Anamorph Me!

User's Guide (Version 0.2)

by Phillip Kent

www.anamorphosis.com

The program is based on the following copyrighted code:

- Paintlib C++ class library, Copyright © Ulrich von Zadow, 1996-2000
- “Piclook” sample application for Paintlib, Copyright © Bernard Delmee, 1998

For information and downloads for Paintlib, see http://www.paintlib.de

FEEDBACK

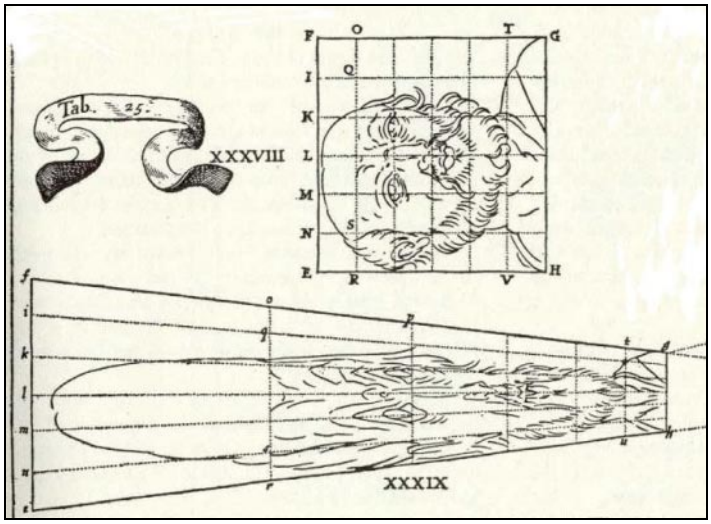
Any comments on the software are extremely welcome, via email to p.kent@mail.com .

For occasional news about the software and web site, you can join the mailing list via the “Listbot” input box at www.anamorphosis.com .

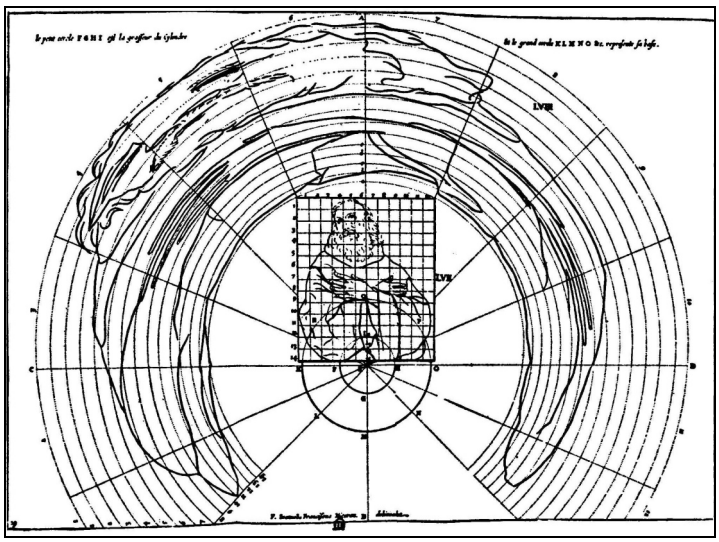
Introduction

***Anamorphosis**: A distorted or monstrous projection or representation of an image on a plane or curved surface, which, when viewed from a certain point, or as reflected from a curved mirror or through a polyhedron, appears regular and in proportion.*
(Webster's Dictionary)

Traditionally, anamorphoses have been created using grid templates. One starts by making the anamorphic transformation of an empty square grid, according to certain choices about the position of the viewpoint, the sizes and angles of the mirrors, etc. Then, the square grid is put on top of the original picture, and the contents of each small grid element are copied across to the corresponding element of the distorted grid. This illustration shows two sets of grids prepared by Jean-Francois Niceron in 1646:



Making an oblique perspective anamorphosis: the parts of the original image (above) are copied square-by-square into the distorted grid. Once this is done, the grid must be removed to leave the anamorphosis.



Making a cylindrical mirror anamorphosis.

Needless to say, using grids is a time-consuming business, and requires a fair amount of artistic skill. With computers, anamorphoses are much easier to make because the rules (algorithms) for anamorphic distortions can be written as computer programs, which can then be applied directly to the many thousands of individual pixels of a digital image. (For the computer, any image is literally a grid of coloured squares, known as “picture elements”, pixels for short.)

Anamorph Me! allows you to carry out almost all the traditional anamorphic transformations that use perspective and mirrors. Though, at the moment, not all the transformations are implemented, and some of those that are implemented are not as good as they should be. These deficiencies will be dealt with in future versions of the program.

If you have used image manipulation software before, you should find *Anamorph Me!* straightforward to use. Do “Open…” in the file menu to load in any JPG, BMP, TIFF, etc. image (but not GIF), click on the “Anamorph” menu and start experimenting. One thing to watch out for is that the transformed images are always made larger than the original—there is no automatic scaling down—so the output images can get very large. Note that under the “Image” menu you can Resize images before anamorphing them.

If you are looking for art images (such as Leonardo’s *Mona Lisa*) to work on, visit web sites such as The Artchive (www.artchive.com) and the Web Gallery of Art (http://gallery.euroweb.hu).

For a detailed introduction to anamorphosis itself, see my web site at www.anamorphosis.com.

Downloading and installing

Anamorph Me! is a program for Microsoft Windows operating systems. It should run in any of Windows 95, 98, ME, NT, 2000 (but see Known Problem 2 below for Windows 95).

You can download the program from
http://www.anamorphosis.com/software.html
More specifically:
http://www.anamorphosis.com/anamorphme02.zip
[file size 252 Kbytes, and you'll need an unzip program]

When unzipped, you should have a single program file “AnamorphMe.exe” (760 KB). To run it, just double-click on the file (in the normal Windows fashion).

There is no installation (or uninstallation) procedure for this version of the program. Simply put the AnamorphMe.exe file in any convenient location — you can make a shortcut to it, or include it in the “Start” menu in the usual ways.

Known problems and Forthcoming features

1. **This is a prototype version, and it will break under some circumstances.** Make sure to save immediately any anamorphosed images that you want to keep. You can save images by doing “Save As...” from the File menu. Unfortunately, the “Save changes” dialog box that appears when you close down a window DOES NOT work for saving.
2. This program needs a Microsoft library file called “MFC42.DLL” to be installed on your computer. If you are using Windows 95, it’s likely that you’ll get an error message saying

that this file cannot be found. You can get a free library update from the Microsoft web site.

3. Printing may be erratic, especially when using a USB connection. I've seen two kinds of problems: (1) the print job hangs in the print queue—rebooting the computer should fix this; (2) the printer output is blank—this is a more persistent problem, which I don't know how to fix. But you can print JPG files using, for example, the Paint program which is included with Windows.
4. The "Zoom" mode (magnifying glass icon in the tool bar) DOES work for zooming out — if you press the Ctrl key whilst you click the mouse inside the image, the image will resize to fit within the window.

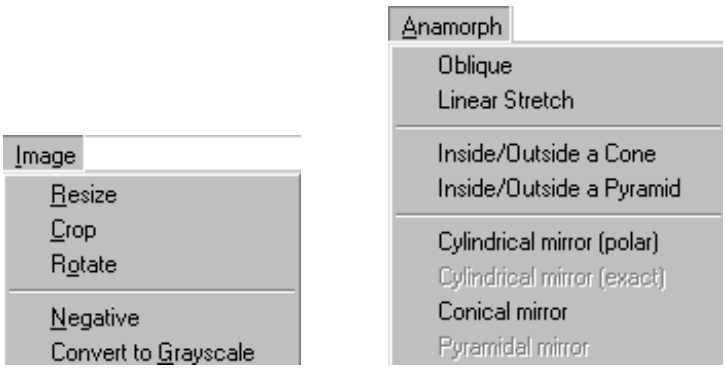
You'll notice that several items in the program menus are greyed out. These will be implemented in the next version:

- a TWAIN interface for digital cameras and scanners;
- a "Copy" option so that you can paste images directly into the program from the Windows clipboard;
- an Anamorph option implementing the exact transformation for a cylindrical mirror;
- an Anamorph option for pyramidal mirrors.

Overview of the program

The "File" menu gives controls over opening, closing, saving and printing of files. You can have any number of image files open (computer memory permitting) at one time. As usual with Windows, the image whose window is "selected" (that is, on top of all the others) will be subject of any operation chosen from the menus.

The "Image" menu contains a few basic manipulations: resizing, rotation (in units of degrees, anticlockwise; use a negative number to rotate clockwise), cropping (ie. selecting out a rectangular part of the image), conversion to black-and-white (greyscale), and negative (which outputs an image which is like the photographic negative of the original).

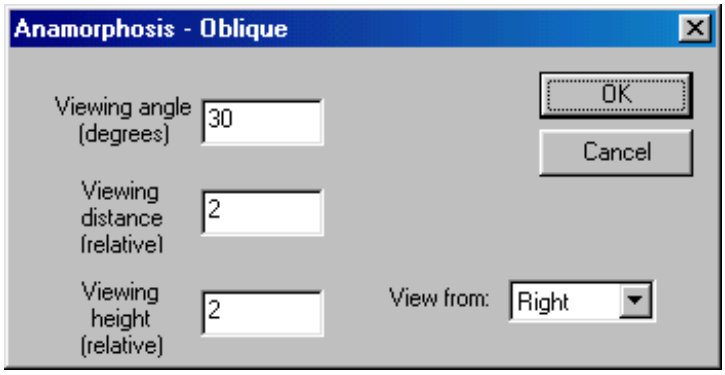


The Image commands are limited, and are not intended to be as good as a dedicated piece of imaging software. If you don't have this kind of software, you can get some very good packages for free — on the web site you'll find web addresses for *Irfanview* and *The GIMP*.

The "Anamorph" menu provides access to the various anamorphic transformations. Each transformation is discussed in detail in the following sections.

Oblique anamorphosis

Viewing an image *obliquely* (that is, from an angle that is not 90 degrees) was the first kind of anamorphosis to be developed, at the end of the 15th century. The earliest known examples are contained in the manuscripts of Leonardo da Vinci. To find out more on the history, see the anamorphosis web site (www.anamorphosis.com/exhibition) . The "Oblique" dialog box contains four inputs:



"View from" controls the direction from which you want to view the anamorphosis:

Right

Left

Top

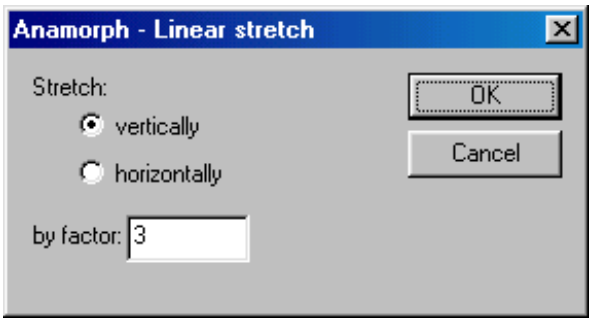
Bottom

The other three inputs control the viewing position for the anamorphosis: the best option to change here is the viewing distance (which is measured relative to the actual dimensions of

the original image). The greater this distance, the more stretched out the anamorphosis will look, and you will need to look from further away to see the undistorted image.

(To be honest, the current version of the Oblique transformation is not that well-designed, and it will be changed significantly in the next version of the program.)

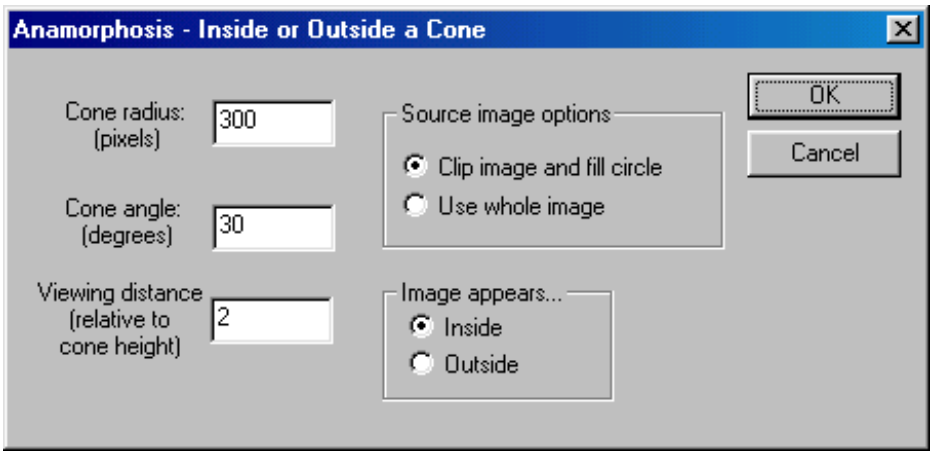
It is easy to think that oblique anamorphosis is to do with stretching an image, but it is more than that, as you will see if you compare the "Oblique" transformation with the "Linear stretch" transformation:



Projections on to cones and pyramids

As explained in the exhibition panels (www.anamorphosis.com/exhibition) anamorphoses do not have to be flat images. They can be made on any shape, but it is easiest to do the calculations for a regular shape such as a cone or a pyramid.

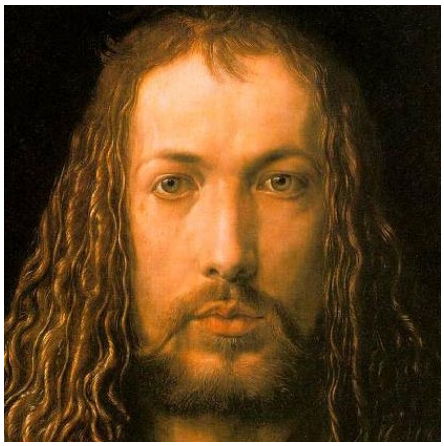
The "Inside/outside a cone" transformation projects a flat original image onto the inside or outside surface of a cone. Then, to view the anamorphosis you need to look into the cone, or look directly at the tip of the cone, from a *specific* distance (called the viewing distance in the dialog box). You can control the cone angle (which is actually half the angle at the top of the cone): the smaller this number the "more pointed" the cone will be.

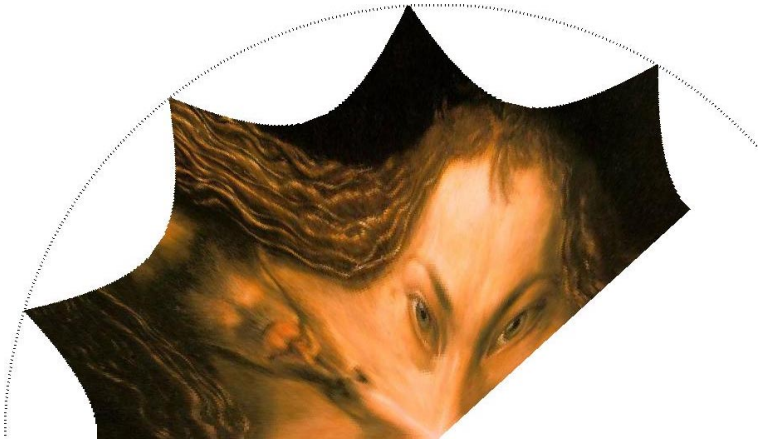


You also need to decide whether you want to use the whole original image, or "clip" the image to use just a central circular portion of it. It's not essential to modify the "cone radius" input, but generally this should be set to about half the smallest dimension of your original image (that way, you'll make most use of the image resolution available).

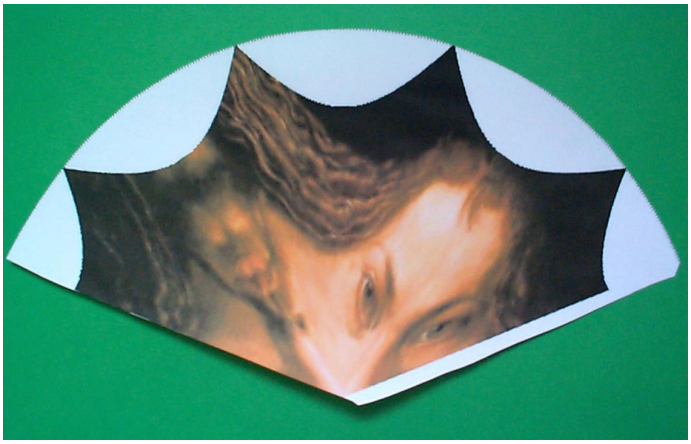
The program cannot easily show you a 3-dimensional cone on a 2-dimensional computer screen, so what it does is to give you a "rolled out", flattened cone. If you print this image, you can roll it up to get the proper cone shape.

For example, let's start with a detail from Dürer's *Self-portrait at age 28*, and transform the whole image to the inside of a cone (angle = 22.5, viewing distance = 2):



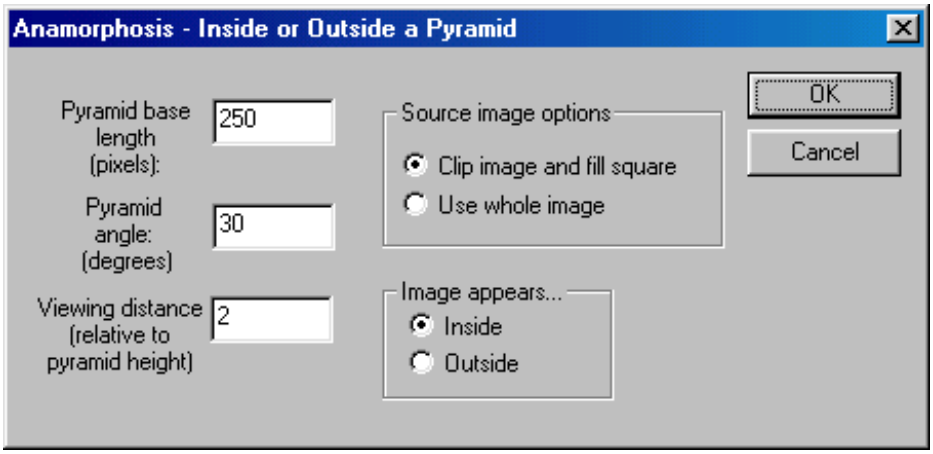


Then, print out the rolled-out cone and cut around the edges leaving a gluing flap on one of the straight edges:



Attach some (preferably) double-sided tape to the gluing flap, join the straight edges together and there is the cone:

Projections onto pyramids work similarly to cones.



"Pyramid angle" refers to the angle at the top of each of the triangular faces that form the pyramid. So, the smaller this angle, the more pointed the pyramid will be. "Base length" refers to the side length of the square at the base of the pyramid; you don't need to modify this number, but it should be roughly equal to the smallest dimension of the original image.

When you come to print out and assemble your pyramid, you need to make a gluing flap as for the cone, and also you need to do make folds along the edges of the pyramid:

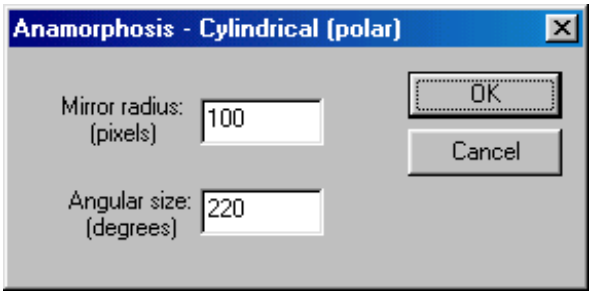
The pyramid as printed flattened out from the program

Cut out, and folded along the edges

Join the edges, and stick with tape, to form the pyramid.

Cylindrical mirror anamorphosis

The mathematics for this transformation can be done exactly or approximately. The current version of the program only implements the approximate version, which makes use of "polar coordinates" (the *x* coordinate of the original image becomes the *angle* coordinate, and the *y* coordinate becomes the *radius* coordinate). The grids for this transformation are shown in the second of Niceron's illustrations on page 3.



The input dialog has just two inputs: the “mirror radius”—or more exactly the radius of the centre “hole” in the anamorphosis, and the angular size of the anamorphosis. The funny thing is that you can get reasonable results for many different choices of these options. Typically, you’ll want the angular size pretty large (200-250 degrees) since this produces an anamorphosis with a good amount of distortion, and the mirror radius set at about one-third of the height in pixels of your original image.

Original image (400 x 600 pixels)

Anamorphosis with radius = 200, angular size = 220

How to construct a cylindrical mirror

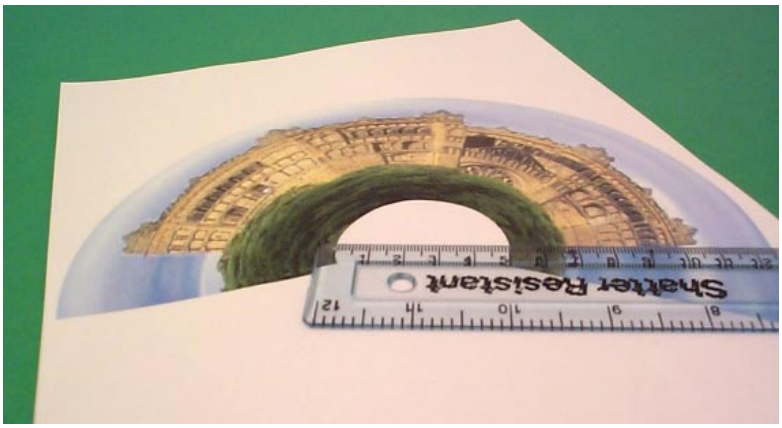
The current version of the program does only approximate cylindrical anamorphoses, and for these you do not need to be very precise with the mirror, since you won’t get a perfect image in the mirror anyway.

Reflective, mirror plastic is produced under the trade name “Mylar” (among others). It can be bought in thin sheets from stationery and craft shops. Thicker versions (which work better) are used for window insulation (eg. in greenhouses) and you may find this in gardening supply stores. It is also used in some forms of commercial printing, and I myself have picked up lots of it very cheaply at a “recycling arts project” in north London, which gets “unusable” rolls of the material donated to it by a local printing company. Besides plastic, it is possible to make stainless steel cylinders which are polished to high reflectiveness, but I have not personally tried this. You can make the mirrors more stable by wrapping the plastic around a cardboard tube (for example from a roll of kitchen towel).

For an anamorphosis printed on A4 paper you’ll need a cylinder about 12cm high. To make this out of plastic, cut out a rectangle that’s 12cm high and whose width is determined by the diameter of the mirror that you want. (Note that on some types of this plastic, one side is more reflective than the other, so make all marks on the duller side.) For example, if the diameter is 5cm, the length of the rectangle should be • (=3.14 approximately) times 5, that is 15.7cm PLUS about 0.5cm extra to make a gluing strip.

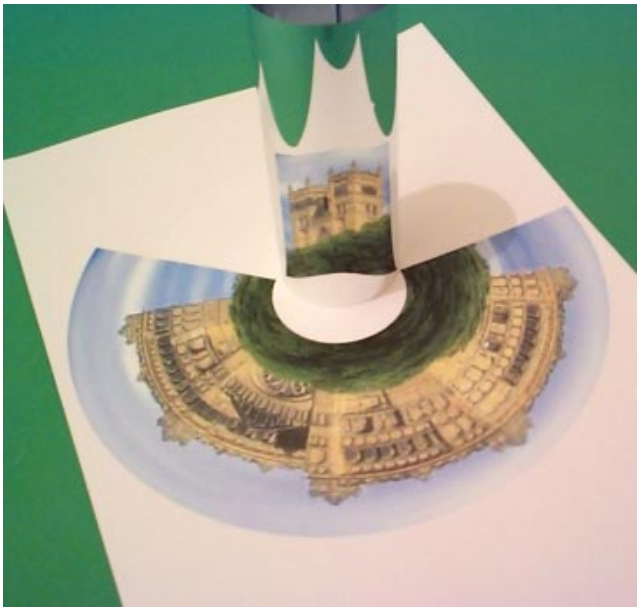
In fact, the diameter you choose is not very crucial. It should be a bit less then the diameter of the centre “hole” at the middle of the printed anamorphosis. If you move the mirror cylinder

around a bit, and change the height and distance from which you are viewing it, you should be able to find a reasonable reflected image.



Measure the diameter of the centre "hole"—it's about 5cm …

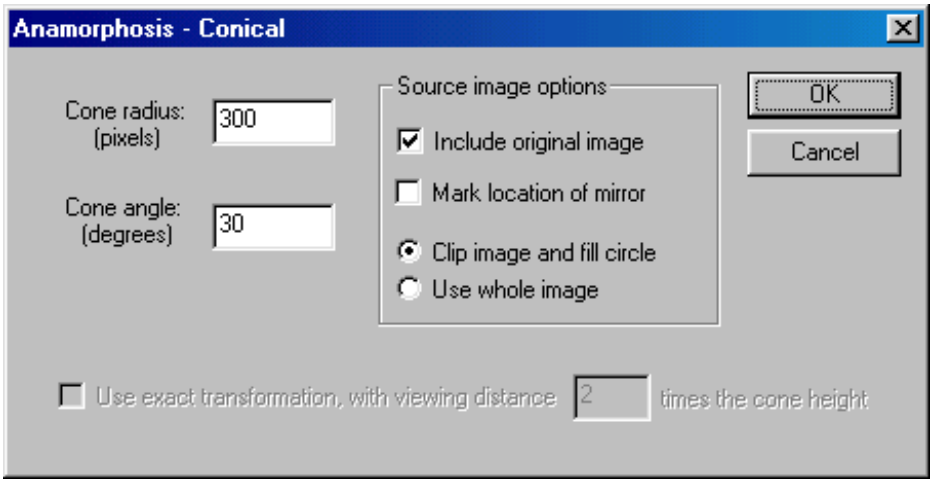
…so we'll use a mirror diameter of 4.5cm, for which we need a rectangle 12cm high and 14.1cm wide PLUS 0.5cm for a gluing strip, which is covered with double-sided tape. The two edges highlighted in red must be made to meet, with the gluing strip on the outside.



To see the reflected and (approximately) undistorted image, experiment with the mirror position and also the height and distance from which you are looking.

Conical mirror anamorphosis

This transformation produces anamorphoses which look especially distorted, because the conical mirror has the effect of "inverting" the image: the centre of the original becomes the outside of the anamorphosis, and vice versa (see Panel 10 of the exhibition, at www.anamorphosis.com/exhibition) . On the negative side, these anamorphoses need a very precise mirror to work well, and this is not easy to make out of plastic.



The input dialog gives you five choices: (1) the cone angle (which is actually half the angle at the top of the cone; the smaller this number the "more pointed" the cone will be); (2) the cone radius, which you don't have to modify, but generally this should be set to about half the smallest dimension of your original image (that way, you'll make most use of the image resolution available); (3) Clip the image (use just a central circular portion of it) or use all of it; (4) include the original image or not; (5) mark the location of the mirror with a black dotted line, or not.

The following example outputs are based on a detail from Leonardo's *Mona Lisa*.

(whole image, include OFF, mark ON)

(whole, include ON)

(clip image, include OFF)

(clip image, include ON)

Clipped images with the original included—which is what you are going to see if put a mirror onto the image—can produce some rather good images which are attractive without having to use a mirror.

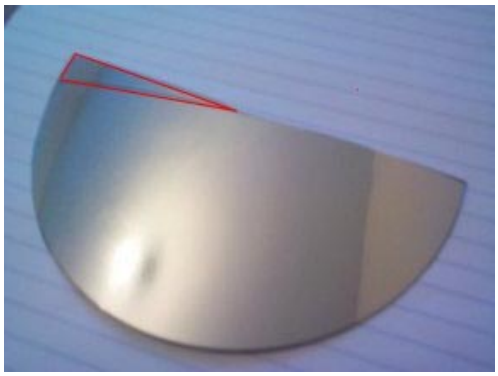
How to construct a conical mirror

Materials required: Mirror plastic, ruler, felt-tip marking pen (eg. “Stabilo Write-4-All”), compasses (with a large enough pen-holder to take the marking pen), double-sided adhesive tape.

The construction is a little tricky because the relationship between screen size (pixels) and printed size depends on the particularities of the viewing software and printer being used. I’ve found that the easiest procedure is to let the viewing software and printer print to the maximum possible size (or less, if you prefer) and then start by measuring the *diameter* of the central circle as printed. It may be easier to measure this if you select the optional “Mark location of mirror” in the “Anamorphosis—Conical” dialog box:

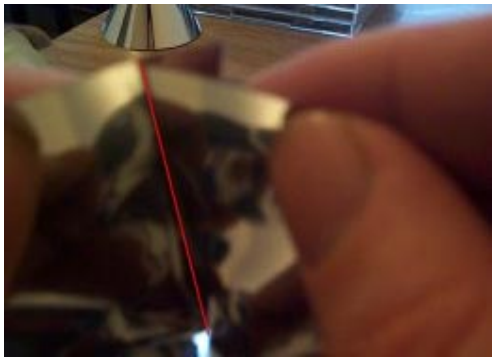
If you use the default “cone angle” setting for the anamorphosis (30 degrees), then this diameter distance (*D*) becomes the *radius* for the piece of mirror plastic that we are going to cut out. (For any cone angle *A*, the radius is given by $\frac{D}{2\sin A}$.)

The cone will be formed from a section of a circular disc; using the default cone angle of 30 degrees, this section is a semicircle. (For any angle *A*, you will need a section whose angular size in radians is $2\pi \sin A$; to convert to degrees, multiply by 180/• .)



Mark out this semicircle onto the mirror plastic. Note that on some types of this plastic, one side is more reflective than the other, so make all marks on the duller side. Also mark out an additional thin slice (as shown) which will form the “gluing flap” to stick the cone in place. Cover the area of the flap (shown in red) with double-sided tape, trimming away any excess.

Now fold the disc into a cone shape—take hold of the outer edge and push the centre away from you. The two edges marked in red (below) must be made to meet, with the flap on the outside.



When the edges meet satisfactorily, press down on the flap to glue the cone into place—start pressing from the bottom of the cone, and take particular care with the join at the top of the cone (it is not possible to get this *exactly* right).

Your cone is now complete. It's a good idea to wipe the outer surface with a tissue since any oil from your hands will spoil the reflectiveness.

You'll notice that Mona Lisa's mouth does not look right. This is because the cone shape is not perfect at the top and neither will be the reflections from it. Therefore, for conical anamorphoses you should try to avoid having important parts of the image near the centre.