



# Light Stage

## Realistic Avatars Made With a Spherical Light Stage



Los Angeles, CA (Institute for Creative Technologies - Army)—Light Stage technology is changing the science of animation. It enables the creation of lifelike virtual avatars that appear in movies and video games and can also be used to train people in the Army. Scientists use photographs taken on a stage surrounded by lights in every direction to produce realistic computer-generated images.

*“When we look at the world, we don’t actually see the world itself. We just see the light that’s reflecting off of it.”*

**Paul Debevec, project director**

### Framework

Middle School

### Standards

- NSES - B.iii.3 ➤ Light interacts with matter.
- STL - 2.N ➤ Systems thinking involves how parts relate.
- STL - 3.D ➤ Systems interact with each other.
- STL - 10.G ➤ Invention and innovation play a role.
- STL - 17.H ➤ Communication systems transfer information from human to machine and machine to machine.

### Content Illustrated

- 2-D and 3-D computer models can be made and used to solve problems.



# Content

## Physical Science

- Sight is the perception of light bouncing off objects and surfaces.
- Light reflects differently off of different surfaces.

## Technology

- Light Stage is a technology that looks like a sphere fitted with LED lights. It can light and photograph a person from all directions and generate a data set describing how light reflects off all of the person's surfaces.
- ICT has several Light Stages that are different sizes. Light Stage 6 can capture an object the size of a whole person. Its shape is the upper 2/3 of a sphere, with an 8-meter diameter. Six thousand LEDs controlled by 60 little computers are distributed around the stage and connect to a master computer.
- The images and data captured from these Light Stages allows computer scientists to create realistic avatars. Images from the real world are manipulated via computer in a virtual world.

## Engineering

- The goal is to make computer-generated objects or situations look completely realistic. Pictures of real things are taken and the information is digitized and then can be manipulated by computer. People can do anything with these objects in the virtual world.
- On the Light Stage, objects can be relit to show how they would look in a different environment. Also geometric information about the object can be gathered so that the image can be reconstructed.

## Math

- The Light Stage must be four times the diameter of the original object to capture realistic lighting.
- Geometric information can be used to create a model of a person.

## Guiding Questions

- How many lighting angles and pictures are needed to make a realistic computer model?

## Suggested Activities

*To think about as you watch:*

- Have students try to reconstruct a 3-D object from a limited number of pictures.
- Have students look at pictures and determine the placement and angle of the light source falling on objects.

## Keywords

animation, avatar, computer-generated, computer graphics, digitize, diffusion, geometric information, LED, Light Stage, modelling, optics, reflection, virtual world

- *Light Stage* can be found online at [www.ndep.us/Light-Stage](http://www.ndep.us/Light-Stage). Visit [www.ndep.us/LabTV](http://www.ndep.us/LabTV) for a list of process skills modeled in webisodes.