Still 3D Photography with

TWIN CAMERAS
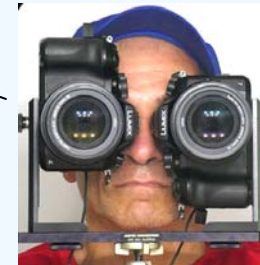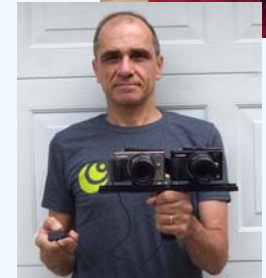
By George Themelis

NSA - 2023
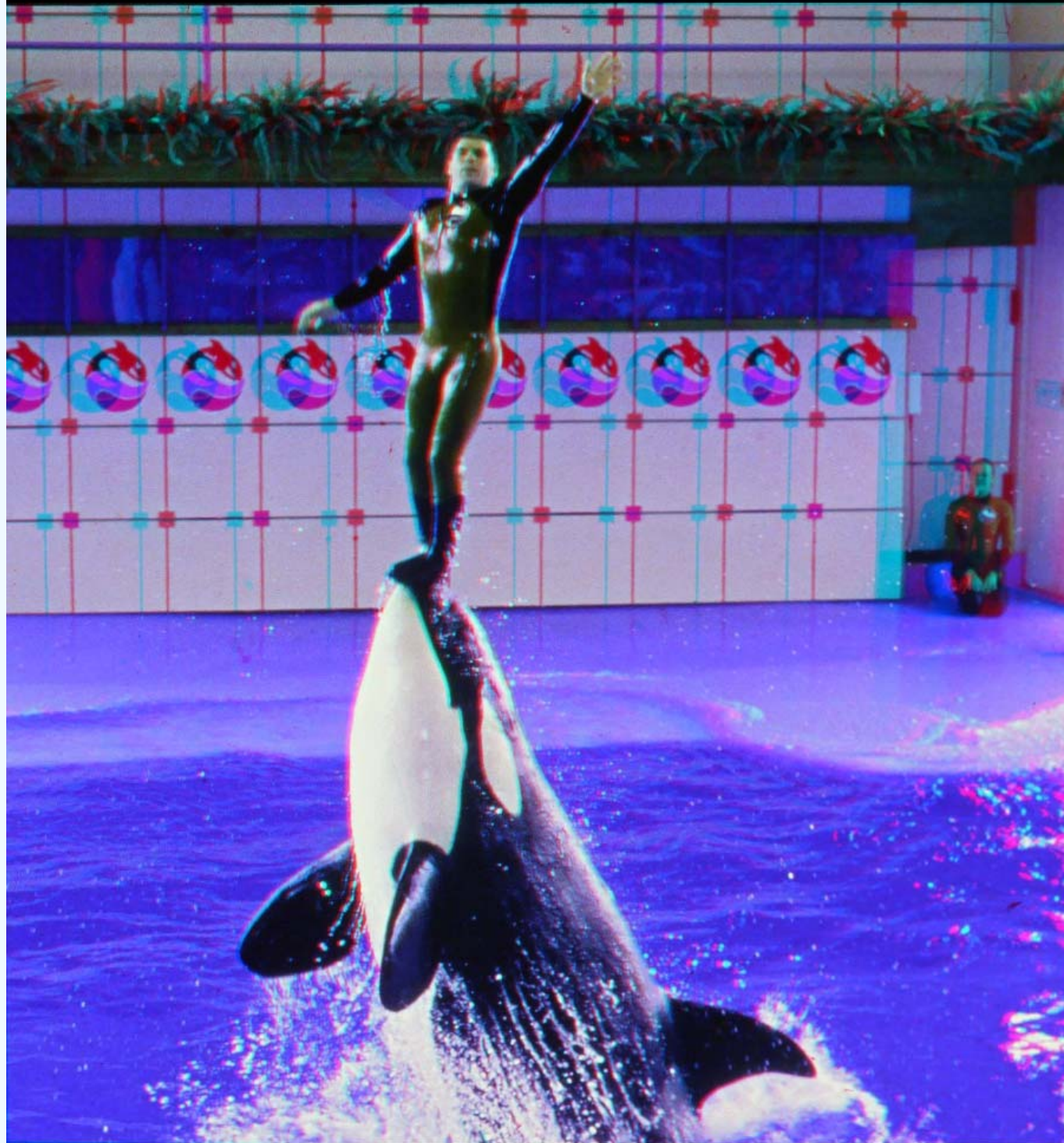
35 Years of Twin Cameras

- **Twin Minolta X700 cameras** (1988)
- **Twin Pentax film cameras**
- **Panasonic TZ10 wired by Ekeren** (2010)
- **Panasonic M 4/3 cameras**
- **Samsung NX1000** (2015)
- **Samsung NX Mini**
- **Canon DSLR**
- **Panasonic TZ80 wired by TenDam**
- **Panasonic FZ2500**
- **Sony RX10** (2019)
- **Sony RX0**
- **Sony RX100**
- **Sony RX1** (2021)

Fuji W1 (2009)

Z - Configuration

75mm

90 mm

2x Minolta X-700 & 135mm

Outline

General Concepts

- Why bother?

- Camera arrangement

- Synchronization

Specific camera rigs

- Compact Canon with SDM

- Wired cameras

- Canon DSLR

- Panasonic Micro 4/3

- Samsung NX1000

- Samsung NX Mini

- Sony cameras
  - RX0
  - RX1
  - RX10
  - RX100

Three Ways to shoot 3D

- ## Stereo Camera

- ## Single Camera

- ## Twin Cameras

	Synchro-nization	Various lenses	Stereo Base
Stereo Camera	🙂	X	X
Single Camera	X	🙂	🙂
Twin cameras	🙂	🙂	🙂

Twin Cameras Issues:

- **Expensive**
- **Heavy**
- **Complicated**

You have to worry about:

- **Alignment of cameras**
- **Matching exposure & focal length**
- **Synchronization**
- **Post processing of images**

Twin Cameras Advantages:

- ## Synchronized exposures

- ## Variable Stereo Base

- ## Different lenses

- **Larger Sensors**

- **RAW images**

- **Stabilization**

- **Burst shooting**

- **Time lapse**

- **Remote control**

- **Better Video**

B
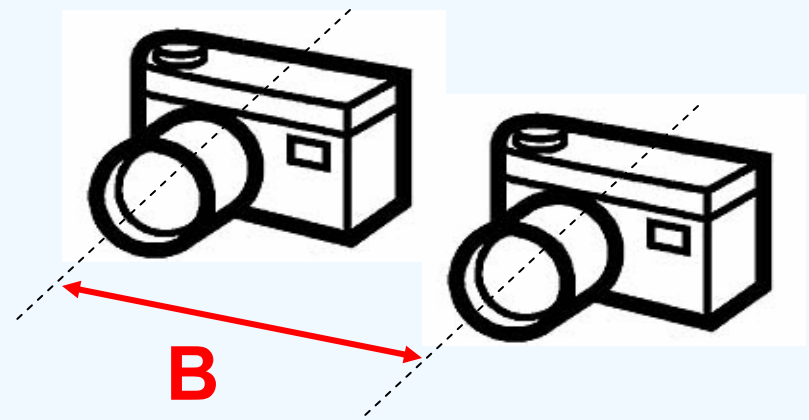
Twin Camera Topics:

- **Arrangement**

- **Synchronization**

Six Camera Arrangements

Horizontal

1. **Side-by-side**

2. **Z-configuration**

3. **Staggering**

Vertical

1. **Bottom-to-Bottom**

2. **Top-to-Top**

3. **Top-to-Bottom**

Side-by-side

- **Easiest to implement:** Plenty of hardware available and generally trouble-free

Lens Spacing: L + g
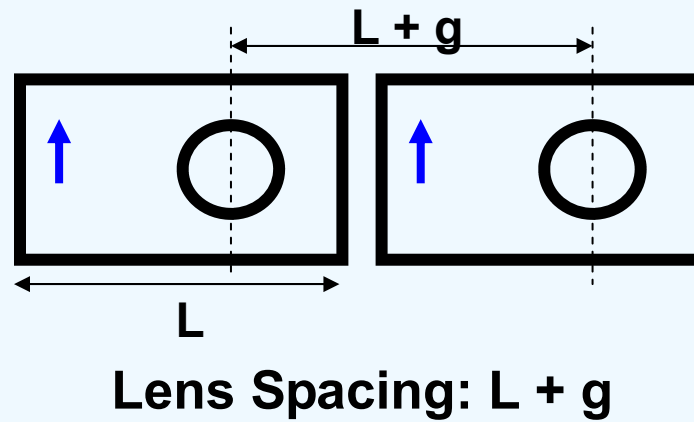
Z-Configuration

- **Z-bars** are generally custom made for a specific pair

- Shutters move in opposite directions

L - 2*offset + g
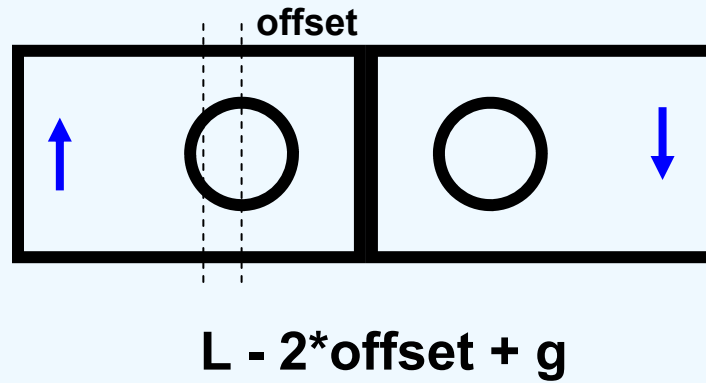
Staggering

- **Different distance to near vs. far objects leads to different size of near versus far objects**

- **Cannot be corrected digitally (not easily)**

- **Users report no problems**
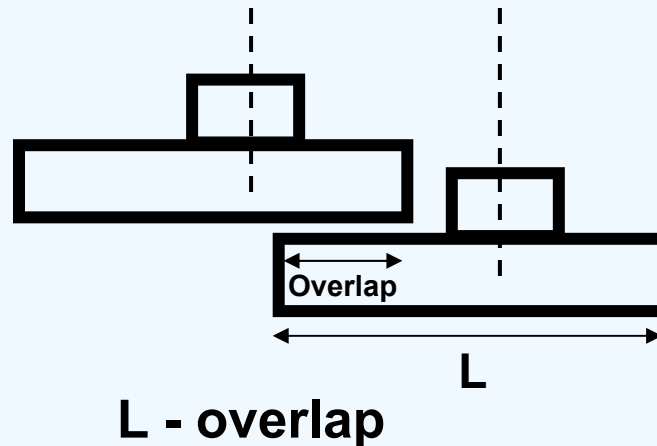
L - overlap

Twin Camera Arrangements
Part 2: Overlapping

Overlapping Arrangement

In the last Tutorial I mentioned that one way to arrange the cameras horizontally, and reduce the lens spacing, is to overlap them. In this case the spacing of the lenses is equal to the camera length minus the overlap. This works with all cameras and it is relatively easy and simple to do. So, **why isn't done more often?** Some stereo photographers avoid camera overlapping because of the inherent error (see below). Others use it and claim not to see any problems.

For a long time, I avoided camera overlapping. When I got my Sony RX100 cameras, in 2020, I first tried the z-configuration (lens spacing = 90mm). In an effort to reduce the lens spacing further I tried overlapping (lens spacing = 75mm, similar to the Fuji W3). In most cases, I was happy with the results and could not see any problems. This prompted me to look closer into this arrangement.

Overlapping Error

In the overlapping arrangement one camera is closer to the near object than the other. This creates a difference in perspective, which results in a size difference error.

Consider an object relatively close to the cameras. The image of this object formed by the camera in the front will be larger than the image formed by the camera in the back. On the other hand, an object at infinity will have the same size. So, **there is a difference in size of the near vs. far objects**. This is an error.

Some people mistakenly think that this error will be corrected during software alignment (using StereoPhoto Maker, for example). That's not true. SPM will scale the entire image and does not differentiate between near and far objects. **The error here is such that the difference in size depends on the distance of the object from the**

camera. SPM will not correct this error.

This error is a 2D problem, so only one camera is needed to investigate it (**Fig. 1**). Take one picture, then move the camera forward by Z and take another. I used different ways to calculate the difference in size of the near vs. a far object and in all cases I ended in this simple formula:

(Maximum Relative) **Error** = Z/D (1)

This is the maximum relative error (difference in size, divided by the size) between an object at distance D and an object at infinity, when the camera is moved by a distance Z.

In a twin camera configuration, Z is called the "**camera offset**" and its value depends on the dimensions of the camera and arrangement of the two cameras. It usually varies from 20-40mm. For the Sony RX100, a relatively compact travel

camera, Z = 25mm, while for the Sony RX1, a larger full frame camera, Z = 35mm.

According to (1), the larger the camera offset (Z) the larger the error, as expected. Also, the closer the near object (smaller D), the larger the error (also expected). The error is independent of the stereo base (B), since it is a 2D issue, and it is also independent of the focal length. This surprised me a bit, but it makes sense because perspective only depends on distances, not the focal length.

Acceptable Error

Given that there is always an error in the overlapping configuration, one might ask: **What is a reasonable error that can be tolerated?**

With infinity in the picture:

$$\frac{Error}{S} = \frac{z}{D}$$

The figure here shows two objects, the Near and Far, separated by a distance d. The two images are scaled so the Far object has the same size in both pictures. This leaves an error in the Near object. It can be shown that this error is equal to (z/D) x (d/(d+D))
- If the Far object is far away then the error becomes z/D
- If the two objects coincide (no depth) then d = 0 and the error is zero
- In a close-up (d small compared to D) the error is approximately (z/D) x (d/D)

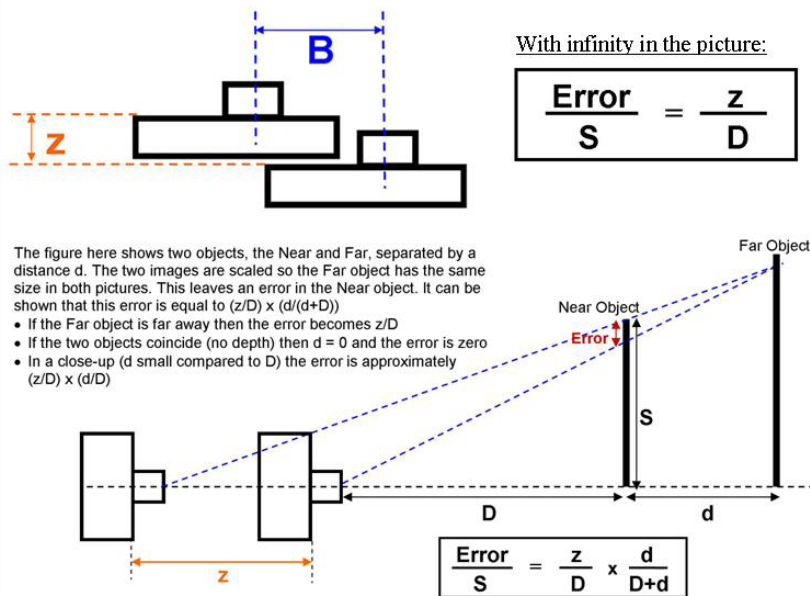$$\frac{Error}{S} = \frac{z}{D} \times \frac{d}{D+d}$$

Fig. 1. *When overlapping cameras the relative error (with infinity in the picture) is proportional to the displacement (offset) of the cameras (Z) and inversely proportional to the distance of the near object (D). The bottom figure shows the general case with a near object at D and a far object at D + d. Using simple geometry we can derive the formula at the bottom.*

My Recommendations

- **Don't be afraid to use overlapping cameras**, if that's a practical way to reduce the stereo base, but be careful regarding object distances.

- When using overlapping cameras with infinity I recommend **staying at least 100 x Z away from the near object**. For the Sony RX100 (Z = 25mm) this is 2.5m, or about 8 feet.

- When using a very short focal length (24mm full frame equivalent, for example) the near object is usually the ground, which can be quite close and create problems during alignment. I prefer to **use longer focal lengths** (35 or 50mm) which helps stay back from the near object, especially the ground.

- **Don't be afraid to shoot close-ups** with overlapping cameras, but make sure that the background is blocked. Also, instead of getting closer to the near subject to increase the image size, it is better to **stay back and zoom in**.

Bottom-to-Bottom

- **Easier to implement** if the tripod screw is centered with the lens (g = 0)

- **Drawback**: Images are in portrait orientation (true for all 3) and shutters move in opposite directions

H

H + g
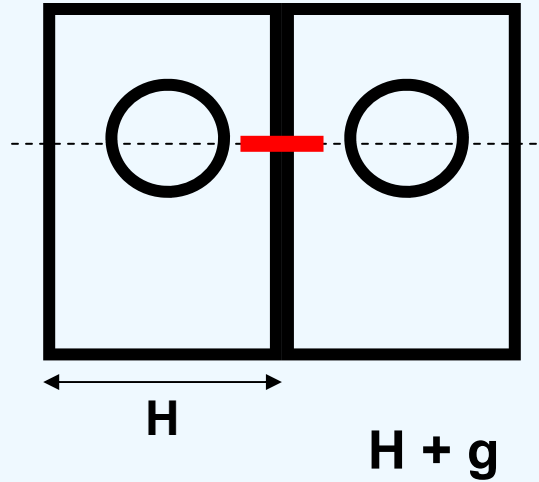
Top-to-Top

- **If the lens is offset to the top** this can bring the lenses closer together

- **Interesting implementation**: Space cameras so the eyes can view through both viewfinders to compose in 3D

Top-to-Bottom

- **Advantage**: Shutters moving in the same direction

There is a sync error if there is substantial movement during the shutter travel. The error is worse at the edges (zero at the center).
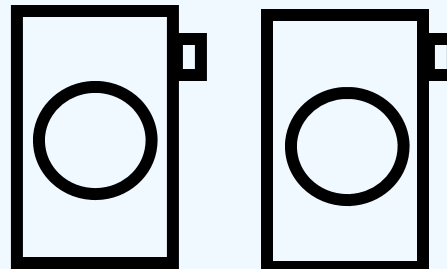
Twin Camera Arrangement
Part 3: Vertical

Vertical Arrangement

Vertical arrangement of two cameras is nothing new. When I first started using my Minolta X700 cameras for twin camera 3D, in addition to using them side-by-side, I also used them vertically with 135mm lenses to take portraits of my daughter Lea (**Fig. 1**). The reason for using the cameras vertically was to bring the lenses closer together and reduce the stereo base. One complication using film was mounting the film chips.

With digital photography cropping and mounting vertical images is not a problem. Still, most stereo photographers do not like the idea of using the cameras vertically for reasons explained in Stereogram 26.06 (Feb. 2022).

I recently became interested in the vertical configuration when I started using my Panasonic FZ2500 cameras (and later the Sony RX10) for tele-stereo (long distance 3D with long lenses). I found that it is easier to align the cameras when they arranged vertically vs. horizontally. Alignment (both

vertical and horizontal) is very important when using long focal lengths/high magnifications. An extra bonus of the vertical arrangement is that I can compose the picture in 3D by looking through both viewfinders.

When I started using the Sony RX1 twin cameras, I became a proponent of the vertical configuration to reduce the stereo base. I agree that, in general, when using standard computer displays and TVs, vertical configuration is not a good choice. However, having a normal stereo base is better, in my opinion, than having a large stereo base. So now I routinely use my Sony cameras vertically and crop to a square or wider aspect ratio.

We can distinguish three versions of vertical configuration (**Fig. 2**):
1. Bottom-to-bottom
2. Top-to-top
3. Top-to-bottom

Bottom-To-Bottom

The most straightforward way to connect two cameras bottom-to-bottom is

to use a single screw piece. **This is only possible if the camera's lens is aligned with the tripod screw**. This is the case for quite a few cameras (Sony RX1, most Panasonic M4/3 cameras, etc.) but not all (Sony RX100, some small Panasonic cameras, etc.).

The screw piece is a 1/4-20 screw, which means that it has a 1/4" diameter with 20 threads per inch (**Fig. 3**). In addition to the screw, you need some kind of friction pad to help with the alignment and to keep the cameras together.

At first, I was selecting the friction

Fig. 1 *Portrait of my daughter Lea (ca. 1994) taken with Twin Minolta X700 cameras and 135mm lenses. The cameras were mounted bottom-to-bottom to reduce the stereo base. Mounting the film chips was challenging (the bottom picture shows the back of an Albion mount) because the film sprockets cannot be used. The film chips must be aligned freehand (by eye, aided perhaps by a mounting gauge).*
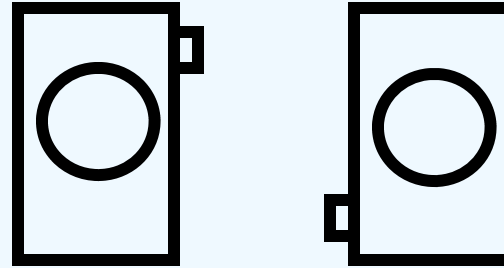
Bottom-to-Bottom
- Easier to implement if the tripod screw is centered with the lens (g = 0)
- Drawback: Images are in portrait orientation (true for all 3) and shutters move in opposite directions
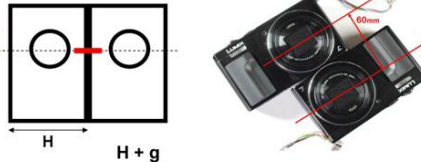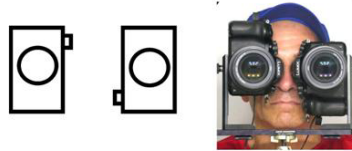
Top-to-Top
- If the lens is offset to the top this can bring the lenses closer together
- Interesting implementation: Space cameras so the eyes can view through both viewfinders to compose

Top-to-Bottom
- Advantage: Shutters moving in the same direction

  There is a sync error if there is substantial movement during the shutter travel. The error is worse at the edges (zero at the center).

Fig. 2 *Three variations of vertical camera configuration.*

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pads with trial and error. You can take some of the guesswork out by using the fact that these screws have a pitch of $1/20" = 1.27$mm. So a full revolution of the one camera with respect to the other moves the cameras by 1.27mm. Common materials that you can use for padding:
- Rubber: 2mm (can be compressed a bit)
- Cardboard: 0.5-1.0 mm
- Paper: 0.1 mm

Another factor when dealing with camera mounting is the depth of the camera's tripod socket. I measured a few of my cameras and found that the depth is around 7.5mm (the Sony RX100 has a very shallow depth of only 5mm).

Putting everything together, to attach two cameras together start with a screw piece about 12mm (0.5") long and then add padding material for the cameras to align well. Be careful not to overtax and damage the camera's tripod socket. I have put together (available for sale) a kit with several screw pieces and padding pieces.

Camera Tripod Socket
1/4x20 Screws

1/4" ~ 6.3mm

1/20" ~ 1.27mm

~7.5mm

About 5 threads inside the socket

Camera Tripod Socket

1/4 x 20 screws
1/2" (~12mm) 5/8" (~16mm) 3/4" (~19mm) Rubber piece Helps remove screw

Friction "Pads"

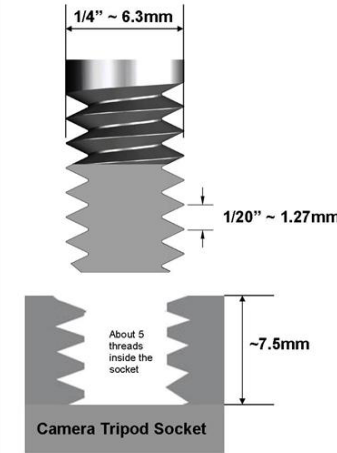~2mm hard rubber ~0.7mm soft rubber ~0.5mm cardboard ~0.08mm paper ~0.1mm paper

Fig. 3 *Top Left: Dimensions and geometry of the 1/4x20 screws (used for camera mounting) and the camera tripod socket. Top Right: Kit for mounting two cameras bottom-to-bottom (item no. 384706666838). The kit contains screw pieces of different lengths, plus a variety of padding materials. These are needed to bring the two cameras to good alignment and also to apply pressure to maintain the alignment.*

Fig. 4 *Top-to-top arrangement of cameras using a pair of vertical posts on a bar.*

Top: Sony RX100—Because in these cameras the lens is not centered to the tripod socket, direct bottom-to-bottom arrangement is not possible so this is a good (but bulkier) arrangement.

Bottom: Sony RX10 cameras- Here the vertical arrangement is used to allow easier alignment of the cameras, both vertical and horizontal (convergence). An extra bonus is the 3D composition using both viewfinders.

Top-To-Top

Top-to-top arrangement of two cameras can be achieved using two vertical posts, supported on a horizontal bar (**Fig. 4**). This has a few advantages over bottom-to-bottom:
- Some cameras come closer when placed top-to-top
- It can be used even when the lens is not centered over the tripod socket
- The cameras can be converged horizontally
- Vertical alignment is easier (important when using long focal lengths)
- It is possible to use the viewfinders for 3D composing

- The rig can be mounted on a tripod or held with a grip

These advantages come at the expense of bulk and weight. I prefer lightweight rigs so I normally use the cameras bottom-to-bottom with a screw (for example the Sony RX1 cameras). But when using cameras with long focal lengths (Sony RX10) for nature and close-ups, I prefer to use the top-to-top configuration.

Top-To-Bottom

This is a variation of the Top-To-Top arrangement and it is also achieved using vertical posts. One disadvantage is that the lens spacing increases because one post is between the cameras. Some people prefer this configuration because the shutters move in the same direction. I have never used it myself.
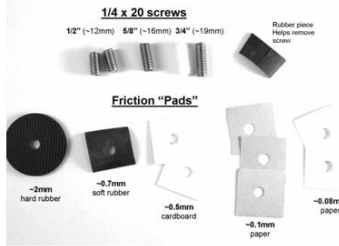
In Conclusion

Using twin cameras vertically allows for a normal stereo base. The resulting images have a (generally non-desirable) portrait aspect ratio, so some cropping might be required. This has become my favorite arrangement with my Sony RX1 cameras for normal 3D and my Sony RX10 cameras for long distance 3D.

George Themelis

Camera Tripod Socket
1/4x20 Screws
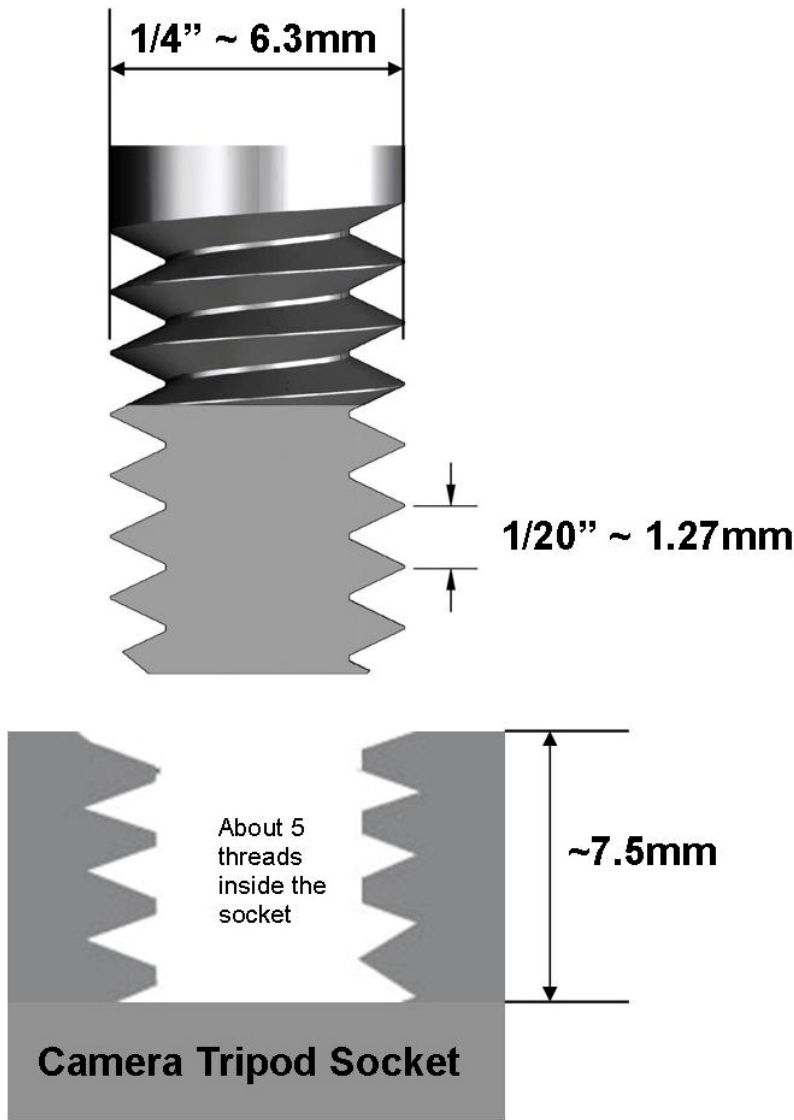
1/4" ~ 6.3mm

1/20" ~ 1.27mm

About 5 threads inside the socket

~7.5mm

Camera Tripod Socket

The most straightforward way to connect two cameras bottom-to-bottom is to use a single screw piece. **This is only possible if the camera's lens is aligned with the tripod screw**. This is the case for quite a few cameras (Sony RX1, most Panasonic M4/3 cameras, etc.) but not all (Sony RX100, some small Panasonic cameras, etc.).
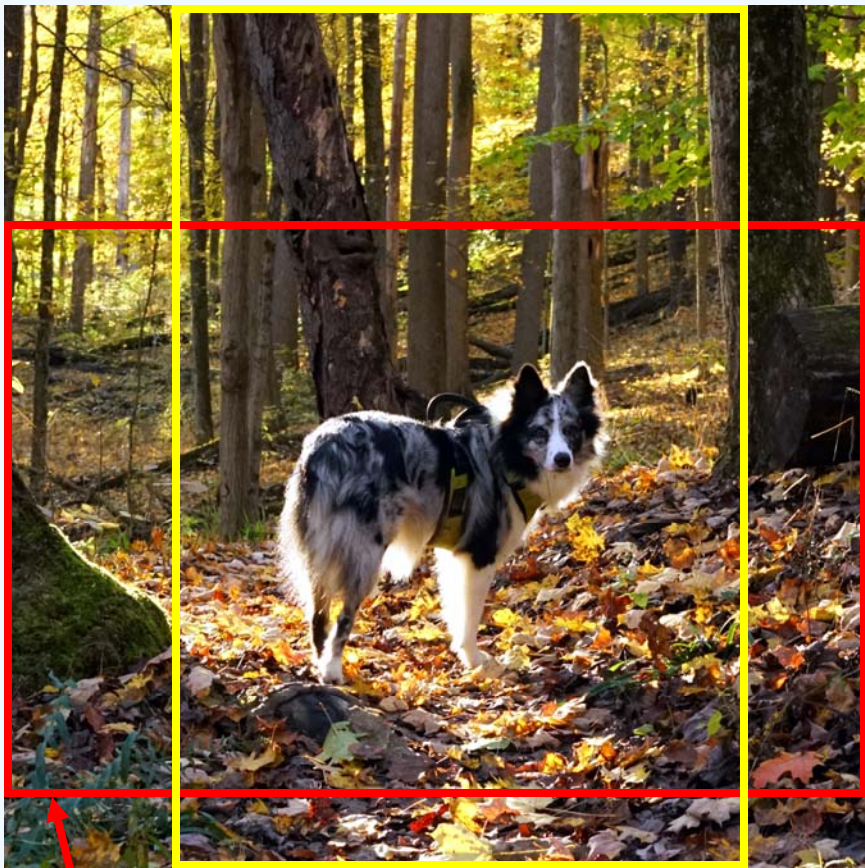
The **screw piece** is a 1/4-20 screw, which means that it has a 1/4" diameter with 20 threads per inch. In addition to the screw, you need some kind of **friction pad** to help with the alignment and to keep the cameras together.

You can take some of the guesswork out by using the fact that these screws have a pitch of 1/20" = 1.27mm. So a full revolution of the one camera with respect to the other moves the cameras by 1.27mm. Common materials that you can use for padding:
- Rubber: 2mm (can be compressed a bit)
- Cardboard: 0.5-1.0 mm
- Paper: 0.1 mm

BTB Kit For Sale

1/4 x 20 screws

1/2" (~12mm)   5/8" (~16mm)   3/4" (~19mm)

Rubber piece
Helps remove screw

Friction "Pads"

~2mm
hard rubber

~0.7mm
soft rubber

~0.5mm
cardboard

~0.1mm
paper

~0.08mm
paper

Sensor Aspect Ratio: 3:2

Red rectangle
Cameras horizontally

Yellow rectangle
Cameras vertically

Stereo Base	RX0	RX1
Horizontal	60mm	130mm
Vertical	40mm	66mm

Vertical composition is cropped 1:1 to fit the display. Compared to the horizontal composition, it has lost field of view in the horizontal direction. But it has less deviation since the stereo base is smaller.

Display Aspect Ratio: 16:9

v1

Sensor Used (RX1): 24x24mm

Vertical composition enlarged (and cropped vertically) to match the aspect ratio of the horizontal composition (3:2). Focal length/magnification and deviation have increased by 1.5x

v2

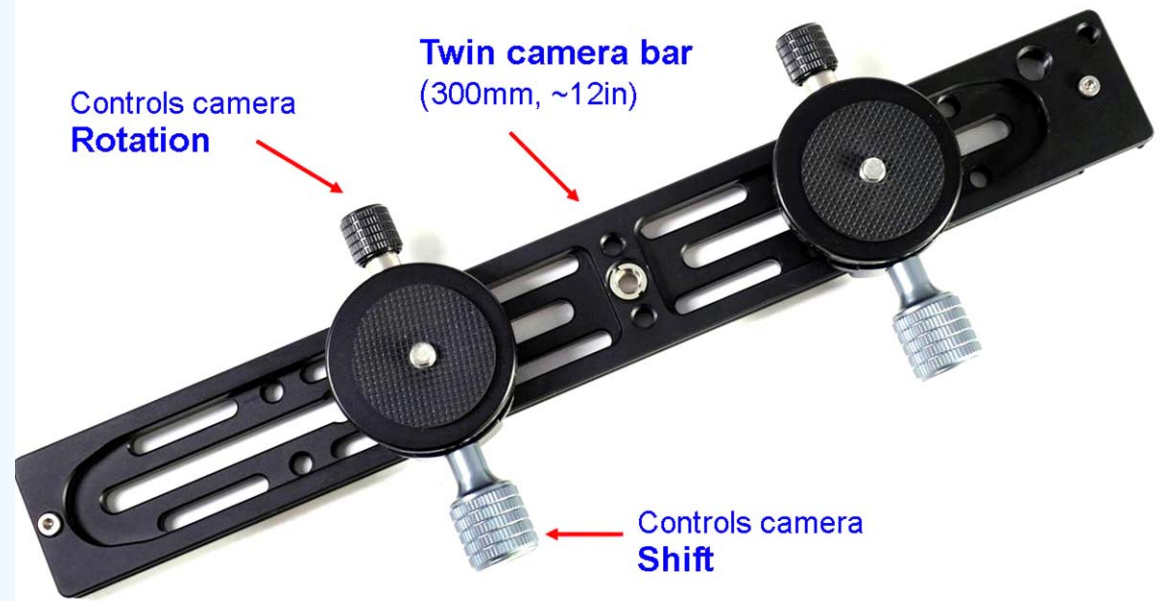Sensor Used (RX1): 16x24mm, EFL = 1.5x35mm = 52mm, EB = 99mm
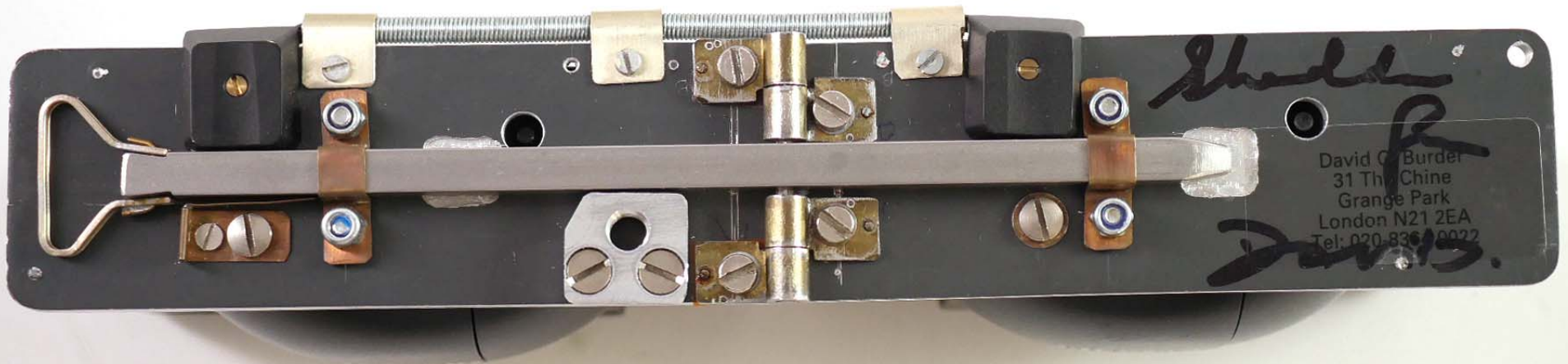
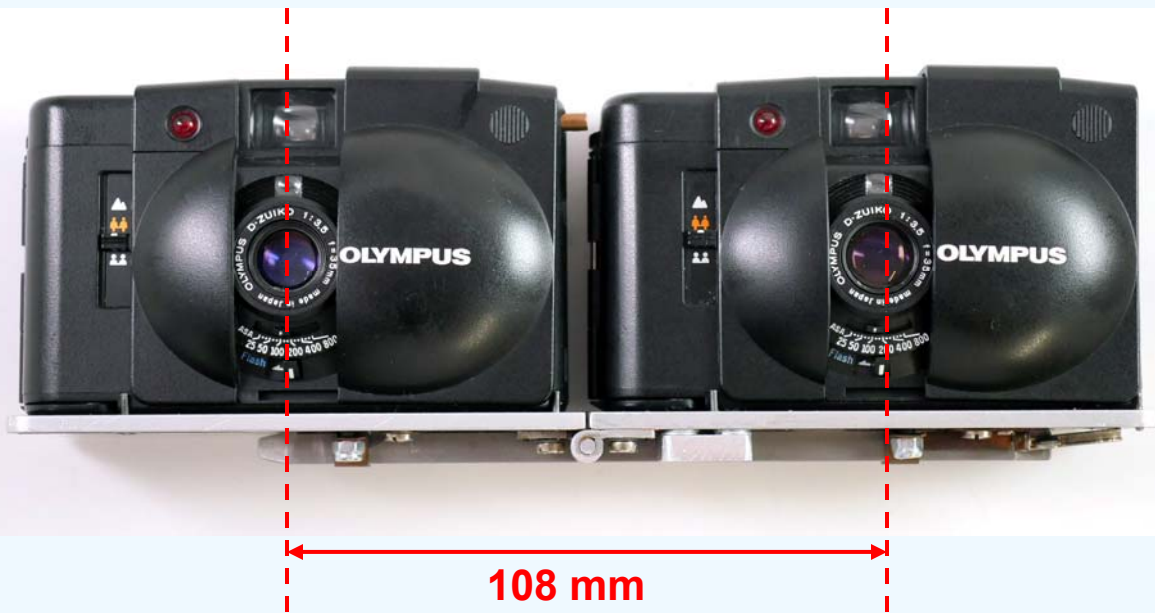# Converting from one configuration to another

Converting from Parallel to Overlap

Twin camera bar w/Mini Clamps

Controls camera **Rotation**

Twin camera bar (300mm, ~12in)
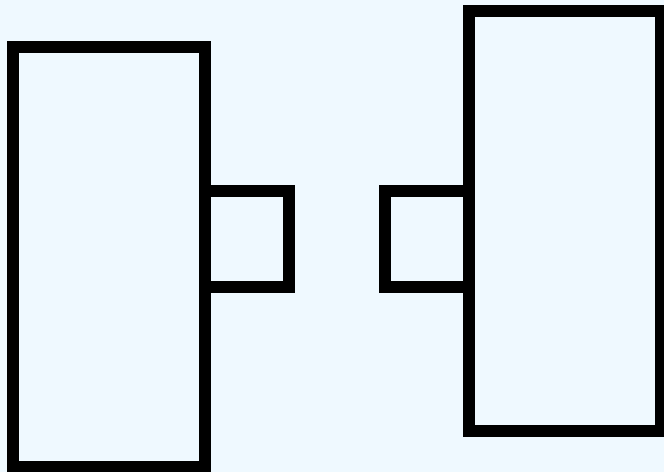
Controls camera **Shift**

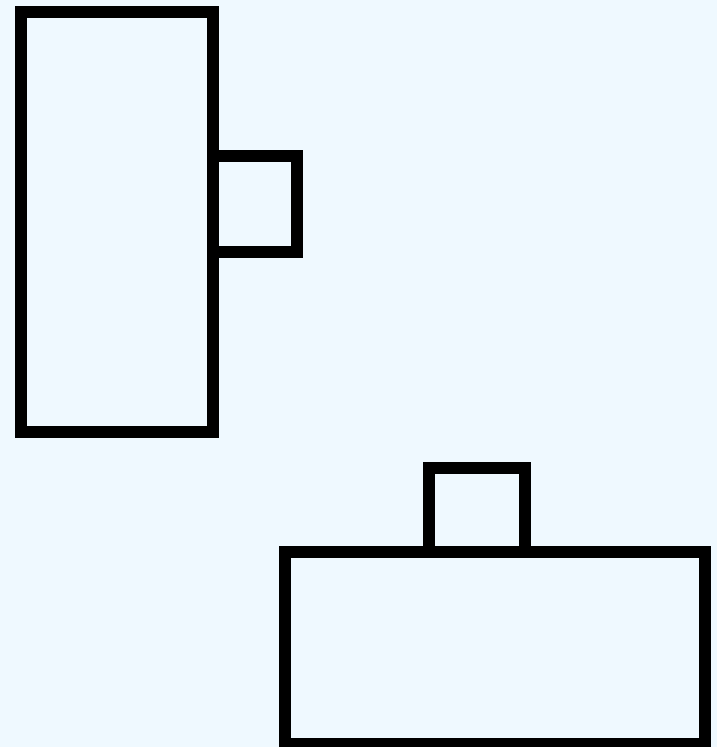# Converting from Parallel to Vertical

108 mm

70 mm

Bar designed and produced by David Burder

Other Camera Arrangements

Face to Face?

Perpendicular?

Everything is possible with mirrors
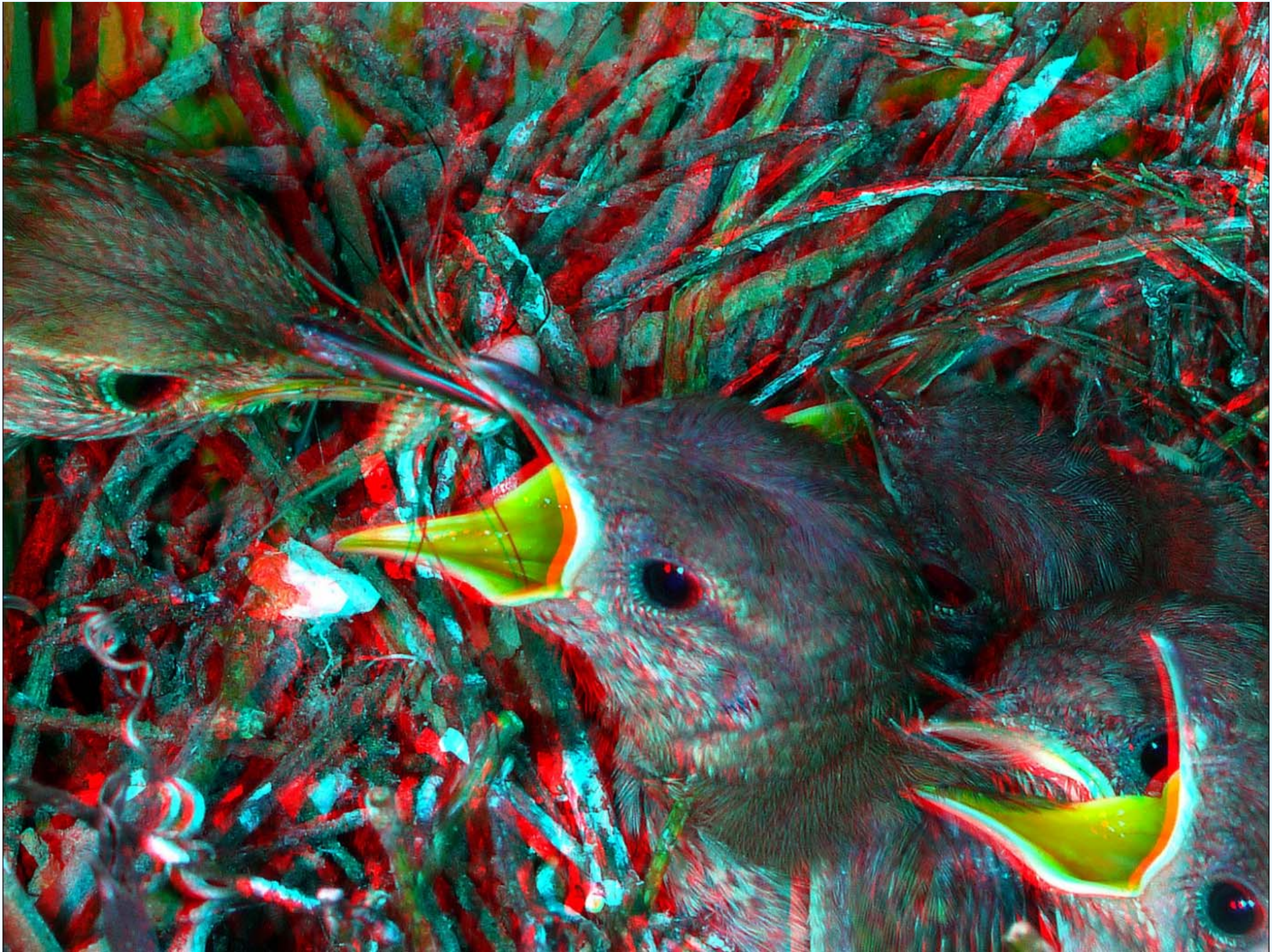## or prisms + a bit of smoke

Semi-Transparent Mirror
(beam splitter)

B
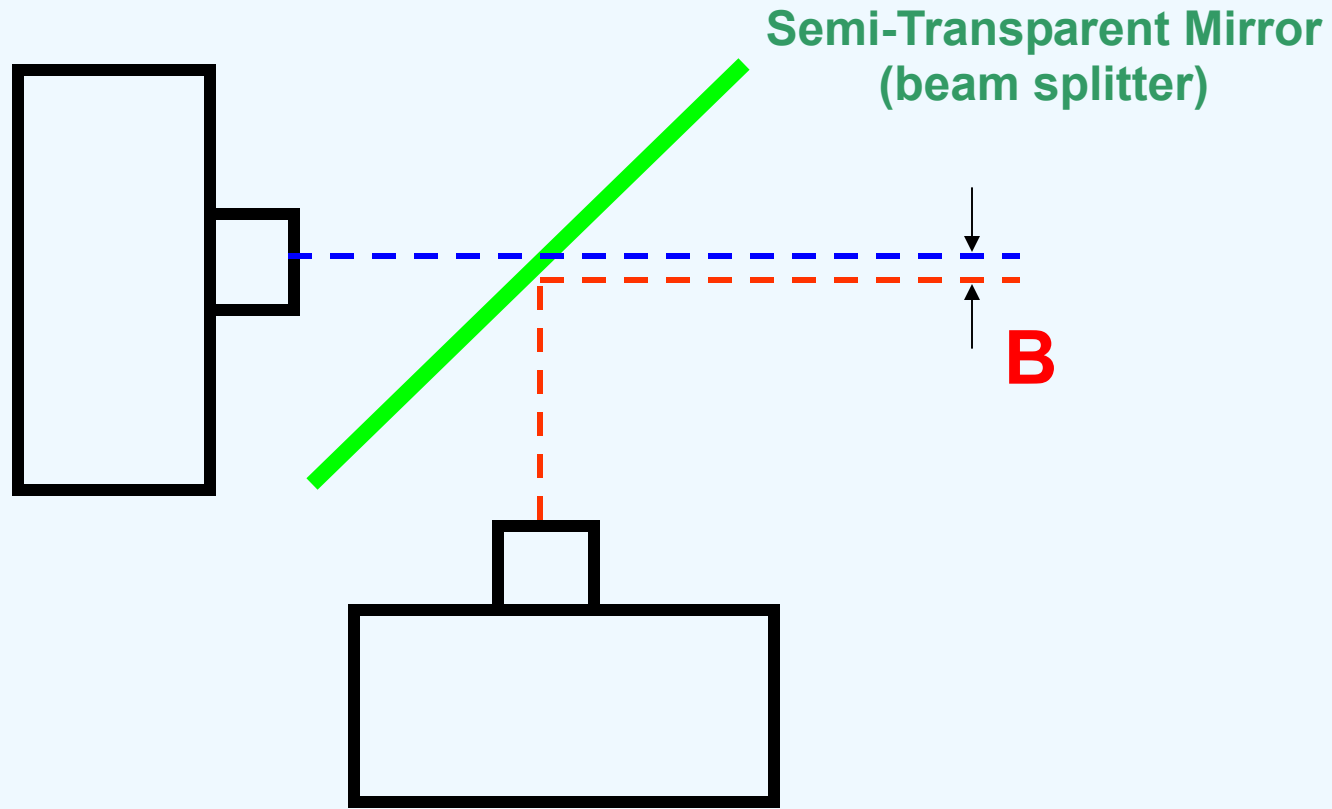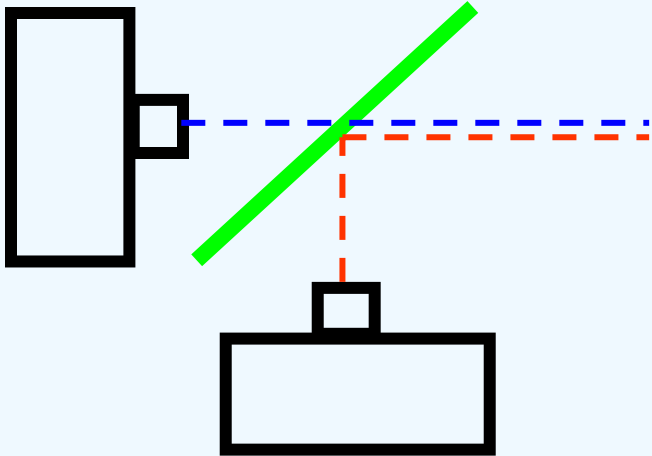
Macrobox

Commercial Macrobox:

- **One camera stationary**
- **Other can move**
- **Range of stereo base 0-50mm (hypostereo)**

From: http://www.digi-dat.de/

Twin Panasonic Cameras (wired by Ekeren) and flash, remotely triggered

Synchronization

- **What is it?**

- **How is it evaluated?**

- **How is it quantified?**

- **Why is mis-synchronization a problem?**

- **What is good synchronization?**

- **How is it achieved?**

How close the two cameras fire together

By photographing a moving object

By the degree (time) of mis-synchronization
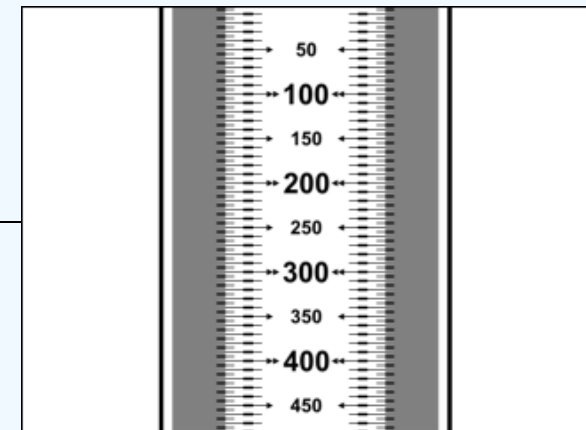
Retinal Rivalry & possible depth anomalies

It Depends

Evaluating Synchronization

Systematically / Scientifically

- **CRT Monitor**

- **Swinging Pendulum**

- **Spinning Wheel**

- **Fast switching LED lights**

Casually

- **Photograph everyday moving objects**

  People walking, car traffic, wind blowing, running water…

From: www.3dtv.at
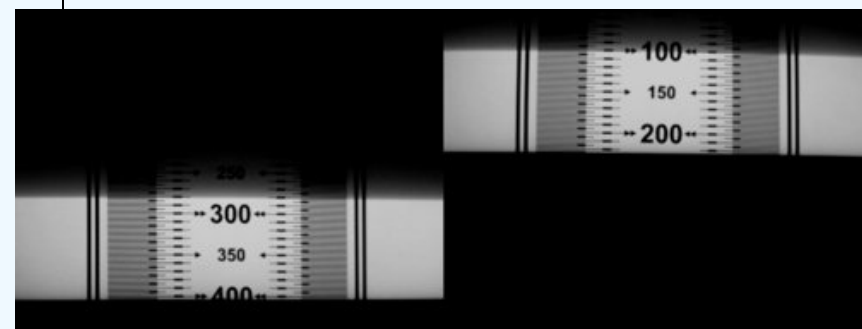
Why is mis-Sync a Problem?

What is important is how fast is the object moving across the frame

This is affected by a number of variables such as:

- **Speed of movement**
- **Size of object**
  - Distance
  - Focal length
  - Cropping & enlargement
- **Viewing Conditions**
- **Direction of movement**

Vertical: Cause retinal rivalry

Perpendicular: Least troublesome

Horizontal: Small movement can interfere with depth
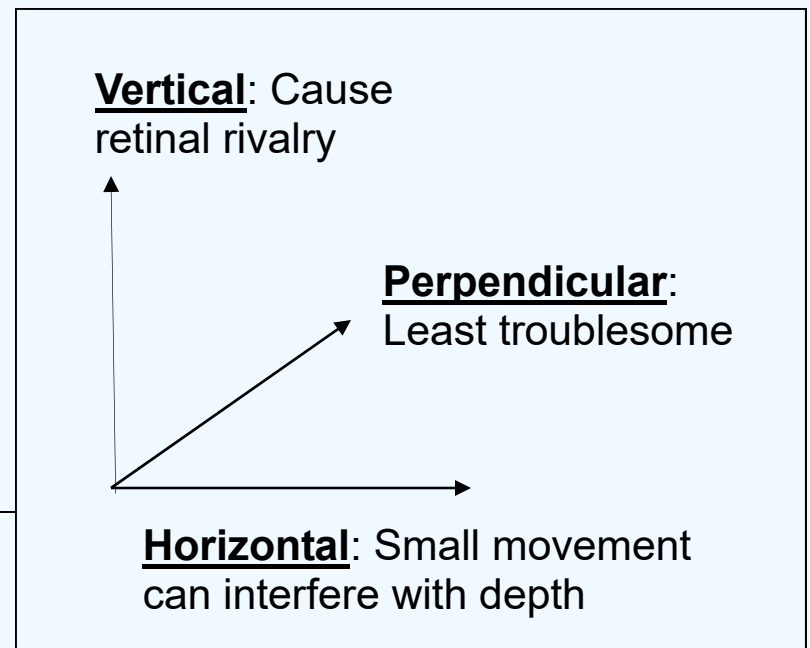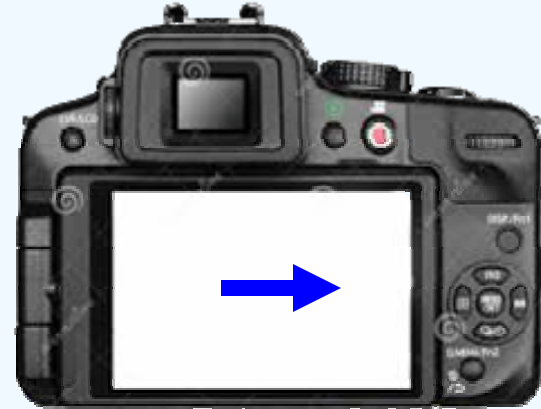
Mis synchronization: Sony RX10 at the ISU Congress in Germany (bike is "floating")

Camera Triggering

1. Finger Triggering

2. Mechanical Triggering

3. Cameras wired internally

4. Electrical triggering through remote ports

5. Wireless Triggering
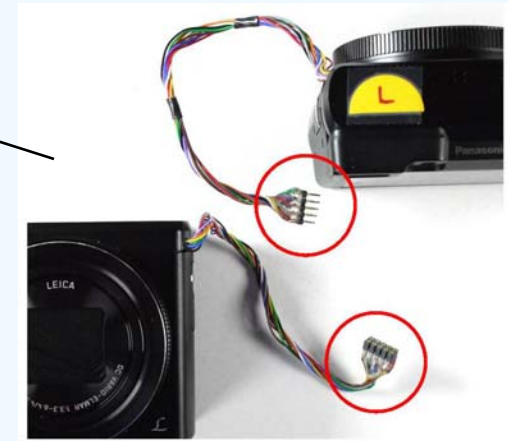
Triggering via Remote Port

Camera with Remote Port
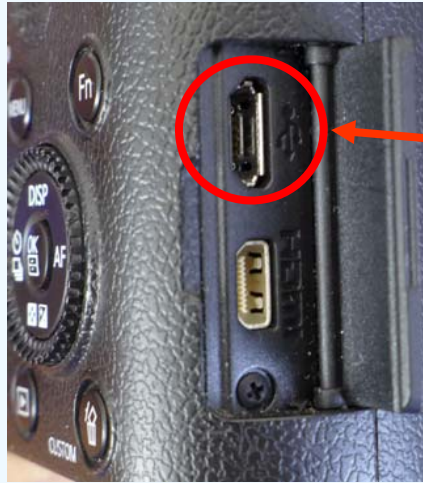
Remote Cable (plug & switch)

How it works:

- **Plug Cable into Remote Port**

- **Half-Press switch button, focuses**

- **Fully press button, fires shutter**

Opening the remote, you find:

- **Three wires & a two way switch**

- **Touching (sorting) 2 wires focuses**

- **Sorting all 3 wires fires the shutter**

- **For two cameras, combine two plugs into one switch**

Generic Configurations
For triggering via the Remote Ports

Use a **camera remote cable** (one side has the camera plug, the other side a 2.5mm common plug)

No switch Cameras are fired from one cameras' shutter button

1.

2.5mm connector

2.

Two stage switch

2.5mm splitter

3.

Receiver

Emitter

Splitter Cable

To each camera

Remote Control
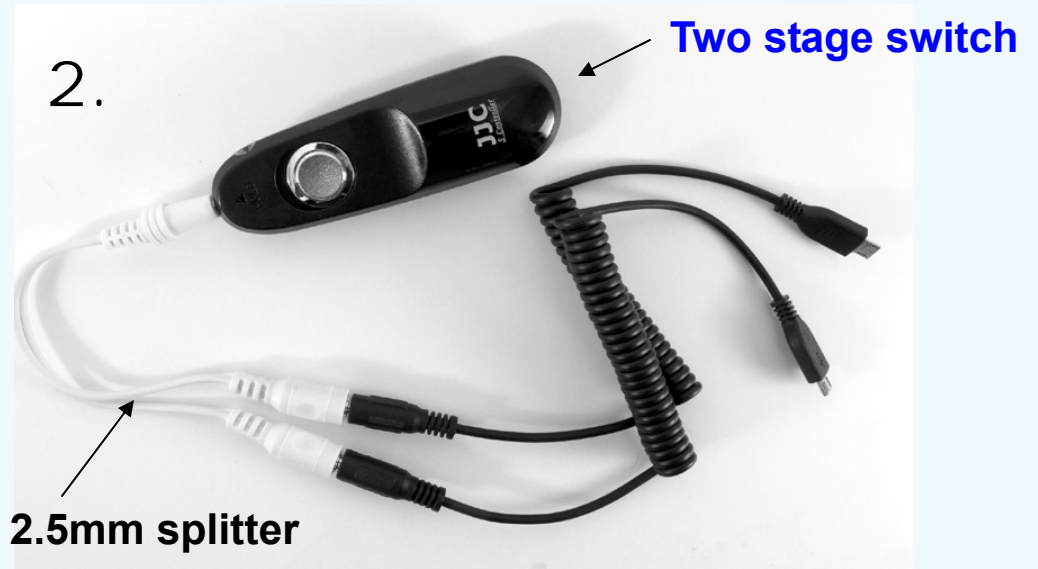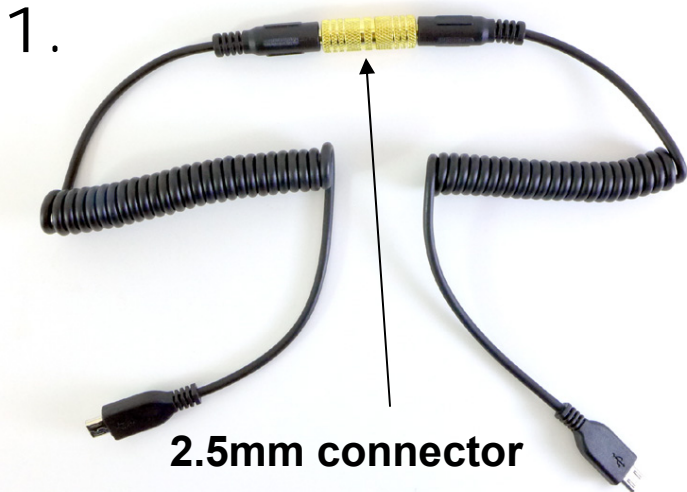
Note: These general configurations apply for some cameras (Samsung NX1000, Canon DSLR, Sonys) but not all (Panasonic M4/3). **Do your research before twining a particular camera system.**

Why isn't Remote Port Synchronization perfect?

When the switch is pressed, the signal is sent simultaneously to each camera to fire the shutter

Electricity travels with the speed of light, so why isn't synchronization perfect?

1. **Small delays exist in every electromechanical system**

2. **Modern <u>digital</u> cameras are like computers. Pressing the shutter button (or giving the signal to the remote port) does not mean that the camera will react instantly to fire the shutter.**

1/30s Polling

- **In many cameras the remote ports are polled cyclically** (typically 1/30 s)

- **Delay is not noticeable when using one camera but it can be a problem when using two cameras**

M lags S

Courtesy of John Hart
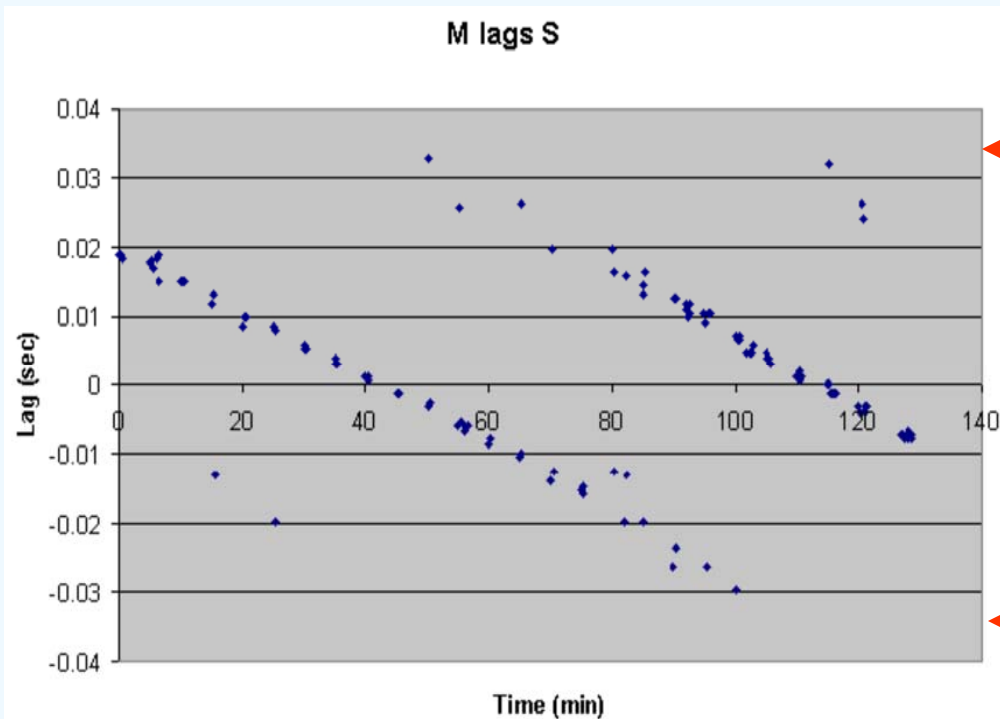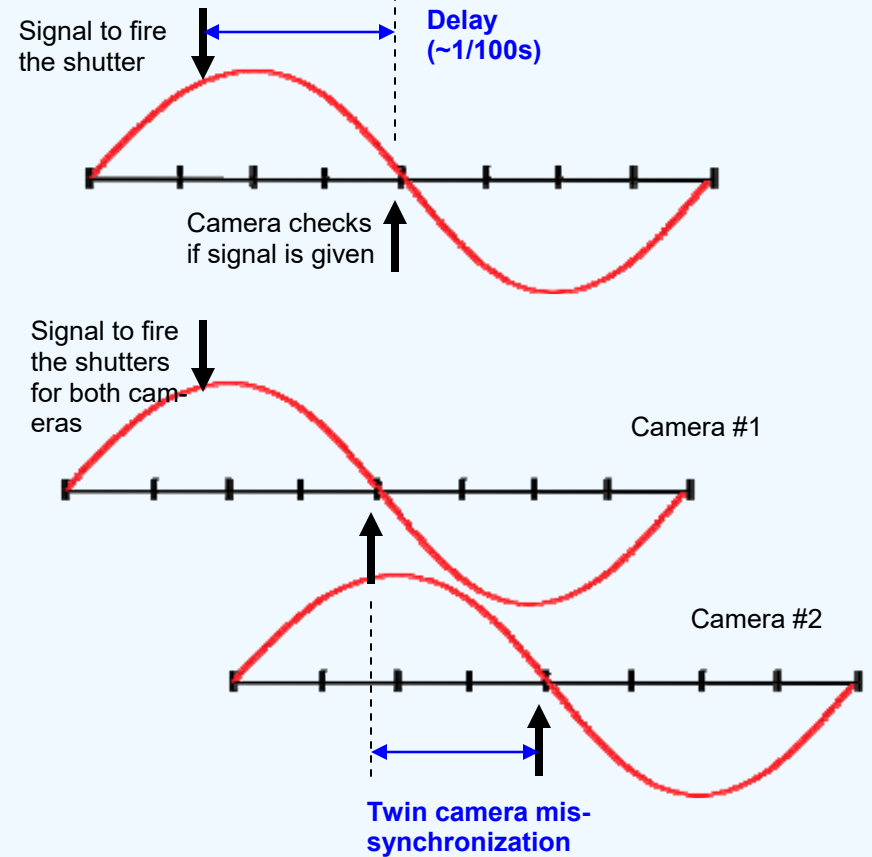
Because the frequencies of the internal cycles are not identical, this polling leads to a "**drift cycle**" where sync varies from ~1/30s to zero

Assisted Triggering via Remote Ports

- ## SDM
StereoData Maker

- **Software hack for certain Canon compact cameras**

- **Excellent synchronization**

- ## Sony LANC
LANC Shepherd

- ## 3DSLR Master
Damir Vrancic

- External Control Unit

- **Powers cameras simultaneously**

- Monitors signal to remote ports

- Applies time delays

When cameras are **powered at the same time**, their internal cycles are most likely synchronized so the cameras fire at the same time
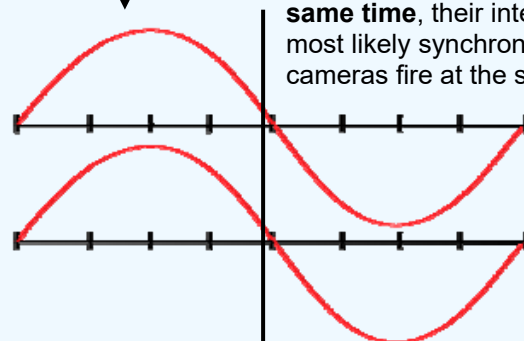
What is good Synchronization?

Synchronization		
0.01ms	**1/100,000s**	Freezes everything except for bullets and propeller tips
0.1ms	**1/10,000s**	Required for fast moving objects (sports, etc.)
1ms	**1/1,000s**	Will freeze most ordinary motion
10ms	**1/100s**	OK for slower moving objects (slow walk)
100ms	**1/10s**	OK for slowly drifting objects (clouds)

Assisted & low power flash

Wired & Remote Port

Canon DSLR
Sony
Samsung

Micro 4/3 (polling)

Finger mechanical
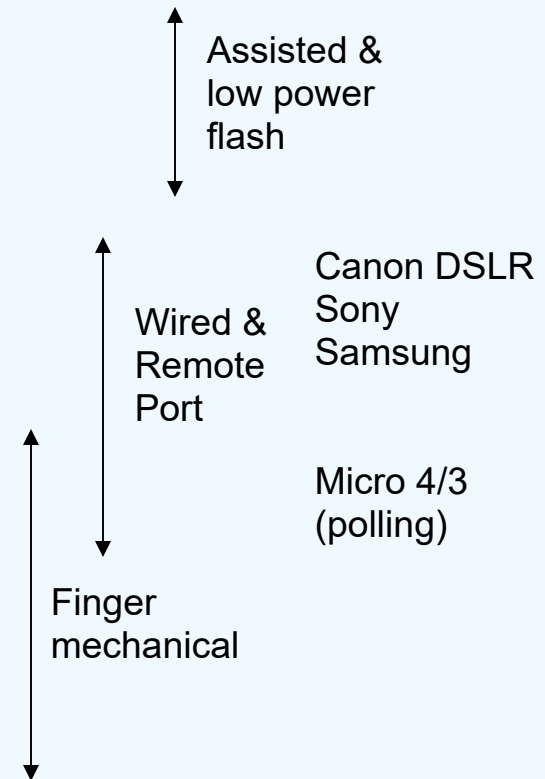
Also important, in addition to the average synchronization is <u>consistency</u>:

How consistent is the synchronization?

There is a lot more to say about twin camera synchronization than what was covered here. **Do your research!**

High Speed Synchronization w/ Flash

Power	s
1/1	1/355
1/2	1/1207
1/4	1/2348
1/8	1/3750
1/16	1/6320
1/32	1/8662
1/64	1/11520
1/128	1/15540

Flash duration depends on power

- **Duration at full power ~ 2 ms**

- **Duration at minimum power ~ 0.1 ms**

One can use the short flash duration to freeze fast motion

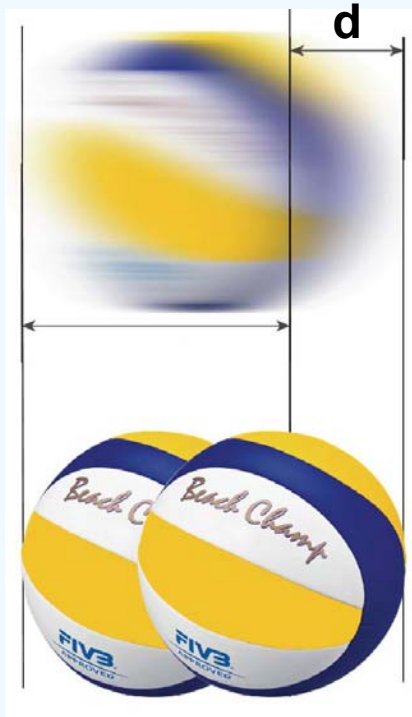- **Camera synchronization not an issue**

- **At low ambient light (dark) both shutters open**

- **Flash fires**

- **Duration of exposure = flash duration (short)**

Synchronization & Shutter Speed

Volleyball photographed with **one camera** and **shutter speed of, say, 1/100s**. There is a **blur** (size of blur = d)

Volleyball photographed with **two cameras** and **shutter speed of 1/1000s** (no blur). There is a mis-synchronization of 1/100s (10ms) between the cameras. This causes a displacement (d)

If a shutter speed causes a certain amount of blur then a mis-synchronization equal to this shutter speed will cause a displacement of the same amount as the blur

Interesting practical way to estimate synchronization:
See how much blur you get at a given shutter speed. If you get no blur then this amount of mis-synchronization is not a problem.

Ball is out of place because of mis synchronication
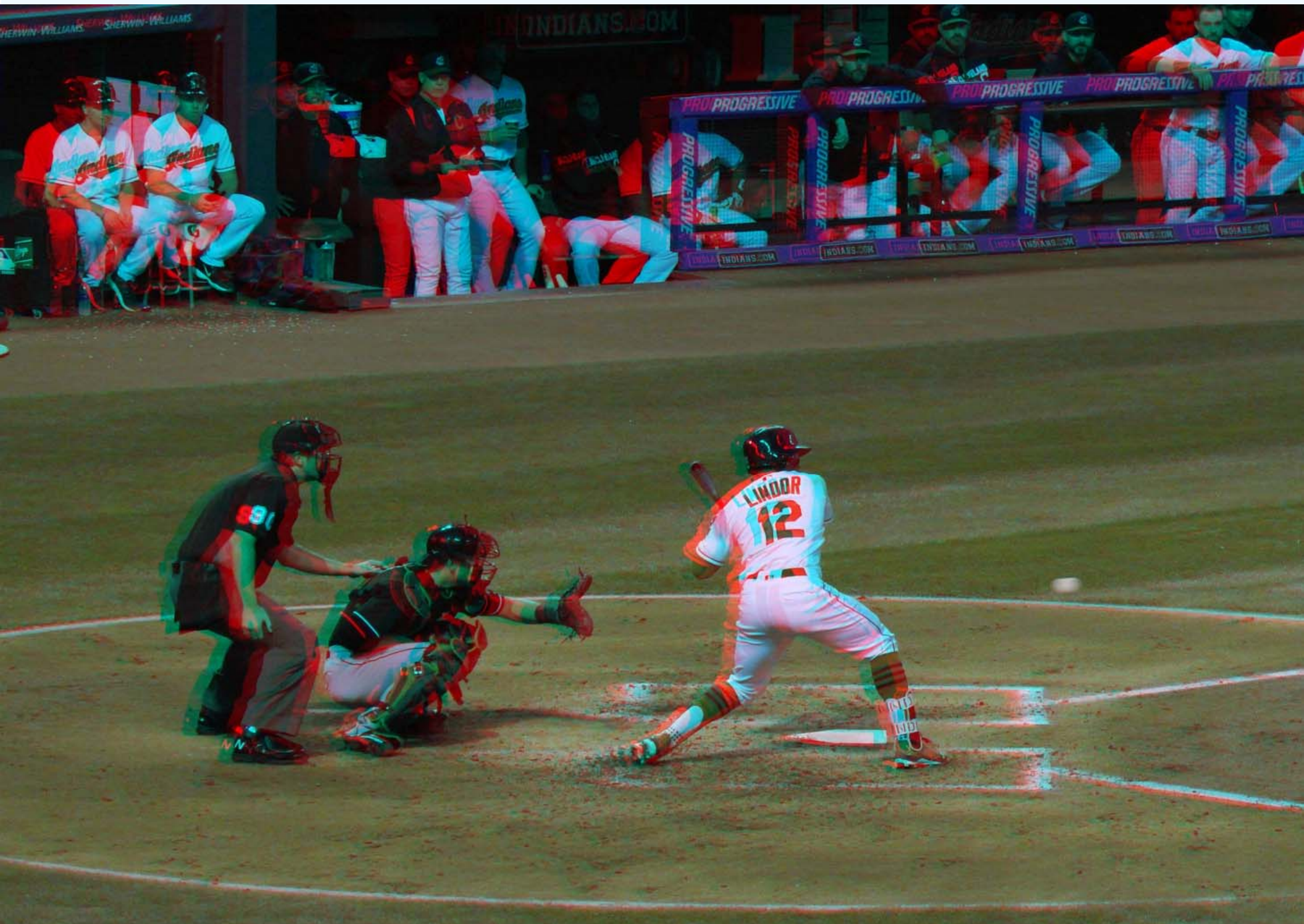
Ref

Shutter Speed = 1/500s

L

R

<u>Practical Twin Camera Rigs</u>

- **Canon compact w/SDM**
- **Wired cameras**
  - Panasonic wired by Ekeren
  - TZ80 by TenDam
- **M4/3 cameras (Panasonic/Olympus)**
- **Canon DSLR**
- **Samsung**
  - NX1000
  - NX Mini
- **Sony w/ Multiport**
  - A6000, RX (1, 0, 10, 100), and others

StereoData Maker

- **Software hack for certain Canon compact cameras**

- Download firmware, copy to SD cards, takes over camera control

- Need USB cables with powered switch

- Pressing the button gets the cameras ready (screens blank), releasing it fires the shutters

- Excellent synchronization

- For more information google StereoData Maker

Action shot by Rick Shomsky using twin Canon cameras & SDM

Wired Cameras

Panasonic TZ10 on z-bar (NSA Convention, Colorado 2011) wired by Ekeren

Pole 3D photography with twin Panasonic cameras wired by Ekeren

Pole 3D Example
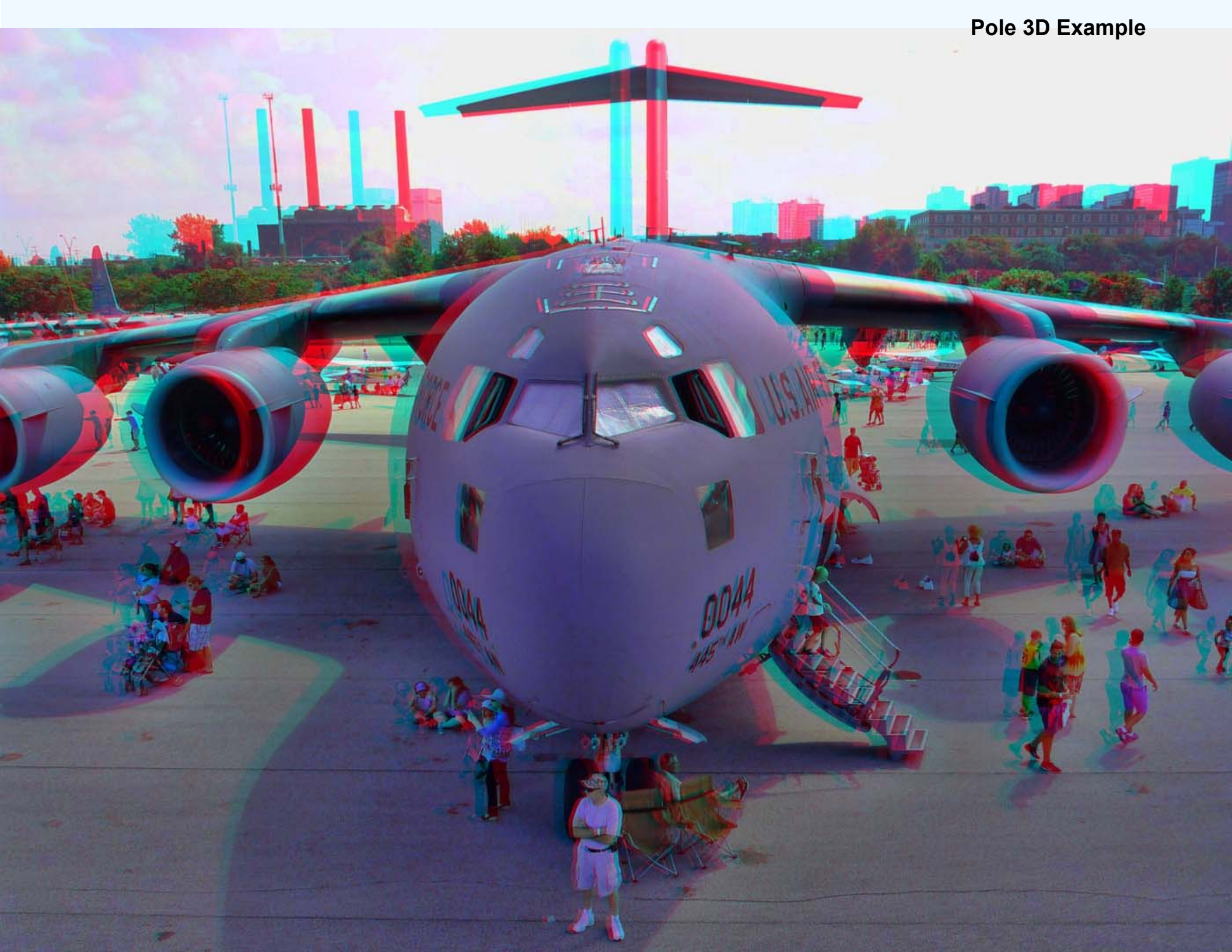
NL | EN

TENDAM 3D equipment

Search Site

panasonic lumix tz-80
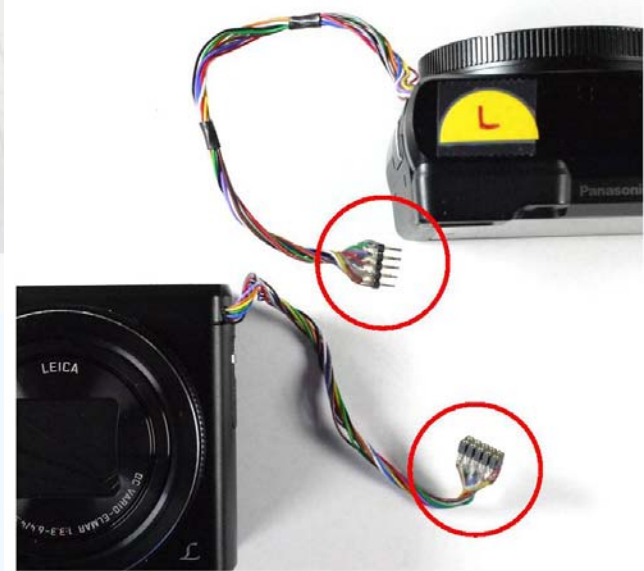
Panasonic TZ80 Wired

Strong points:

- **Fast Startup, quick & accurate focus**
- **Colorful sharp images w/ good light**
- **Wide end (24mm EFL) works well**
- **Long FLs (300mm eq) are useful for close-ups**
- **Excellent stabilization**
- **Uncomplicated connections**
- **Flexible Stereo Base**

Weak points:

- **Small sensor**
- **Rather poor / inconsistent synchronization (typical of 1/30 polling)**
- **Care required to match settings**
- **Large minimum stereo base (side-by-side), not a normal stereo camera**
- **Wires can break with use**
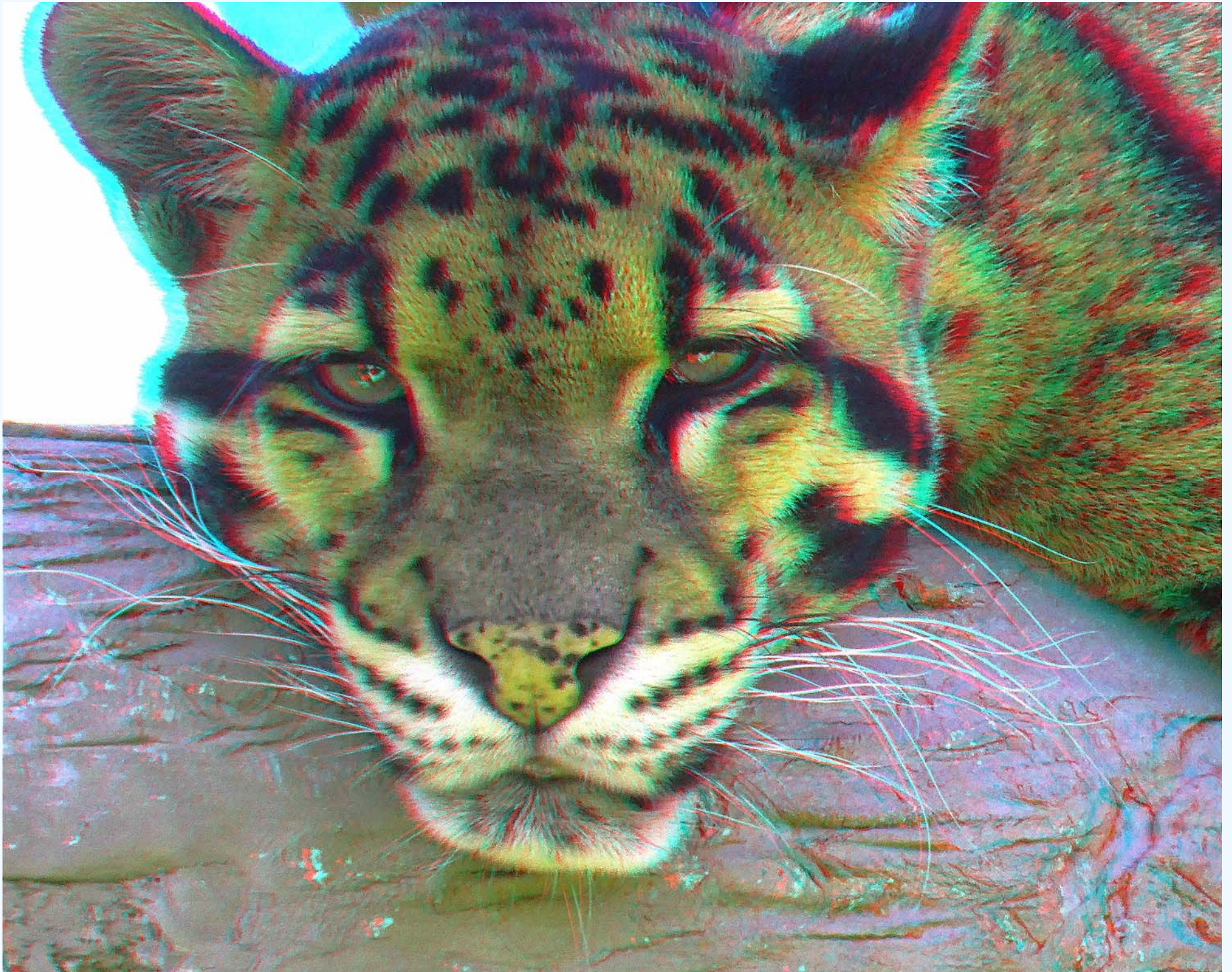
CANON DSLR cameras

Vertical

Horizontal

- **Excellent synchronization (~1ms)**

- **Simple connections**

Full-frame cameras too heavy for me to use in the field.

Takeaway: The best camera system is no good for you if it is too heavy to carry or too complicated to use

The best cameras are the ones you most likely have with you and enjoy to use

Panasonic M 4/3 cameras

- **Popular & attractive system w/lots of support**

- **Good quality in compact size**

- **Compatible with Panasonic 3D lens**

- **Remote works with resistance so it is not straight forward**

- **Inconsistent synchronization due to 1/30s polling**

Samsung NX1000

34 mm

3

2

1

(1) Lens offset from the center by quite a bit
(2) Remote port is on the right side
(3) Wide lens mount, can be used to hold cameras

1 + 2 = The lens spacing in the z-configuration is as short as 68mm

Samsung NX1000

Strong points:

- **Compact & decent sensor size**
- **Good synchronization**
- **Good lens selection**
- **3D support available**
- **Normal spacing in z-configuration**
- **Uncomplicated use of Flash**

Weak points:

- **Dead system**
- **Older cameras, missing newer features**
- **Not very reliable**

SAMSUNG NX1000
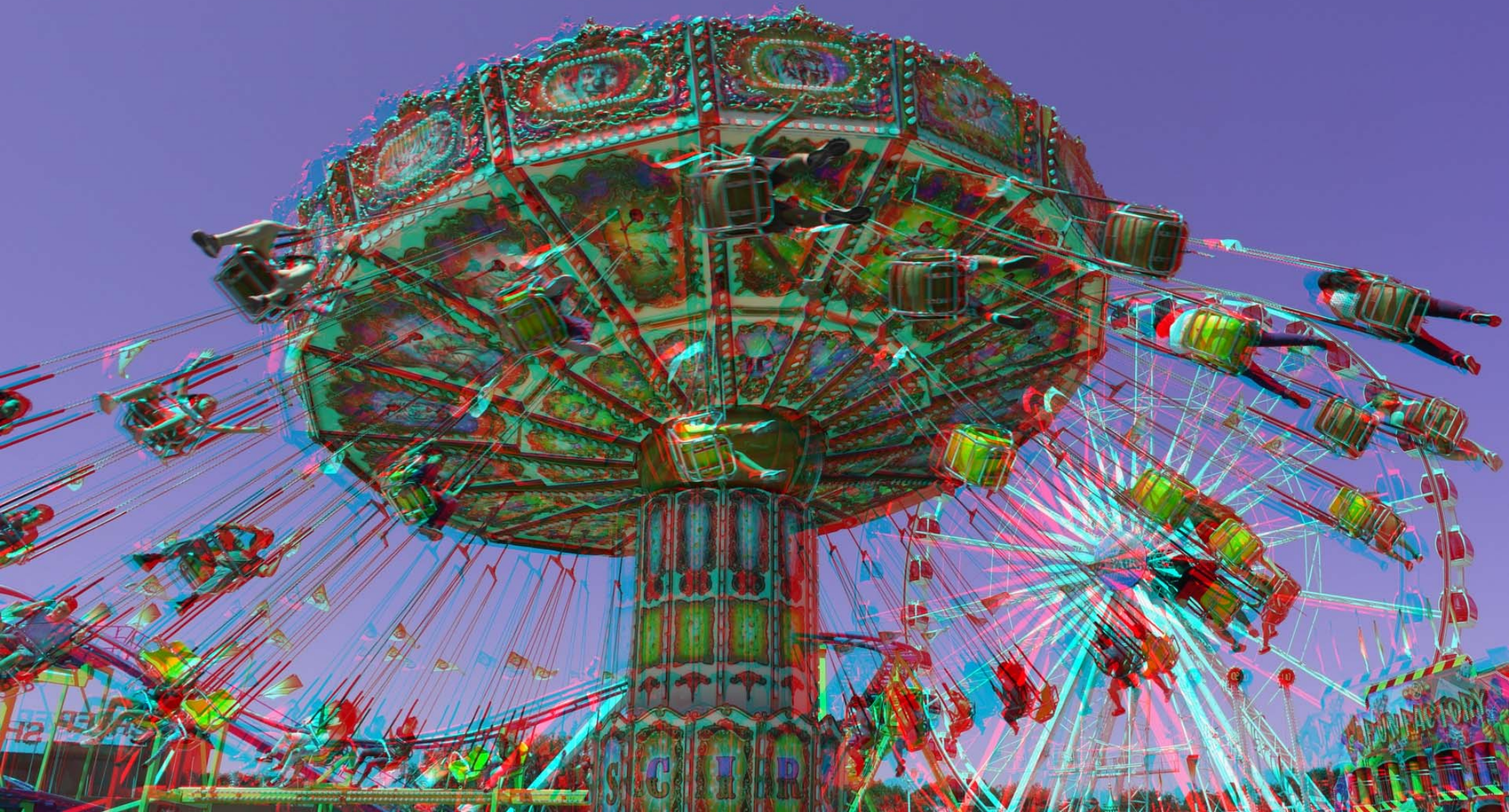
Samsung NX1000 (68mm spacing), 24mm lenses (equivalent), bounce flash

Samsung NX Mini

Strong points:

- **Larger sensor (1 inch)** for a compact camera
- **Interchangeable lenses** (but small selection)
- **Tilting screens**
- **60mm spacing in z-config**

Weak points:

- **Dead system / no support**
- **Poor synchronization**
- **No flash**

"Family Portrait" - Samsung NX-Mini (60mm), tilted screens to compose, remotely triggered
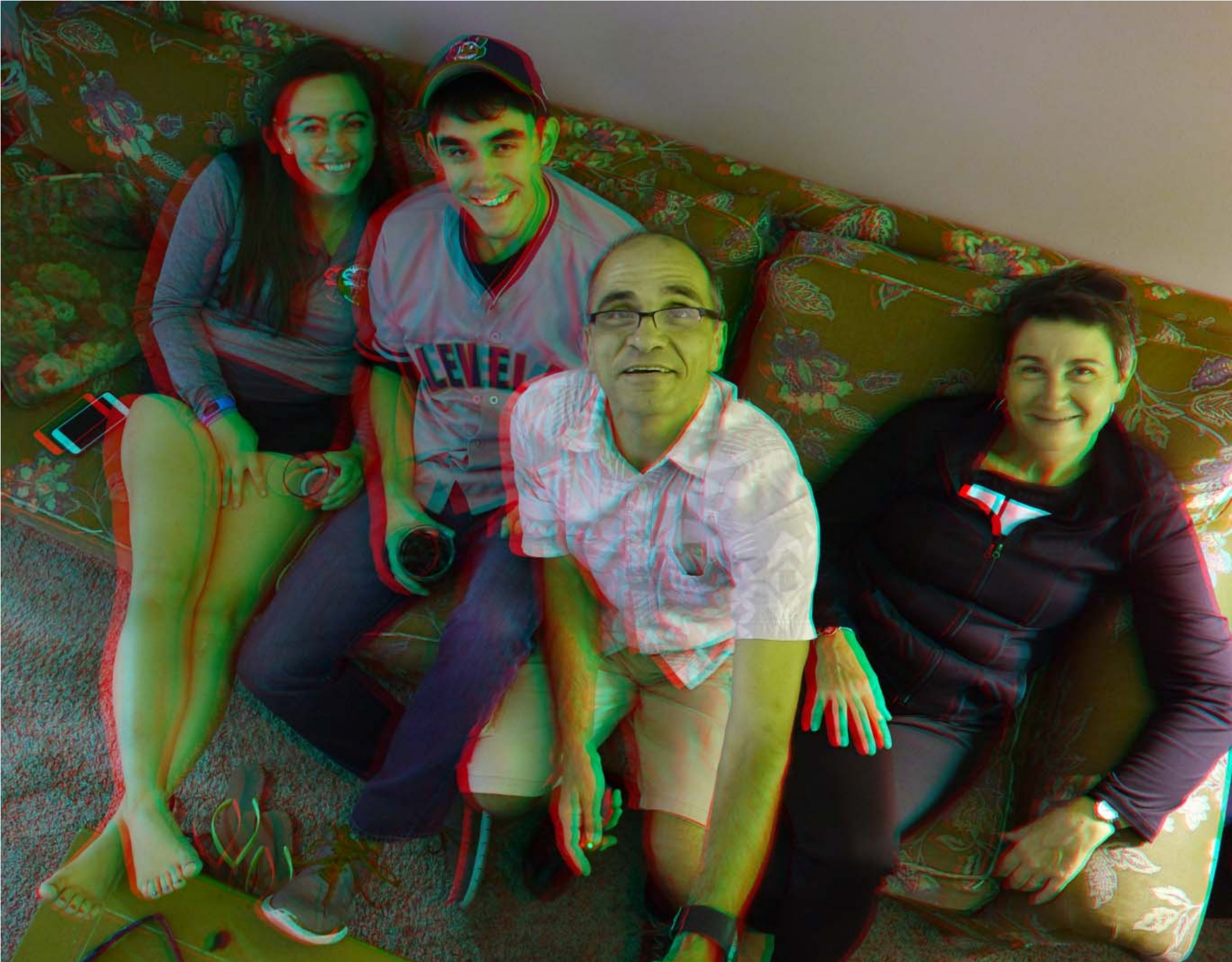
Sony Twin Cameras

- **Innovative**

- **Expensive**

- **Multi-port**

  - **Excellent Synchronization**

  - **Uncomplicated connection**

- **Sony reputation & reliability**

- **Large variety of cameras**

A7, A7R, A7S, A9, A58, A68, A77II, A99II, RX1 — Full frame

A5000, A5100

A6000, A6100, A6300, A6400, A6500, A6600 — APS-C sensor

A3000, A3500

RX0, RX10, RX100 — "1 inch" sensor

HX300, HX350, HX400, HX50, HX60, HX80, HX90 — 1/2.3 inch

Sony RX cameras

- **Fixed Zeiss lens**
- **Multiport**
- **Most have 1" sensor**

RX10: **Bridge** type camera with very long zoom range (24-600mm)
versions 1-4 ($1700)

RX1 Full Frame camera w/fixed 35mm lens
versions 1-2 ($2000-$3000)

RX100: **Compact travel** camera highly acclaimed
versions 1-7 ($1300)

RX0: **GoPro type** camera compact, waterproof
versions 1-2 ($700)

All Sony Cameras:
Many versions co-existing
Latest version very expensive
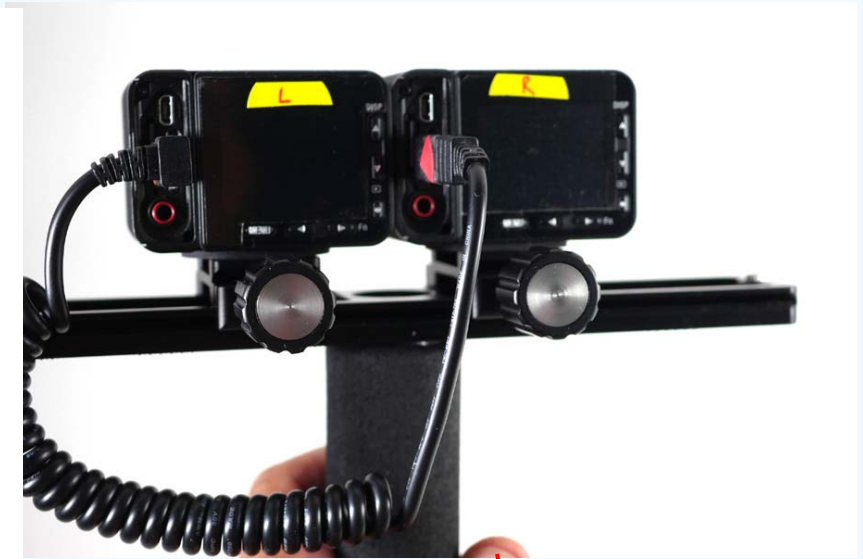Earlier gently used are affordable

Sony RX0 camera

60 mm

40 mm

- Zeiss 24mm (equiv) lens
- F4 fixed aperture
- Tilting screen (II)
- Multiport terminal
- Waterproof
- Tripod socket

Twin RX0 camera mounting

60 mm

40 mm

Advantages

- **Compact, easy to carry**
- **Good quality wide lens**
- **Excellent synchronization**
- **Simple connection**
- **Variable stereo base from 60mm** (or 40mm bottom-to-bottom)
- **Tilting screens**
- **Splash proof, shock proof**

Issues

- **Image quality not great**
- **JPEG over processed**
- **Wide angle lens not ideal**
- **No image stabilization**
- **Tends to overexpose**
- **Does not handle high contrast or backlit scenes well**
- **Small screen (difficult to see)**
- **Small / minimal buttons (difficult to change settings)**
- **Not robust built**

Bottom Line: It is a compromise

- **You get variable stereo base (with short minimal) & excellent synchronization in a compact package**
- **But not the image or built quality of other larger cameras (RX10, or RX100) which have the same sensor but better (zoom) lenses, better image processing and more features (stabilization, easy to use controls)**

Sony RX0II at ground level, using tilting screens to compose

Sony RX100

90 mm

60 mm

115 mm

75 mm
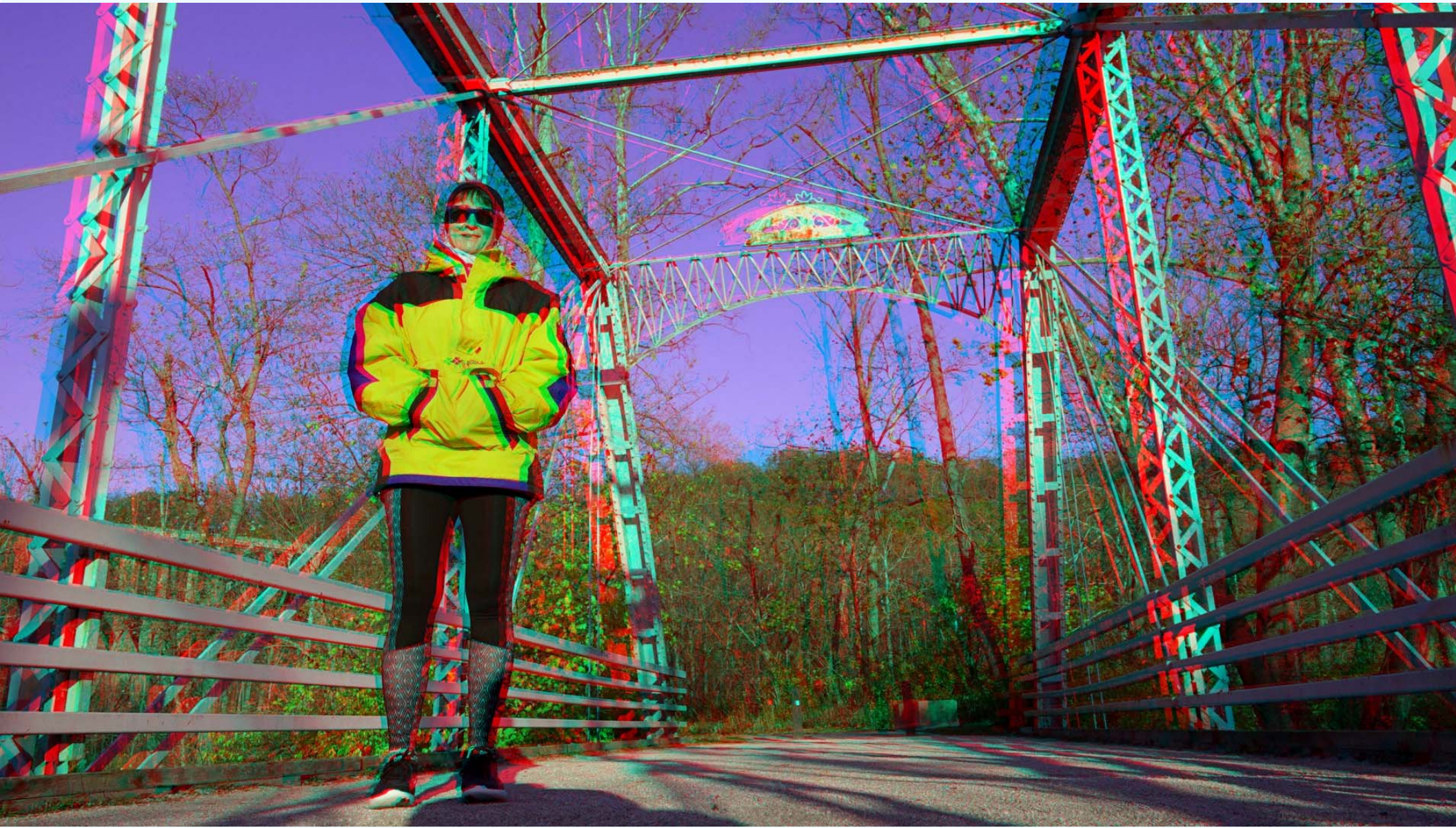
- Currently there are **7 versions** of the RX100, summarized here: https://en.wikipedia.org/wiki/Sony_Cyber-shot_DSC-RX100 all have multiport, except for 1 (avoid)

- **All cameras have the same dimensions: 102 x 58 mm**

- Lenses vary: **28-100 f1.8** (1, 2) **24-70 f1.8** (3-5), **24-200 f2.8** (6-7)

- EVF: 3-7

Show during cruise. Sony RX100 vi

Tips for Using Twin Cameras

1. Matching settings

- **Shooting mode / Exposure**

- **Focus (single auto focus - avoid C)**

- **Zoom (step)**

Control Ring — Zoom

Zoom Func. on Ring — Step

Sony RX100

2. Firing Shutter:

Half-press shutter to lock focus, **fully-press** to fire the shutter

(if you hurry, you will most likely end up in mis-synchronization)
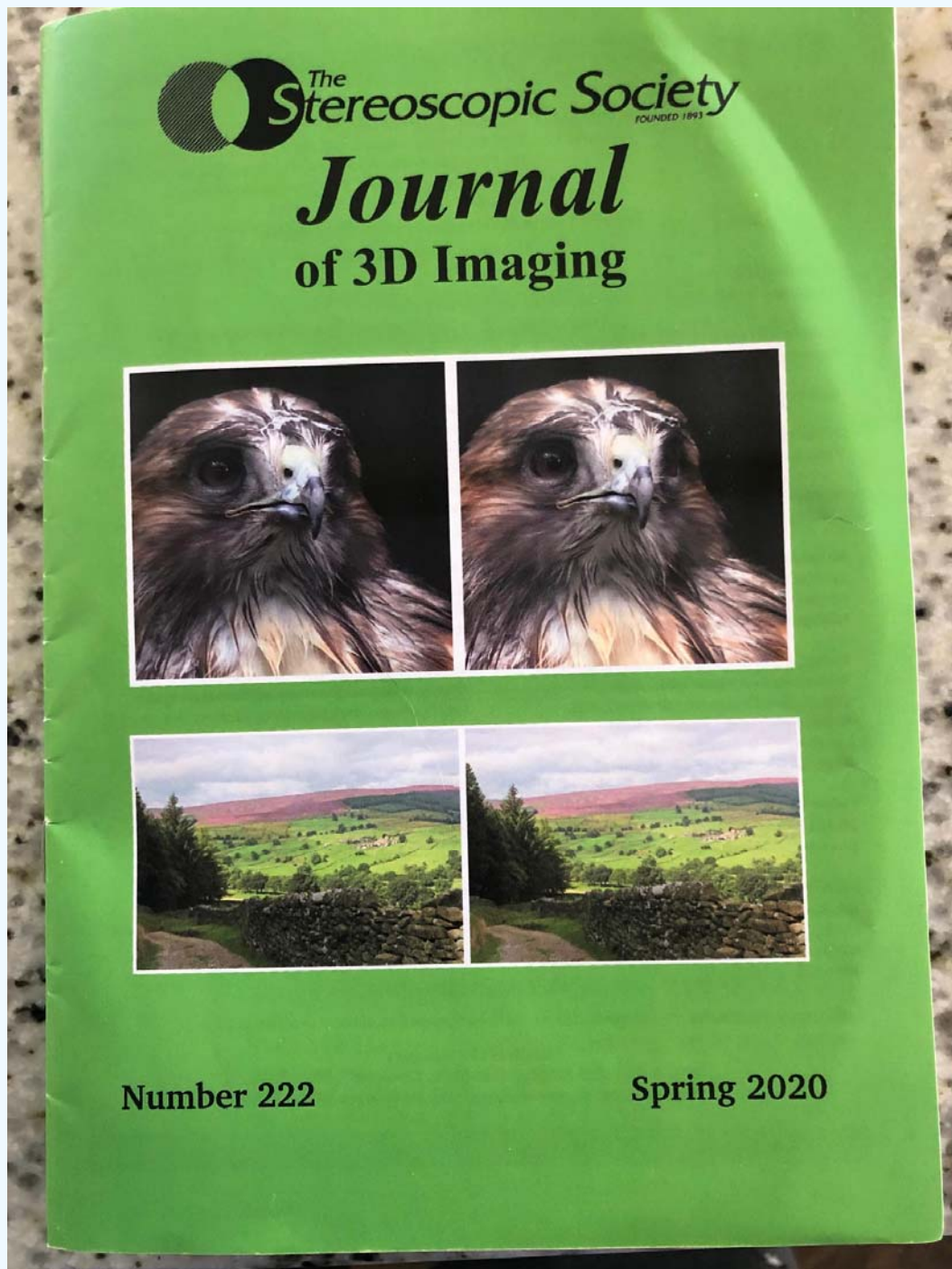
Twin Sony RX10 IV

- 25x ZEISS Vario-Sonnar T* zoom lens, (**24-600mm**)

- 20.1MP **1" Sensor**

- Perfect for **long distance nature photography**

- I use it in the configuration shown here which allows me to **compose in 3D**

Twin Sony RX10

The
Stereoscopic Society
FOUNDED 1893

Journal
of 3D Imaging

Number 222   Spring 2020

**2020 Stereoscopic Society Annual Exhibition and Competition
Competition Secretary's Report**   *David Ford*

The competition this year has been memorable for a number of reasons. As usual, the competition is divided into nine different categories, and it is most unusual for any individual to win more than one section. However, this year Brian Davis won the print and common theme sections, while David Kuntz and George Themelis each won two digital sections. Five out of the six digital sections were won by American members, the 'People and Pets' section winner being Robert Blomberg. The remaining digital section was won by myself to my great surprise, the great surprise of my wife, and a great surprise to the selectors, when the identity was revealed.

There was considerable discussion over the winner for the slide section, and for the first time ever it was decided to award a joint win to images by John Taylor and Fred Lowe.

Again, American members did well as runners-up in the digital sections with four awards. The remaining runner-up images were from members within the United Kingdom. We also received some excellent images from those living in continental Europe.

It is unusual for somebody entering the competition for the first time to be a winner or runner up, but Kate Sullivan achieved this.

Sixty members entered the competition, the same as last year. Slide images continue to decline in number and also the number of prints, while interest in the common theme increased slightly.

For the third time George Themelis won the image of the show, with a splendid image of a hawk. This is a new record.

Journal 222 Spring 2020   9

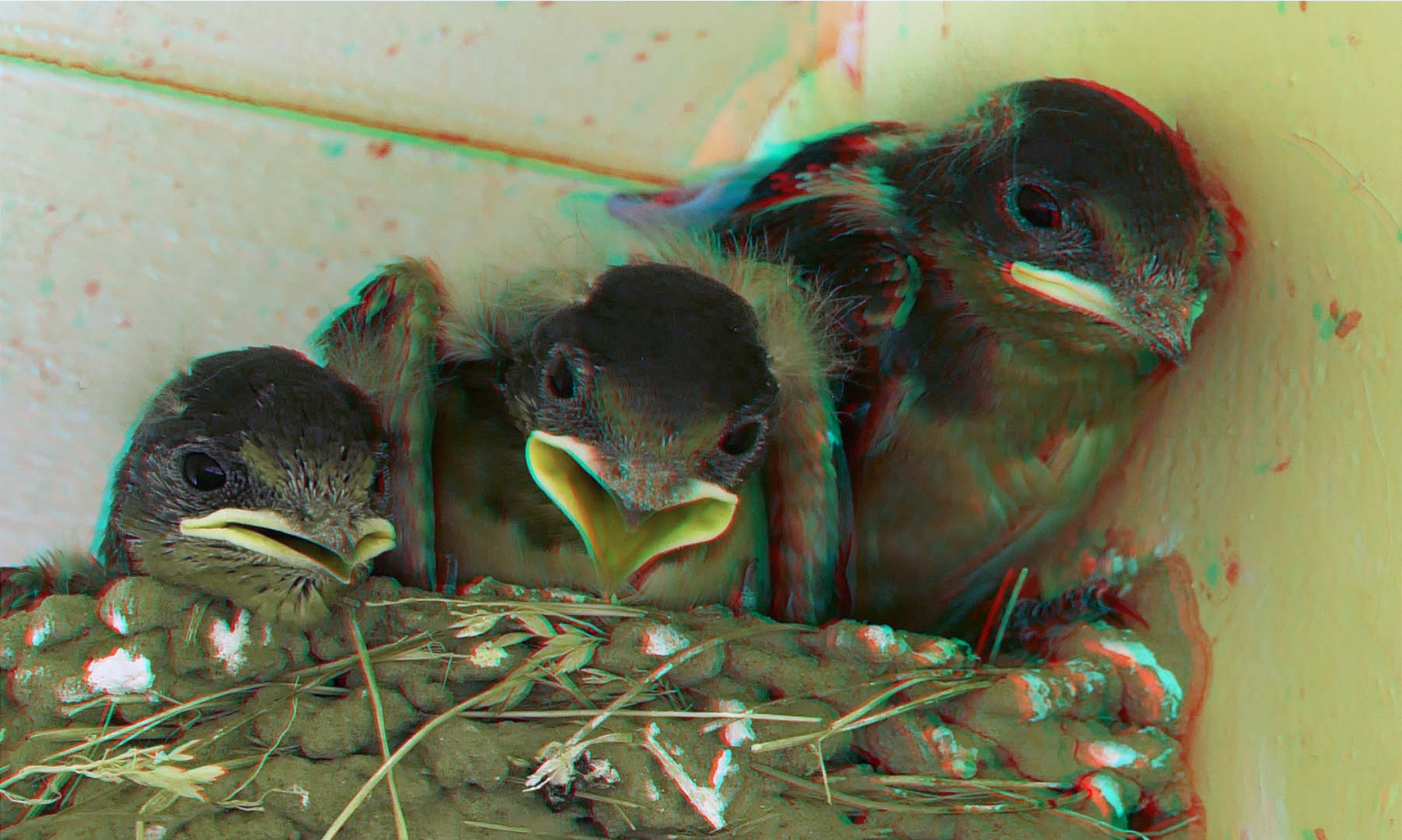## Man Made Objects

Winner   George Themelis

Spinning Water

19
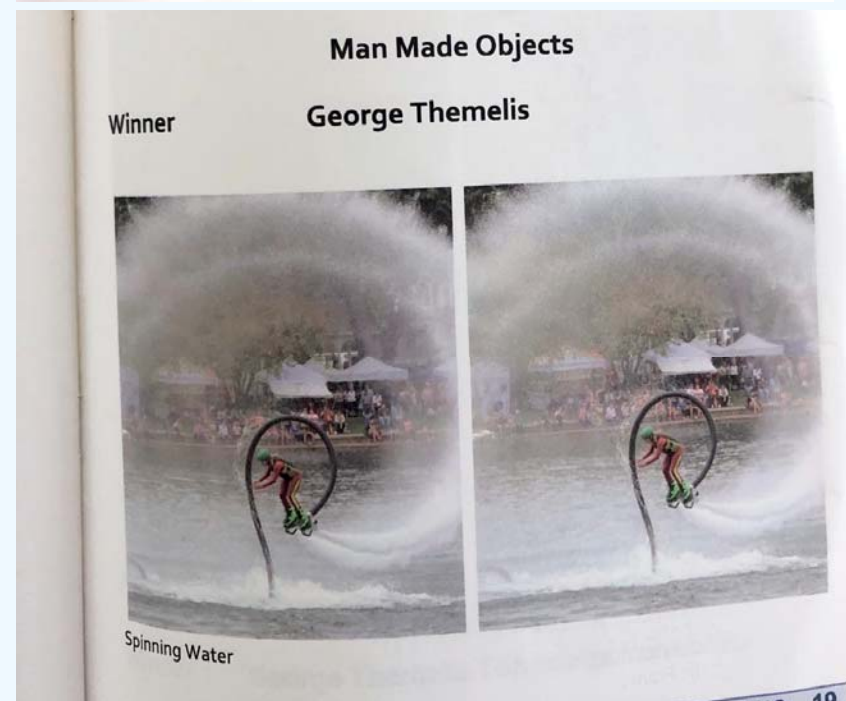
Hawk at Bird Rehabilitation center, Sony RX10 (zoomed at 600mm)

Bird nest - Sony RX10 zoomed at 600mm and cropped

Shot with the Fuji W3 zoomed at 135mm from the same spot (compare the size)

Fuji W3 @ 135mm
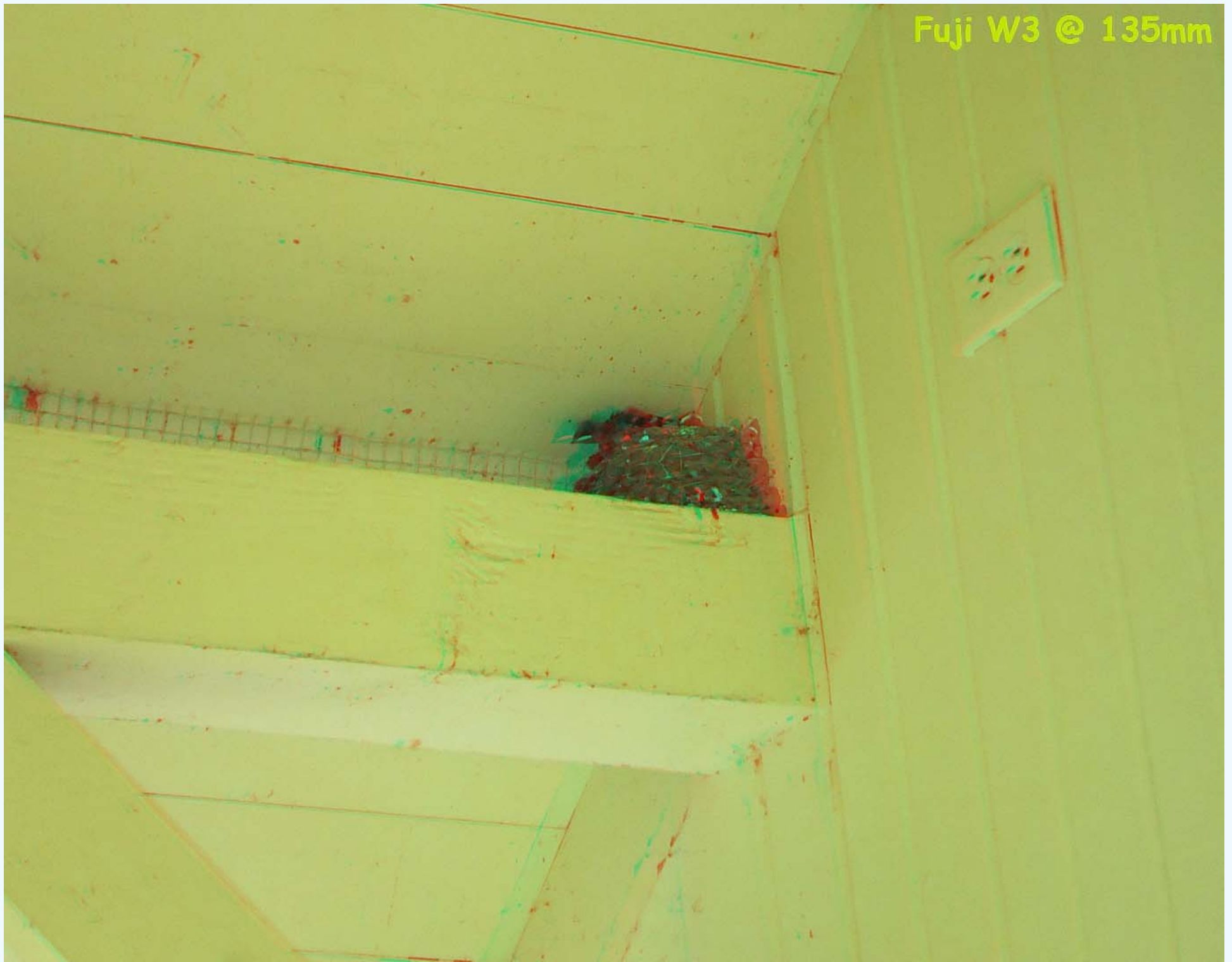
Viewing in 3D - A Luxury?

- **See a clear & sharp 3D image** even under full sun

- **See camera alignment** zooms matched, vertical alignment

- **See & set the stereo window** by adjusting the convergence

- **See the 3D composition** & move around to improve it

- **See the background** & move around to eliminate distractions

- **Improve ratio of good pictures** & reduced time in post processing

- **Preview the picture taken in 3D** for mirrorless cameras, not DSLR

It's like using a Giant pair of
Binoculars

Sony RX1RII

- **Full-frame** camera

- **42.4 MP** sensor (allows for extreme cropping)

- **Fixed** Zeiss Sonnar T* **35mm f/2 lens**

- **Compact** (for the sensor size)

- Physical Controls & Magnesium Alloy Construction = **professionally built**

Configuration	Min B
Bottom-to-bottom	66 mm
Overlapping	~100 mm
Side-by-side	~130 mm

Twin SONY RX1
The Ultimate 3D camera? - Part 2

What I like about the RX1

I have been using the Sony RX1M2 cameras for a few months now. I like them so much that I got a second pair so I do not have to switch from vertical to horizontal and waste time when I am out shooting. When I use them vertically (my preferred configuration), I have the aspect ratio at 1:1, which throws away 1/3 of the image. **Can this be a good choice for an all-around 3D camera?** For me, it is, for a number of reasons:

- It takes **beautiful 3D pictures**, especially nature (see #1 below).
- I like the **normal stereo base** for general 3D photography and I can also take good **portraits** (#2) and **close-ups** (#3).
- If I want longer effective focal lengths, I can get them by **cropping** (#4)
- The camera rig is really **compact**, two cameras attached bottom-to-bottom with a screw, no bars, etc. I can take it running with Vinny, #5 (**Fig. 1**).
- I like the simplicity of **fixed lenses / focal length**. I turn the cameras on and they are ready to shoot. There is no fiddling around with matching focal lengths or carrying / switching lenses.

- I rarely change settings from my standard: Aperture priority at f8 and 1/125s minimum shutter speed (the camera adjusts the ISO and shutter speed if needed). I increase the shutter speed if I shoot action. This camera is really **simple to use** if you understand basic photography and the effect of aperture, shutter speed, and ISO.
- The **lens** is fast (f2.0) and sharp, even wide open. I have taken long exposures at night with good results.
- The cameras are **built very well** (#6), the controls (aperture, exposure compensation dial) are stiff, everything works well and is trouble-free. I rarely miss shots due to wrong settings, and I keep most of the 3D pictures I take.
- **Synchronization** is good (not prefect), typical of Sony cameras with multiport (see **Fig. 2**)
- With one pair of cameras, I can switch from bottom-to-bottom to side-by-side. This takes less than a minute, but I need to carry a bar. Not very convenient, but definitely possible. **Hyperstereos** are then possible.
- Extra bonus: The cameras are synchronized with **electronic flash** most of the time. This opens up the

possibility of using these cameras for studio work (#2).

#1 – Nature Photography: Through my 12 years of digital photography, if there is one type of photography that I found unsatisfying, it is nature/scenic 3D photography (landscapes, not close-ups). With the RBT S1, I took great pictures of nature, landscapes, trees, mountains, etc. With digital, nope! There is something called "color fringing" where you see bluish around small details (like leaves against the sky) something that I had never seen with film (I discussed this earlier when I reviewed the Sony RX0). If you look close at details, you realize that compact digital cameras with smaller sensors cannot give you the quality that you were getting with 35mm full frame film cameras for nature landscape photography. The RX1, even though it is not perfect, it is as close to film quality as I have seen. One particular challenge in nature photography is shooting **backlit subjects**. That's a good test for the quality of a camera/lens. Backlit photography works great with these cameras and I seek the opportunities to shoot against the sun peeking behind trees, etc. (see **Fig. 3**)

Fig. 1: What I enjoy the most about using the Sony RX1 cameras in the bottom-to-bottom configuration, is how compact to carry and easy to use they are. Even though the Sony RX1 is a rather heavy camera, without a bar it is compact, so it fits nicely inside a small camera bag. I carry the bag when running or everywhere I go. I also like the simplicity, just turn on and shoot without worrying about different settings (my standard settings are f8 and 1/125s) or changing lenses or matching focal lengths. I feel free to focus on my subject instead of fiddling with the cameras.

#2 - Portraits: For portraits (**Fig. 6**) I use Sony's "clear image zoom" setting. This is a setting where you double the focal length using a proprietary algorithm, without losing resolution. So the 35mm becomes 70mm. I use f2 wide open aperture, to throw the background out of focus. It works well. For studio work (like when going to PSA Conferences with model shoots) I can connect the cameras to the flash setup (not possible with any of my other digital camera rigs, except for the Samsung NX1000).

#3 - Close-ups: I simply shoot and crop later. So, say I see some mushrooms I want to photograph. I point the cameras at them and shoot from a relatively close distance. I then crop (**Fig. 4**). There are a lot of pixels in each picture so cropping is not a problem.

#4 – Zooming: The camera has a fixed focal length, so there is no zooming. But you can crop a lot, which has the same effect (**Fig. 5**). For example, I took a series of pictures of a train coming towards me, using the cameras side-by-side. In the first picture, the train was far away. I cropped the picture to HD resolution. The original picture size was 7952x5304 pixels. From that size, I cropped a 1920x1080 section. This increases the effective focal length by 5304/1080 ~5x so it is like I have used a 5x35mm = 175mm focal length lens.

#5 - Running with Vinny: A while back I published a Tutorial where I tried a variety of stereo cameras/rigs while running every morning on the trails with Vinny. I needed something compact (for hiking/running) that takes good low light nature shots and has a short/normal base. I tried the Fuji W3, Panasonic 3D1, Sony RX0, Sony RX100. I took decent pictures with all these rigs, but concluded that the Sony RX100 in overlapping configuration gave me the best results. Well, now I have been running with Vinny with the Sony RX1 vertically, and this setup is even better.

#6 – Quality of Construction: Even though I bought all my cameras well-used, they are all working fine. The quality of construction is very good and I do not see any weak points or anything going wrong. This is in contrast to other

Fig. 2: I love photographing action with the RX1 rig. Here is Vinny jumping over a log, under the watchful eye of my wife, Liz, in the back. For these pictures I set the camera at 1/500s and f8. The challenge is making Vinny jump, not using the cameras. Synchronization is usually excellent., but you need to take more than one shot, just in case the synchronization is off.

Fig. 3: Nature Photography and backlit scenes work very well with these cameras.

Fig. 4: Close-ups are very easy: Point the cameras at close range and shoot, then crop later.


Fig. 5: There is no optical zoom with these cameras but zooming can be achieved by cropping. I took this picture of the train from far away and cropped to about 5x enlargement. The end result looks as if I had used 35x5 = 175mm lenses. I like the long focal length perspective.

cameras I have used (Samsung NX1000 is one example, or Sony cameras like the RX0 or RX100). I am known to be a bit rough in handling my equipment (dropping cameras, etc.) so it is nice to know that these cameras can take some abuse and still work fine.

Mt Rainier at NSA 2022 (Sony RX1II - example of scenic shot)
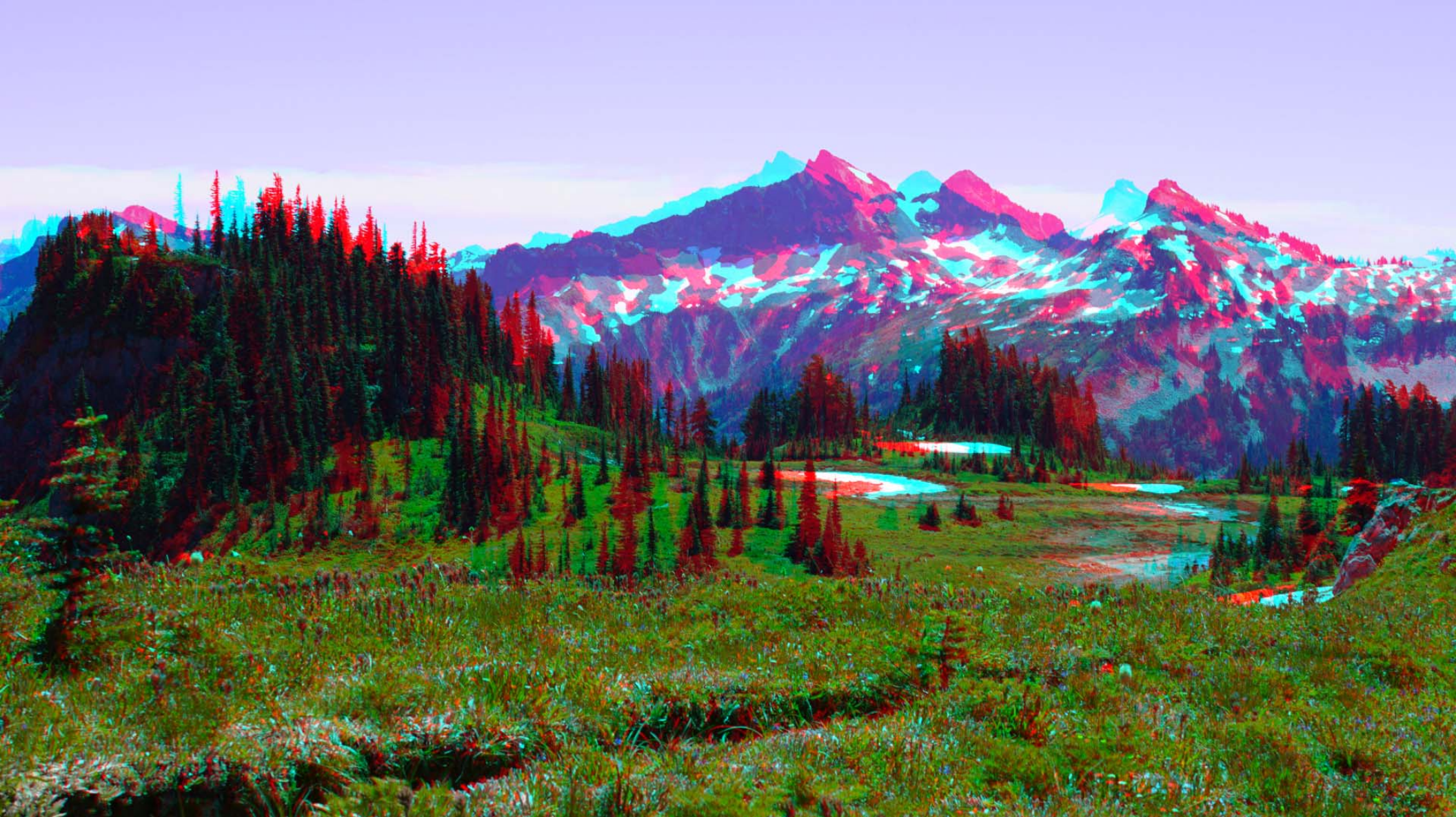
Tacoma at Night, NSA 2022 (example of night photography with the Sony RX1)

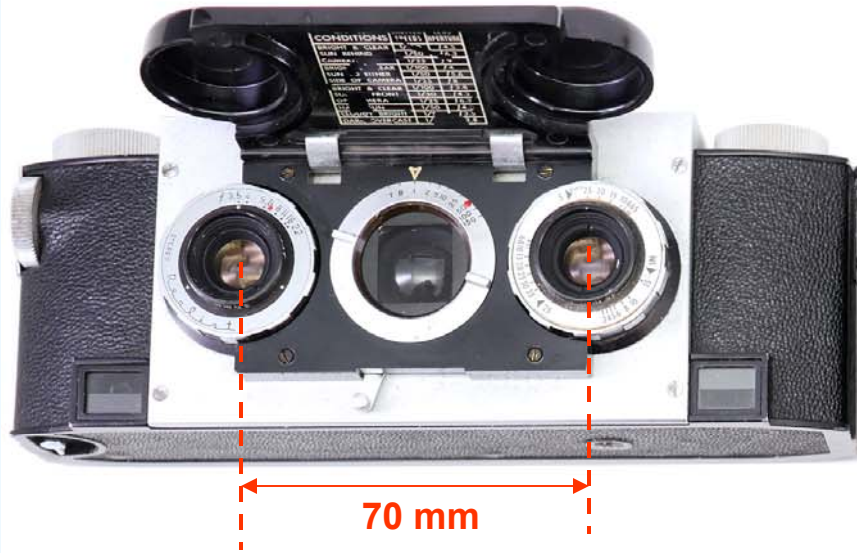Example of extreme cropping with the Sony RX1

Left: Original pictures using the fixed 35mm lenses

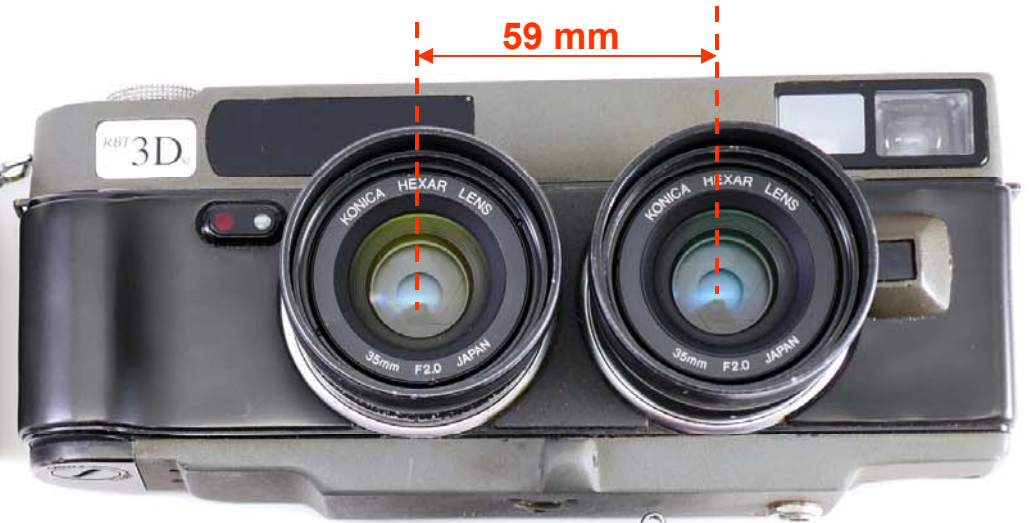Bottom: Cropped about 4x (~135mm eq. FL) for a nice portrait

Favorite Stereo Cameras through the Years

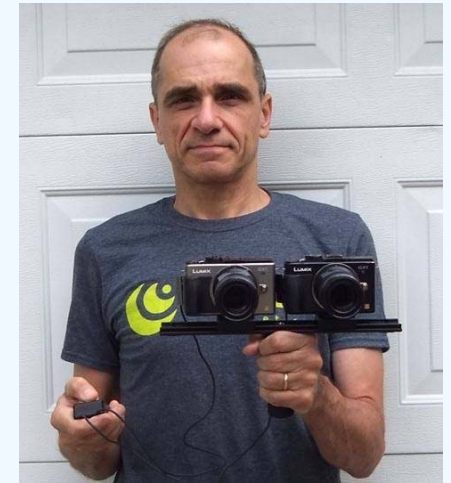**Stereo Realist (1984)**

RBT S1 (1994)

59 mm

70 mm

75 mm

Fuji 3D (2009)

Sony RX1 (2022)

66 mm

3D with TWIN CAMERAS

- **Why? Better quality, variable stereo base, choice of lenses, etc.**

- **No one system is perfect (compact, easy to use, normal base, good synchronization) or good for everything**

- **Keep looking / experimenting!**