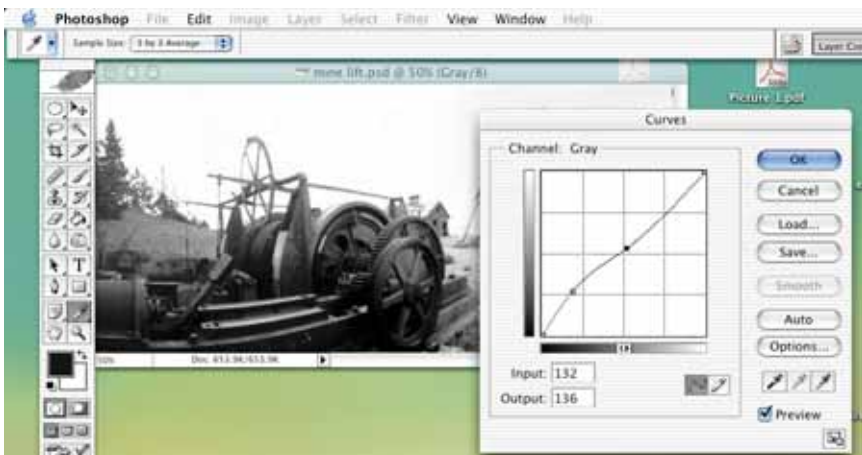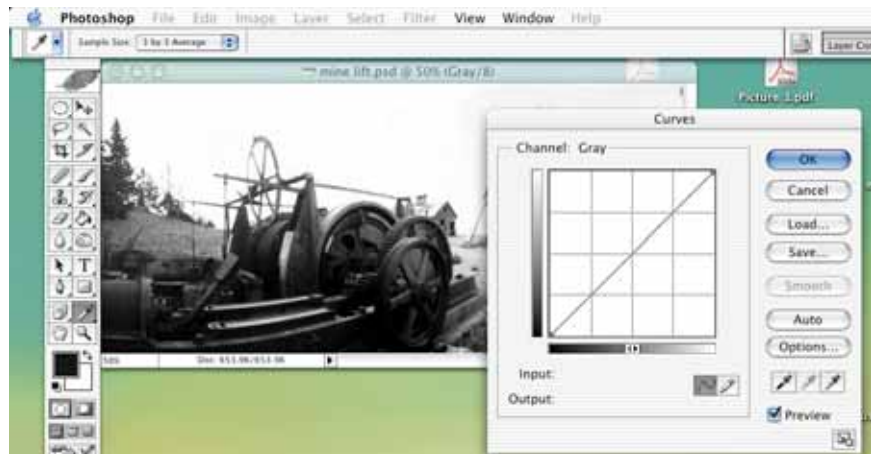
Clicking on the line will make a control point, which you can drag in any direction. In this example, dragging the lower side of the line upward increases the visible detail in the shadow areas. Making a control point in the center prevents the upper part of the curve from moving.

Some thoughts on pinhole aesthetics

In an age of increasing automation and sophisticated technology, the idea of creating a photographic image using nothing but a box with a hole is at once idiosyncratic and reactionary, yet strangely compelling. The essential simplicity of photography at this level was for a long time — perhaps until the invention of electronic circuits — widely understood by almost everyone. After all, the cameras of those days were nothing more than primitive wood or bakelite plastic boxes. The viewfinder was just a hole whose function was obvious, and the shutter could easily be seen to be nothing more than a little door that opened and closed.

But those days are long gone. Whenever someone shows curiosity about my pinhole cameras, they soon realize that there are no moving parts and no batteries; in short, there's no "machinery." they're mystified. The most frequent question is something like, "But how does it *run*?" As if rays of light required mechanical assistance to go through a hole. We have been seduced by technology and brainwashed by the complications of modern life.

With this in mind, I am training myself to see things in a new way. Although I have been making the test exposures with my Photonbox cameras in a purely traditional mode, it's clear that there's really no point in trying to duplicate the results of my expensive digital SLR with a pinhole. Life is complicated enough without using the wrong tool for the wrong purpose.

> "There's nothing quite so facetious as creating an artifical problem and then congratulating yourself for solving it."
> *— Syd Mead, American artist and illustrator*

So as I build the cameras, I am becoming increasingly aware that I really should concentrate on exploiting the inherent qualities of pinhole functionality and I would encourage you to do the same. These include primarily

- infinite depth of field
- extreme wide angle (of most designs)
- long time exposures

Regarding the third quality, I initially considered these long exposures as a problem to overcome, but now I want to use them to my advantage. I have a good friend with a copy of a famous photograph by Eugène Atget hanging on his wall. Taken in the early years of the 20th century, it shows what should be a busy intersection in Paris. But there are no vehicles and no pedestrians in the photograph. The streets appear eerily empty, allowing the viewer to concentrate on the curiously shaped building in the center of the picture.

Of course, you've realized the truth by now. Although most people believe the streets to be empty, they were not when the picture was taken. Looking at it carefully, you can see slightly darker smudges where people had briefly hesitated while walking, perhaps to gawk at the camera. Vehicles were moving just a bit too quickly to register on the film.

This kind of thing comes naturally to a pinhole camera, but would be difficult with a modern camera without extra accessories like neutral density filters.

Just as the form of these cameras has been established by their function, I believe their function should in some way affect the aesthetics of their photographs.