



SI4 - CRÉATION DE MONDES VIRTUELS

CINEMATOGRAPHY AND LIGHTING

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PLAN

1. Cinematography basics
2. 3D camera control
3. Light, materials and textures

CINEMATOGRAPHY BASICS

CINEMATOGRAPHY BASICS

Metaphors of the camera. Think of the camera as :

- an invisible observer
- the audience (and breaking the fourth wall)
- a user
- a storyteller (think of comics)

CINEMATOGRAPHY BASICS

Degrees of freedom (DoF) -- no. of independent values that are free to vary.

- Normal camera: translation (3), rotation (3), field of view (1)
- Virtual camera: frustum (depth of field, aspect ratio)

CINEMATOGRAPHY BASICS

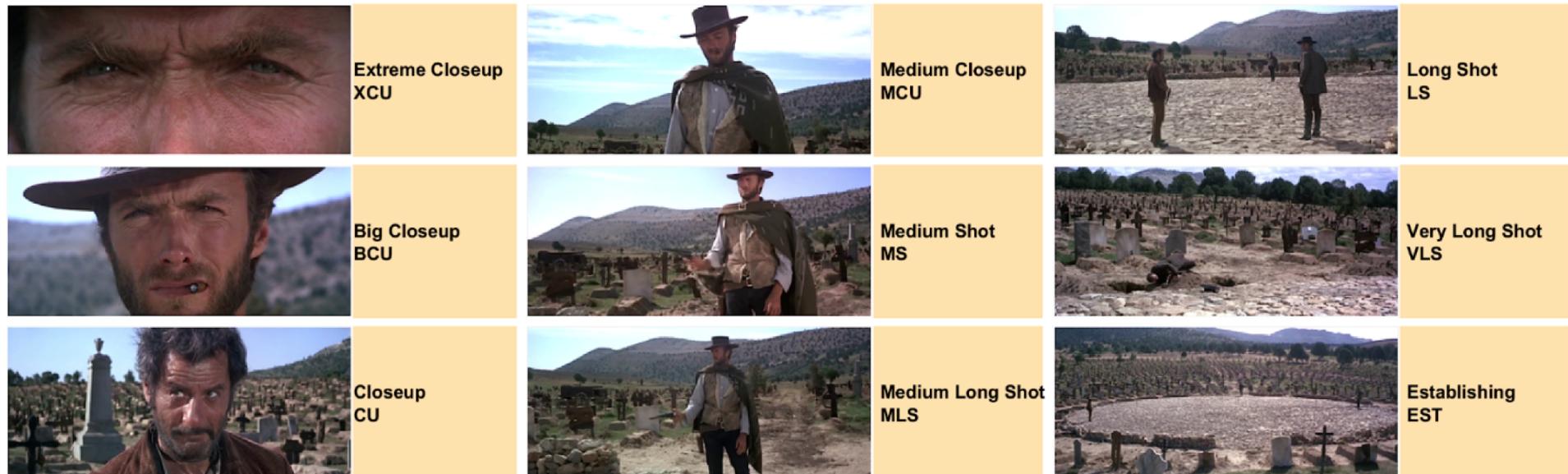
Framing: the way on-screen characters and objects are arranged.

- Shot size
- Shot angle
- Positioning (mise en scène)
- Occlusion
- Artistic style

CINEMATOGRAPHY BASICS

Framing

Shot size: distance between the camera and object of interest

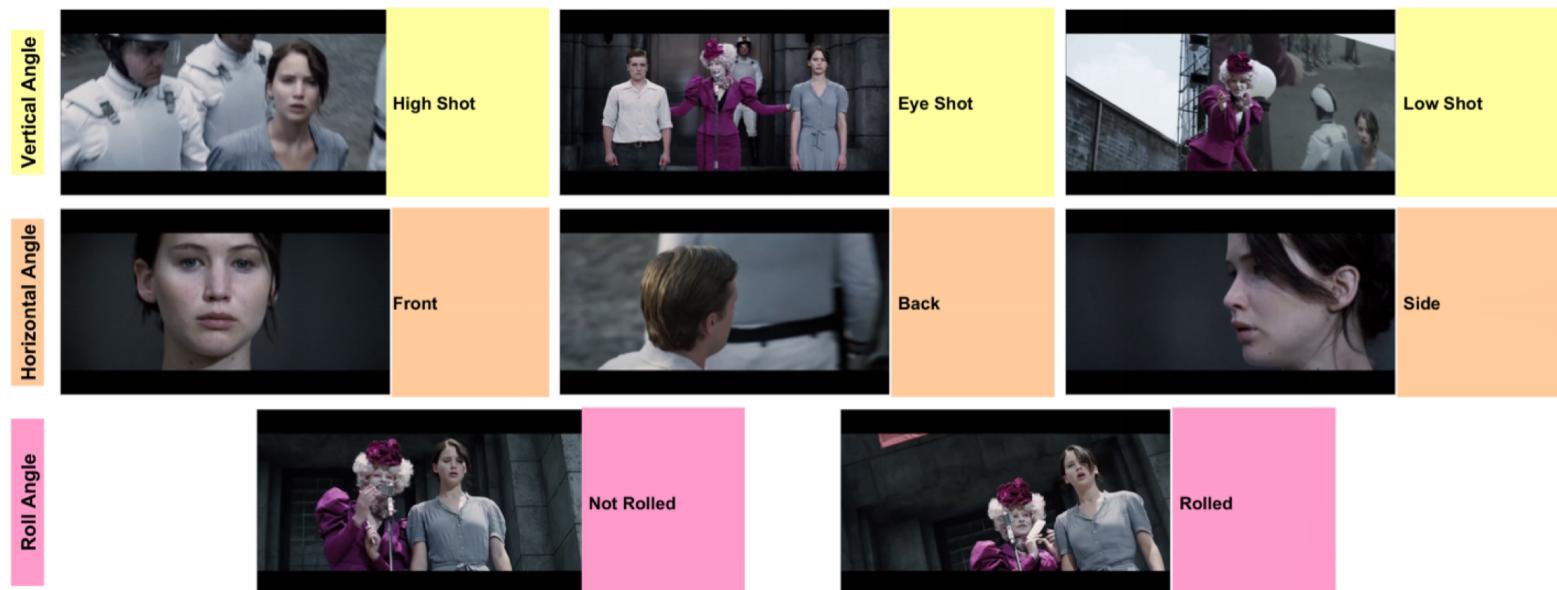


Wu, H. Y., Palù, F., Ranon, R., & Christie, M. (2018). Thinking like a director: Film editing patterns for virtual cinematographic storytelling. ACM Transactions on Multimedia Computing, Communications, and Applications (TOMM), 14(4), 1-22.

CINEMATOGRAPHY BASICS

Framing

Shot angle: horizontal, vertical, and roll angle of the camera

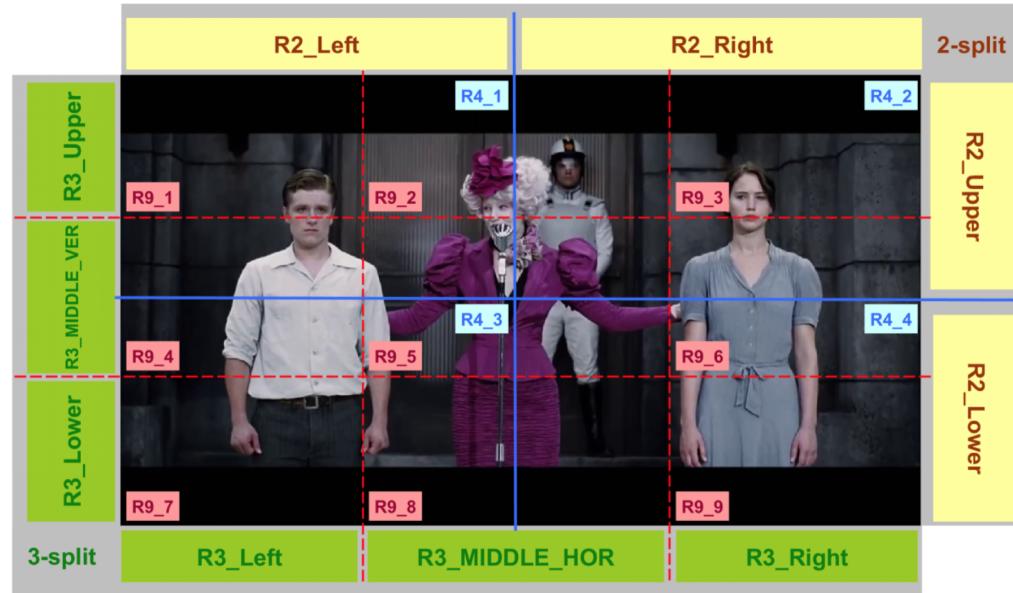


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CINEMATOGRAPHY BASICS

Framing

Positioning (mise en scène): positioning of objects and people



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CINEMATOGRAPHY BASICS

Framing

Occlusion: partially showing or hiding elements to create meaning



Madame a des envies



(COCO 2017)



Wu, H.-Y., Nguyen, L., Tabei, Y., Sassatelli, L. Evaluation of deep pose detectors for automatic analysis of film style. 10th Eurographics Workshop on Intelligent Cinematography and Editing, Apr 2022, Reims, France.

CINEMATOGRAPHY BASICS

Framing

Artistic styles: well-known portrayals in film history



Borne Supremacy (FLIC)



Mr. & Mrs. Smith (FLIC)



Silence of the Lambs



Marie Antoinette



Bend of the River (FLIC)

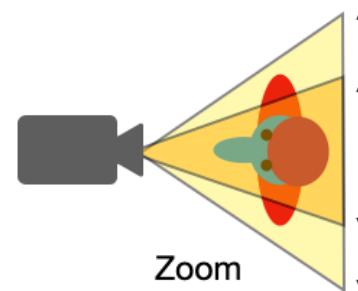
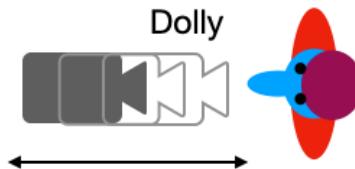
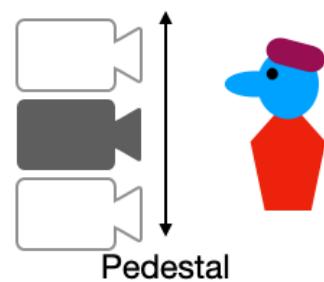
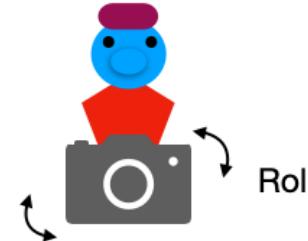
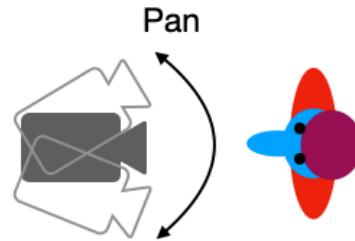
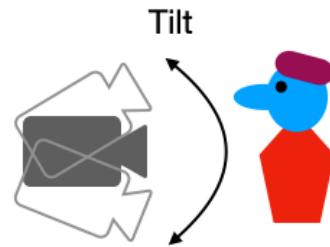


Wonder Woman

Wu, H.-Y., Nguyen, L., Tabei, Y., Sassatelli, L. Evaluation of deep pose detectors for automatic analysis of film style. 10th Eurographics Workshop on Intelligent Cinematography and Editing, Apr 2022, Reims, France.

CINEMATOGRAPHY BASICS

Camera motions



CINEMATOGRAPHY BASICS

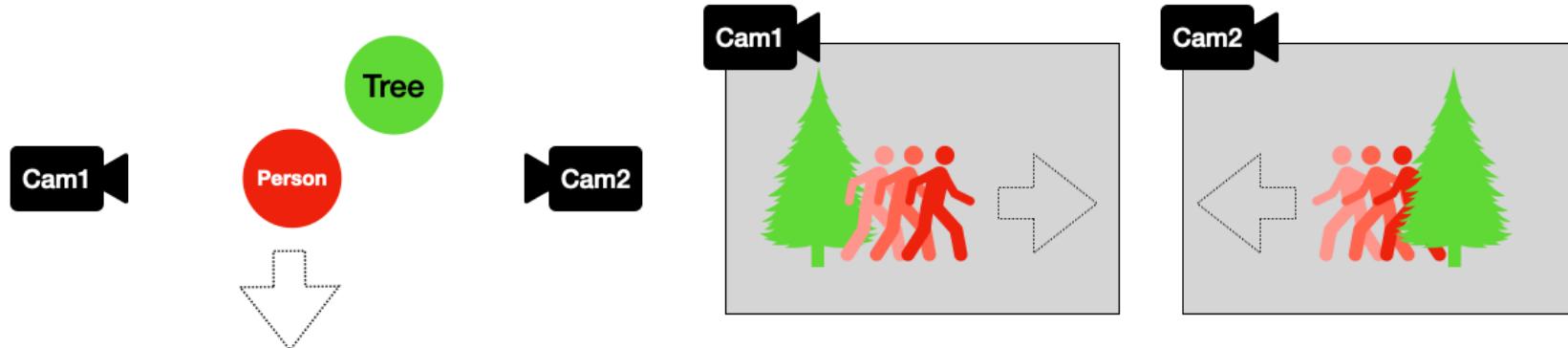
Editing (montage): assembling of multiple camera takes into a sequence

- **Continuity:**
 - on-screen elements should move in the same direction after a cut
 - the camera should not cross the 180 degree line
- **Narrative:** displaying spatial temporal relations of the visual story

CINEMATOGRAPHY BASICS

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CINEMATOGRAPHY BASICS

Food for thought 1: 2D visual storytelling techniques (in film, anime, manga, ...) are widely applicable and adopted in 3D gaming

Food for thought 2: Are they equally applicable to virtual and augmented reality?

Food for thought 3: Do not forget other modalities of visual storytelling!

PLAN

1. Cinematography basics
2. **3D camera control**
3. Light, materials and textures

GAME CAMERA CONTROL

Observe the cinematographic style that is used in real-time gameplay

Metroid Dread - All Cutscenes The Movie HD



GAME CAMERA CONTROL

Additional elements of the game camera

- Genre
- Interaction
- Perspective
- Occlusion

Haigh-Hutchinson, M. (2009). Real time cameras: A guide for game designers and developers. CRC Press.

GAME CAMERA CONTROL

Genre and interaction

- Platformer, first-person shooter (FPS), escape game, racing...
- 3D, 2D, 2.5D, virtual reality
- What kind of control, and the amount of precision

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GAME CAMERA CONTROL

Genre and interaction

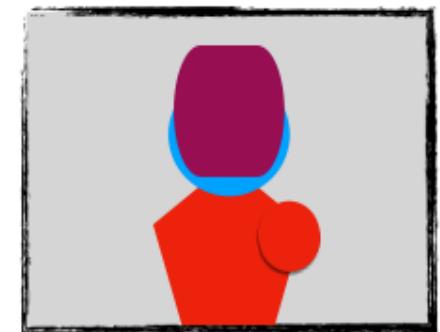
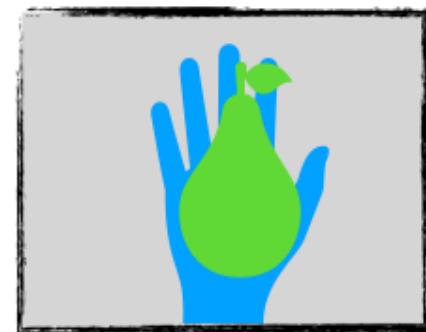
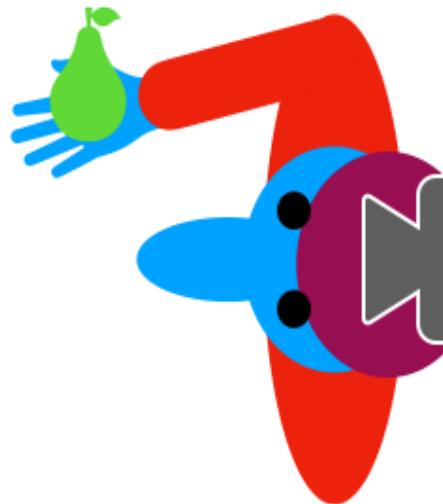
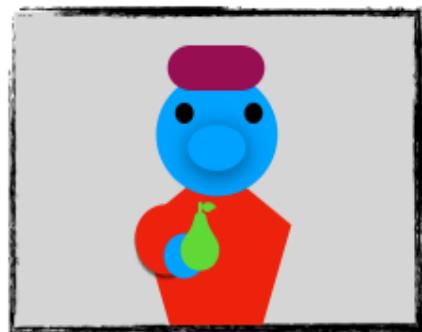
Bow and Arrow - The Legend of Zelda: Breath of the Wild



Bow and arrow mechanism in Zelda Breath of the Wild

GAME CAMERA CONTROL

Perspective: from whose point of view the camera takes



GAME CAMERA CONTROL

Switching perspectives (1st, 2nd, 3rd, cinematics)

Metroid Prime Trilogy: Metroid Prime 3: Corruption (HD) (P...


GAME CAMERA CONTROL

Occlusion: either plan a "perfect" camera trajectory, or use dithering for fake transparency

Super Mario Odyssey - Full Game Walkthrough



GAME CAMERA CONTROL

An exercise of observation: next time when playing a video game, observe the placement of the camera both in gameplay and cinematic cutscenes.

- What is the genre?
- How is the camera placed?
- How does the camera move?
- Does the camera avoid occlusion?
- Does this placement and movement make sense?

GAME CAMERA CONTROL

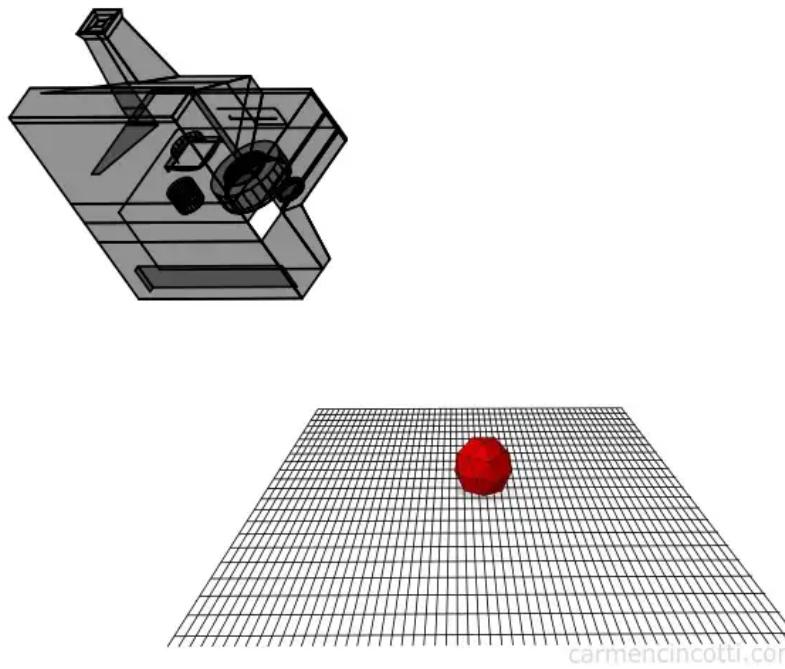
Common game camera control functions

- Track: maintaining an object position on screen through space
- Look-at: directing the camera to look at an object
- Shaking: simulating eqrthquakes, disruptions, or "normal" walking style

Haigh-Hutchinson, M. (2009). Real time cameras: A guide for game designers and developers. CRC Press.

GAME CAMERA CONTROL

Look-at camera example



Source: [The Magic of the LookAt Matrix](#), Carmen Cincotti

Haigh-Hutchinson, M. (2009). Real time cameras: A guide for game designers and developers. CRC Press.

GAME CAMERA CONTROL

Look-at camera example

```
1 Mat4 const Mat4::LookAt(Vec3 const & source, Vec3 const & dest)
2     Vec3 viewDirection = Vec3(dest-source).AsNormalized();
3     Vec3 right = Vec3::Cross(worldUp, viewDirection).AsNormalized();
4     Vec3 up = Vec3::Cross(right, viewDirection).AsNormalized();
5
6     return Mat4(
7         right[X], viewDirection[X], up[X], source[X],
8         right[Y], viewDirection[Y], up[Y], source[Y],
9         right[Z], viewDirection[Z], up[Z], source[Z],
10    )
11 }
```

Haigh-Hutchinson, M. (2009). Real time cameras: A guide for game designers and developers. CRC Press.

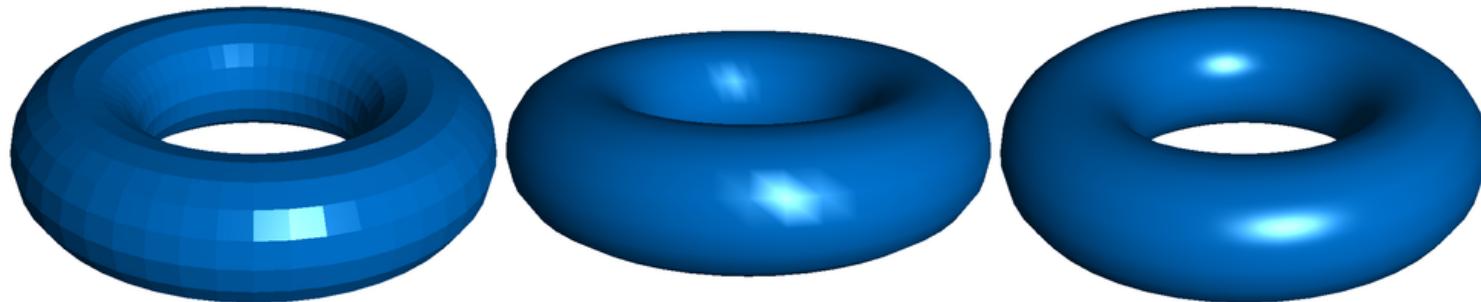
PLAN

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LIGHTING, MATERIALS AND TEXTURES

A bit of computer graphics (math)

- Flat shading: each polygon is shaded the same color
- Gouraud shading (1971): interpolation of vertex coloring across polygon
- Phong shading (1973): interpolation of vertex normals for each pixel across polygons



LIGHTING, MATERIALS AND TEXTURES

- Environmental lighting
- Lighting interactions

LIGHTING, MATERIALS AND TEXTURES

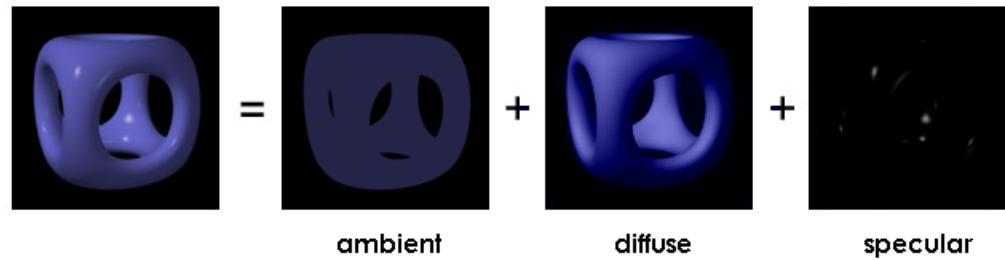
Environmental Lighting

- Point light: light emitted from a single point in all directions (e.g., a lamp)
- Directional light: uniform scene lighting from a single direction (e.g., the sun)
- Spotlight: a cone of light
- Ambient lighting: uniform illumination of the scene with no light source

LIGHTING, MATERIALS AND TEXTURES

Lighting interactions (Materials and textures)

- Ambient: global uniform illumination
- Diffuse: level of "scattering" of light across a surface
- Specular: shine and highlights



Source: [Wikipedia](#)

LIGHTING, MATERIALS AND TEXTURES

In filmmaking, a basic lighting setup consists of multiple lights

- Key light: main source of light
- Backlight: lighting from behind actor highlighting features and textures
- Fill light: weaker secondary light to compensate shadows created by the key light



ANNOUNCEMENTS

- Next week you will need to arrive with Unity installed on your PC (version 2021.3.11f1)
- Rendu TD3 : 23:59:59 7th February
- FAQ:
 - Q: Can I follow a tutorial? A: Of course! But make sure to (1) cite your source, and (2) add a personal touch
 - Q: Can I use an existing model / animation I found on the internet? A: No.
 - Q: Can I use external assets (image background, textures...)? A: Yes, but cite your source
 - Q: How many points will I get if _____? A: Somewhere between 15-20 if it meets the minimum requirements, and 0-15 otherwise.

BLENDER CAMERA MOTION DEMO

- pan, tilt, roll
- track, pedestal, dolly
- zoom
- Hitchcock effect