CSC Stereography Course 101

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I. What is Stereoscopic Photography?

A. Binocular Vision

1. Depth perception due to stereopsis

The brain reconstructs the images into a combined single image with a sense of depth.

2. Concept was understood hundreds of years ago

3. Stereo drawings were made long ago, including tracings from a stereo camera obscura

4. Various physical and neurological conditions can prevent depth perception

5. Uses of binocular vision

a. Range finding (measuring distance remotely)

b. Opthalmological eye training

c. Stereo microscopy

B. "Binocular" (Stereo) Photography

1. Like binocular vision, uses two images from slightly different perspectives

The perspectives differ only by a horizontal displacement.

The displacement is horizontal because this corresponds to the placement of our eyes.

2. Works for both still and motion photography

3. Distinct from Holography

A traditional photograph has just one perspective. A stereo photo has two.

A holograph has infinitely many perspectives. You can see a different perspective by moving your head relative to the holograph.

4. History of Stereo Photography

a. Began with stereoscopic drawings and tracings

b. Actual stereo photography began immediately after the invention of photography

c. First images were probably single camera

d. Mirror stereoscope invented by Wheatstone in 1832

e. Glass negatives in late 1800s and early 1900s allowed mass production

i. Oliver Wendell Holmes designed the stereo card format used today

ii. Starting in the 1860s, the Anthonys of New York made a business

of selling stereo views to the public.

f. Popularity waned, perhaps due to loss of novelty and the inconvenience

g. Development of 35mm film produced another spurt of interest

i. Color adds to realism

ii. Projection allows simultaneous viewing by many

iii. Stereo Realist introduced in late 1940s followed by dozens of others

iv. Trend lasted until early 1960s

v. Internet and other technology spurred wider interest in the 1990s

II. Making Stereographs

A. Equipment

1. Single-lens systems

a. Requires non-moving subject/scene

b. "Cha-Cha" method

Stand holding camera to eye. Shift weight to one side and release shutter. Hold camera steady, shift to other side, and shoot again. A motor drive is very helpful.

Motion creates irrational disparities between the two images

c. Slide bar

Same principle, but allows precise setting of displacement and maintains level

and rotation (when mounted on a tripod).

d. Early stereo photos were made with cameras that shifted either the lens or the film.

e. Theoretically, camera should point along parallel lines for the two shots rather than turning in to center the subject.

2. Image Splitters

a. May be lens attachment (example: Pentax and Stereotach) or built in to a stereo camera (example: Loreo).

b. Optical quality may be compromised - should use "first surface" mirrors.

3. Twin Rigs

a. Conventional cameras (usually 35mm) mounted side-by-side

b. Shutters may be synchronized mechanically (perhaps using a "Y" cable release) or electronically.

c. In most cases, cameras cannot be mounted close enough together for standard horizontal displacement

d. Provides full-frame images, which most stereo cameras do not

e. Cameras and lenses must be well matched (set zooms to exact same focal length)

4. Multi-lens cameras

a. Two lens examples

i. View Master (not current)

ii. Realist format (multiple manufacturers, non current)

iii. Full frame (RBT - hybrid of two conventional cameras - current, but expensive)

b. More than two lenses

i. Used for "lenticular" prints. ii. Image Tech (current) iii. Nimslo (not current)

B. Principles and Techniques for Stereography

1. Start with rules of conventional photography (exposure, composition, focus, etc.)

2. Stereo Effect

a. Separation must be strictly horizontal

b. Should have objects at many (at least 3) different depths (distances)

c. Distance to closest object must be appropriate for lens separation The "rule of thumb" is separation = 1/30 distance to closest object.

3. Depth of field

In most cases, the entire image should be in focus. Selective focus is not needed to

isolate the subject - depth will do that.

4. Stereographs may be made as either prints or slides. Conventional film is used in either case.

5. Remember that your image will probably be cropped to the stereo viewing format (see next section).

III. Preparing (Mounting) Stereo Pairs

A. Cards

1. Standard format is "Holmes Card", which is 3.5" x 7" with 3" x 3" prints

2. Crop prints to achieve vertical and horizontal alignment (see section C below)

B. Slides

1. "2x2x2" format for projection or viewer (pairs of standard 35mm slides)

Special processing and cropping are not usually done. Will not usually work for

"Cha-Cha" shots because adjustment will be needed.

2. "Realist format" slide mounts

a. Defines outer dimensions of mount - image width varies, although "Realist" is actually limited to 5 perforations

b. Various types of mounts: RBT (reusable plastic), cardboard, glass and metal

c. Allows for various chip widths plus horizontal and vertical alignment

3. View Master format

a. Generally does not allow adjustments (images from View Master camera)

b. Seven pairs per reel

C. The Stereo Window

1. The window is the plane in the image which appears at the same depth as the viewing surface

2. In most images all objects should be behind the window

3. The effect of "coming through the window" can be dramatic, but will create viewing problems if any object in front of the window touches an edge of the frame.

4. Common mounting technique is to find the closest object and set the horizontal separation for that object to be equal to the frame separation. This places that object at the stereo window and everything else behind it.

IV. Viewing Stereographs

A. Equipment

1. Prints

a. Holmes viewer (antique or modern)

Uses lenses and baffling to allow comfortable viewing

b. Lorgnette lens

A Holmes viewer without the frame and baffle (harder to use)

c. Specialized ("over/under", Quimby, etc.)

Variations on basic viewer - used for varying sizes of prints.

d. Lenticular prints

Print has "built-in" baffles, so no apparatus is required, but viewing is tricky

e. Anaglyph prints

Left and right separated by color - viewer wears red/blue or red/green glasses

2. Slides

a. Slide viewers (illuminated or "catch the light")

b. Projectors (antique or modern)

i. essentially two projectors in one. ii. each projector has a polarizing filter at relative 90-degree rotation. iii. viewer wears polarizing glasses with corresponding rotation iv. screen must be silver or lenticular to avoid de-polarization.

3. Video

a. Used with either conventional TV or computer display

b. Left and right images are shown alternately at high rate

c. Viewer wears "shutter goggles" that block one eye at a time, synchronized with the alternating display. Thus each eye sees only the image intended for that eye.

B. Principles and Techniques

1. The basic problem is to present a separate image to each eye

2. Slide and card viewers are best because the images are actually physically separated

3. Lenticular requires multiple views and must be viewed at correct angle and distance

4. Anaglyph images distort color and are usually uncomfortable to view

5. Stereo projectors use polarizers, which limits the brightness and cannot completely separate left and right, resulting in "ghost" images in some cases

6. Shutter goggles also do not completely separate left and right, and alternating speed is often limited, resulting in flicker.

7. "Free viewing" takes practice, but allows good quality viewing with no equipment

a. Images are placed side-by-side

b. May be Left-Right or Right-Left ("wide eyed" or "cross eyed" view)

c. Train eyes to "de-couple" focus from parallax

C. Viewing Problems and How to avoid them

1. Some people simply do not perceive depth in stereo images, sometimes even if they do in the real world. This can't be helped, but it's a good reason to make images that are good "flat" photographs as well as good stereos.

2. While the eye/brain team can accommodate a wide range of perspectives, some people are more sensitive than others and find some images uncomfortable to view. Avoid extreme differences in nearest and farthest object distance.

3. Vertical disparities (same part of image is at different vertical position in left vs. right) causes strain. Carefully adjust both cards and slides to match vertical placement.

4. Window violations (objects in front of the stereo window touch the frame) are disturbing because in the real world a frame can only "clip" the view of objects behind the frame. If you want something to "come through the window" be sure it is entirely inside the frame. Watch out for "non-subject" areas that are closer - it's easy to ignore them until you see it in stereo.

5. Exaggeration of separation ("hyper-stereo") may give the impression that the objects portrayed are miniature models rather than reality. This affect tends to diminish with experience in viewing stereo images. Don't use more separation than is needed.

6. Various technology limitations noted above

a. Ghosting: Avoid high contrast situations

b. Dim projection: Avoid need for shadow details. Use good projector

c. Flicker (video systems): Upgrade display system to provide higher refresh rate

V. Uses of Stereo Photography

A. Popular (consumer) uses

1. Most people are familiar with View Master reels and viewers

2. Many classic and contemporary movies are made in "3-D" (some anaglyph, but more polarized)

3. Magic Eye posters are actually "Single Image Random Dot Stereograms"

4. Virtual Reality entertainment systems

B. Industrial uses

1. Aerial Stereo Photography

a. Military surveillance

b. Cartography

c. Geographic and geological studies

2. Medical applications (more historical than current)

3. Manufacturing automation (machine vision systems)

4. Visualization of industrial and scientific 3D models

VI. Collecting

A. Books

B. Images

C. Equipment

VII. Bibliography

A. Books

1. How To

2. Art

3. Collecting

B. Periodicals

C. Web Pages

1. Clubs

2. Personal

3. Products & Services