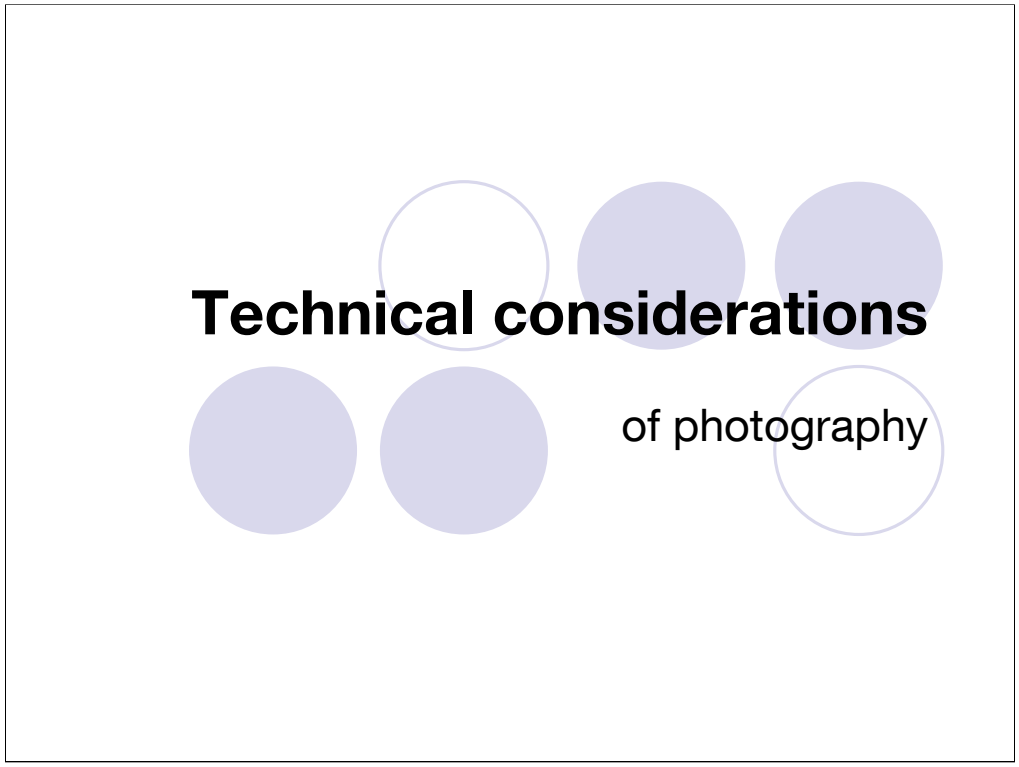
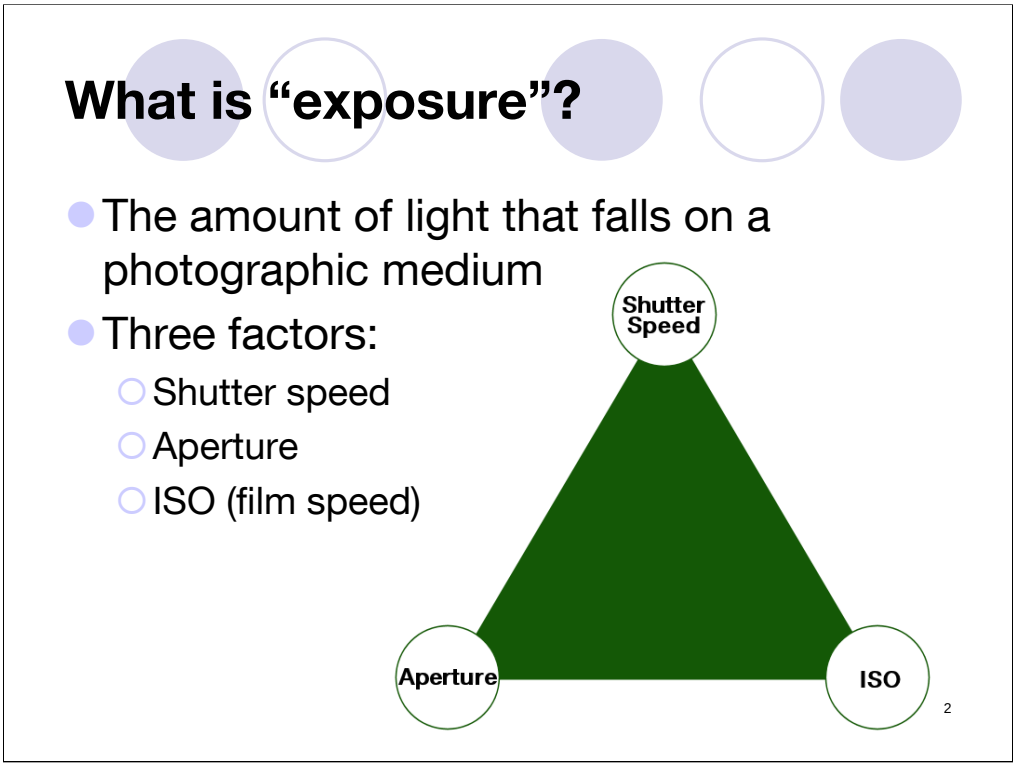
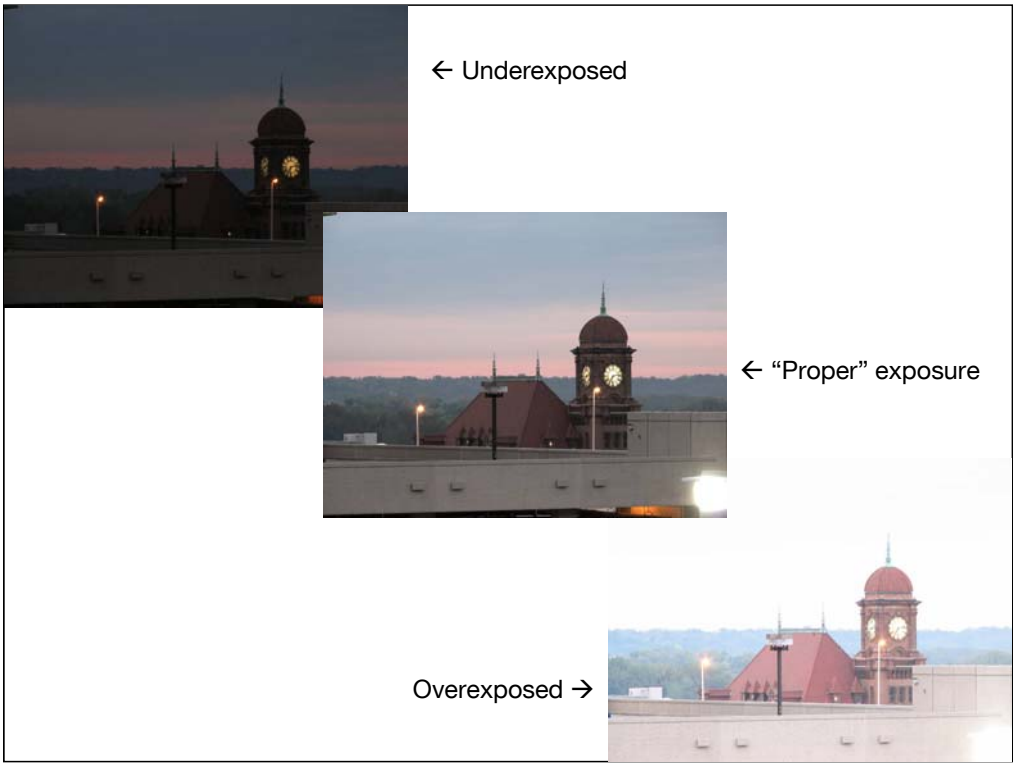


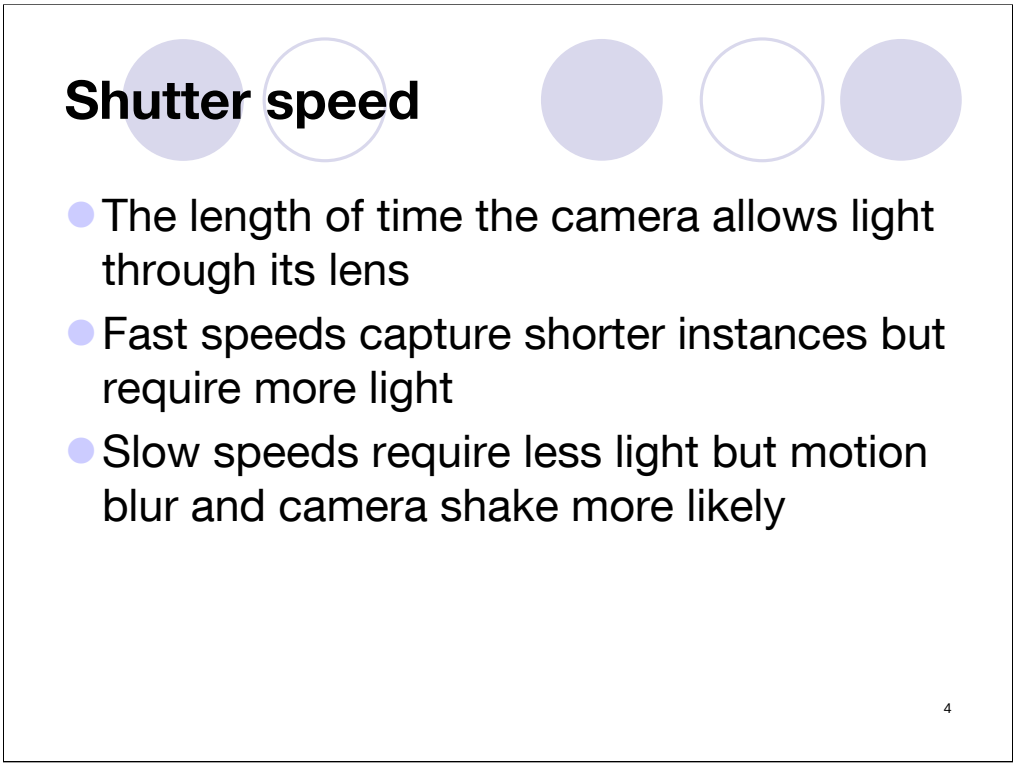
Title slide



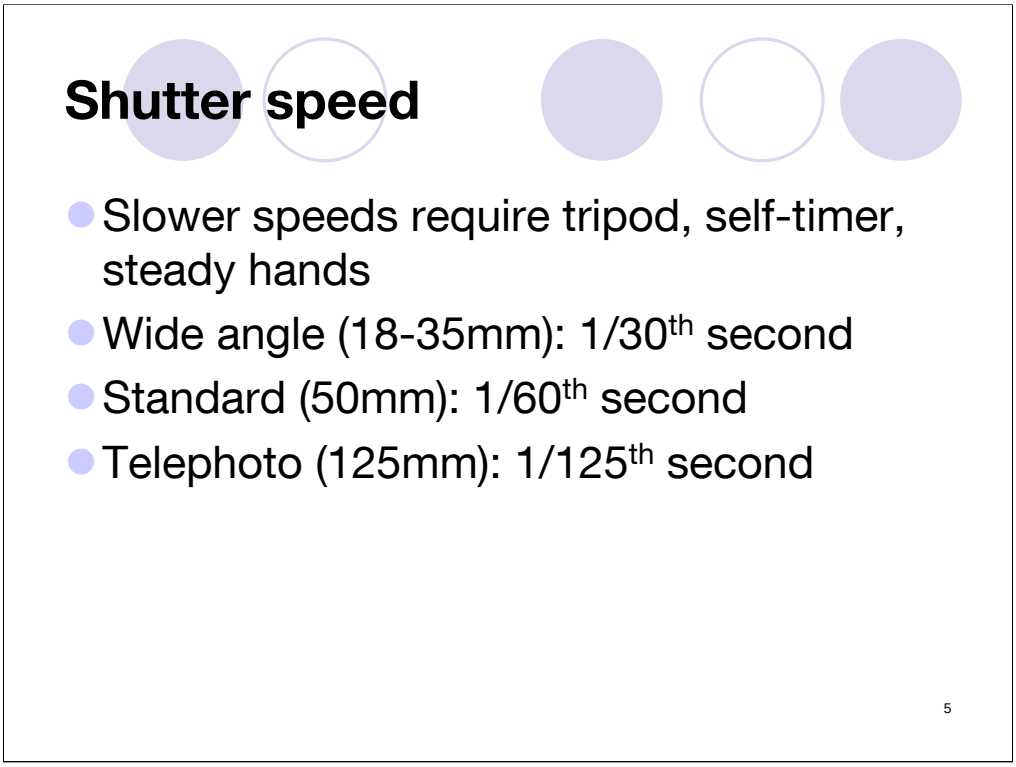
2. Exposure is the amount of light that falls on a photographic medium (film, digital image sensor). Getting the desired exposure mainly depends on three things: shutter speed, aperture and ISO (a/k/a, film speed). The *desired* exposure usually allows viewers to differentiate between dark areas and black and bright areas and white. Traditionally, the “correct” setting is an 18 percent reflectance of light, which is roughly that of Caucasian skin. Obviously, that often won’t be the subject you’re exposing for so you’ll need to make adjustments.



3. Underexposed, “proper” exposure, overexposed.



4. Shutter speed - Imagine if your eyes were always shut but, every so often, you opened them for an instant… the opposite of a blink. That's basically what shutter speed is. It's the length of time that a camera allows light to pass through its lens. Faster shutter speeds capture shorter instances – e.g., a long-jumper landing in a pit. Slower shutter speeds are often necessary in low-light situations, but bear in mind that motion blur, camera shake or both are more likely to occur. It's fine to use fast or slow shutter speeds, so long as you understand the consequences.



5. Fast shutter speeds capture something quick, like at a sporting event. Of course, you need more light, more sensitive film/image sensor or both to use higher shutter speeds. You'd use a slower shutter speed when lighting is limited or if you deliberately want motion blur, for example, to make waterfalls look opalescent. Slow shutter speeds require steadier hands or a tripod. In general, use 1/30th or faster to avoid camera shake when using a wide angle lens. For a standard 50mm lens, use 1/60th or faster. For a telephoto, use 1/125th or greater.

Shutter speed

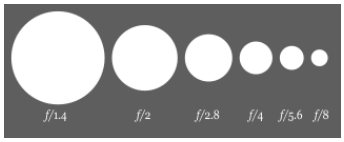
1/60th second (normal)

3 seconds (slow)

6. At left is a “normal” speed of 1/60th of a second. At right is a 3-second exposure.

Aperture

- Diameter of the hole through which light passes
- f-number: focal length/aperture diameter
  - Higher number, smaller hole – less light, more objects in focus (greater depth of field)
  - Lower number, greater hole – more light, fewer objects in focus (more limited depth of field)
- Pupil works the same way



7. Aperture (F-number) – Aperture is the diameter of the hole in the lens through which light passes. It is expressed as an f-number, which is the focal length divided by the aperture diameter. The lower the f-number, the greater the diameter. The higher the f-number, the smaller the hole. Smaller apertures (higher f-numbers) ensure that more objects are in focus. The photo will have a greater “depth of field” with smaller apertures. Wider apertures (smaller f-numbers) yield photos with a more limited depth of field. (Depth of field also changes relative to the distance to subject and focal length, but aperture is usually the main factor – more on this later.) So aperture is much like the eye’s pupil. When it’s bright, pupils constrict. When it’s dark, they dilate to allow more light through.

Aperture

- A. Tight aperture = more objects in focus (but less light)
- B. Use wide aperture to eliminate distracting foreground, background or both

A. Tight aperture

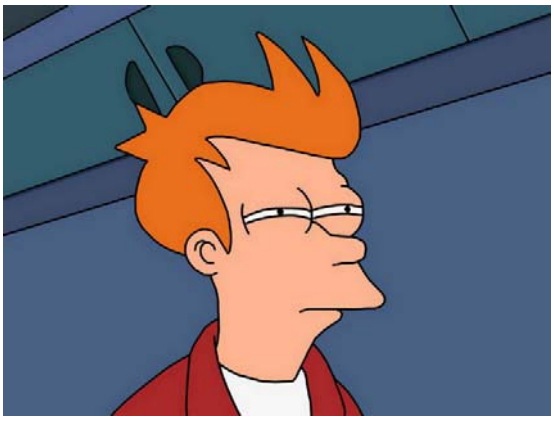
B. Wide aperture

8

8. Use a tight aperture to get more of a photo's objects in focus – say people standing six feet from you with a mountain in the background. Use a wider aperture to throw a distracting background or foreground out-of-focus, so that viewers focus on the intended subject. Such a shallow depth-of-field becomes more pronounced the closer you are to the subject.

Aperture

- Squinting narrows pupil's aperture, increasing the viewer's depth of field



9

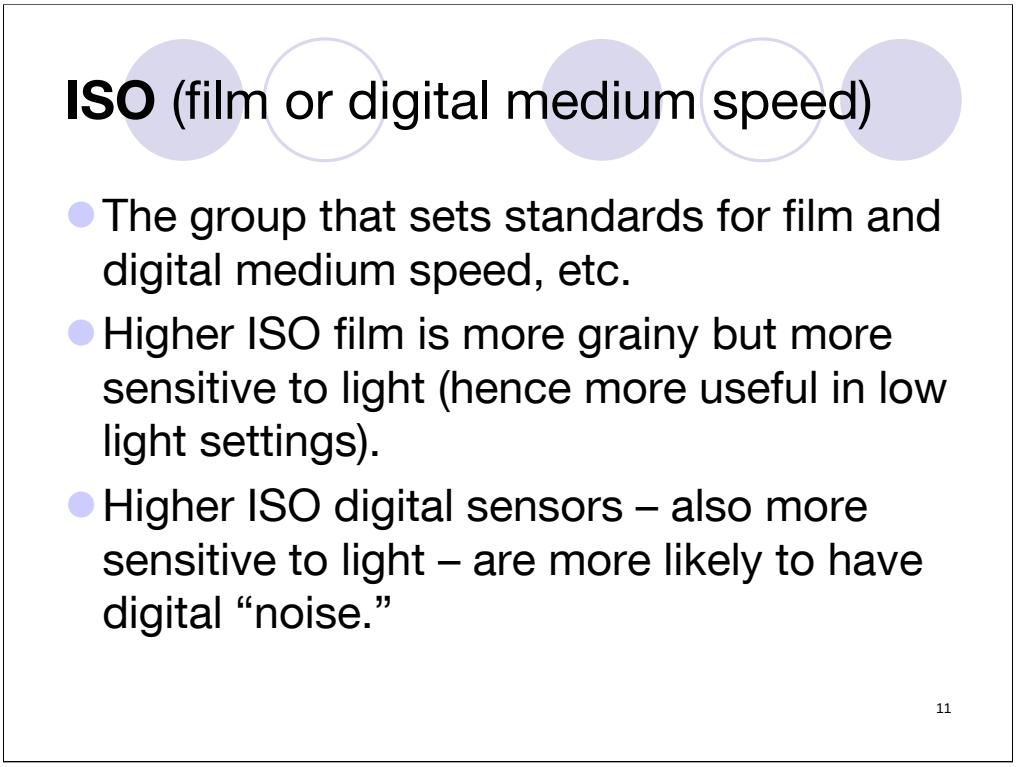
9. Have you ever seen a near-sighted person squint to see what's written on the chalkboard or highway sign? It works just like aperture: Squinting narrows the pupil's aperture, so more objects are in focus.

Aperture and Shutter Speed

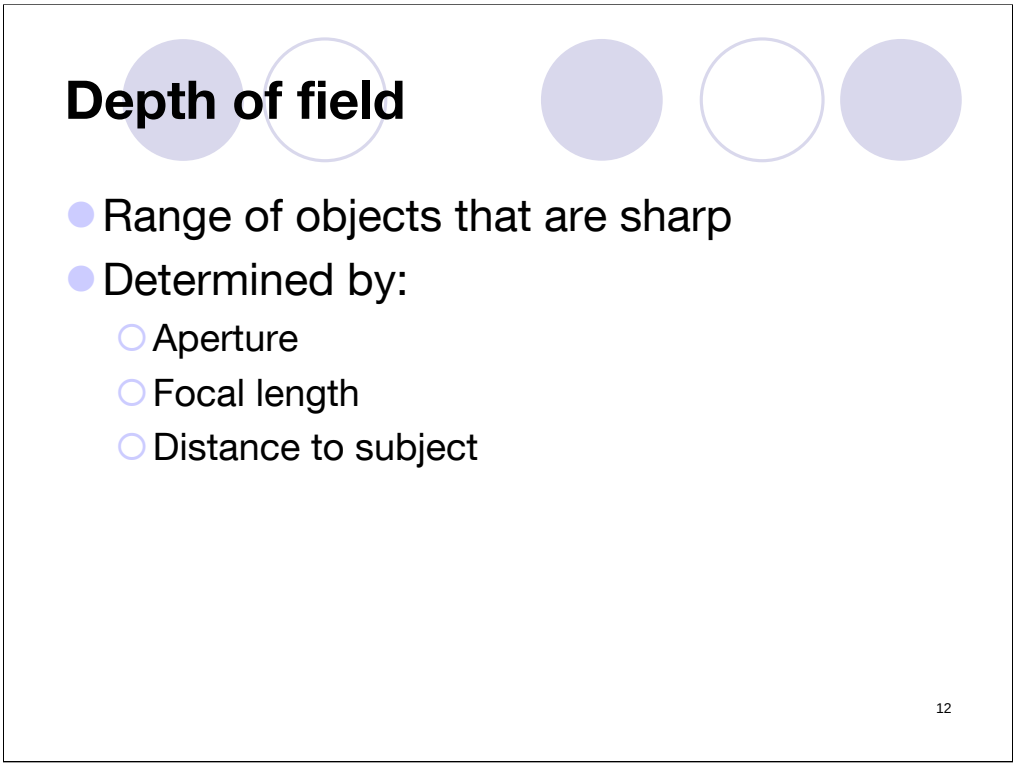
- Aperture and shutter speed reciprocate, like a slide rule
- For example, 1/125th of a second at *f*/4 has same exposure as 1/250th at *f*/2.8, assuming the same amount of light
  - But the depth of field would be slightly greater at *f*/4 because the aperture's tighter

10

10. Shutter speed and aperture reciprocate. Just as 1/30th of a second is half the speed of 1/60th, so f/4 allows half the light that f/2.8 does. This means, given constant lighting, the same exposure occurs when you halve one and double the other. Thus, in terms of exposure, 1/125th of a second at *f*/4 is the same as 1/250th of a second at *f*/2.8. Each would have a different depth-of-field, but both of those settings allow the same amount of light to reach the film or sensor.



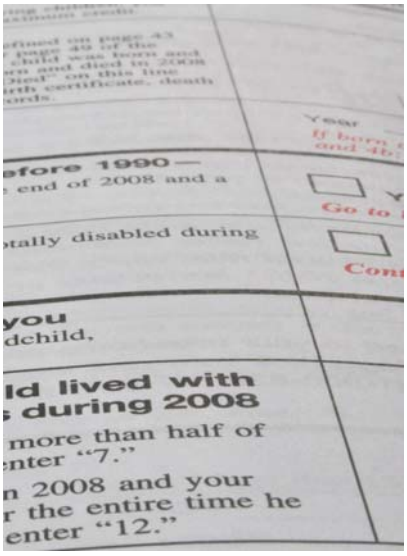
11. ISO (Film/medium speed) stands for International Standardisation Organization. It's a group, to which the U.S. belongs, that sets agreed-to standards for many things, including film and digital medium speed. If you're talking about film, lower ISO film has better resolution and definition but is less sensitive to light, hence more light is required for a given exposure. Higher ISO film requires less light, hence is better for low-light events, but it has more grain. (That is, the photo will look more "grainy.") The same is true of most digital image sensors, except that higher ISO numbers yield more digital noise rather than grain.



12. Depth of field is the range of a photo's objects that are sharp. Aperture, focal length and distance-to-subject affect depth of field. Assuming constant focal length and distance, less is sharp with wider apertures than with smaller apertures.

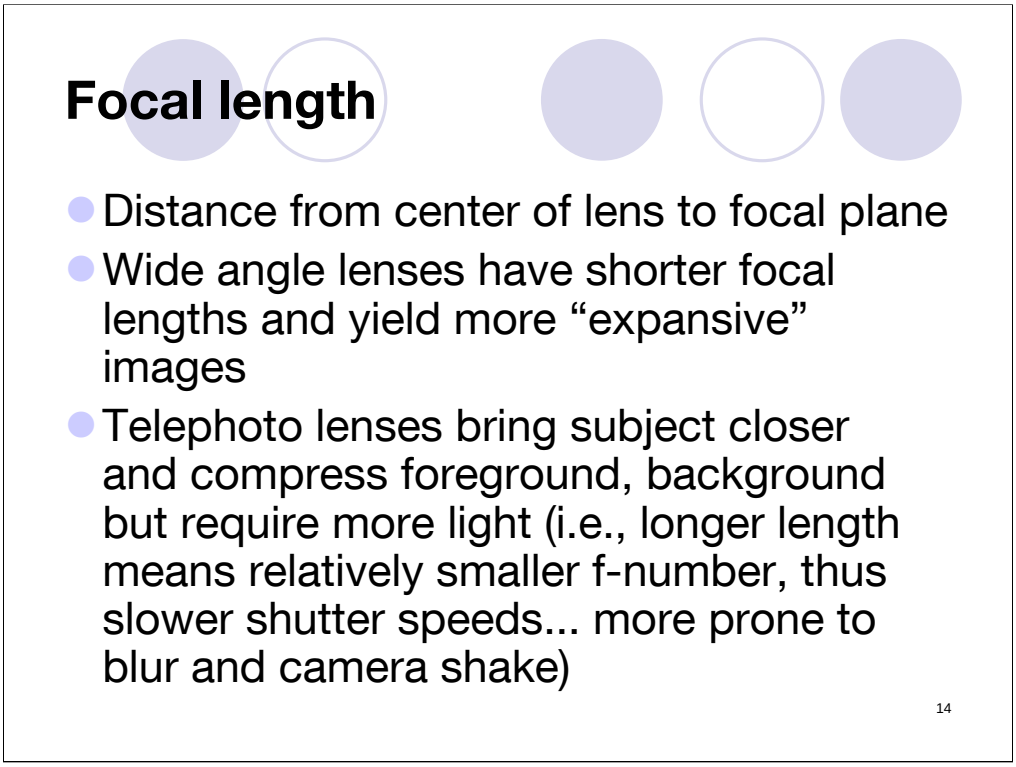
Depth of field

f/3.5

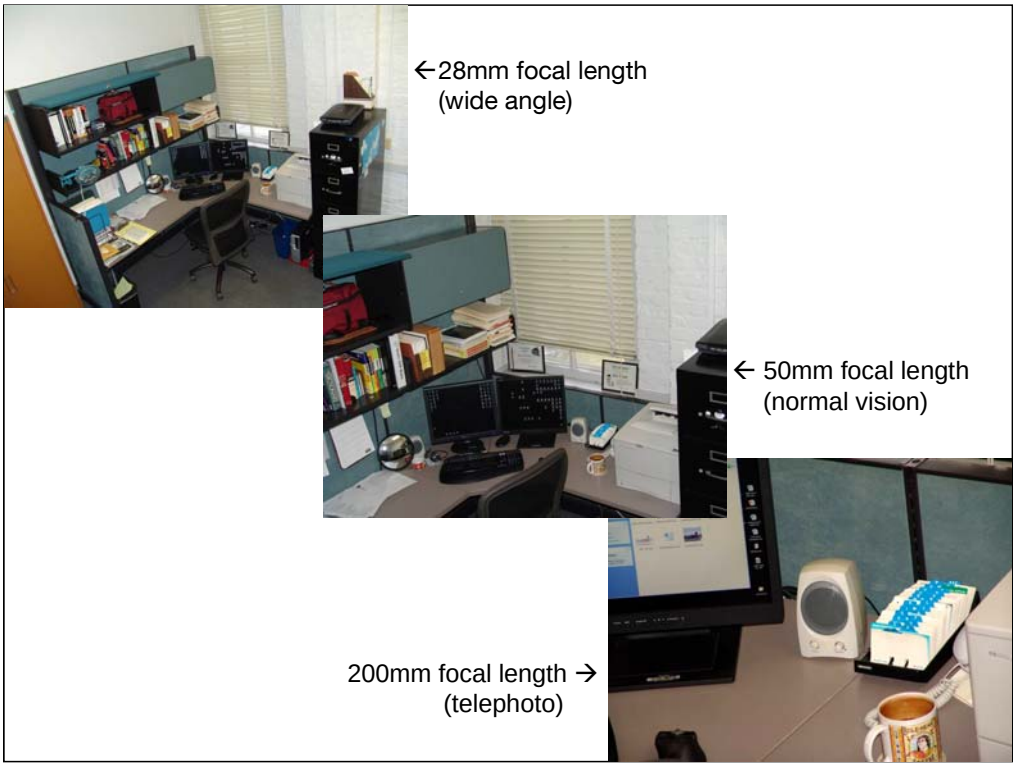


f/36

13. Here you photos shot at *f*/3.5 (l) and *f*/36 (r). Use a broad depth of field for landscapes and a shallow depth of field for portraits and photos with distracting backgrounds.



14. Focal length is the distance from the center of the lens to the focal point (film plane, digital image sensor), which is where the lens is meant to focus light. Wide angle lenses, such as a 28mm lens, have shorter focal lengths and produce a more expansive look. Objects in the background appear to be unnaturally farther away, and objects in the foreground appear to be unnaturally close. A normal lens is typically 50mm, and objects appear pretty much as the human eye sees them. A telephoto, such as a 210mm lens, brings the subject closer and compresses the foreground and background. Longer lenses require more light and a steady hand because their length makes them more sensitive to camera shake. This is further compounded because you may need to use a slow shutter speed because of diminished aperture. (Telephotos have longer focal length and, remember, an f-number is the focal length divided by the diameter of the aperture.) So a tripod and self-timer come in handy when using a longer lens. Zoom lenses offer a range of focal lengths, say from 28mm to 210mm.



15. Here you see how focal length affects framing.

Focal length affects depth

35mm focal length | 50mm focal length | 200mm focal length

16. And here you see how focal length affects depth. A zoom lens was used for these shots. As you zoom out, decreasing focal length, objects appear farther apart. The opposite is true when you zoom in (i.e., increase focal length). Zoom lenses are well-suited for bringing objects closer, compressing foreground and background, and framing. But zooms have an extra lens element, which slightly degrades performance of the optics.

White balance

- Used to keep neutral tones neutral so colors are accurate
- Different light sources yield different light
- Goal is pleasing, natural colors – not too red, green or blue

17

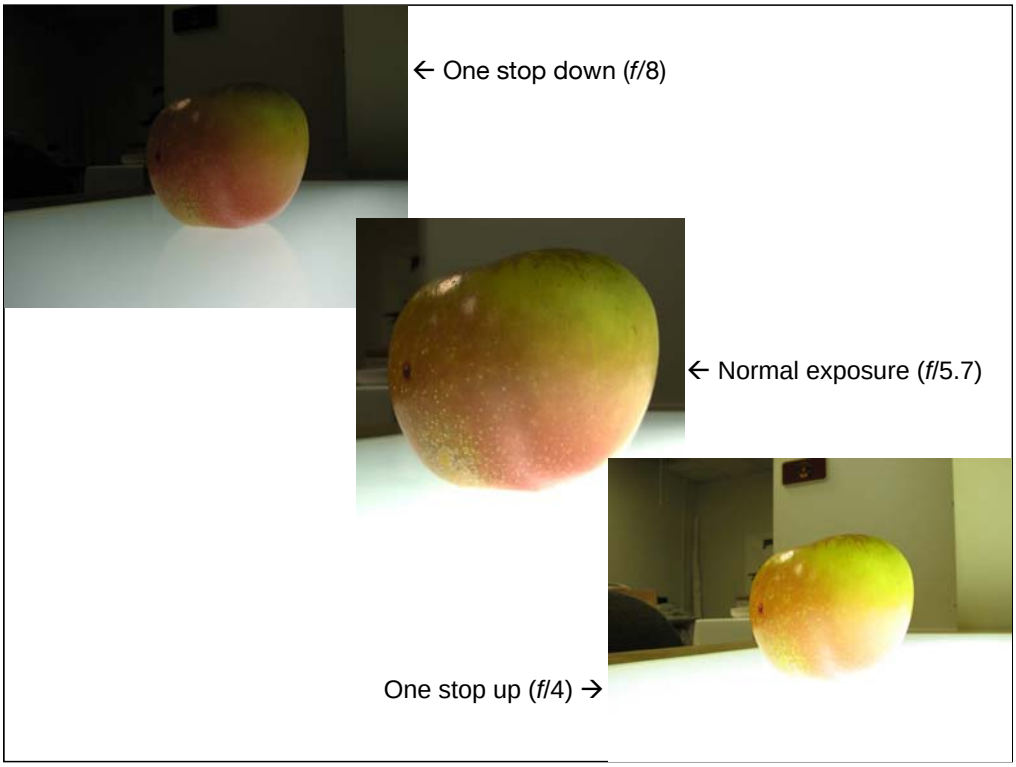
17. White balance is used to keep neutral tones neutral, so that colors are accurately captured. Different light sources - the sun, a fluorescent bulb, a flash, etc. – yield different light, so colors turn out differently. The goal is to have a lily that looks natural, not too red, green or blue. Most digital cameras automatically handle white balance and do a pretty good job. It's more difficult to handle with film cameras.

Exposure compensation

- Opening, closing (*stopping down*) aperture to add or reduce level of exposure
- Snow is white, not 18 percent gray, which is assumed by many automatic exposure system. Hence, the snow will be too dark unless the aperture is increased.

18

18. Exposure compensation is simply opening or closing the aperture to add or reduce exposure. The assumption of 18 percent reflectance is necessary but in fact rarely accurate. A photo in which snow is the subject would, using automatic exposure, actually turn out underexposed and too gray because snow is very bright. To reduce exposure, keep shutter speed constant and increase the f-number incrementally – ½, 1, even 2 stops. “Stopping down,” let’s say from 2.8 to 4, reduces aperture diameter and allows less light through. Add exposure by incrementally *decreasing* the f-number, which opens aperture diameter and allows more light through.



19. Exposure compensation down an f-stop, normal and up one f-stop.

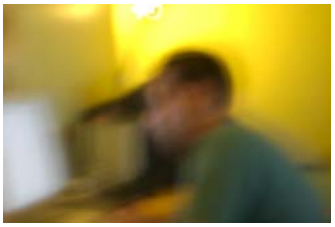
High Dynamic Range (HDR)

20

20. There is a new digital technique called “high dynamic range” that takes numerous, variously exposed photos and mashes together the best of each exposure to produce a “perfect” – yet unnatural – exposure.

Camera shake

- Blur caused by camera movement during exposure
- More likely with…
  - Longer shutter speeds
  - Longer lenses
  - Jerky press of shutter release button



- Eliminate by using faster shutter speed, tripod, self-timer, flash, shorter lens or combination thereof

21

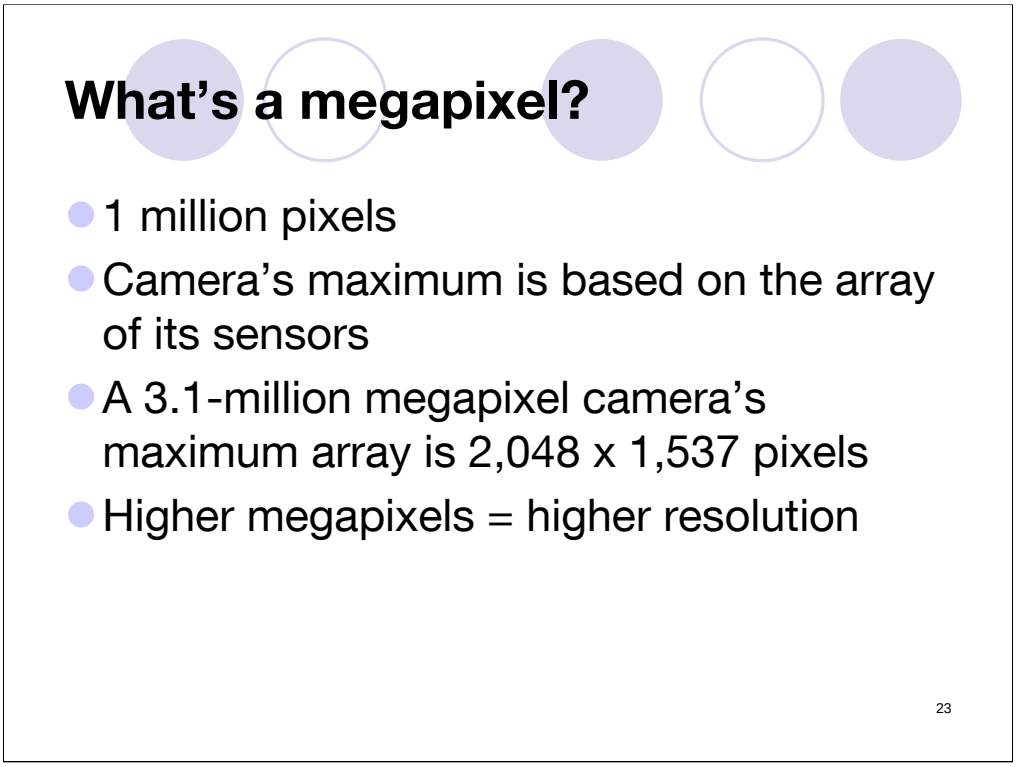
21. Camera shake occurs when a too-slow shutter speed is used for the given exposure. Longer lenses are more prone to camera shake, and longer shutter speeds increase the likelihood of camera shake. Even a heartbeat can cause camera shake. Image stabilization helps mitigate camera shake but goes only so far. It's best to use a tripod the camera's self timer when camera shake is probable.

How to hold a camera

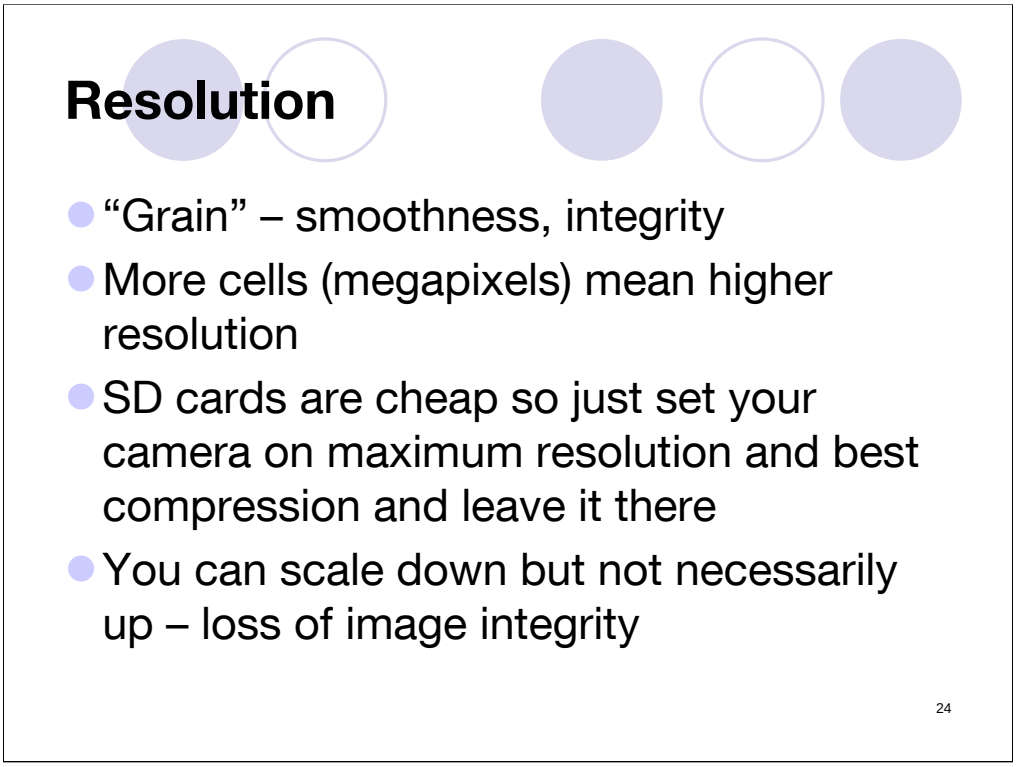
- Be a human tripod
- Securely grip right side
- Cradle with left hand
- Hold close to face
- Left elbow against body
- Gently press shutter release

22

22. Securely grip the right side of the camera, resting your index finger on the shutter release button. Use your left hand to cradle the lens and left side of the camera body. Use your left hand to turn lens rings (to zoom, focus, etc.). Brace your left elbow against your body and make sure the camera's close to your face. Gently press the shutter release button. It eventually becomes second nature.

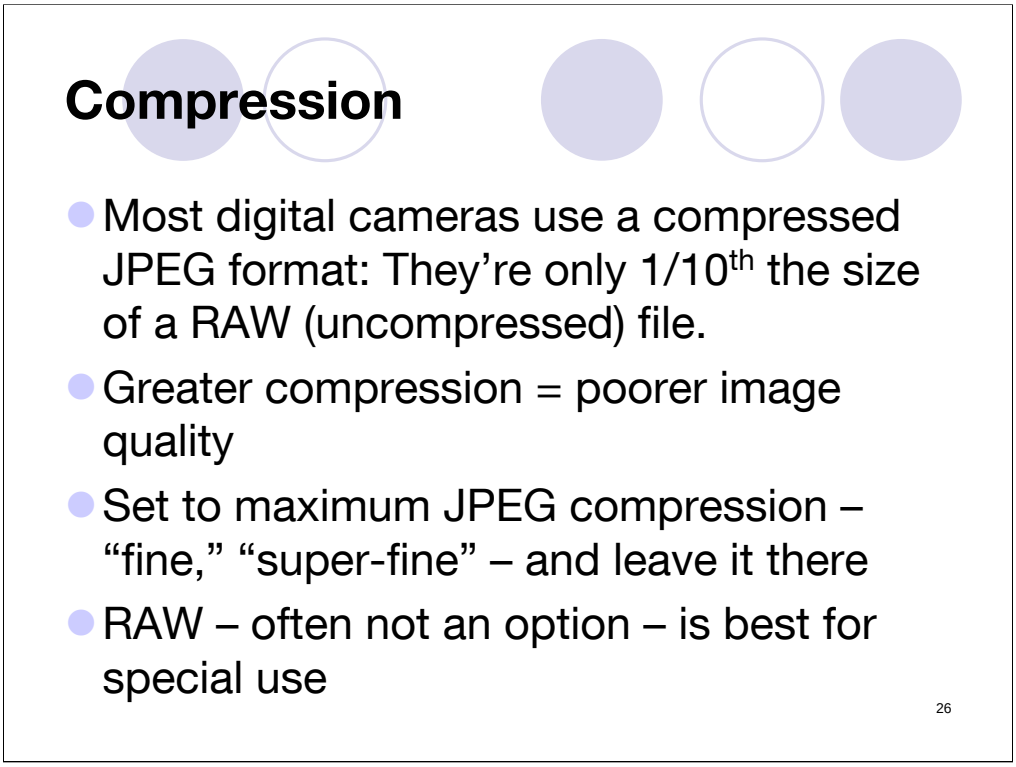


23. A megapixel is a million pixels. The maximum number a camera has is based on the size of the sensor element's array. Thus, a camera with a maximum array of 2,048 by 1,536 has 3.1 megapixels. The higher the megapixel number, the greater the resolution.

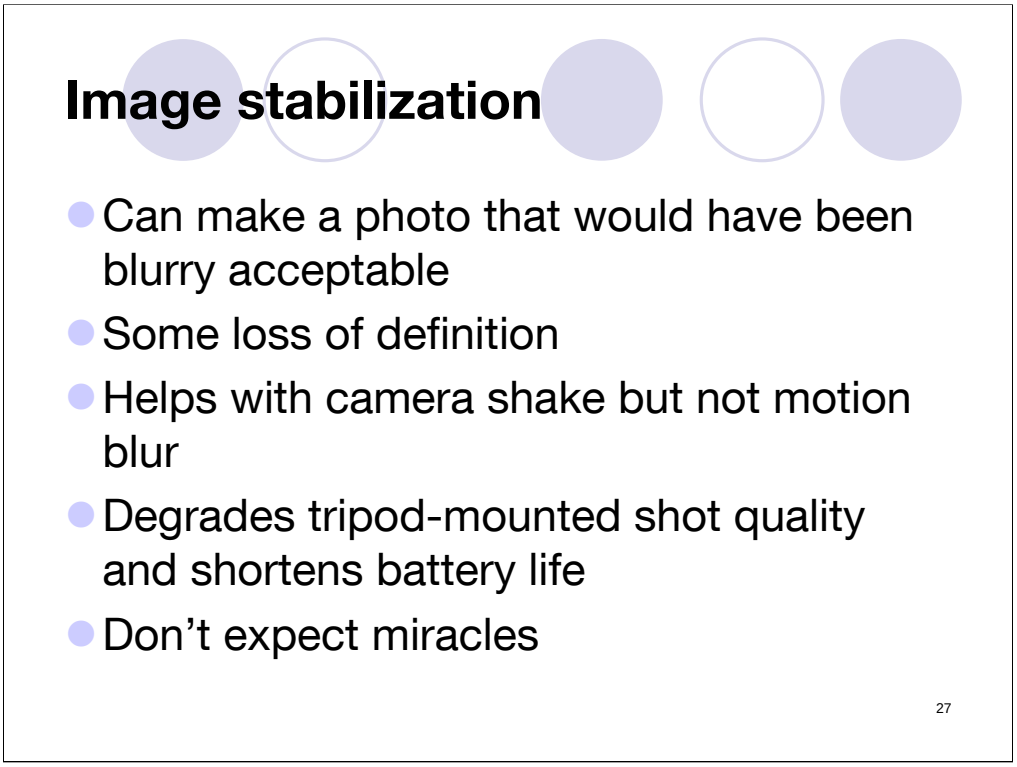


24. Resolution is basically the “grain” of a photo. A camera with more megapixels can produce photos with greater resolution. An array with more cells yields photos that look finer and smoother and have greater integrity. Given how inexpensive flash memory has become, your best bet is to set your camera at its highest resolution and keep it there. That way, the photo’s integrity will remain intact if you need to scale it down later. With low resolution photos, you might suffer image degradation when scaling up. Stair-stepping and choppiness are likely to occur.

25. It won’t show up well through an LCD projector, but look at the difference. The left half is the original photo, 3,264 pixels wide. The right half, to scale, is the same shot enlarged from a 640-pixel original. It’s too blurry. It’s not even good enough for PowerPoint, which is a forgiving medium.



26. Most digital cameras use data **compression** – JPEGs use various compression levels – because files would be very large otherwise. You wouldn't be able to take many photos, for example, if you were using a RAW setting instead. A JPEG of 4 megabytes would be 10 times larger in uncompressed RAW format. The greater the compression, the poorer the image quality but, on the plus side, more compression enables you to fit more photos on the memory card. As with resolution, opt for your camera's best quality JPEG compression. Set the camera to the max - usually "fine" or "super fine"- and leave it there. Unless you have a particular reason for using the RAW setting - most cameras don't even offer RAW - such as, say, for a large display or when the photo's likely to require much manipulation, don't bother with RAW.



27. Image stabilization (IS) can make a photo that would have been blurry useful, but don’t depend on it. It works by sensing vibration and adjusting the optical path of light through the lens onto an optical sensor. The problem is, you lose some definition. If optimum quality matters, you’re better off instead using a solid shutter speed, shorter lens, stable camera mount (tripod, self-timer) or a combination thereof. And IS reduces only camera shake. It has no effect on motion blur. IS actually degrades the quality of tripod-mounted shots and shortens battery life. Leave it on, if you prefer, but don’t expect miracles.

Image stabilization

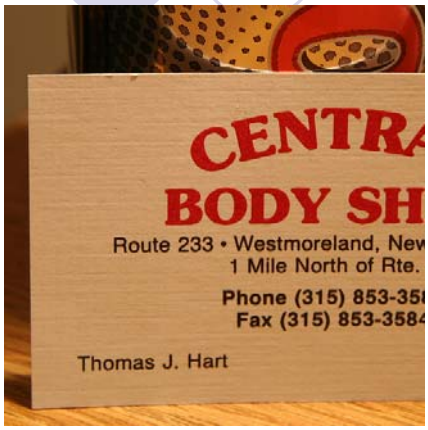


Image stabilization on

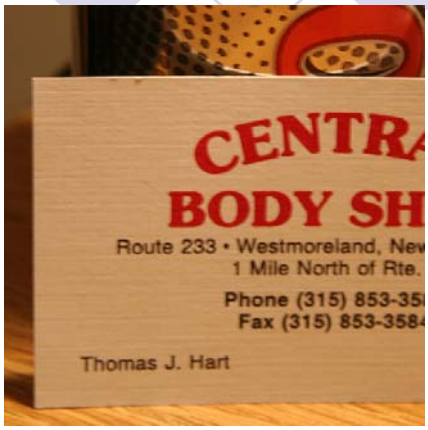
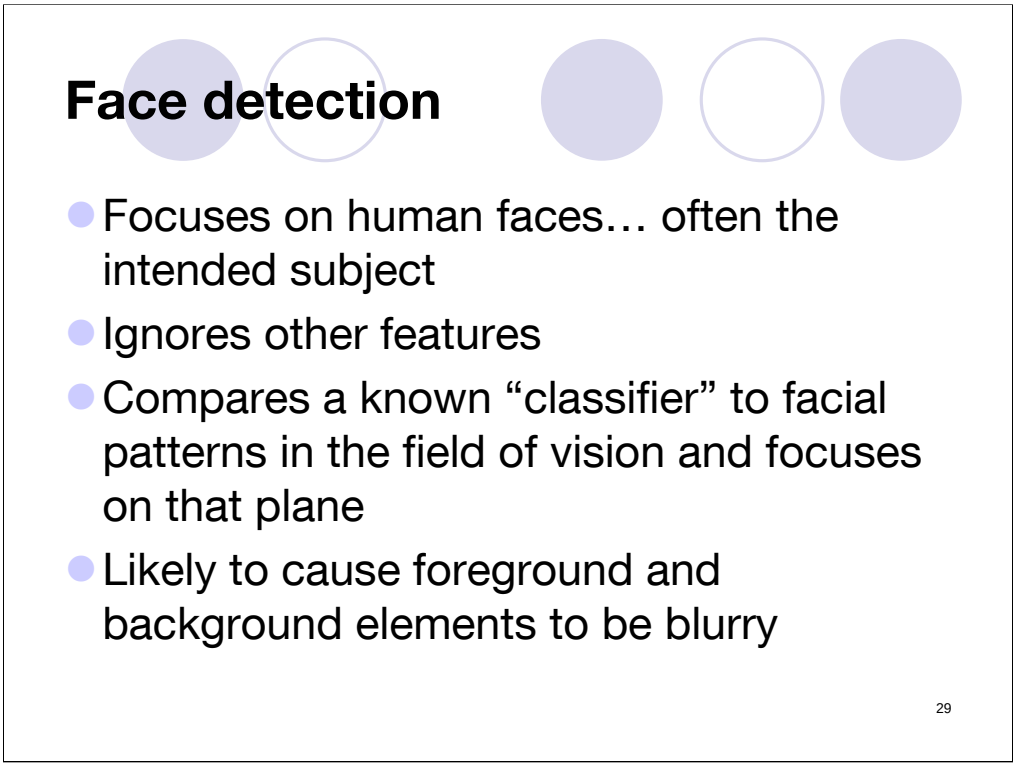


Image stabilization off

28

28. Image stabilization helps, but image quality is better by avoiding camera shake to begin with.



29. Face detection is great if the intent is to have human faces in sharp focus. It detects faces’ sizes and locations and ignores other features such as trees and buildings. It works by comparing a known facial pattern – a “classifier” – to facial patterns in the given field of vision and focusing on that plane. Face detection is more than 90 percent accurate. Just remember that foreground and background elements might be blurry.

Face detection

30

30. It works. Maybe too well.