Light

AR0771 Light Lecture

Design Informatics

Why do we need light ? Or darkness

- Defines the shape and appearanceof objects

- Works at an emotional level, setting mood and atmosphere

- Emphasizes areas or objects

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Why do we need shadow?

- Gives depth to an image

- Positions objects

- Sun direction (time and place)

- Dramatize, mistery

Digital Light

- Need to simulate everything

- Limited computing power

- No laws of physics

- Lots of possibilities

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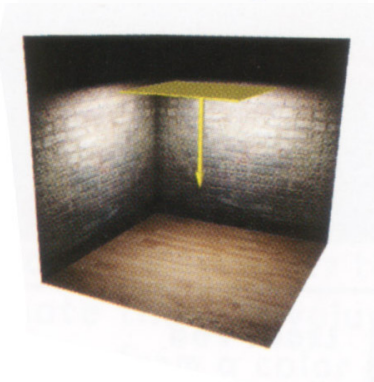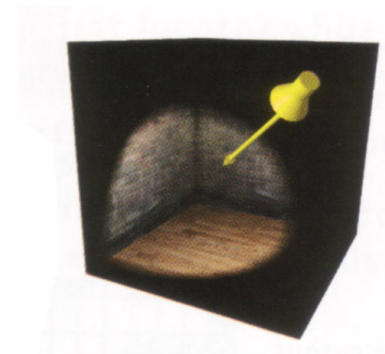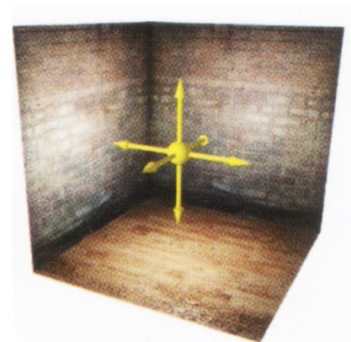# Digital Light Sources

- Ambient

- Directional

- Point

- Spot

- Area

- Objects (material)

- Image File (IBL)
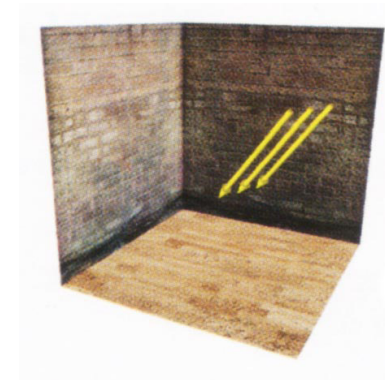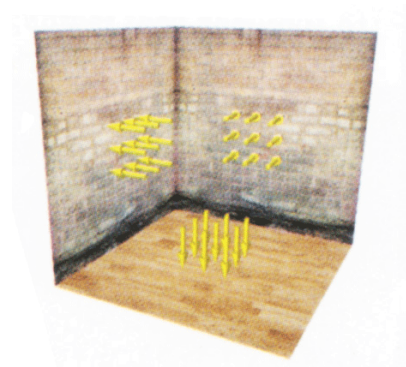
Common settings of a light

- Intensity

- Color

- Shadow

  - off

  - raytrace

  - depth map

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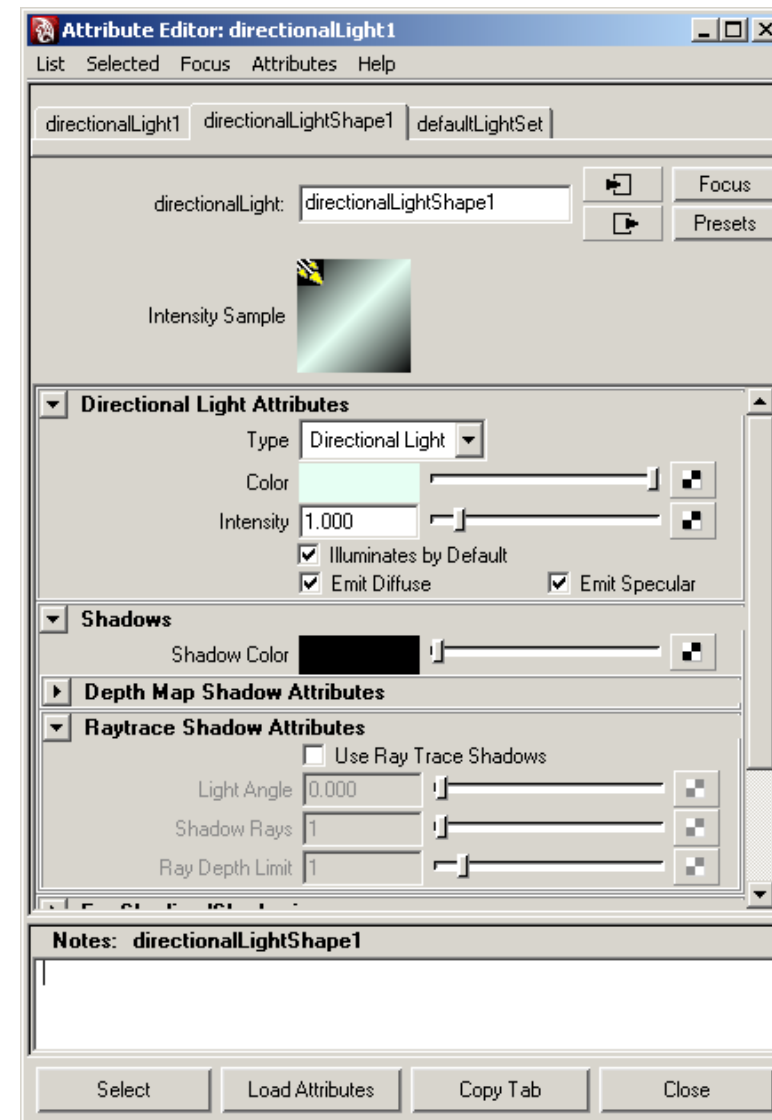
Color

The color depends on several factors

- Time

- Weather

- Type of light

- Mood

- etc

Degrees Kelvin	Type of Light Source	Indoor (3200k) Color Balance	Outdoor (5500k) Color Balance
1700-1800K	Match Flame		
1850-1930K	Candle Flame		
2000-3000K	Sun: At Sunrise or Sunset		
2500-2900K	Household Tungsten Bulbs		
3000K	Tungsten lamp 500W-1k		
3200-3500K	Quartz Lights		
3200-7500K	Fluorescent Lights		
3275K	Tungsten Lamp 2k		
3380K	Tungsten Lamp 5k, 10k		
5000-5400K	Sun: Direct at Noon		
5500-6500K	Daylight (Sun + Sky)		
5500-6500K	Sun: through clouds/haze		
6000-7500K	Sky: Overcast		
6500K	RGB Monitor (White Pt.)		
7000-8000K	Outdoor Shade Areas		
8000-10000K	Sky: Partly Cloudy		

Based on information from the book [digital] Lighting & Rendering 3D
Chart and colors (c)2001 Jeremy Birn for 3DU.com .COM

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'Real world' light in CG

Using the Environment

• Image Based Lighting (dome)

• Physical Sun and Sky

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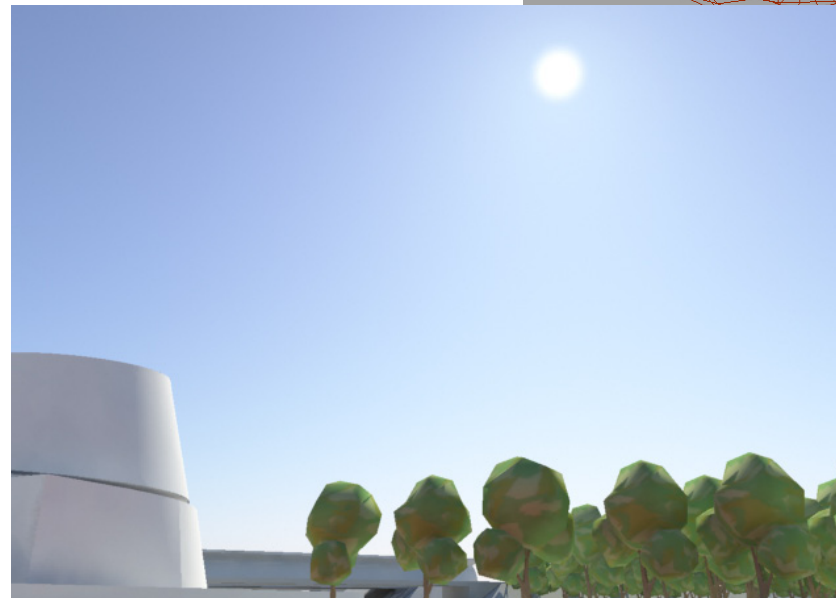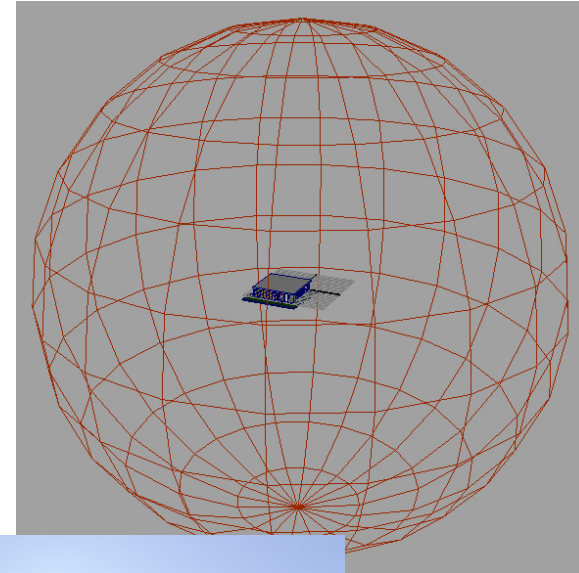
Light is everywhere
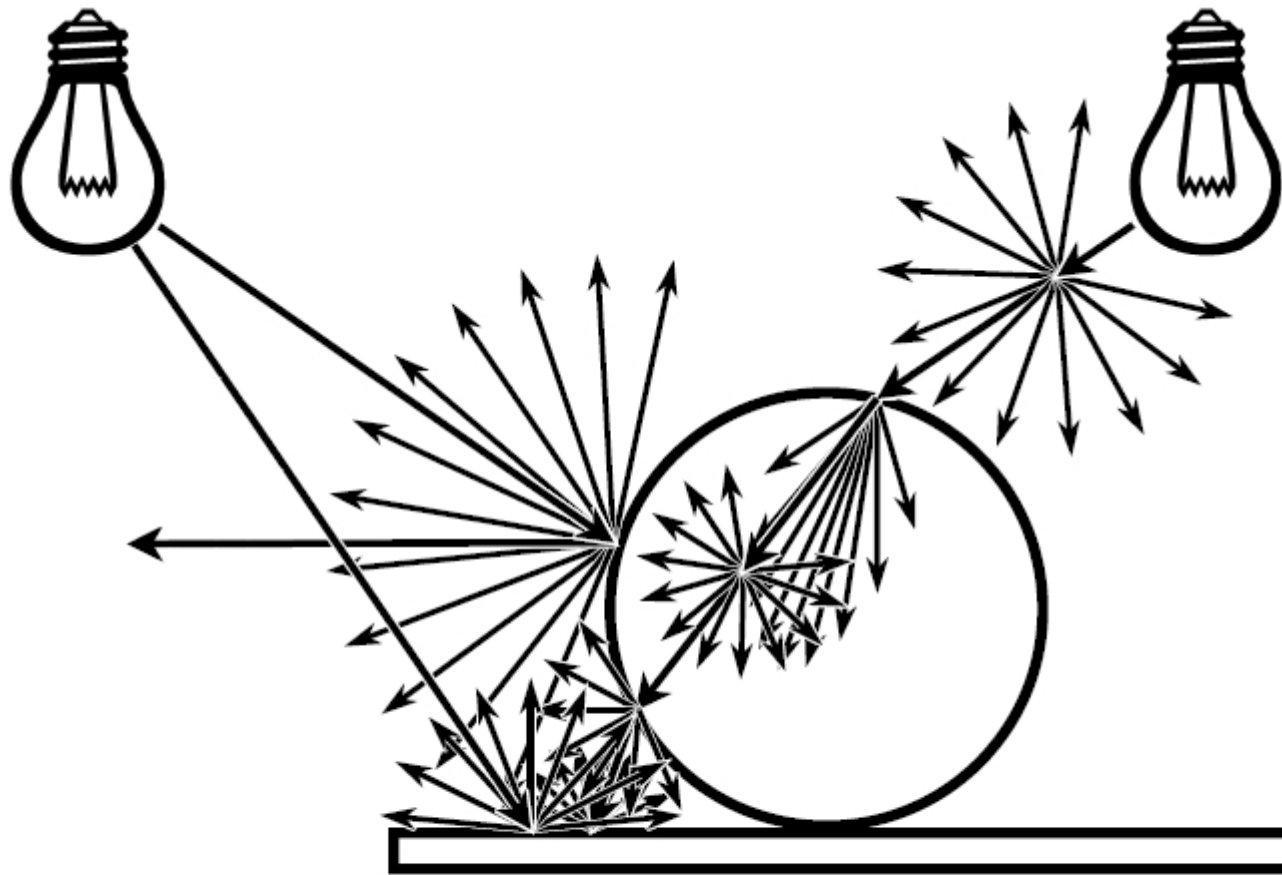
Light everywhere

Illumination Types

- Direct Illumination

Light directly from a source (i.e. Sun)

- Indirect Illumination

light that bounces of other surfaces
(secondary light)

- Caustics

Refraction of Light
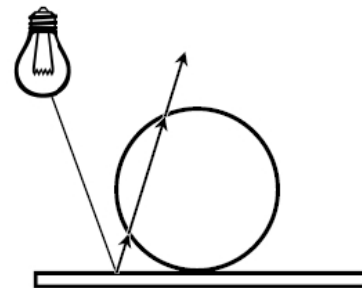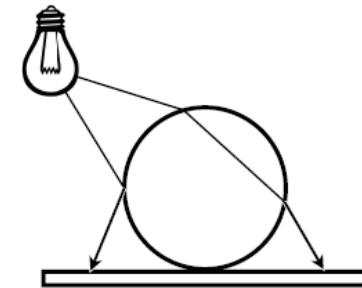
Raytracing

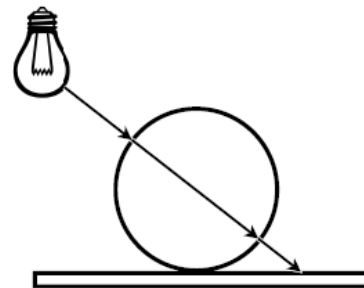The direct component of a light source is easy to calculate using raytracing techniques. Rays are used to determine the position of a lightsource in relation to the camera and the objects in the scene. Since this is a camera based method it is considered to be very effective in its calculations.

Image

Camera

Light Source

View Ray

Shadow Ray

Scene Object

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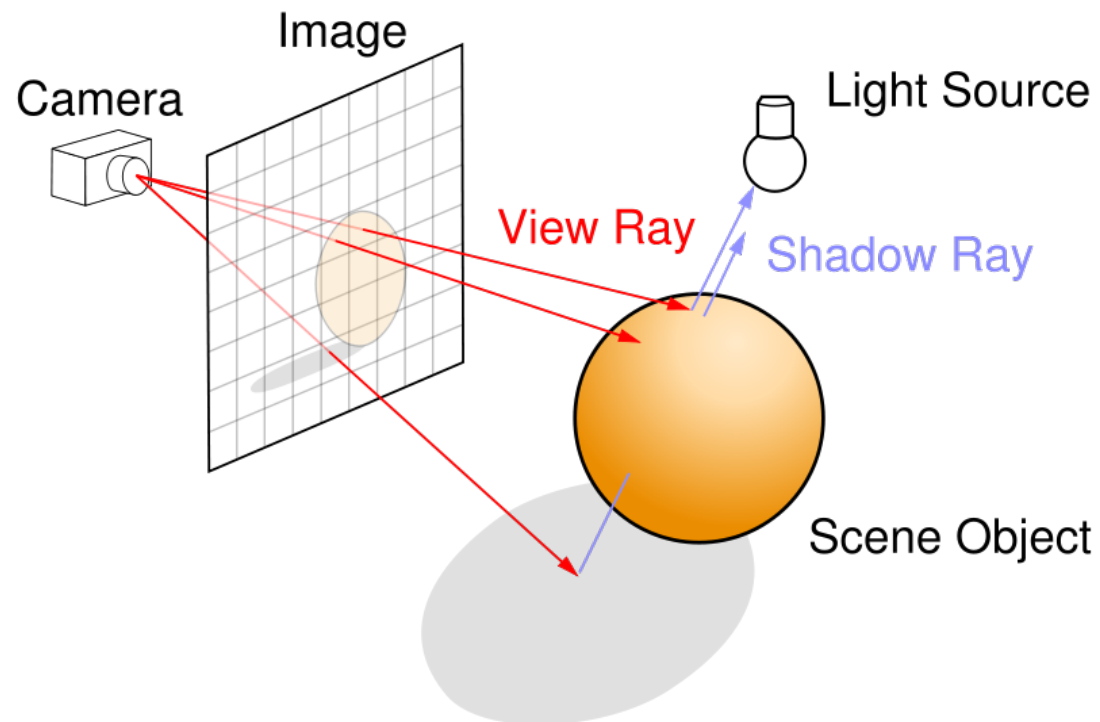
Indirect Illumination

Mental Ray uses to methods to calculate the indirect light:

- Final Gather

- Global Illumination

Since both these methods are time consuming it is recommended to seek alternatives. If none are found Final Gather might be an option.

Final Gather

Final Gather works much alike the raytracing methods since it uses an extra ray to determine the indirect component of the light source.
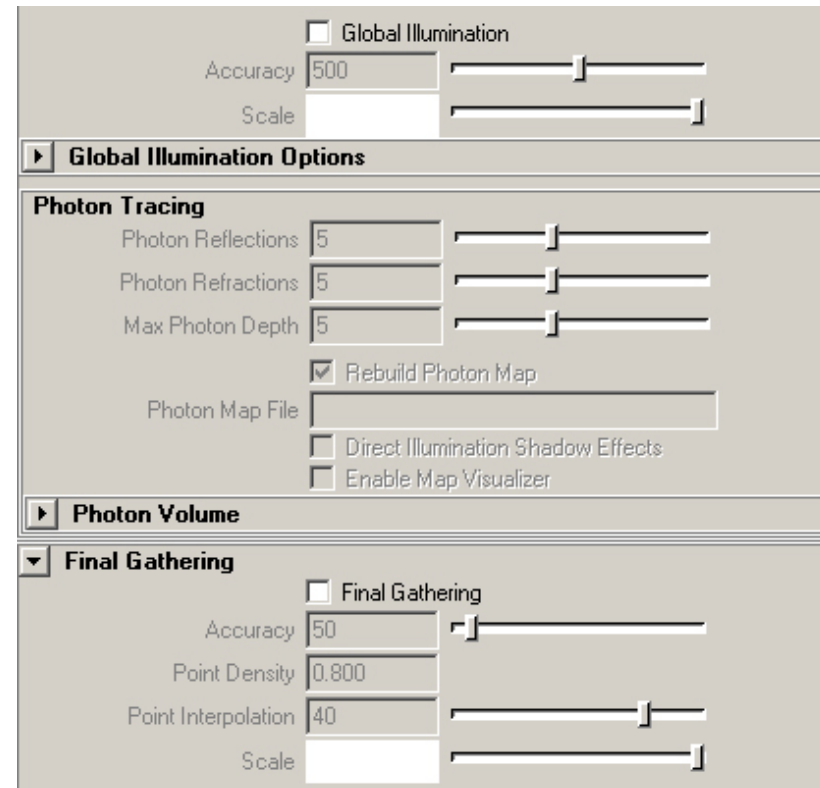
Light Direction
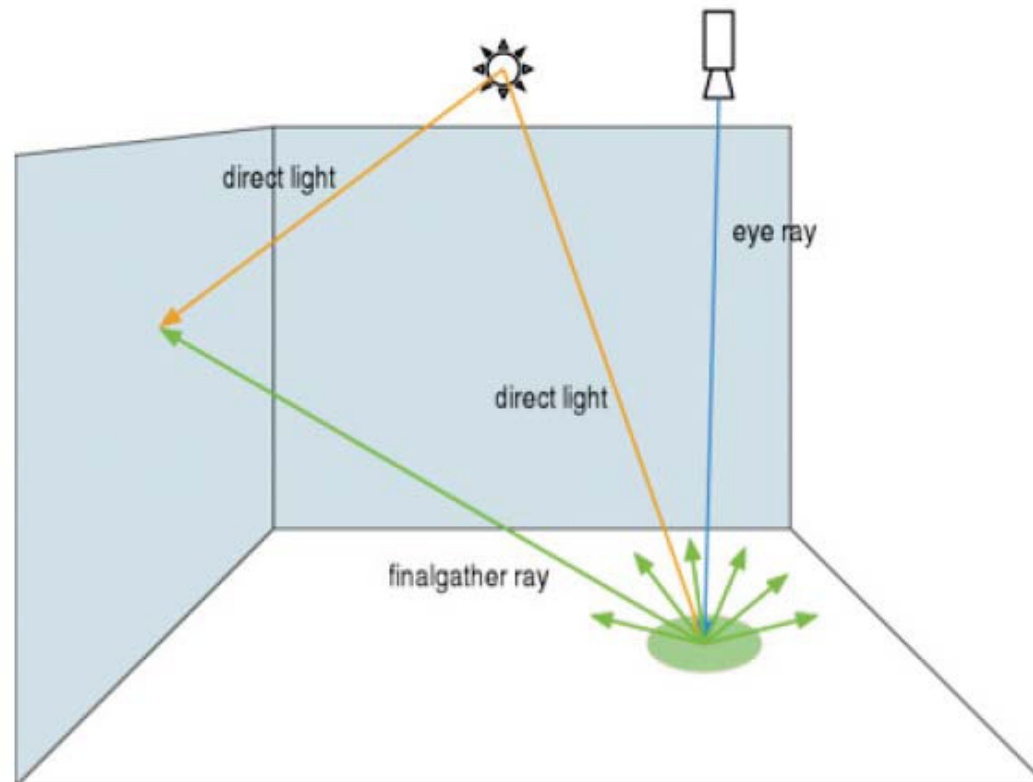
Front Light

This is where the light source is directly behind the viewer's point of view. It is most commonly seen in flash photography and is often fairly unappealing if the light source is hard - there are exceptions and in some situations very attractive images can come from soft frontal lighting.

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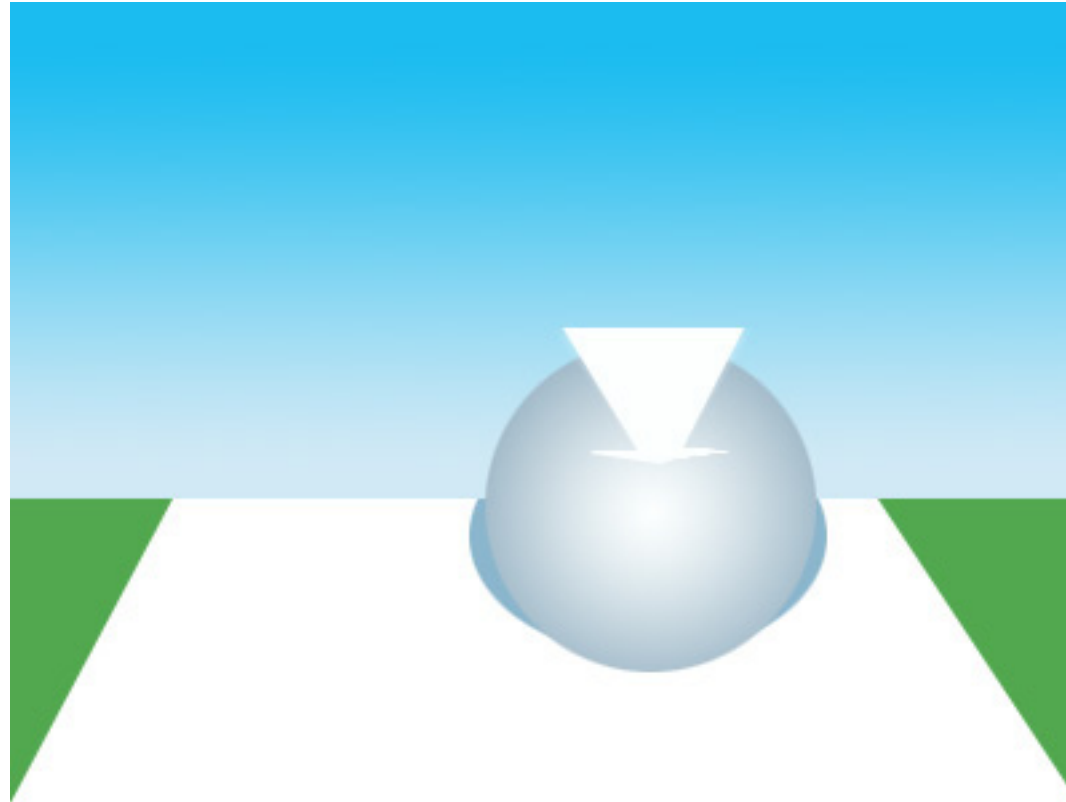
Light Direction

Front Light

Front lighting does little to reveal form or texture since the shadows are mostly hidden from view, as a result it can make things look flat.

Light Direction

Back Light (Rim Light)

Back lighting is where the viewer is looking into the light source, and objects will have their lit sides facing away from us to appear either as silhouettes or darkly lit by the fill light.
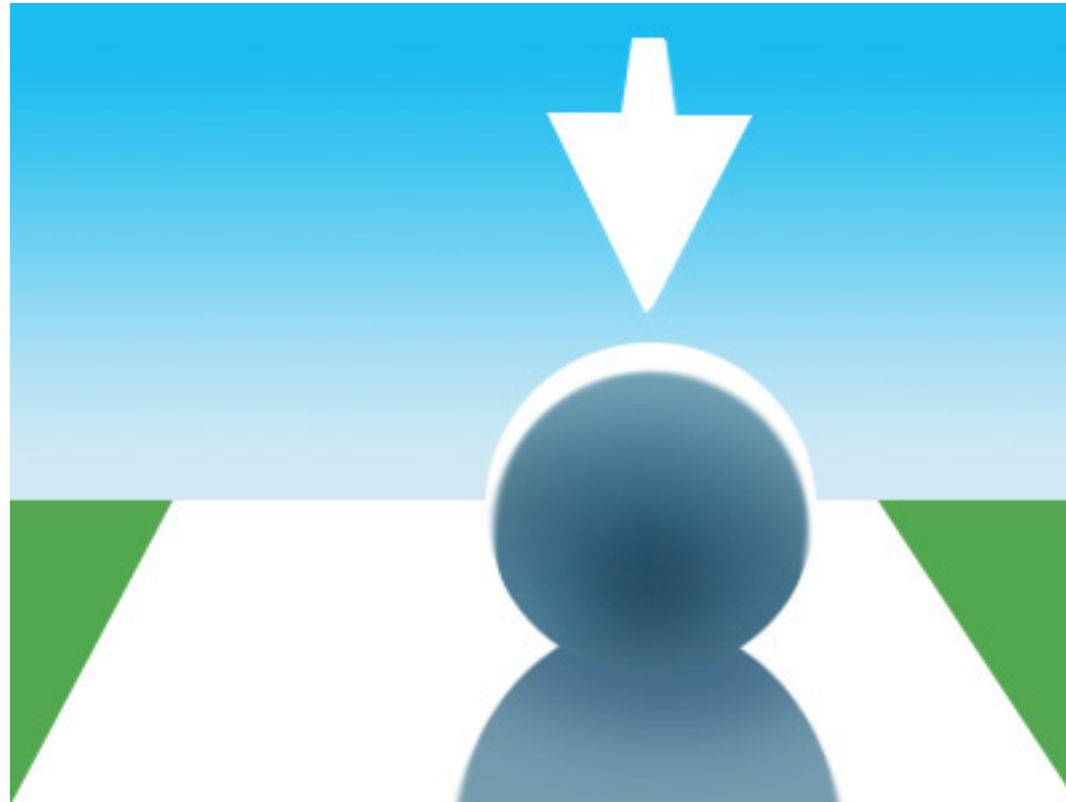
Light Direction

Back Light (Rim Light)

It is usually a high contrast situation and can often look very atmospheric and dramatic.

Light Direction

Back Light (Rim Light)

Back lighting can work to
seperate your character from the
background and create a sense
of depth.

Light Direction

Side Light

Side lighting is very good for showing form and texture and lends a three-dimensional quality to objects. Shadows are prominent and contrast can be high as a result.

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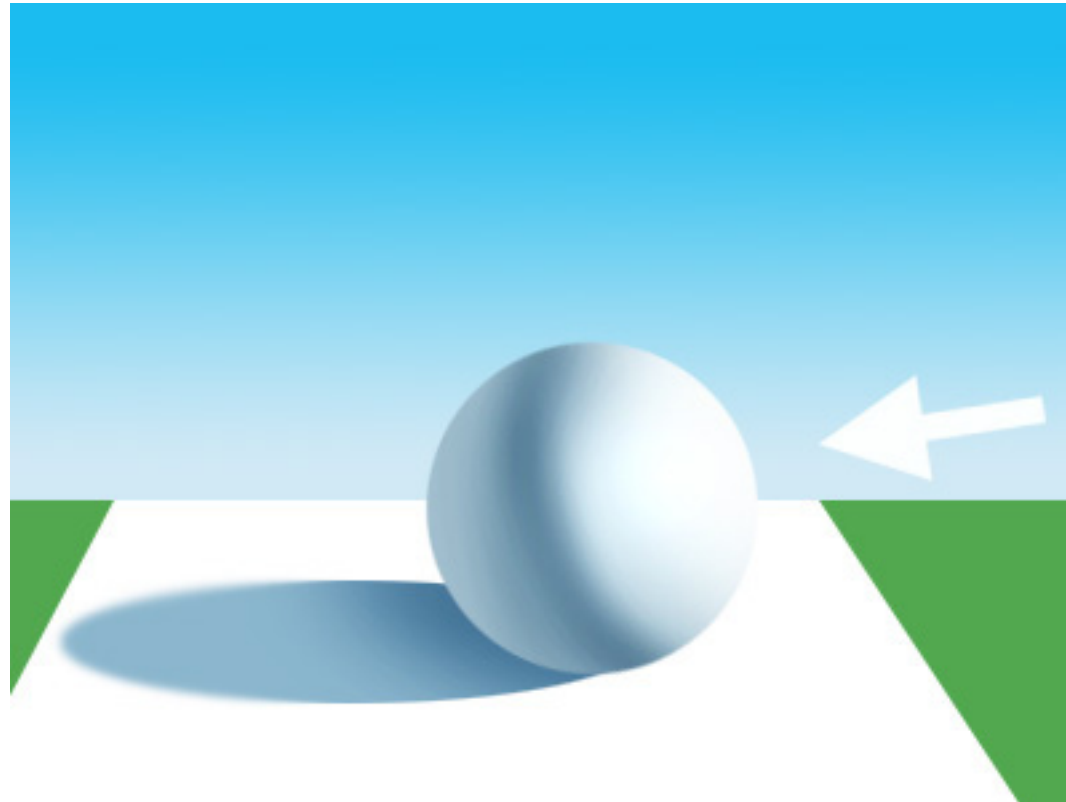
Light Direction

Side Light

Side lighting can be used to throw dramatic shadows onto surfaces such as walls and create atmosphere.

Light Direction

Top Light

Top lighting is a slightly more unusual situation, although it is common in overcast daylight. It can also be encountered in sunshine at midday, in some interiors and in other situations such as stage lighting.
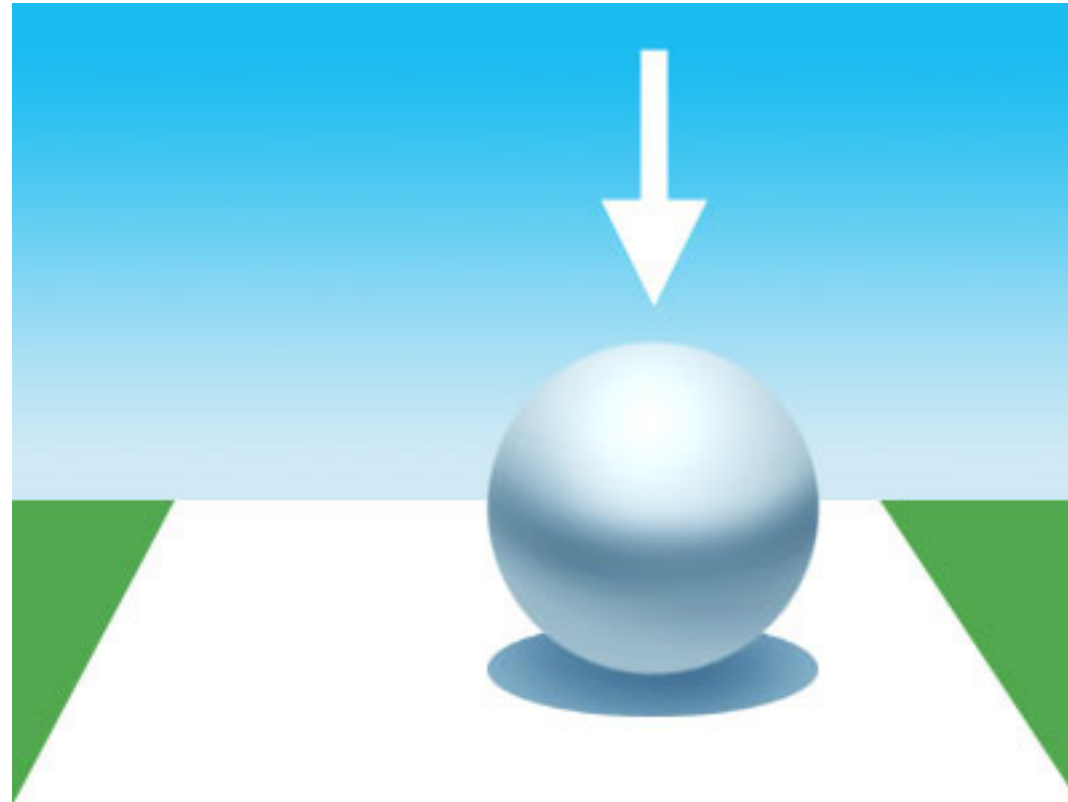
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Light Direction

Top Light

In soft light it is an effective way of showing form. Under hard light it can lend an air of mystery by casting dramatic shadows which conceal most of the forms beneath them: for instance people directly underneath hard lights will have black holes for eyes since their eye sockets will be in total shadow. Same with buildings.

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Light Direction

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Light Color

Photo Light

This kind of light is easily recognised by the absence of shadows, so if your photographic reference features this sort of lighting you should take this into account and adapt it according to your own requirements.
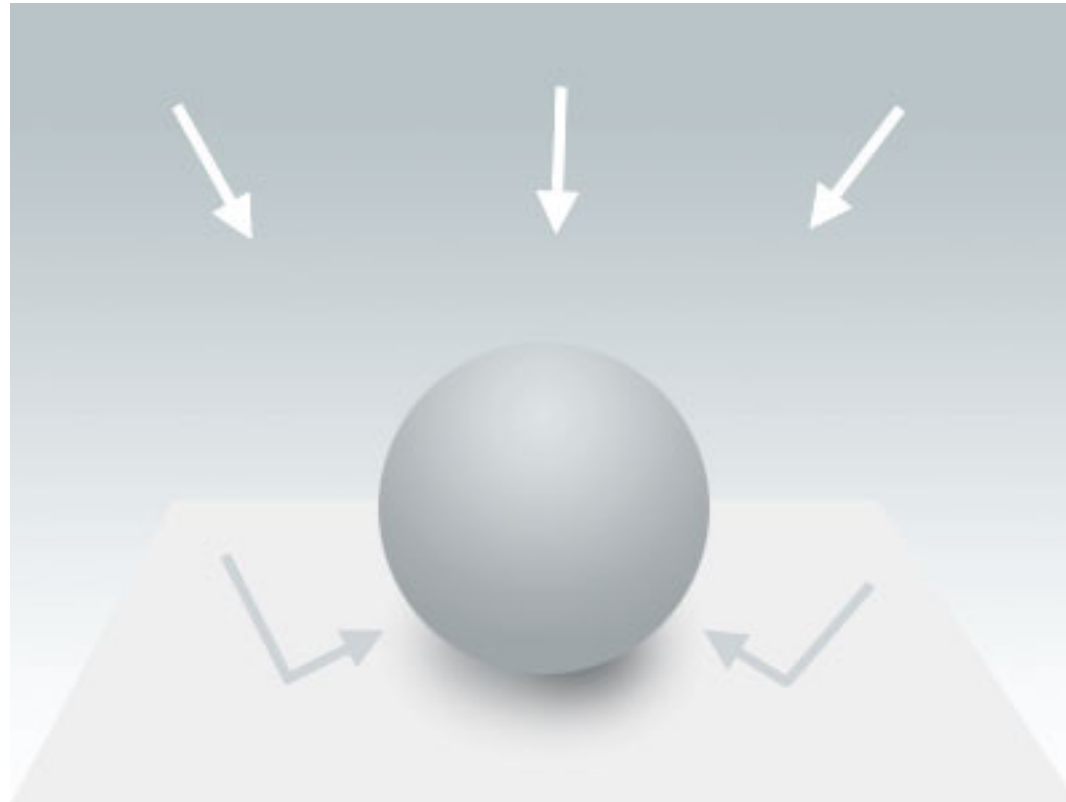
Light Color

Photo Light

This kind of lighting gives a very "flat" look.

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Light Color

Fire or Candle Light

Light that comes from a flame is even redder than incandescent light from light bulbs, in fact its colour temperature is so low that our brain can't compensate for it and we actually perceive it as orange or red.

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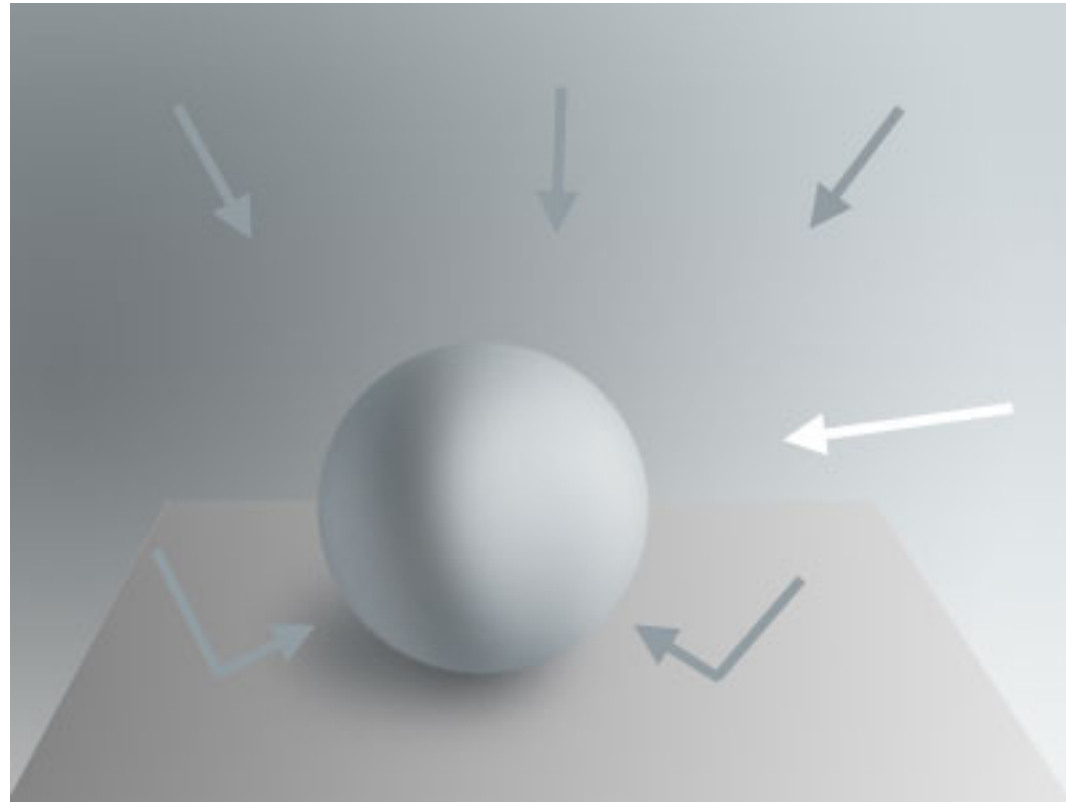

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Light Color

Window Light

Window light is how we generally see natural light indoors. Since the window itself is the effective light source this means that the light is quite soft (since a window is a large source). Window light is attractive and very photogenic. If there is only one window then contrast is relatively high despite the soft light source, with multiple windows contrast can be lower since there will be more fill light.

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Light Color

Window Light

The colour of the light is dependent on many things: firstly the weather will affect the light coming through the window, if it is overcast the initial light will be white, grey or blue. In sunny conditions it will be either blue skylight or white, yellow or red sunlight (depending on time of day). So it tell a lot about the outside conditions.

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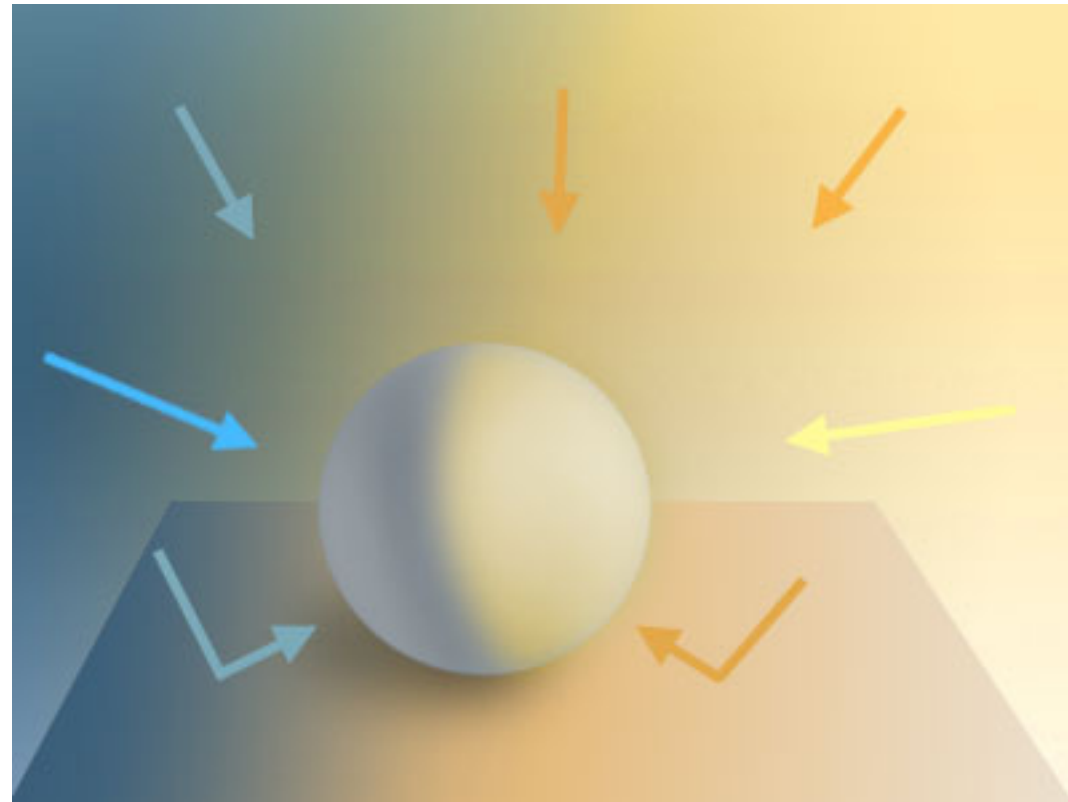

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Light Color

Mixed lighting

Both indoors and outdoors it is very common to see a mixture of natural light and artificial light, especially at dusk and at night. This can lead to very interesting mixtures of colours and intensities, especially since natural light and tungsten light often have complimentary colours in blue and orange.
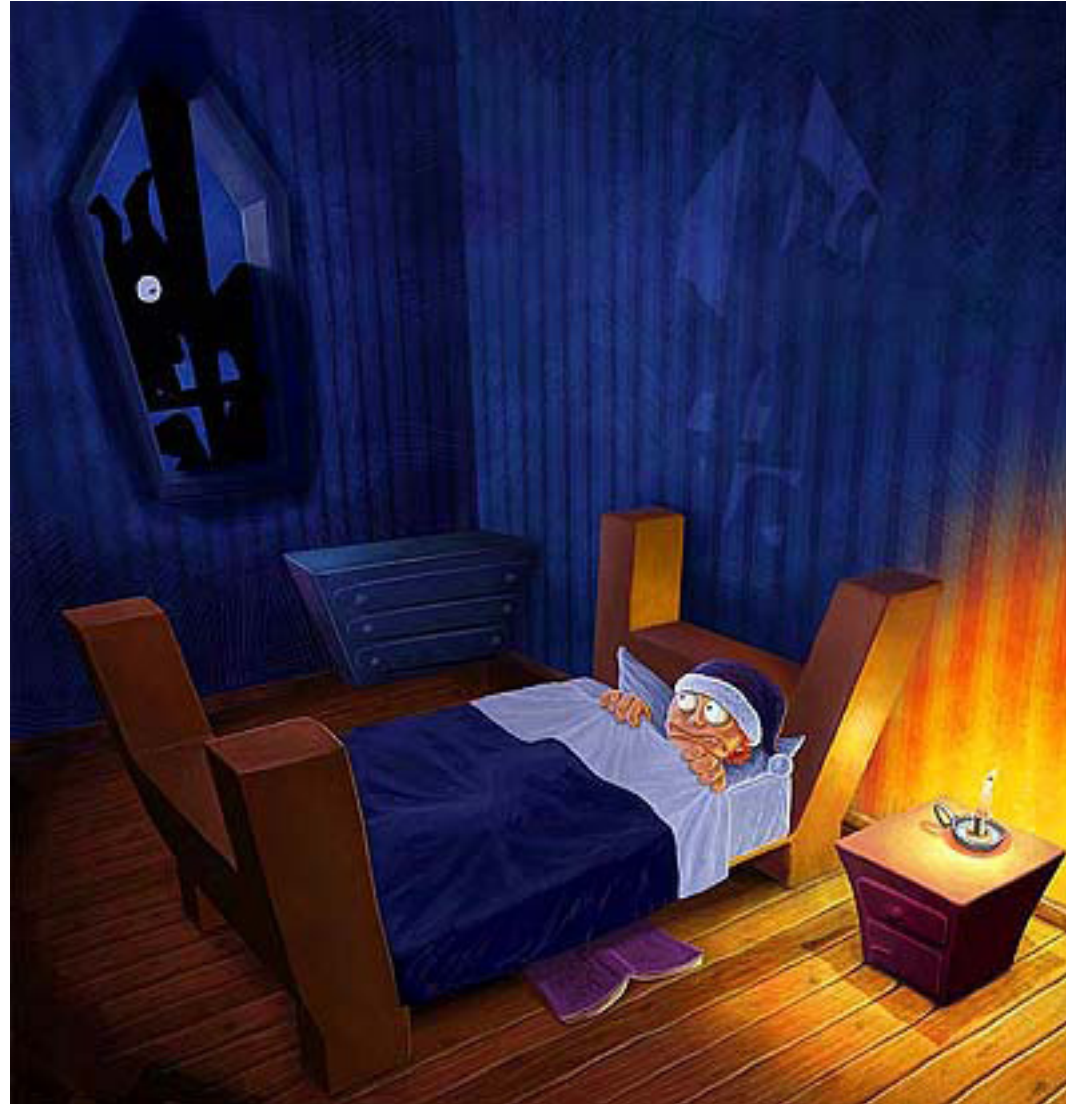

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Light Color

Mixed lighting

Any object near a window whose curtains aren't drawn in the evening or at night would have some mixture of natural and artificial light on it. This kind of lighting is obviously very commonly found outdoors too, for example things illuminated by street lights usually have some natural light as fill. Lights on buildings too can have very interesting colours and create striking contrasts with natural light coming from the sky.

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Isolation

Ritchie L. Roberts
ritchie@zeroneuro.com

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Examples - Studio Setup

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