

13.4 Artifacts of Real Footage

Cameras and film do not produce perfect images. While the goal is to produce an image which looks convincingly like the real scene in view, the camera captures only a subset of the information in the real world. It is limited in a number of ways. Photographers can exploit these differences to create artistic representations of the real view. Digital artists often times must match differences intrinsic to real cameras and film, including the imperfections.

Commonly found artifacts of real footage include:

- Grain
- Lens Flare
- Barrel Distortion

When desired, these artifacts are generally added to the CG render in the composite.

13.4.1 Grain

Foremost among the imperfections of film is *grain*. You may have noticed grain on photographs or film frames. Grain is the granular, uneven coloration of the image. Film grain results from the clumping of the silver halide crystals formed during the exposure of film.

The amount and unique look of grain is determined by the type of film used, known as film stock. How responsive a film is to light is known as its' film speed. Films which to respond to light quickly, needing less light, are known as "fast" while films which respond to light more slowly are known as "slow". Film speed is measured in ASA numbers, in which a higher number means a faster film.

Film speed will affect both exposure time and the amount of grain. "Fast" film which is useful in low-light conditions has more grain. On fast film, the silver halide forms larger crystals. This allows for faster reaction to light, but the crystals are large enough to be more visible. Video sensors also have grain, a similar artifact due to how the sensor has responded to light, known as *gain*. Video gain is especially noticeable in low-light conditions when the exposure time is long.

3D renders do not have grain. To have the look of grain, it must be added. This is done in the compositing stage, after the image is rendered. Grain is added to digital elements which need to be integrated with live action. In these cases, the appearance of the grain in terms of its size and intensity in each color channel (red, green, and blue) is carefully matched to that of the film stock. In a full CG animation, grain is usually *not* added, unless it is desired for a certain look.



Figure 13.61-62 A photograph with a detail image showing grain (wiki commons).



13.4.1 Lens Flare

Another commonly known and often imitated imperfection of the real camera is *lens flare*. Lens flare results when a bright light source shines directly into the camera body, refracting off the lens to produce multiple areas of over-exposure on the film or sensor. The look of a lens flare is unique to a particular lens. Once upon a time, lens flares were considered a mistake, requiring a re-filming of the scene. Now they are deliberately included for aesthetic reasons, and may be artificially added to digital renders. Lens flares may be shaped like simple halos or stars around light sources, or be rather spectacular arrangements of circles, hexagons and stars in varying colors. Be careful of over-doing lens flare if you are adding it, as it can be a bit cheesy.



Figure 13.63-64 Photographic lens flare

Figure 13.65 Render by David Bryant (student work, SCAD-Atlanta)



13.4.3 Barrel Distortion

← Figure 13.66 Barrel distortion in a fish-eye lens. Notice how the straight lines of the buildings look curved.

An additional artifact of lenses is distortion of the images along the edges, known as *barrel distortion*. Ideally, a camera captures an image in which straight lines in the scene are represented as straight lines in the image. Unfortunately, this is not always the case. Often the lines become distorted along the edges, bowing outward. Wide angle lenses in particular often display barrel distortion. For example with the fish-eye lens this distortion is dramatic (Figure 1.69). Barrel distortion can be a problem when tracking elements or integrating digital elements to live action. Virtual 3D cameras, by default, do not have distortion. If it is needed for integration, then it will need to be added to the digital element. This may be done at the time of render, but it is more typical to add distortion after the images are rendered in the compositing stage.