

SP.747 Final Project

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Motivation

My final project, a 160° HDR panorama of the Boston skyline that blends day to dusk to night, was primarily motivated by a desire for something that was interesting to look at and interesting to create. The city as seen walking east along Memorial Drive is one of my favorite views, and I've been fascinated by the concept of panoramas – especially by the process of making them without any special equipment – so the choice of subject was natural. The idea for a day-to-night transition came mostly from my inability to choose the time of day for shooting the panorama. I wanted the final project to be technically challenging but not heavily altered, and blending the scene seemed to satisfy both criteria. HDRI was used (and excessive tonemapping – the “surreal” look – was avoided) to attempt to give the scene a more natural feel.

Technique

The creation process consisted of four major steps: shooting, HDRI, stitching, and blending.

Shooting

The images were shot using an Olympus E500 DSLR camera with a telephoto lens at 25mm. The camera was placed on a tripod along the edge of the Charles river; I marked the spot with chalk, as I'd be shooting in three different sessions. Lens choice resulted in a tradeoff between image detail and sharpness: a longer focal length means more images composing the panorama and a higher resolution overall, but wind and long exposures caused longer focal lengths to produce blurrier images overall. 25mm was the shortest focal length I could really use – any more and I would have had enough images to exceed the limits of the computers I was working with.

After several rounds of shooting in three sessions – one 1.5 hours before sunset, one at sunset, and one 1.5 hours after sunset – a total of 48 images were retained. Since HDRI was being used, each piece of the panorama had to be shot three times: one overexposed, one correctly exposed, and one underexposed. HDRI techniques merge these three exposures

into a single image to retain details that would normally be in blown-out or shadowed parts of a correct exposure, thus giving a better approximation of a scene. Three images were shot for day, six for dusk, and seven for night (times three exposures each, yielding 48). The difference in the number of shots in each session was due to the fact that I didn't know exactly where the dusk/night overlap should occur – it would largely depend on how much effect the Fenway lights had on the photographs. So that HDRI could be employed, the images were shot on the highest resolution in raw format; so that there would be as little noise as possible, everything was shot at ISO 100 (as a result, some of the night overexposures required shutter speeds of over 30 seconds!).

HDRI

Using the “Merge to HDR” feature in Photoshop CS2, each set of three exposures was converted to a 32-bit HDR image. I avoided performing excessive tonemapping on the images; instead, when converting to 8-bit, I used histogram equalization (stretching the input image's dynamic range to fill that of the output image) for the day and dusk images, and highlighting compression for the night images. This process was very straightforward and worked well (though at some point I'd like to play with HDR tools that are less automated and have more features).

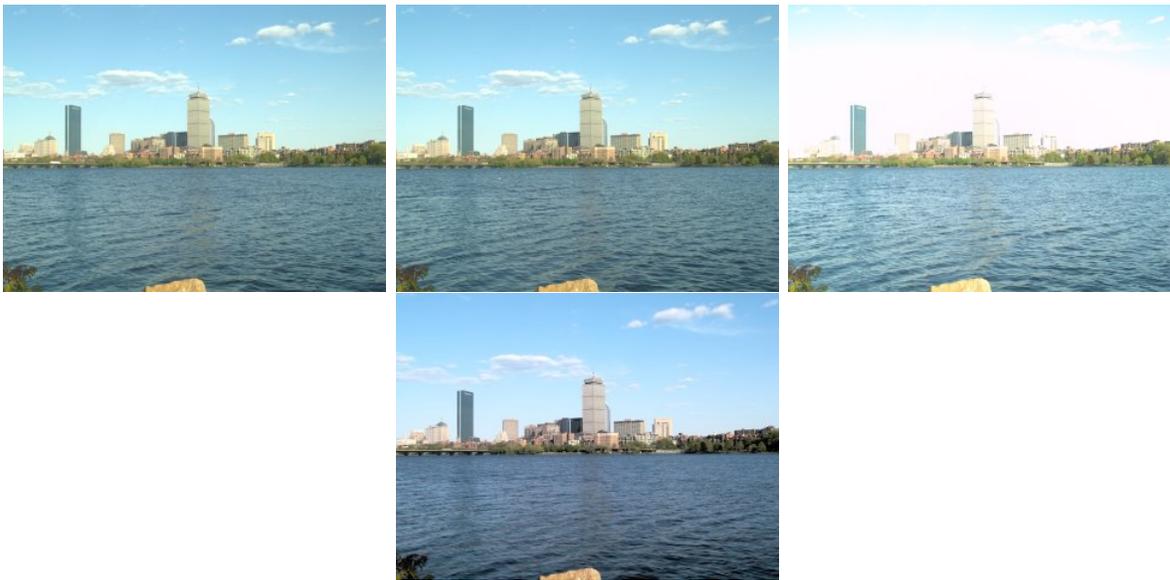


Figure 1: Three exposures and the merged HDR image.

Stitching

Stitching was performed using the Hugin tool, which is Free Software and is available from <http://hugin.sourceforge.net>. Hugin has several handy features, including image fea-

ture detection to help automatically align, rotate, and skew images, and a high-quality blending tool for getting rid of the seams between component images. The day, dusk, and night HDR images were stitched into three separate panoramas. I used the equirectangular projection, since it seemed to give the straightest horizon line and the least amount of distortion for all the panoramas.



Figure 2: The day, dusk, and night stitched images.

Blending

Using the Gimp (also Free Software; <http://gimp.org>), I created an image in which each of the three panoramas was a layer. Since the dusk panorama was to be the central one, it was placed as the background; for day and night, an opaque-to-transparent gradient layer mask was created (with the gradient in the overlap region). Then, the day and night layers had to be scaled, rotated, and moved to align as closely as possible with the background dusk layer. This was definitely the hardest part of the entire process, since a bit of blur had accumulated from HDR merging and stitching, and since the panoramas were shot in three sessions (the camera and tripod setup was disassembled and reassembled between each one). After blending, I cropped the image (the original stitched images were slightly skewed from the projection) and made some minor adjustments to increase the sharpness of the image.



Figure 3: The final blended image.