The Animation Process

Lighting: Illusions of Illumination
Lighting = realism

- Although real people versus real clay/plastic is up to textures
- Realistic lighting = render time
Some properties of lights

- Colour
- Brightness
- Shadow-casting
- Volumetric
Types of lights: directional light

- Also known as sun (light), infinite light
- Parallel rays
- Same lighting at any point in the scene
Types of lights: point light

- Also known as bulb light, omni light, local light
- Spherical volume
- Fall-off is possible (distance)
Types of lights: spotlight

- Also known as klieg
- Radius – limited area
- Fall-off is possible
- Penumbra
- Soft shadows are possible (can be simulated with a cluster of point lights)
A word about ambient light

- Can be set for each object, or sometimes can be set for entire scene
- Simple 3D may use only ambient lighting
- Can be simulated with light at camera position
100% ambient lighting

- Texture without lighting
- Usually renders very fast
- Used for games & VR
- Drawback: lack of shadows can look weird
- Workaround: use a light-mapper, which "bakes" lighting and shadows into the texture map
Traditional 3-point light setup

- Main light
- Fill light (one or more)
- Rim light
- May need to be set up for each camera angle
Light example: “model” lighting

“Model light” = Ambient lighting = light at camera
Light example: main light only

- Usually casts shadows
- Soft shadow edges will depend on main light – spotlight, point light, directional
Light example: added fill light

- In real film or photography, use of matte white boards, sheets, umbrellas
- Similar to ambient lighting
- Simulates low-intensity reflection from other surfaces in the scene
- Often no shadows
Light example: added rim light

- Makes a character stand out from the background, as 3D
- Can be thought of as a variation on a fill light
Light example: added feature light

- Lights that only interact with the eyes, to add sparkle
- Obvious examples in old black-and-white movies = light “masks”
- Shadows from the environment – window frames, sun through leaves
Variations on the traditional setup

- Use sun (directional) light as main light
- Fill or rim lights only (film noir look, moonlight)
- Feature lights (eye glitter, eye emphasis)
- Ambient plus one main light for simple lighting
Special lighting setups

- Instrument up-lighting for dramatic effects
- Heavenly down-lighting for “aura”
- Uplighting: evil and/or instrument panels
- Back-lighting for suspense and science fiction
- “Film noir” minimal lighting, black & white
- Old-fashioned feature lighting
- “Lens flare” effects
- Glows
- Volumetric effects
- Image-projecting lights (colour, stencil/mask)
Standard lighting: raytracing

- Trace rays through virtual monitor from every visible surface point back to every light.
- Spotlights count as a cluster of multiple lights.
High-tech lighting techniques

- Some techniques more modern than others, particularly in consumer-level software.
- These lighting techniques often require more intensive calculations = longer rendering times.
- Trade-off: rendering time vs. realism.
- Larger studios have massive “render farms”, which can consist of hundreds of high-powered computers (often rack-mounted, with a central control set-up).
High-tech lighting: radiosity

- Divide surface into patches, energy equations
- Good for architecture – light equations only calculated once

But
- No transparency
- No mirror reflectivity

[Sample images from POV-Ray]
High-tech lighting: global illumination

- Superset of raytracing and radiosity, attempts to realistically model lighting
- Virtual photons fired from light sources
- Accumulative light effects, surfaces
- Capable of simulating reflective and refractive caustics

[Sample images from POV-Ray]
High-tech lighting: hybrid renderers

- Capable of more than one rendering technology
- Radiosity for matte surfaces, raytracing for reflective surfaces, photons for transparent and refractive surfaces
High-tech lighting: area lights

- Area lights
- Light arrays
- Grids
- Domes

Simulate fluorescent lighting, light from ceilings, light from all areas of sky
High-tech lighting: Image-based lighting

- An extension of radiosity, using pixels as luminous patches

- HDRI - High Dynamic Range Imaging

- Floating point colour channels - much more than 256 values, including subtle detail in overlit and underlit areas.
2D lighting: highlights

- As geometry
- As overlay
- As effects
  - Sparkle
  - Lens flare
2D lighting : shadows

- Shading applied to individual objects
  - As an effect
  - As geometry
- Shading applied as an object in blending mode (like a 3D stencil light)
- Light as “white shadow”, blending