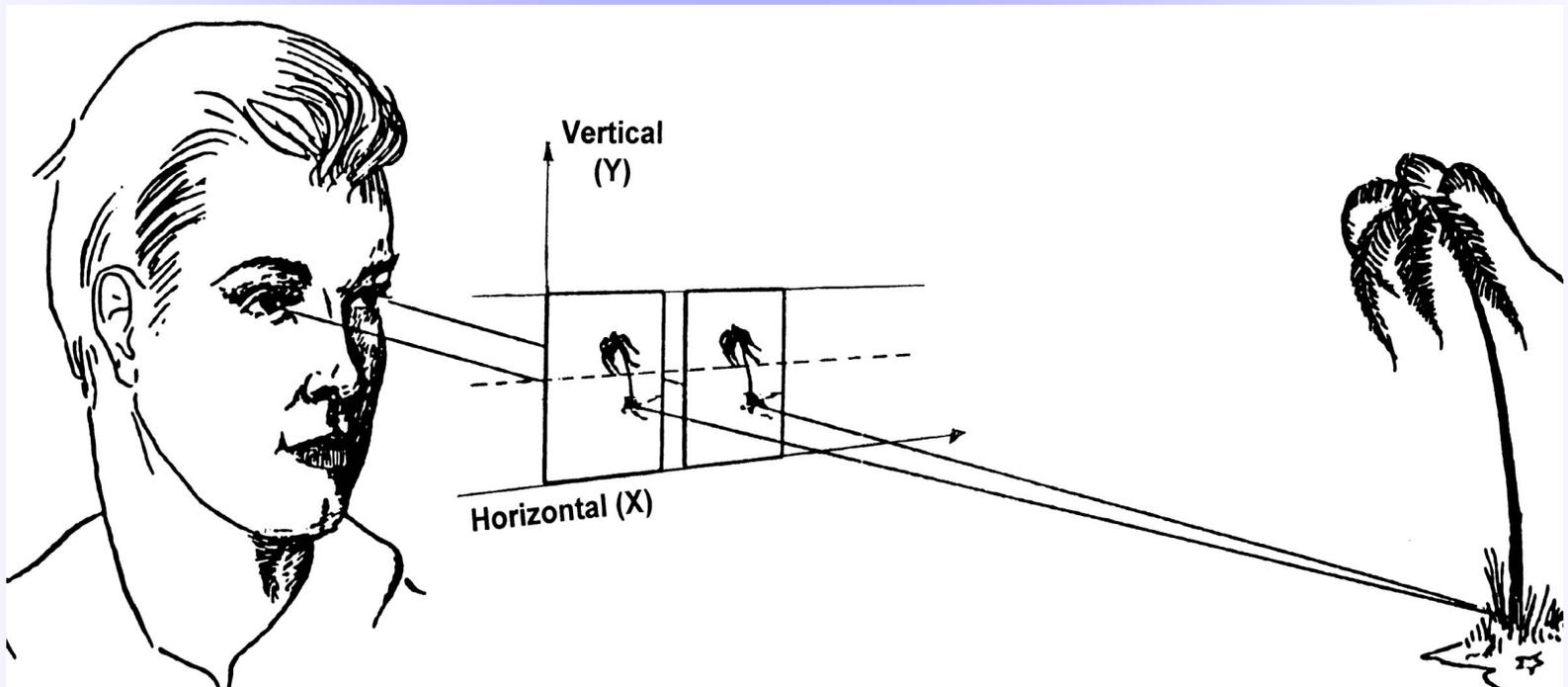


Digital 3D Photography 101



**An introduction to Digital Stereoscopic (3d)
Photography by George Themelis**

Detroit (DSS) - September 2011

Digital 3D 101

- 1. How to take digital 3d pictures**
- 2. How to view digital 3d pictures**
- 3. How to edit digital 3d pictures**
 - Alignment - Cropping - Adjusting stereo window
- 4. How to improve digital pictures**
 - Contrast - Color Saturation - Sharpness
- 5. How to prepare 3d pictures for DSS competitions**
- 6. My personal workflow**

Notes at: www.detroit3d.org

How to Take Digital 3D

1. Digital 3d camera (Fuji)



2. ONE digital camera & shift

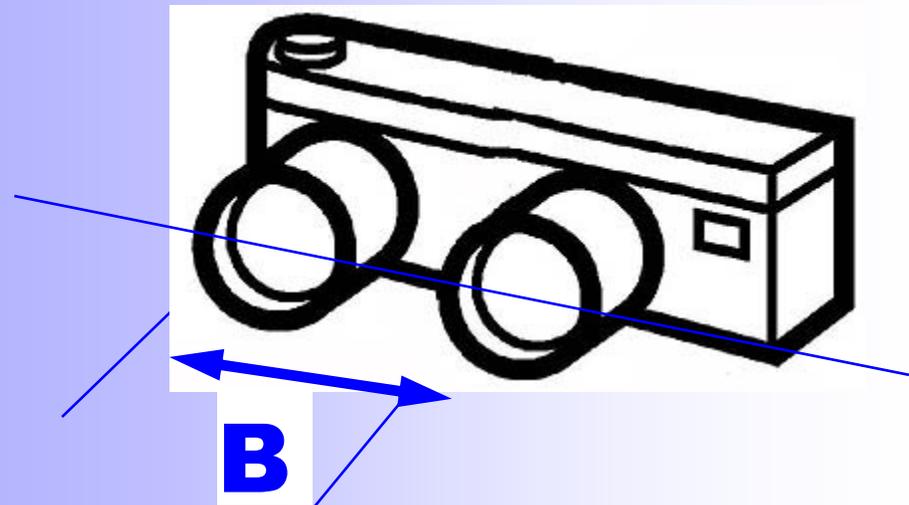
3. TWO digital cameras



4. 2D camera & stereo attachment

1. Digital 3D Cameras

A digital stereo camera is, in my opinion, **the easiest and most convenient way to take stereo pictures.**



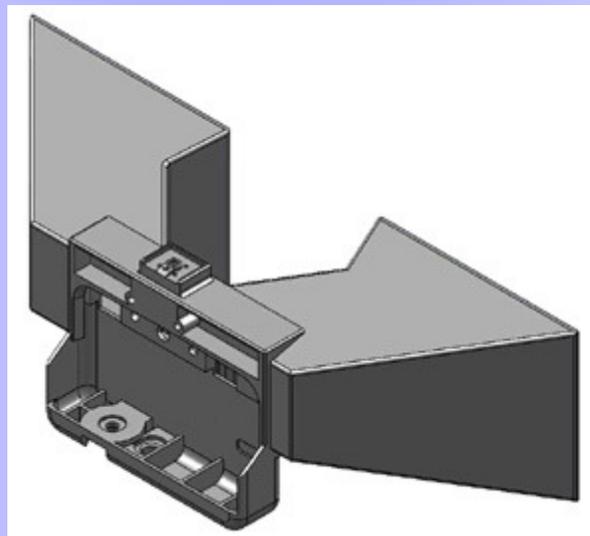
Fuji Attachments

www.cyclopital3d.com



Ken Bugress of cyclopital3d.com has produced with 3 attachments for the Fuji:

- 1) **Macro/Close-up** attachment (25mm)
- 2) **Auxiliary** lens attachment
- 3) **Base Extender** (225mm)



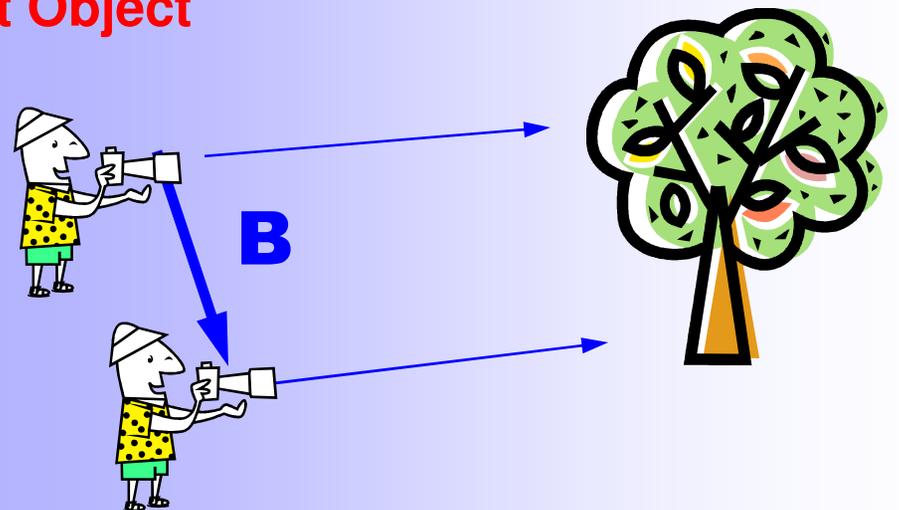
2. ONE camera & shift

A **single 2D camera** is perhaps the **easiest** and **least expensive** way to start, especially if you already have a digital camera. All you need to do is take one picture, shift the camera, take another picture, and you are done!

I know a few stereo photographers who are shooting 3d with a 2d digital camera exclusively.

Big advantage: Flexible stereo base!

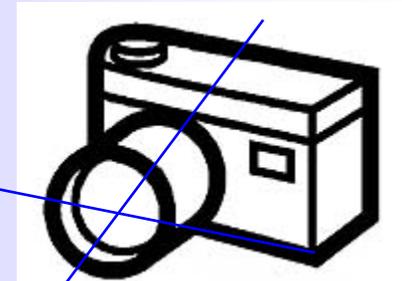
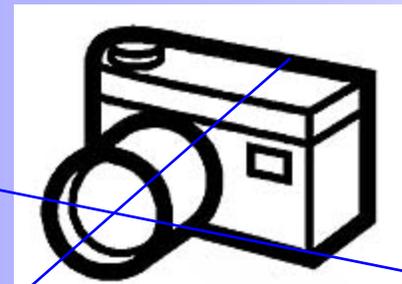
Starting recommendation for Stereo Base:
65mm or $\sim 1/30 \times$ Distance Of Nearest Object



3. TWO Digital Cameras

Synchronization of the two cameras is an issue with digital cameras, as it is with film cameras. Some solutions:

1. **Finger Synch**
2. **StereoData Maker**
3. **Hard-Wired**



B

Stereo Data Maker (SDM)

StereoData Maker (SDM) is an ingenious synchronization method that has been developed for certain Canon digital cameras.

This involves using a cable and switch to connect the two cameras, and software to control them. The software is free.



For more details, see:

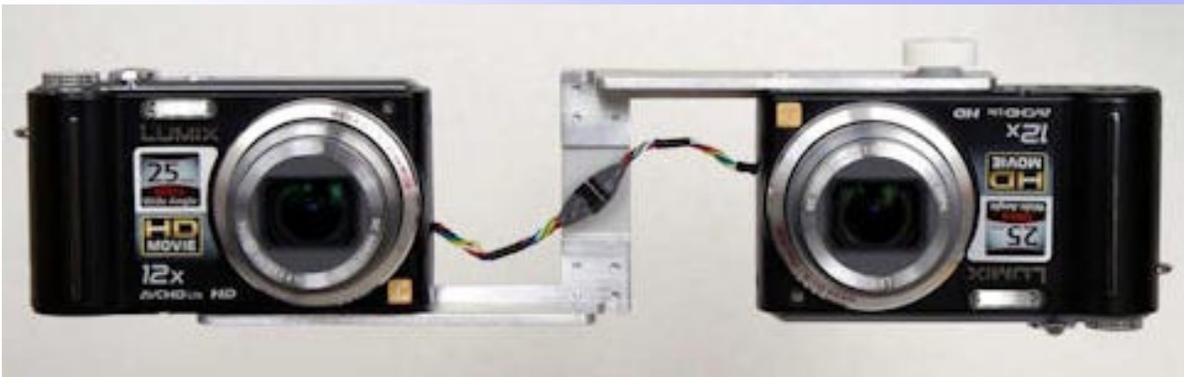
<http://stereo.jpn.org/eng/sdm/index.htm>

(Photos courtesy of Werner Bloos, http://www.digi-dat.de/produkte/index_eng.html#SDM_flash)

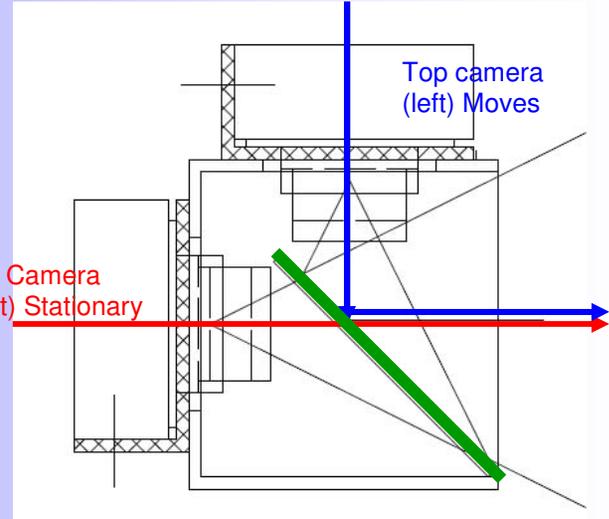
I personally have no experience with SDM but a lot of stereo photographers use this system.

Hard-wired Cameras

Co Ekeren (Netherlands): www.ekeren3d.com



(Photos courtesy of Co Ekeren, www.ekeren3d.com)



Semitransparent Mirror (beamsplitter)

- Cameras can be taken apart and separated further (hyperstereos)
- Possibility of Pole 3d photography.
- Possibility of macro photography (Macrobox)

4. Stereo Attachments



LOREO 3D Lens in a Cap

3D effect by transposing two images. No keystone imperfections. Matched pair of lenses, focusing range from one meter to infinity. f11/f22 lenses, focal length 38mm.



LOREO 3D Lens in a Cap 9005 (APS-C) (Model 9005A)

Patented stereo 3D by transposing two images. f11/f22 lenses. Focal length 46 mm. Designed for APS-C format cameras. Digital built-in lightmeter & meter-averaging system. Patented.



In Mei Foo Park - with 3D 9005

LOREO 3D Lens in a Cap 9005 - APS-C - Model 9005A
f/11, 1/150 sec, Canon EOS 40D Digital SLR, ASA 200, outdoors, PS Autolevels



Cockatoo having her head scratched

LOREO 3D Macro Lens in a Cap
f/22, 1/250 sec, Canon 10D Digital SLR, ASA 400, outdoors

Advantage: Convenience

Disadvantages:

- Limited range of focal lengths f-stops, maybe stereo base
- Distortions
- Favors vertical (portrait) format



LOREO 3D Macro Lens in a Cap

3D effect by transposing two images. f11/f22 lenses. Focal length 38mm reflective 60mm. Designed for full-frame Digital SLRs.

- Possible an acceptable solution for someone how does mostly 2d with only occasional 3D
- Most serious stereo photographers have traditionally stayed away from stereo attachments

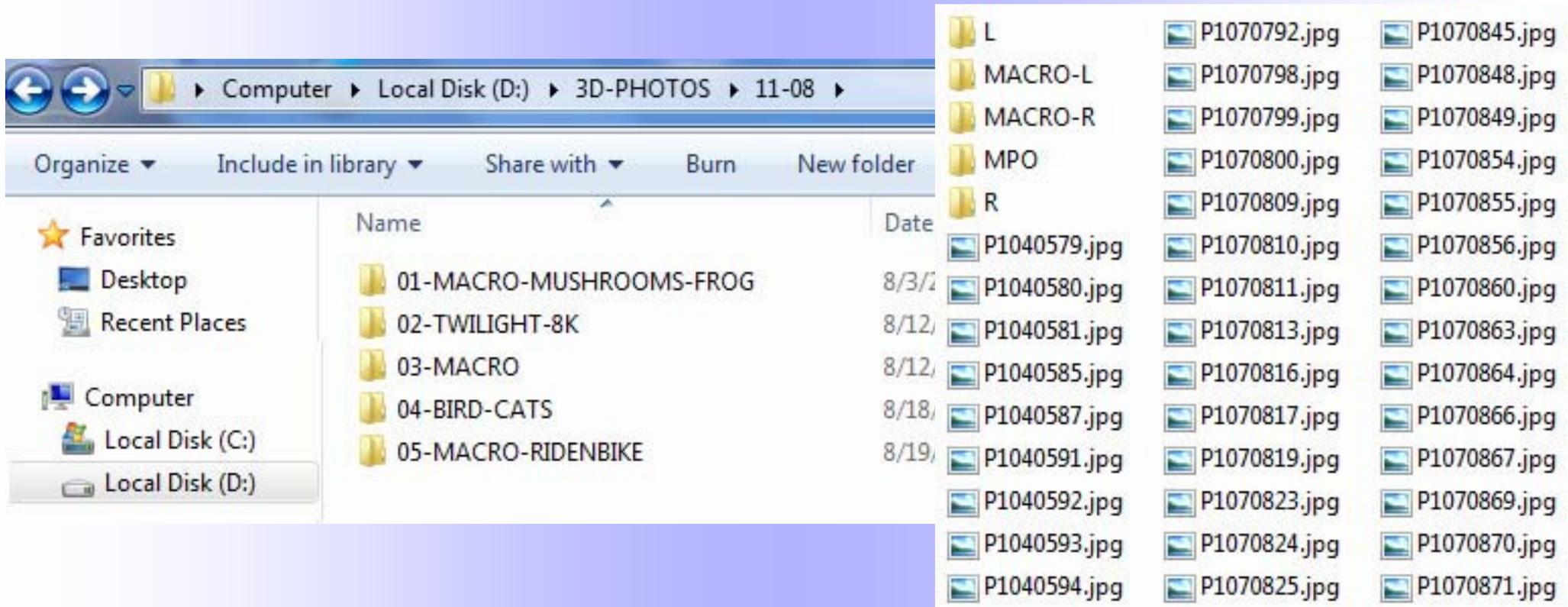
Taking Digital Stereo—Summary

Method	+	-	Files
Stereo (3D) digital camera	Most Convenient	Rather expensive, fixed B	1
Single (2D) digital camera & shift	Least Expensive, flexible B	Limited subject, rather advanced	2
Two cameras—wired or SDM	Flexible stereo base, versatile	Potentially Expensive, advanced	2
2D camera & stereo attachment	Convenient	Limited (best for 2d with occasional 3d use)	1

What's Next?

Transfer Pictures to computer & Organization

1. Create folders to hold your images
2. Remove the memory card from the camera, put it in the computer, copy files



MPO vs JPG ?

Digital Image File Formats

Extension	Full Name	Type	Uses
.JPG	JPEG—Join Photographic Experts Group	Compressed	Most common
.MPO	MPO—Multi Picture Open Format	Compressed	Used for 3d images
.TIF	TIFF—Tagged Image File Format	Lossless	Some people used it instead of JPG
.GIF	GIF—Graphics Interchange Format	Lossless	Mainly for graphics with few colors, small files
.BMP	BMP—Windows Bitmap	Uncompressed	Very large files

The Fuji 3d camera by default (as it comes from the factory) saves two files:

- **JPG** file is 2d (only one side of the 3d image)
- **MPO** file is 3d (both sides in one file)

Windows and many programs do not know yet how to deal with MPO
Thankfully, SPM does!

StereoPhoto Maker (SPM)

Powerful & free software that works with digital stereo images (viewing, cropping, aligning, changing size/format, etc).

You can download SPM from here: <http://stereo.jpn.org/eng/stphmkr/>



Getting Started with SPM

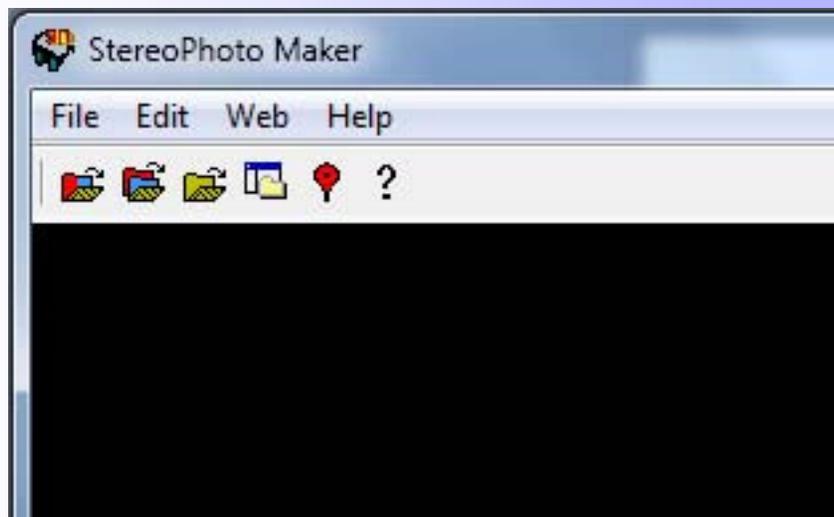


SPM Menus—Three Ways to do something:

1. Use the pull-down menus.
2. Click at one of the buttons at the top (under the menu line).
3. Use a keyboard shortcut key.

Useful SPM Shortcuts

<i>Key</i>	<i>Function</i>
W	Open Stereo Image
Space Bar	Open next file in same folder
Backspace	Open previous file in same folder
F	Resize image to fit the screen
J	Make image to 100%
X	Swap right and left
A	Starts/Stops Slide Show
Arrows	Move Stereo Window
Enter	Toggle Full Screen/Menu Screen
S	Save Stereo File



HOW to VIEW digital 3d

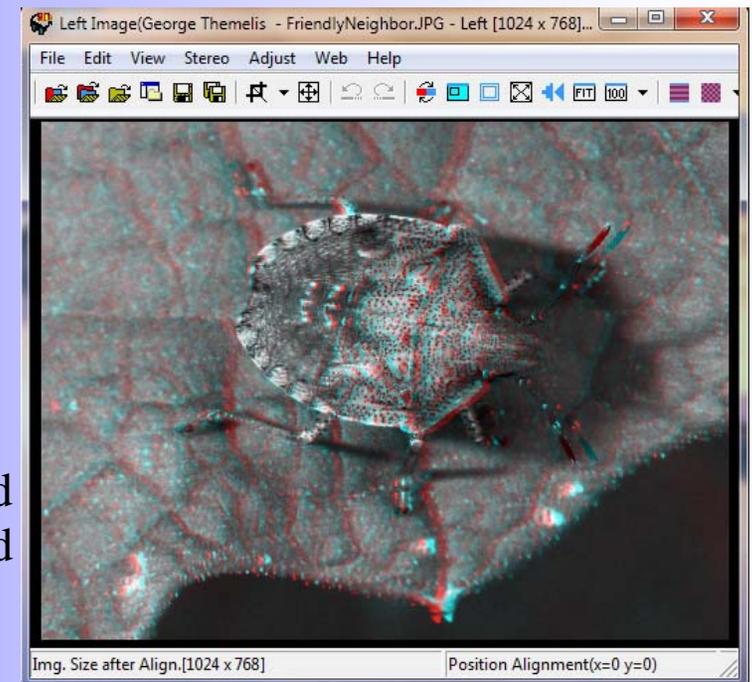
In the Computer (with SPM):

- 1) **Freeview**, (parallel or cross-eye)
- 2) Use a **simple viewer** (Loreo, Pokescope)
- 3) Using **anaglyph** format & glasses

Other methods include:

- 4) **Digital projection**
- 5) **Digital viewer** (Cyclopital, ipod & My3D)
- 6) **Making prints**
- 7) Convert digital images to **slides**
- 8) **3D Laptops/screens, TVs**

Personally, I use the **Acer 3D laptop** or my Zalman 3d computer monitor, and a pair of circularly polarized glasses both to preview and view my digital 3d images.

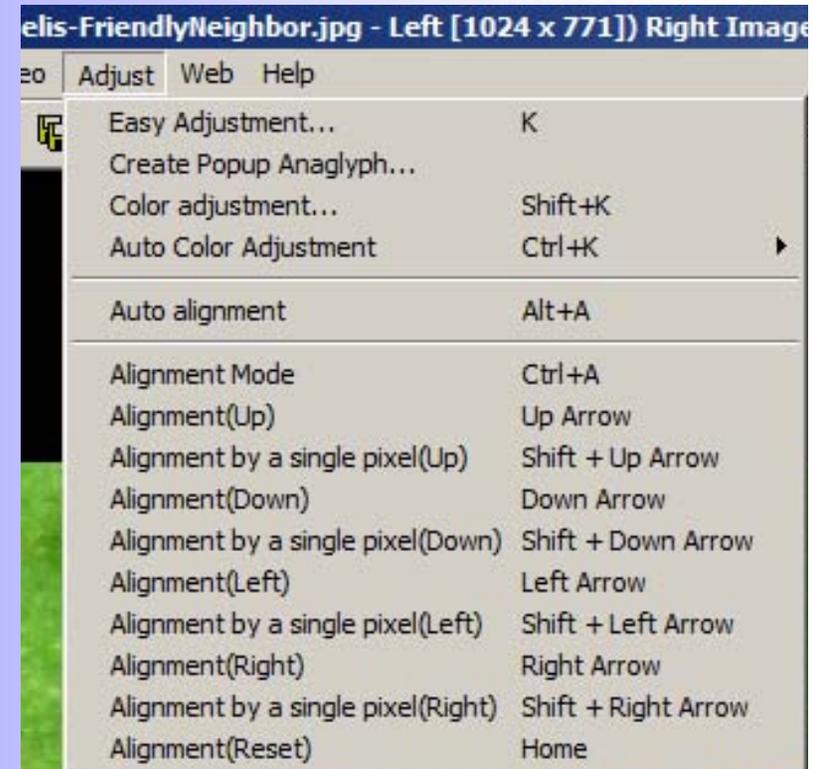


HOW to EDIT Digital 3D

1. Alignment
2. Cropping
3. Adjustment of Stereo Window



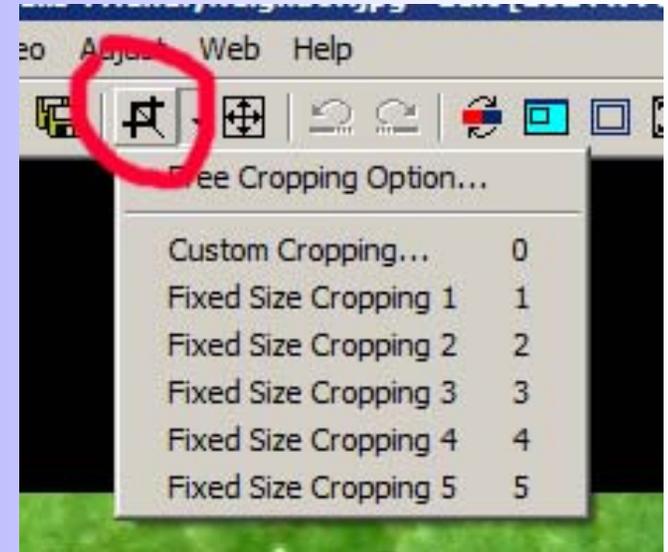
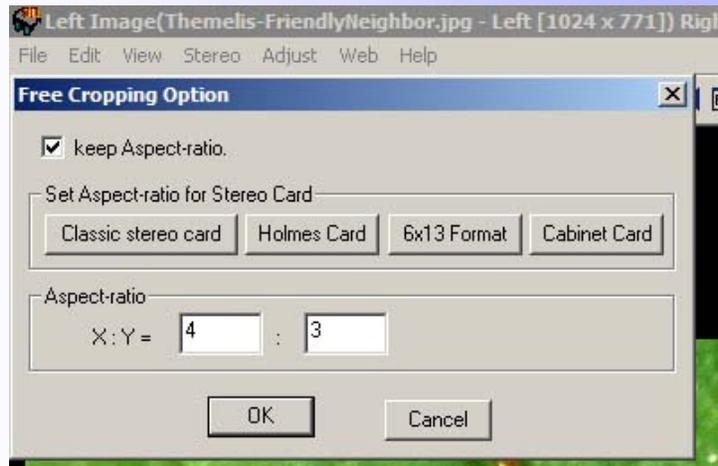
1. ALIGNMENT



Auto alignment values

Rotation(deg.)	L: -0.1 deg.	R: 0.0 deg.
Size	L: 0.1 %	R: -0.2 %
V_Perspective(deg.)	L: 0.7 deg.	R: -0.7 deg.
H_Perspective(deg.)	L: 0.1 deg.	R: -0.2 deg.
Position V:	-7 Pixels	
Position H:	-29 Pixels	
disparity of the infinity points:	1/29(124/3648)	
Correct barrel distortion before Auto-adjustment:	0.0	

2. CROPPING



3. STEREO WINDOW Adjustment

- The stereo window can be adjusted by using **the right and left arrows** of the keyboard
- This moves the entire image back and forth (in the z-direction) with respect to the screen
- It is best to view the image in 3d while adjusting the stereo window
- This is unique in 3d and a powerful 3d composition tool

For some reason, SPM does not consider window adjustment as a change of the image and will not warn you to save the image before loading another one, and the window adjustment will be lost. So **remember to save the image if you want to make the window adjustment permanent.**

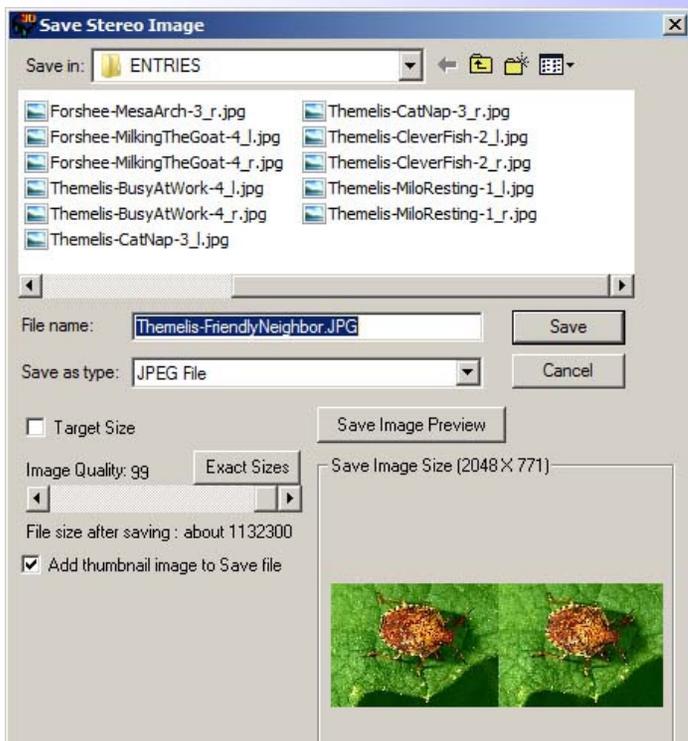
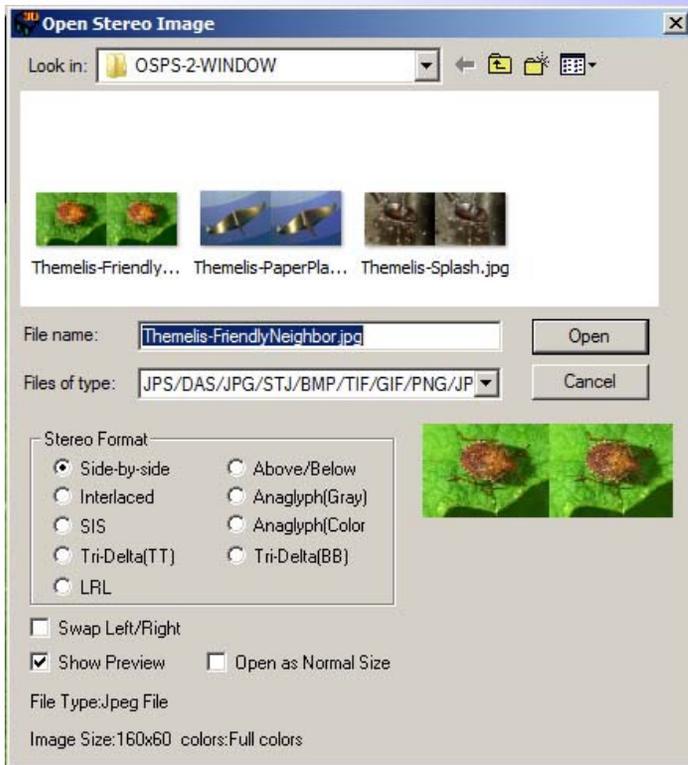
OPENING & SAVING FILES

Opening a file

A stereo image can have many forms. The most common are:

1. **Side-by-side**
2. **Left and Right images in separate files**

- You can open the next file in the same folder by pressing the <Space Bar>. To go to the previous file in the same folder, press <Backspace>.
- SPM can only work on one image at a time
- You can open as many copies of SPM as you want and have each one do different things.



Saving a file - Caution!

- Before saving a stereo image, bring it back to parallel format.
- I save my files as JPEG. Set image quality to the highest value (99). You can also save the file in other file formats, including MPO, TIFF, etc.
- **IMPORTANT:** SPM saves the file not in the folder it came from but in the folder SPM used to save a file the last time. SPM will ask for confirmation if a file with this name exists in the folder when you are trying to save it.
- You can save a stereo image in a different stereo format.

OUTLINE

- 1. How to take digital 3d pictures**
- 2. How to view digital 3d pictures**
- 3. How to edit digital 3d pictures**
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- 4. How to improve digital pictures**
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- 5. How to prepare 3d pictures for DSS competitions**
- 6. My personal workflow**

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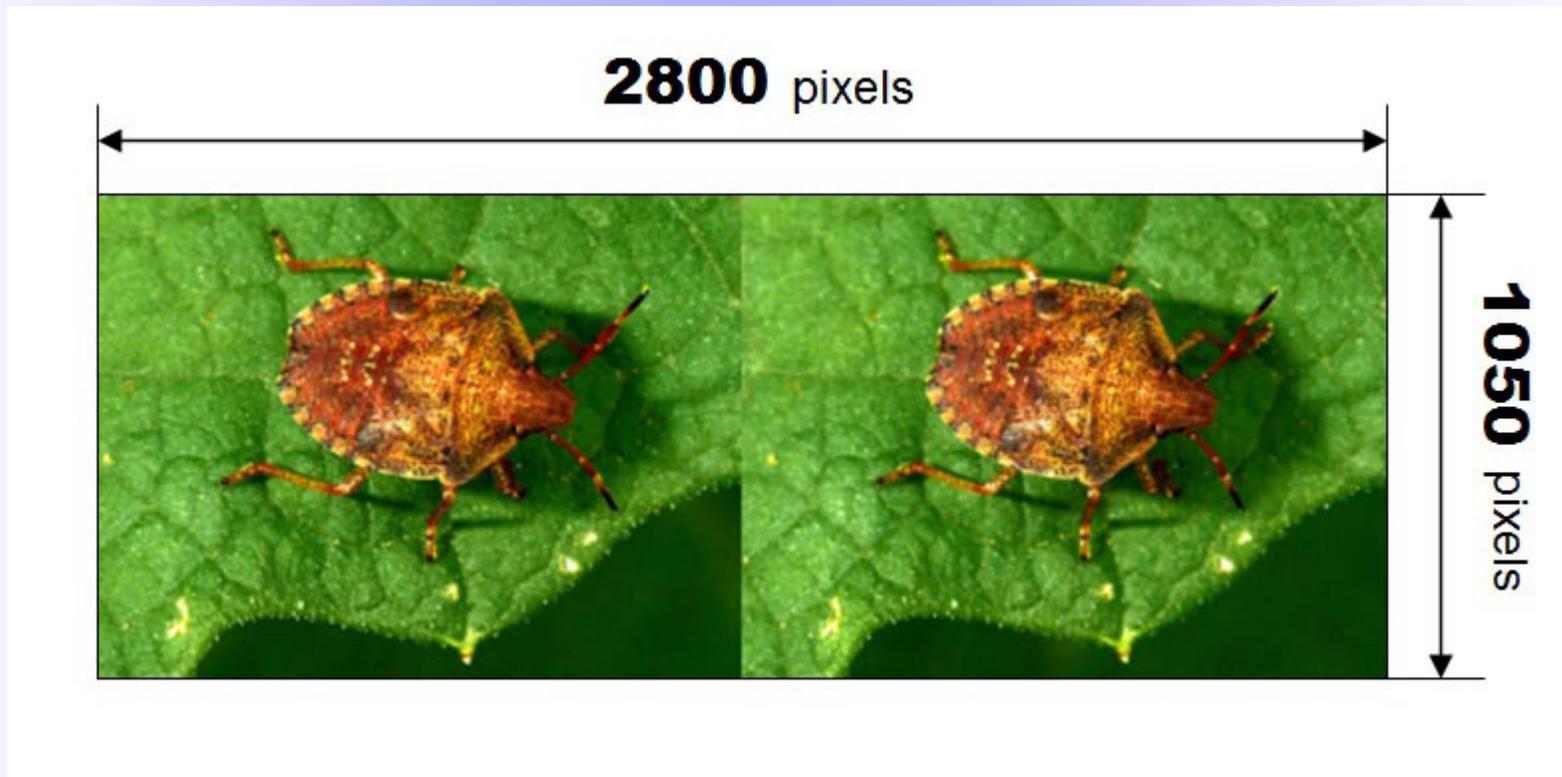
HOW to IMPROVE

Digital 3D

- 1. Brightness & Contrast**
- 2. Color Saturation**
- 3. Sharpness**

- Need a regular photo editor: Photoshop, Photoshop Elements
- Free photo editors can be downloaded from the internet
- Most images can be improved by just clicking “Auto Contrast”, “Auto Levels”
- There is a lot more than can be done—beyond the scope of this Workshop

HOW to Prepare Images For DSS Competitions



Arrangement

Stereo Pairs must be **side by side in parallel format** (one image containing the Left image in left side, right image in right side). Borders are not required and are not encouraged, unless if you feel that they are needed for the presentation. We recommend that you use StereoPhoto Maker (SPM) to align your images and adjust the stereo window.

2. Resolution (Size)

1400x1050 for each image or **2800x1050** for the side by side stereo pair image. (this is 4:3 aspect ratio)

To resize images use SPM as follows:

- Load the image
- Hit R (this bring up the resize dialog screen)
- Check: "Keep Aspect Ratio with border"
- Enter: X: 1400, Y: 1050
- Hit S (this brings up the save screen)
- Make sure you have the right folder and then save the file following the correct naming convention (see below)



3. Naming

Name file as yyymmdd-entry number-last name-first name-title.

The date should be the date of the meeting - the entry number should be the order in which you would like the images presented, e.g.:

20100908-1-Huberty-Al-Nova Scotia Coastline #3

20100908-2-Huberty-Al-Riding the Waves

20100908-3-Huberty-Al-Seagulls on the Shore

Put your images on a flash drive and give them to the person in charge)

Digital 3D 201

Easy Adjustment

Indication

Both Images(Anaglyph)
Left(Red) Right(Cyan)
Flashing 20 x 10 ms.

Show Grid 33
 Reverse Perspective Rotation
 link both rotations together

100% SIZE
Edge detection

Basic | Barrel | V_Pers. | H_Pers.

Guide Line
Reset Guide Auto Adjust

Rotation
L : 0.0 Degree
R : 0.0 Degree

Image Size
L : 100.0 %
R : 100.0 %

Alignment Value
Restore(File) Restore Save

OK Cancel

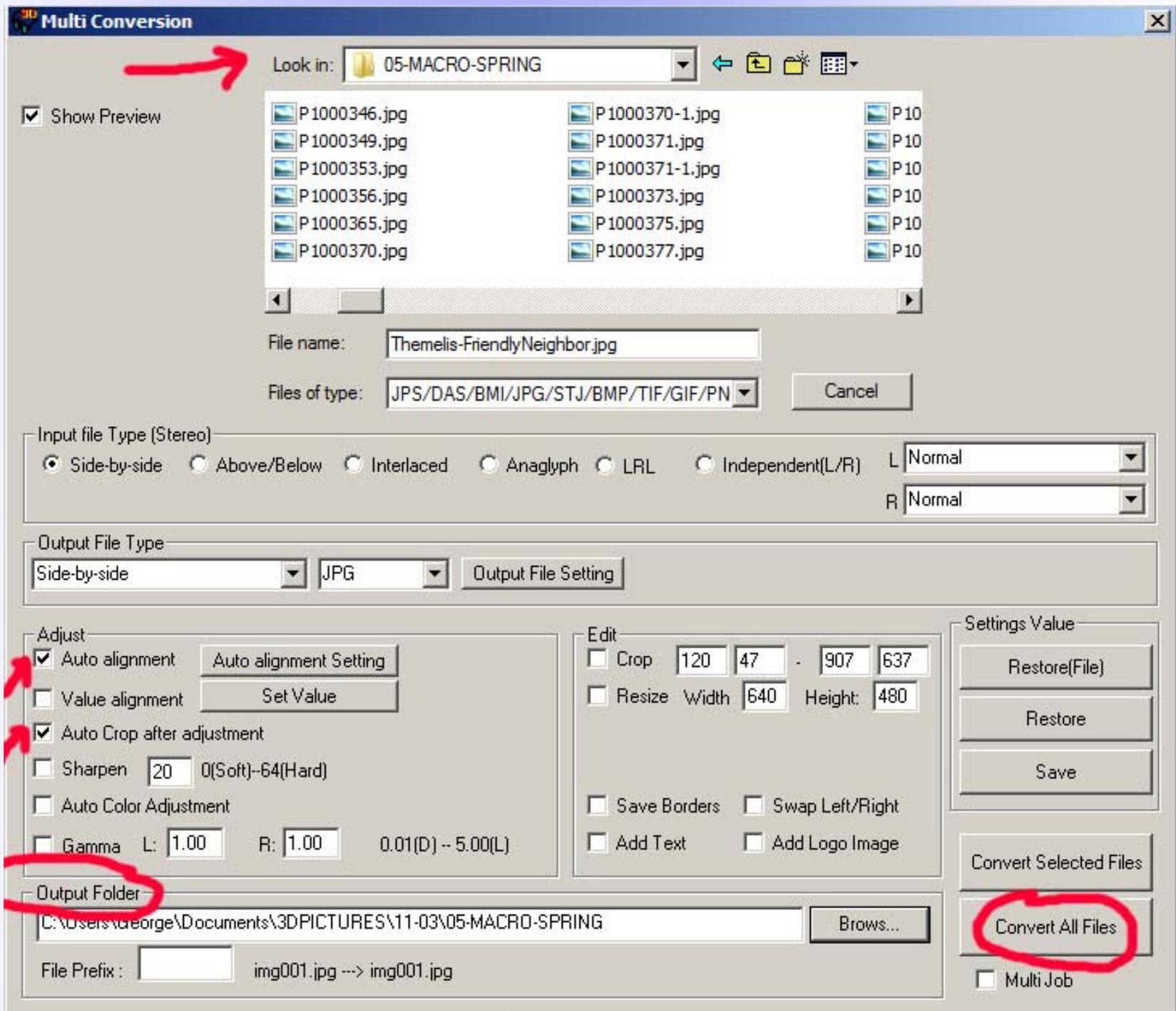
H. Position: 0 V. Position: 0



Easy adjustment

After pushing the "OK" button, PLS. undo (Press 'Z' key), before retry easy adjustment.

Multi Conversion



Developing a Routine

Sooner or later each one of us develops a routine to deal with digital images. This helps do things faster and avoid mistakes.

Different people have different routines, and this is fine as long as they work for them. Here is my routine: After a trip, or a photoshoot where I took a number of pictures with one theme (club meeting, running race, etc), I do the following:

1. Remove the SD memory card(s) from the camera(s) and put it in the computer.
2. Create a new directory to store the files.
3. Transfer the image files from the SD card to this new directory. If using twin cameras, create two subdirectories, Right and Left to hold the corresponding pictures.
4. Delete old files from the card (if needed, to make room), eject it and return it to the camera.
5. Use SPM to preview the files and delete the ones that I do not want to keep.
6. The images as they come out of the Fuji or twin cameras are not perfectly aligned so I use SPM to align them. I first create a subdirectory to store the aligned images. Instead of aligning each individual image, I use “File” and “Multiconversion” to align a batch of images at once. In the dialog screen that opens, I select “Autoalignment” and “Autocrop after adjustment”

Developing a Routine II

7. I use SPM again to view the .JPG files and make adjustments (cropping, stereo window) as I see fit. The adjusted file replaces the original JPG file but sometimes, when I am not sure about these adjustments, I create a copy of the file.
8. So far, these pictures are for my own enjoyment only. If I decide that a picture is good enough to share with others, for example enter in the competition, put it in the newsletter, upload them in the internet, project it in the club, etc., an extra step of processing is involved. That's when I use both SPM and a Photo Editor to adjust the size, contrast, sharpness, etc. Some times I just crop one side of the stereo pair if only the 2d picture is sufficient (facebook, blogs, newsletter). While up to this point the pictures had a generic file name (as it comes out of the camera, like DSCF6992.MPO or DSCF6992.jpg), any picture that gets this final treatment will get a more meaningful name.
9. Every month I **backup** the pictures that I took this month, i.e. I copy them in a separate (external) hard drive. Some people backup their pictures more often and in several hard drives. You can never be too careful with this.

LIVE Demo