AMP^{TM} High Dynamic Range Camera

What is HDR?

High Dynamic Range (HDR) imaging is a technique used in photography to get more range from the light levels captured by a digital camera.

Why HDR?

The human eye is capable of viewing scenes with a very large range of light levels. Standing inside a darkened room and looking out the window to see a scene lit with a bright sky is a good example. You are easily able to discern details inside the room, and at the same time you can see details in the clouds in the sky. The sky outside is about 1 million times brighter than the inside of the dark room you're standing in. In photographer's terms, the sky is 20 f/stops (or simply, "20 stops") brighter than the inside of the room.

Now try capturing the same exact scene with a typical digital point-and-shoot camera. You'll find that the camera is unable to capture the scene the same way your eye was viewing it.

If you choose to take a bright exposure with the camera, then the inside of the room looks about right, but the scene outside looks completely white (Top Photo). If you choose to "expose for the highlights" (dark exposure) then the detail in the clouds can be seen clearly, but the inside of the room looks completely black (Middle Photo). If you try to take a balanced exposure then you end up with the clouds being saturated while the inside scene is drastically underexposed (Bottom Photo). This balanced-exposure image represents the best compromise possible with a typical digital camera.

None of these three photographs captures the scene the way you remember seeing it with your eye. This is because the camera is unable to capture the same *dynamic range* as your eye. Whereas the human eye has over 20 stops of dynamic range, a typical consumer camera has about 7 stops. High end professional cameras may have as much as 13 stops of dynamic range, but this is still several hundred times less light level range than your eye can see. This is why snapshots taken of breathtaking scenes often look lackluster. This is also why lighting is such an important aspect of photography and cinematography, and why so many scenes in films are taken from a fixed viewpoint (the camera cannot move, otherwise the lighting in the scene gets disrupted).
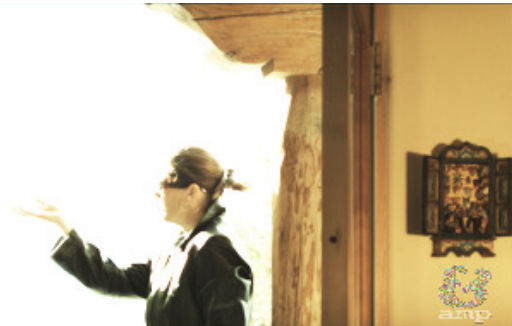
Bright Exposure -- Overexposed
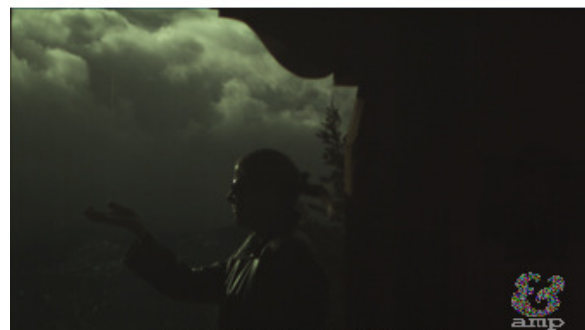
Dark Exposure -- Underexposed
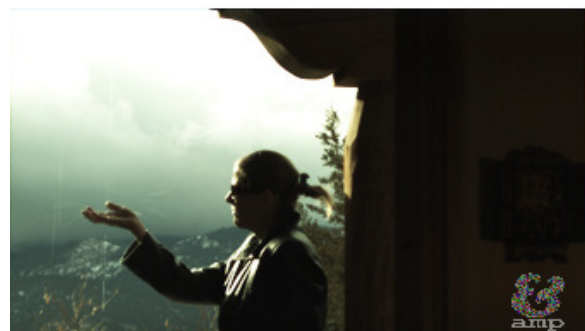
Balanced Exposure

How Does HDR work?

About fifteen years ago, when digital photography started to become popular, a new method arose for producing images with higher dynamic range. This method involved placing a camera on a tripod and then capturing multiple images, each at a different exposure level (like the 3 images shown above). In photography terms, these three photos, each taken with a different exposure setting, are called a "bracketed series". Using some sophisticated algorithms, the images are combined to produce a single HDR image that exhibits the best parts of each original image.

The Problem with HDRI

One key problem exists with the current state-of-the-art in HDR images: nothing in the scene can move. Since the photos are taken sequentially, any movement causes the combined HDR image to be blurry.

The AMP^{TM} Camera Solution

Contrast Optical's AMP camera technology solves this key problem by capturing truly simultaneous, pixel-for-pixel identical images. AMP is the first camera to use commercially-viable technology to deliver real-time, high dynamic range, high-definition imaging.

Contrast's in-house developed AMP camera technology uses specialized optics to split the light from a single camera lens onto three camera sensors simultaneously. Image-splitting is performed optically, at the speed of light, guaranteeing perfect motion registration between images. A new image-combining algorithm was developed specifically for this AMP camera system to transform the data from the three camera sensors into a true HDR video stream in real time.

Combined HDR image captured with the AMP camera

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