

# Panoramic Photography

by Jon Lesser

## Keywords

Panorama, Digital photography, QTVR

## Introduction

The Library of Congress (1998) traces panoramic photography back to the birth of the modern photographic process in the 19th century. The first panoramic images were simply a series of daguerreotypes arranged next to each other. Soon after, panoramic film cameras were developed that use a pivoting lens design to expose a long length of film (online). Contemporary versions of these cameras are made with extreme precision and subsequently are expensive. Today special digital image processing software makes it possible to "stitch" multiple digital photographs together to create a virtual panorama.

The first objective in creating the panoramic image on page 27-28 of this publication was to explore a unique imaging process to capture the hardworking members of the Test Targets team. To achieve this, a specialized tripod head, a Nikon Coolpix 5000 digital camera, and Apple's QuickTime VR Authoring Studio were used.

The second objective was to ensure pleasing color reproduction by adjusting the image in Adobe Photoshop with a calibrated monitor for output to the Heidelberg Sunday 2000 web offset press.

## Procedure

Our process of can be broken down into three sections: image capture, image stitching, and image adjustment.

### Image Capture

The first step in creating high quality panoramic images is the setup of the appropriate hardware. A Manfrotto QTVR tripod head was used allowing us to level the camera and accurately maneuver it so that the nodal point, or optical center, was positioned directly

over the tripod's axis of rotation. Figure 1 describes the location of the nodal point: where the image focuses to a point before expanding to cover the film plane or CCD. The QuickTime VR Authoring Studio manual (1998) explains how this procedure avoids parallax problems which would otherwise distort the final image (Apple Computer, p. 81).

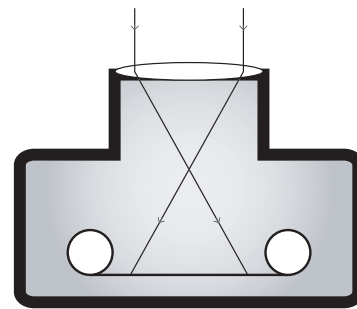


Figure 1: We estimated the nodal point of the Nikon Coolpix 5000 by look straight down from above.

Once the camera is in position and the first exposure is made, the camera needs to rotate a certain number of degrees to ensure a 50% overlap between exposures as seen in Figure 2. James Rigg (2002) explains how the number of degrees is dependent on the field of view (FOV) of the lens being used and can be derived with the following formula (online):

$$FOV = 2 \times \tan^{-1} (24 / (2 \times f))$$

where 24 is the 24mm dimension of 35mm film in portrait orientation. (35mm film is 35 x 24 mm.) The focal length of the lens,  $f$ , must then be relative to 35mm film and was in our case 28mm. The Nikon's actual focal length was 7.1mm but we had to use the 35mm film equivalent because we didn't know the size of its CCD.

Simply dividing the field of view by two will yield the number of degrees necessary between exposures. In my setup the camera focal length was 28mm and the FOV was 46.4 degrees indicating 23.2 degrees between expo-

sure. The Manfrotto QTVR head facilitates image capture by clicking into place at defined degree intervals ranging from 10 to 90 degrees.

Everyone in the picture was instructed to remain as still as possible as the pictures were taken and the camera rotated. Any movement of the subject can create problems with the stitching process.

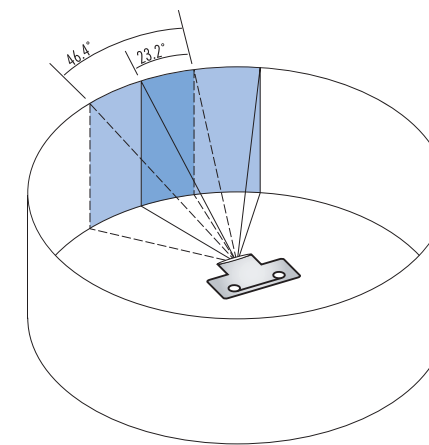


Figure 2: The darker blue represents where the two images overlap. The degrees between exposures will be different for both landscape and portrait orientations.

### Image Stitching

Stitching is a very automated process if the nodal point and degrees between exposures are correct as ensured by the Manfrotto QTVR head. The images were imported into QuickTime VR Authoring Studio and arranged in the order they were taken. The software then goes about blending and contorting the files into a single panoramic image. Inevitably, people moved slightly between exposures and Somika Shetty and Hemachand Kolli had to be reconstructed from the source images using Adobe Photoshop.

### Image Adjustment

Working in the default sRGB color space of the Nikon Coolpix 5000, we isolated and corrected numerous color casts with Photoshop layer masks. The casts were the result of three competing light sources in my composition: simulated D50 over the press controls, sodium-vapor lamps on the ceiling, and daylight from the windows behind the camera.

Digital noise appears as a sort of colorful speckling most apparent in the dark areas of digital photos. Jeremy McCreary (2002) describes two primary classifications of noise. Random noise is temporally dependent and occurs arbitrarily over the whole image. Fixed pattern noise is spatially static but varies over time (online). To remove the digital noise a Gaussian blur filter was applied with a seven-pixel radius and then immediately faded to color with 100% opacity. Figure 3 is a detail of Franz Sigg's sweater where the noise removal was particularly noticeable.

An inkjet proof from an Epson P2200 allowed us to inspect how effectively the color casts were removed. We shared the proof with professors and peers to receive constructive criticism on the composition and lighting of the image. Unsharp masking was applied appropriately for web offset press output and finally

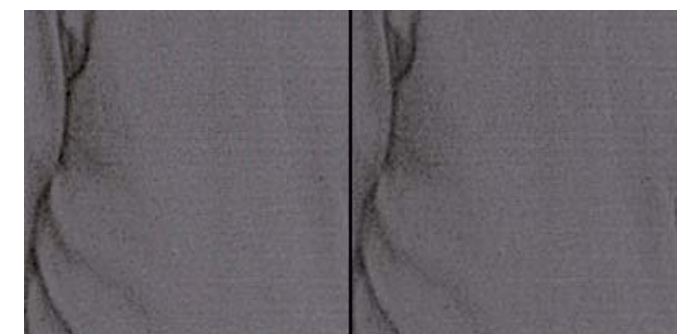


Figure 3: Digital noise most noticeably manifests itself in dark colors and shadow areas.



Pictured above from left to right: Franz Sigg, Somika Shetty, Vikaas Gupta, Edline Chun, Seunga Kang Ha, Hemachand Kolli, Lingjun Kong, Chao-Yi (Fred) Hsu, and Bob Chung. Not pictured: Ryan Testa, Jon Lesser.

the image was converted to the custom CMYK profile created for Test Targets 3.1.

## Conclusion

The specialized tripod head from Manfrotto was very helpful to us because of its ability to optically center the camera and avoid parallax errors. There are other companies, such as Kaidan, who also make tripod heads specially designed for panoramic photography.

The inkjet proof we made was not meant to be a press proof as the custom press profile was not available at

the time. It did, however, show how well we neutralized color casts, removed noise, and retouched the image. Our post-capture workflow could have been more streamlined with more static subject matter.

Panoramic photography is a visually effective way to communicate an image. The extremely wide angle invites the eye to study what is normally only perceived in peripheral vision. From a more pragmatic standpoint, panoramic images let you show very large objects by simulating the turning of the head motion.

## References

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