
HumanEyes³D[®] Photography Guide

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Introduction

Almost all people possess the innate ability to see depth; when we look at the world that surrounds us, we see the objects around us in three dimensions. But how does it happen? It happens when each eye sees a slightly different picture than the other, and the combination of the two images in our minds creates one picture containing both points of view – a stereoscopic image.

Three-dimensional pictures have been available for quite some time but they have never been so easy to create or had such life-like qualities as they are now. Until now, there have been two main methods of creating three-dimensional images. One method required multiple cameras, a camera with multiple lenses or a camera moving along a rail taking pictures from pre-defined points. This method had several drawbacks: it required specialized equipment, which was very costly and required special training, extensive calculations had to be done when setting up each shot and any change in the output required shooting it again in its entirety. Another method used is layering – a method in which several two-dimensional pictures are layered one on top of the other by graphic designers using special software, thus creating the illusion that some objects are in front of the others. This method requires extensive work, and, in many cases generates images that looked artificial.

HumanEyes uses groundbreaking technology to produce three-dimensional pictures. First, a sequence of photos, either stills or video, is loaded into the software. Once the original sequence is loaded, HumanEyes creates different viewpoints of the set, thus emulating human sight. These views are then interlaced into one image, containing all the viewpoints created. The lenticular lens placed on the interlaced image allows the human eye to see different viewpoints from different angles.

HumanEyes, therefore, makes it possible, by using one ordinary digital camera to shoot a sequence of photos, for almost anyone to create a three dimensional picture with real and continuous depth and no limitations of output size: the same sequence of shots can be used to produce additional 3D pictures with different parameters. The HumanEyes software allows you to control the number of views created, the extent of the depth effect of the final image, and the dimensions of the final image. There are also no limitations to the width of the final image, and you can even shoot a scene spanning 360°.

In addition to three-dimensional views, other lenticular effects such as layered 3D or motion effects can be created and interlaced easily and quickly.

The tips provided in the various sections are guidelines to help you achieve the best results. You may use one or more of these tips, though some of the guidelines may be irrelevant to your specific set. Using as many of these guidelines as possible will allow for a better result.

On page 17 you will find a glossary of terms important for the understanding of the HumanEyes process.

Getting Started

This is the required equipment for creating three-dimensional HumanEyes images. See page 9 for more details on this section

- Digital camera or a digital back
- Tripod or camera stand with rotating arm
- Memory card (1GB recommended) or fire-wire or other high speed connection
- The HumanEyes³D software
- An inkjet printer for proofing

General Guidelines for Photography

The photography process is an interactive one; it requires the photographer to shoot the set, and then process it in the software to evaluate the set's effectiveness. Consult the HumanEyes^{3D} software User Guide for details on working with the software itself.

Process Overview

Photography

1. Build the set.
 - Make sure you have fulfilled as many of the guidelines on page 11 as possible, with special attention to contrast, coloring and object positioning.
2. Set up the photography equipment.
 - Make sure the ratio between the arm length, set distance and set depth are as described in "Set Parameters" below.
3. Shoot as explained on pages 13 and 14 and in low resolution (if using a digital camera) or shoot and develop raw files in low resolution (if using a digital back), as explained on page 16.
4. Open a new project in HumanEyes^{3D}.
 - Set the size to 8" width, the lens type to 40 LPI, and the resolution to the default resolution (usually 720 DPI).
5. Import the photo source and analyze.
6. Define the work area and set the near and far marks. Make new low-res views to reach the recommended depth and check that the separation is 25% or less.
7. Make high-res views and interlace.
8. Print the interlaced image and test image with the lenticular lens.
9. If necessary, perform any applicable changes according to the suggestions in "Improving the Project" on page 7.
10. Repeat stages 3-8 but import the photo source into the existing project, until you are fully satisfied with the results.
11. Shoot as explained on pages 13 and 14 and in high resolution (or shoot and develop the images in high resolution), as explained on page 16.

Production

1. Open a new project in HumanEyes^{3D} with the relevant parameters.
2. Import the high resolution photo source and scan it for bad frames.
3. Analyze using the entire area of the frame. If the initial views are somewhat broken, analyze again with a different priority area.
4. Make low-res views with the recommended depth.

5. Find the optimal pivot point using the variations tool. Set the pivot point.
6. Find the optimal depth for your project using the variations tool and make blended views with that depth.
7. Export the views package and make any necessary color corrections in a digital imaging software (such as PhotoShop©) and import the corrected files as a views package to HumanEyes^{3D}.
8. Use the Composition tool to add any graphic elements to the views.
9. Interlace the views if you are using one of the production versions of HumanEyes^{3D} (HumanEyes Platinum^{3D}, HumanEyes Gold^{3D}, HumanEyes Litho^{3D}, HumanEyes Studio^{3D}) or export the view package for interlacing with a version of HumanEyes^{3D} with production capabilities.

Set Parameters

The photographer has five parameters in the set which can be changed to improve the results:

- Set arrangement
- Distance between the first and last objects of the set (set depth)
- Distance between the camera and the first object in the set (set distance)
- Arm length

When setting up initially, the arm length should be larger or equal to the set distance, and the set distance should be about equal to the set depth. These parameters will usually achieve good results, but as each project is different, they might require some adjusting.

Note that changing the arm length does not necessarily mean the set distance is changed.

NOTE: if you change the set, remember to adjust the other parameters accordingly.

Important Tips

- Shoot and print a low resolution proof before shooting in high resolution.
- Ensure a high color contrast between the objects in the scene.
- Include as many details and textured items in the scene as possible.
- Make sure all areas are well lit, as dark areas do not provide a sense of depth.
- Place objects in varying distances from the camera.

Improving the Project

This section for the photography process contains different phenomena which might arise during processing, an explanation on possible causes and the enhancements which can improve on these phenomena.

As explained earlier, when setting up initially, the arm length should be equal to or smaller than the set distance, and the set distance should be about equal to the set depth. These parameters will usually achieve good results, but as each project is different, they might require some adjusting.

Phenomenon: duplication in background / cropping in front / bloating / shrinkage / other deformations

Cause: high separation or faulty set parameters

Enhancement: Increase set distance and compensate by lengthening the arm or increasing set depth

Use narrower camera lens angle (switch from wide to normal) and compensate by either lengthening the arm or increasing set depth.

Decrease set depth and compensate by lengthening the arm or reducing set distance

Cause: might be caused by objects too close to the camera, even lighting equipment or other objects close to the set but not in it.

Enhancement: Move objects away from camera or away from set if possible.

Cause: camera was tilted incorrectly

Enhancement: Shoot again; ensuring that the camera is at exactly 90° from the arm, and arm is exactly 90° from the axis of rotation. See “Shooting ” on page 13.

Phenomenon: views are broken

Cause: not enough images in sequence.

Enhancement: Shoot again, this time shooting more pictures but shooting them closer together.

Phenomenon: views have darker and lighter strips

Cause: change in flash lighting during the shooting due to uneven strobe operation (can be caused by low quality strobes or overheated strobes)

Enhancement: Drop frames (if only a few frames are damaged)

Re-shoot (if many frames are unusable)

Cause: neon lighting was used

Enhancement: Re-shoot with other lighting methods (see page xxx)

Cause: change in focus / wide balance / shutter

Enhancement: Re-shoot, this time with focus, wide balance and shutter modes set to manual.

Phenomenon: objects are broken in views

Cause: objects moved during shooting. Note that small movement may not be noticed in the final image.

Enhancement: Drop frames (if only a few frames are damaged)

Make views again with higher blend level

Re-shoot (if many frames are unusable)

Phenomenon: Analyze failed

Cause: not enough texture in some area or areas.

Enhancement: Textured items, such as nets or fabrics can be added to the edges of the set and cropped later.

Cause: there were bad frames in the sequence

Enhancement: Drop any frames in which objects move, lighting wasn't sufficient or that are placed in the wrong location in the sequence.

Phenomenon: bad frames were detected

Enhancement: Drop any frames in which objects move, lighting wasn't sufficient or that are placed in the wrong location in the sequence.

Phenomenon: the views appear stretched into a narrowing funnel-like extension

Cause: not enough texture in some area or areas.

Enhancement: Textured items, such as nets or fabrics can be added to the edges of the set and cropped later.

Cause: there was a significant change between consecutive frames in the photo source.

Enhancement: Scan the source again and drop any frames which are significantly different than the other frames in the photo source.

Phenomenon: the views are tilted sideways

Cause: the camera or set were not level during shooting

Enhancement: Re-shoot, using a spirit-level to ensure both camera and set are level.

Equipment

The better the quality of your equipment the better your results will be. The three-dimensional image that HumanEyes^{3D} produces is based on your two-dimensional stills or video and while the software manipulates the images it does not compensate for poor quality pictures.

The photographic equipment required is shown in the following picture:

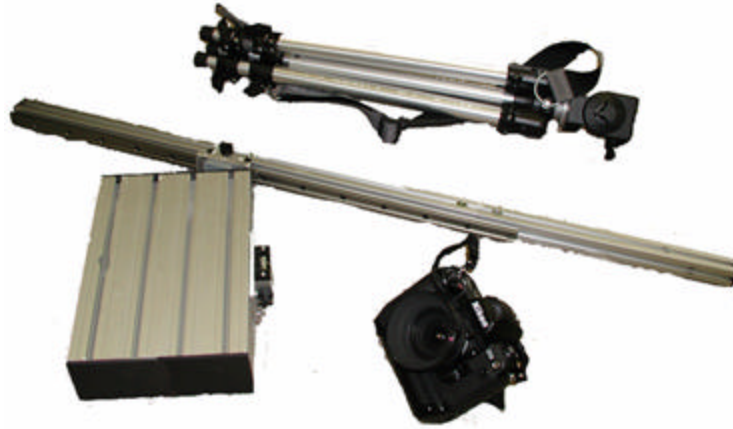


Figure 1: Photographic Equipment Required

Cameras

- A professional digital camera – a high quality still camera with a memory (at least 1 GB is recommended). For example: Nikon DH1 or DX1, Cannon EOS-1D or DS, Fuji S2.
- Alternatively, a camera with one-pass digital backs like Leaf, Sinar and PhaseOne.
- For proofing only (like a Polaroid) one of the following:
 - Digital back low-resolution output mode (if it is supported).
 - JPEG low resolution output of your digital SLR camera.
 - Digital still camera with high resolution (640*480) video mode like Canon digital IXUS v3 (EU name)/S200 DIGITAL ELPH (US name).
 - A digital video camera with progressive scan mode e.g. Sony TRV 900. If a video camera is used a firewire and suitable software will be required to capture the movie.

Camera Stand and Arm

- Studio camera stand with rotation arm or a studio tripod with an extension arm attached to the head with a rotation option such as a Foba head. The recommended arm length is 1-2 meters with an option to control the length.
- Spirit level to ensure that the arm is level

Lighting

- Flash equipment (for indoor photography): high quality flash equipment is recommended, as uneven lighting will cause distortions in the final result. Also, due to the number of pictures taken (80-200 pictures per image) a flash system with a short reload time and ventilation system is recommended. A possible alternative is a high end continuous light system (recommended for fast shooting). Do not use neon lighting.

Image Capture

- A laptop or desktop computer with a firewire connection and the camera software installed which will enable taking a sequence of pictures without pausing between each one, or, alternatively, a high capacity, fast memory card (minimum 1GB). (E.g. IBM Microdrive)

Set Arrangement

Tips for the Set

- Use a variety of objects at different distances.
- Place similar secondary objects at different distances.
- Place highly textured items such as coffee beans or leaves in the foreground and the background.
- Place objects at a slight diagonal both in width and in depth so that as many sides of the objects will be visible as possible.
- Place items both in front of the main object and behind it.
- Protruding elements (objects that appear to be at the front of the picture) should remain entirely within the borders of the final image. Therefore, such objects should not be placed near the image borders.
- The set should be still without any background movement, because the details of the scene must remain identical in all frames. Therefore, use of animals, water or wind might not be possible, and human subjects must be able to stay absolutely still for the entire shoot (the length of the shoot depends on the quality of the equipment).
- Place objects so that some elements can be seen from some points of view, but are hidden by other objects from other points of view.
- Objects that contain text or fine details which you would like to be clearly visible should not be placed too close to the camera or the backdrop.
- Cold colors (such as blue or green) naturally create a sense of distance. Warm colors (like red or orange) create a sense of proximity. Therefore, cold colors should be used in the background, and warm colors should be used in the foreground.
- Use regions with high contrast. To get high contrast, use well illuminated areas.
- A uniform colored background can reduce the 3D effect. Horizontal stripes should not be used in the background either.
- Although you can place the objects where the flash affects only one angle in two-dimensional photography, for three-dimensional photography take note of the effect of the flash on multiple angles, especially if glass or other reflective items are used. Therefore, we recommend that you do a test run of the shoot by looking through the camera with the modeling light on to see how the light affects it.
- Place the object you would like to be sharpest at about 40% between the front and the back of the set.

Indoor Lighting

Use the same lighting considerations as for two-dimensional photography while taking into consideration the following:

- Surround lighting improves the 3D effect.
- Light that is directly behind the main object emphasizes it.

Outdoor Photography

- When taking pictures out of doors ensure that there is adequate light and that there is no movement caused by wind. It is not recommended to take pictures of sunrise, sunset or clouds due to the different lighting effects when shooting the photo sequence.
- If there is some movement in a small number of pictures, such as a bird entering and leaving the set, you can edit it using a graphics program.
- Outdoor photography has the advantage that the pictures can be taken quicker, as there is no need to wait for a flash to reload. This makes it easier for human subjects who will not be required to remain absolutely still for long periods of time when waiting for the flash to load.

Photography

Setting Up the Camera on the Arm

When placing the camera on the arm you have to consider the distance it will be from the set and from the tripod. When setting up initially and using a wide or normal camera lens, the arm length should be larger or equal to the set distance, and the set distance should be about equal to the set depth. These parameters will usually achieve good results, but as each project is different, some adjustment might be required.

If a narrow camera lens is used, a longer arm might be necessary for achieving good results.



Figure 2: Camera Resting on Arm with Weight (L) and a Tripod with Rotating Arm (R)

Shooting the Set at an Angle

If you wish to shoot the scene at an angle, the entire arm should be at the tilted angle, and the camera should be parallel to the rotating arm. Do not simply tilt the camera, as doing so will result in frames which may produce faulty images.

There are three options for shooting a tilted set:

- When using a camera stand, the recommended option is to attach an extension arm to the tripod head at the end of the stand's arm, and tilt the arm extension to the desired angle. In this instance, only the extension arm will be rotated during shooting.
- When using a tripod, shorten or lengthen one of the legs of the tripod to achieve the desired angle. When using a camera stand, tilt the entire stand by placing an object of appropriate height underneath one side of the base of the stand.
- Using a panning head in addition to the rotating head of the stand. The tilt can be achieved by setting the angle of the rotating head, and then attaching the arm to it using a panning head, as illustrated below.

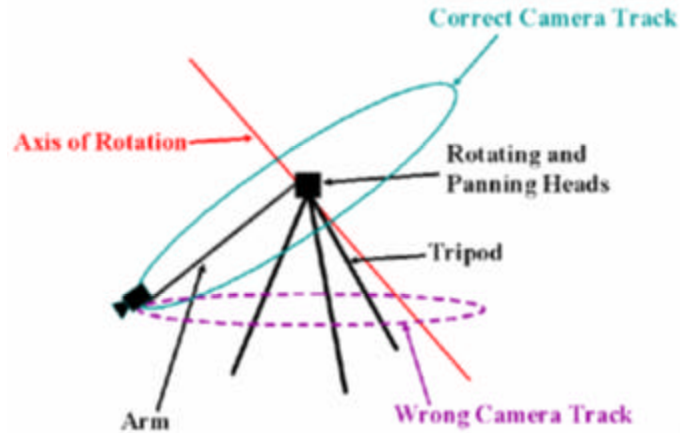


Figure 3: Correct Rotation of Tilted Camera, Using Rotating and Panning Heads

NOTE: it is crucial to ensure that the angle between the camera and arm and between the arm and the axis of rotation remains 90° at all times.

Taking the Pictures

Begin at one end of the scene, taking a full frame of unwanted area. Using the arm, move the camera steadily toward the other end, taking pictures at a rate of at least one frame for every degree that you move the camera. The rate should be as even as possible throughout the shoot. Continue taking pictures until you have taken a full frame of unwanted area at the other end of the scene.

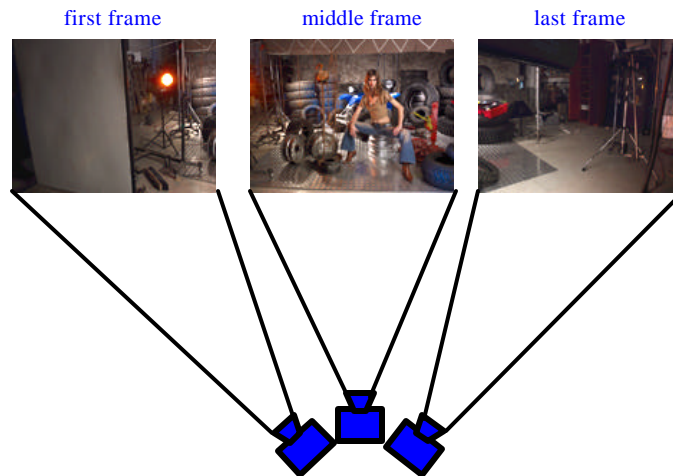


Figure 4: Begin and End Shooting with an Entire Frame of Unwanted Area

When using a stills camera, set the camera to manual (M) mode for both focus and white balance. When using a video camera, set it in progressive scan mode.

NOTE: it is highly recommended to produce a final image from low resolution stills or a video file prior to taking the pictures and producing the final image in a very high resolution, to test the overall effectiveness and quality of the set.

Important Tips

- The focus must remain the same throughout the shoot.
- In order to ensure identical scenes in all shots, the camera must be set as followed: auto-focus disabled (manual focus), manual light measuring program and manual white balance.
- Use progressive scan mode when using a video camera. The white balance should be manual.

Saving the Pictures

Resolution

Like in ordinary photography, the optimal resolution is determined by the final print size. It is recommended to use high resolution pictures when producing a large final image. However, each picture used should not exceed 20 MB in size, due to the significant increase in processing time.

File Formats & Names

- When developing raw files from a digital back in low resolution, it is most recommended to reduce file size in addition to a strong jpeg compression.
- When developing raw files from a digital back in high resolution, it is recommended to create tiff files with lzw compression.
- The supported file formats for digital stills are RGB jpeg and tiff.
- Videos should be in avi or mov format. It is important to note that using a video file, rather than still pictures, will produce significantly lower quality images.
- Scanning films is not recommended, as the scanning process can create distortions in the pictures and therefore produce a low quality image.
- When saving digital stills the files must be numbered sequentially (most cameras do this automatically). They can have a text beginning but must be followed by numbers. For example, the files may be named Ad001.jpg – Ad192.jpg or Poster001.tif – Poster150.tif.
- The files from each shoot should be placed in a separate folder.
- If you are using a camera with a digital back the proofing can be done with more frames developed as low resolution jpeg images, and if the results are satisfactory the raw images can be converted to high resolution tiff images.

Glossary of Terms

Anaglyph

A method of showing and viewing 3D. The anaglyph can only be prepared from two views. These views are superimposed one on top of the other, and each is color converted so that when looking through the anaglyph (red/blue) glasses, only one view will be seen through the blue side, and only the other view will be seen through the red side.

Analyze

HumanEyes^{3D} analyzes the sequence of frames in order to track camera motion and create two initial views of the scene. You can adjust some of the parameters that are used for the analysis by using the different tools HumanEyes supplies.

Bad Frames

Any frames that are dark, poorly lit or misplaced (not in their correct position in the sequence) should not be used when the sequence is analyzed. The analysis cannot be completed if such frames are used.

Blending

The Blend option smoothes any lighting problems and other imperfections in the views and renders high quality images, but can add up to twice the processing time, depending on the quality and size of the original sequence used.

Parallax

The depth effect is achieved by combining several slightly different viewpoints; in a similar fashion to the way the human brain combines the pictures each eye sees, into one picture containing the elements of both viewpoints.

The parallax measured by HumanEyes is the relative distance between the object designated as 'near' and the object designated as 'far'. The greater the distance between the same point in the different viewpoints, the greater the parallax will be. The recommended depth is determined according to the dimensions of the final image and the specific lenticular lens type, as provided by the user. If the parallax value is too large, meaning that the viewpoints are too far away from each other, then the viewpoints are too different for the brain to be able to fuse them into one image. If the parallax value is too small, however, the 3D effect of the image will be poor. Using HumanEyes to reach the desired parallax ensures that neither of these possibilities occurs. HumanEyes generates a recommended parallax, according to standard sets. This parallax can be tested using the Variations tool, to ensure that it is optimal.

Pivot Point

The pivot point is the object or area of the image which appears the sharpest. It is the perceived center of the image. Objects further from it will seem concave, while nearer objects will seem protruding.

Separation

An internal parameter which refers to the percentage of each frame in the source (from the center of the frame) used in creating the views. When the separation is too high, different deformations are more likely to occur. The separation is also an indication of the distance between the virtual viewpoints and therefore the depth when processed by HumanEyes^{3D}.

Sequence of Frames or Photos

A group of pictures, either a series of stills or a single video file which is imported into HumanEyes. The sequence must begin and end with a full frame of area outside the set, and the pictures (in the case of stills) should be taken at least every 1°.

Views

In order to see 3D, each eye needs to receive a different view. In order for each eye to experience a different view, it is necessary to have multiple views. Views are a compilation of all the pictures taken in the shooting sequence. E.g. if 100 pictures are shot in the initial sequence, each view is a compilation of all of the 100 pictures. HumanEyes allows the user to generate the optimal number of views according to the specifications of each project.

Work Area

The area of the views used to create the final image.

Variations

The variations tool allows the user to test small sections of the final image at different parallaxes and pivot points to determine which parameters are ideal for the image.