The Effect of Lighting on Spatial Perception: A Survey

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Project Goals

- Gain familiarity with lighting techniques and factors
- Compare and contrast different articles
- Learn to thoroughly read graphics literature

Procedures

- Collected articles published by ACM and IEEE
- Stored results in Google Sheets file
- Analyzed articles
- Grouped articles
- Compare and contrast articles

Importance of Our Project

- Lighting enhances quality of perceived image
- Universal in photography and film
- Accurate rendering of images
- Compilation of research within the last decade

Anisotropic and Isotropic Highlights

- **Anisotropic:** light scatters in a specific direction, usually perpendicular to the grooves
- **Isotropic:** light scatters evenly in all directions
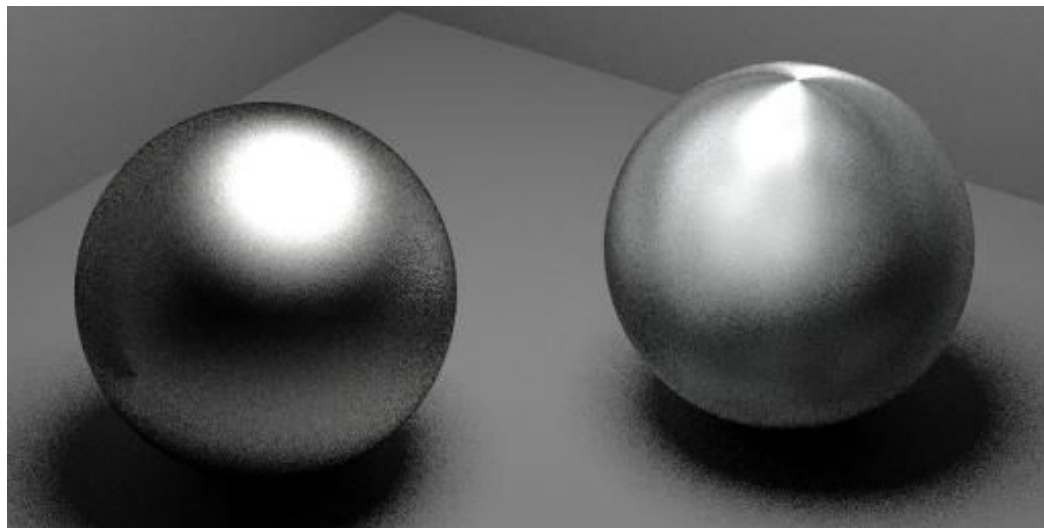
http://www.graphics.cornell.edu/~westin/image_gallery.html
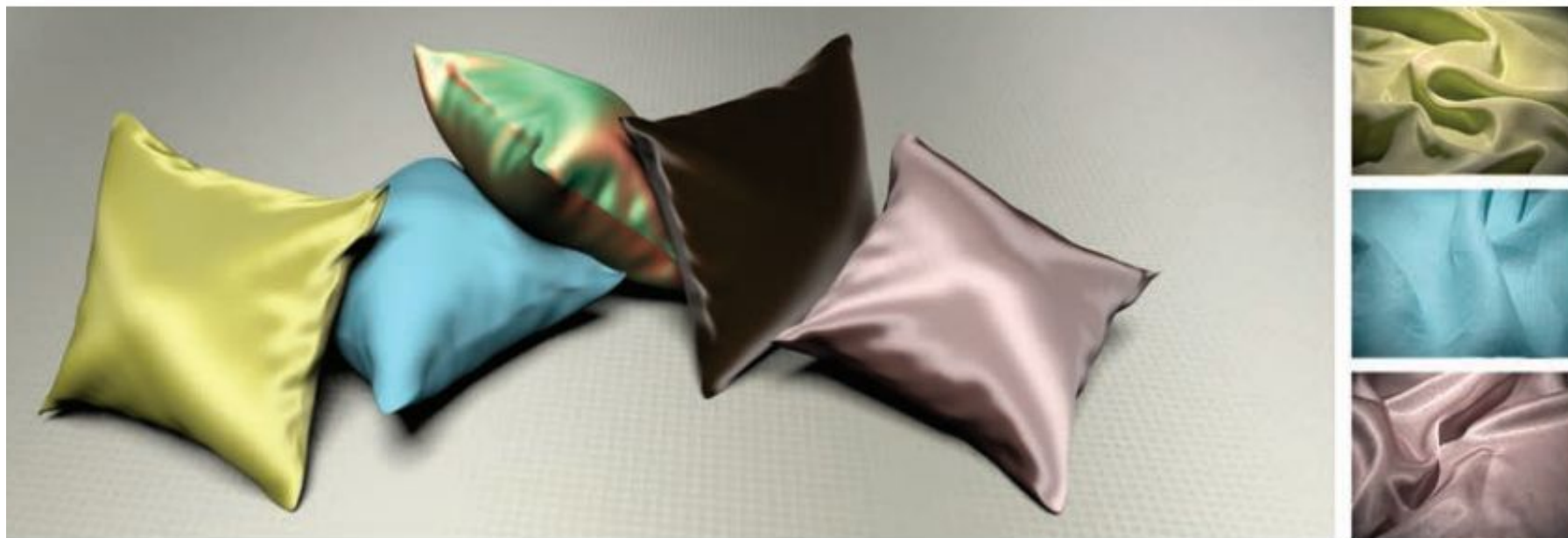
Sadeghi, I., Bisker, O., de Deken, J., and Jensen, H. W. 2013. A practical microcylinder appearance model for cloth rendering. ACM Trans. Graph. 32, 2. Article 14 (April 2013) 12 pages.

Impact on Spatial Perception

- Realistic rendering of 3D shape
- Visibly see edges of the object
- Accurately render creases
- Shading: identify relative locations of objects in a scene

Light Positioning

Fleece
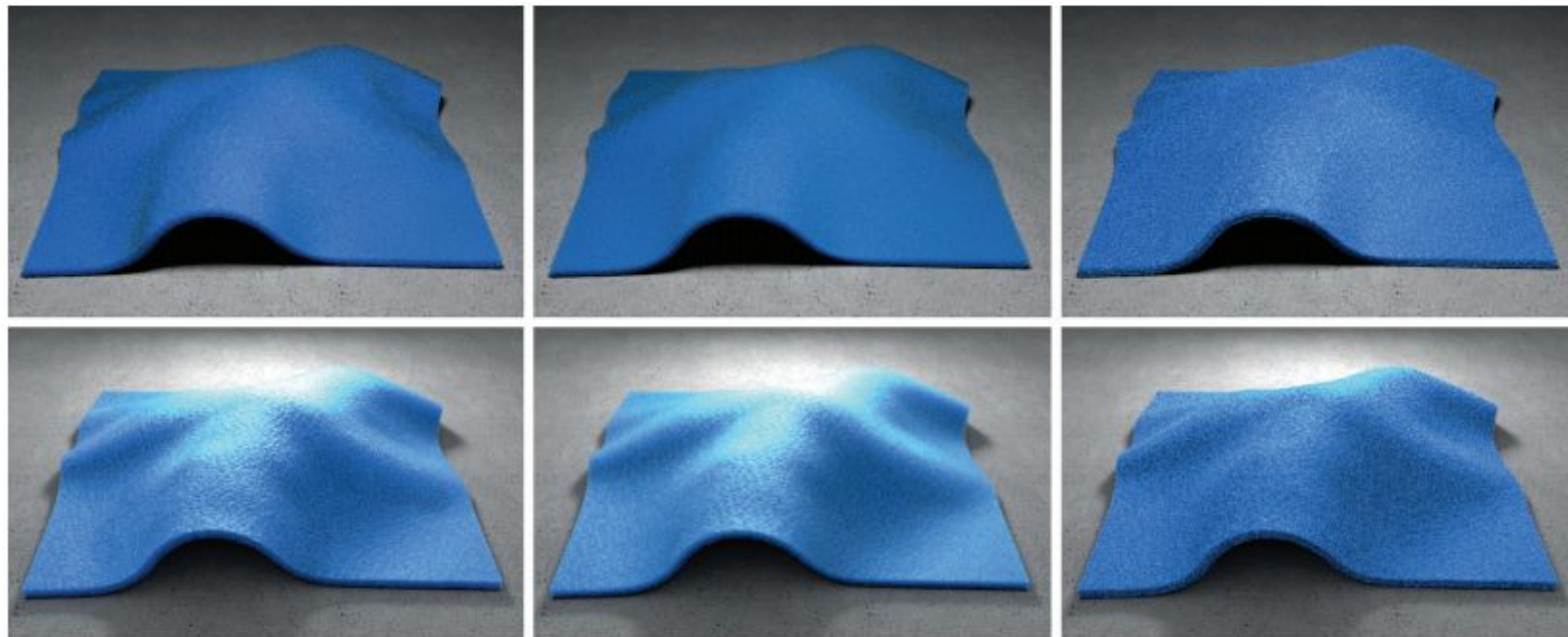
Pramook Khungurn, Daniel Schroeder, Shuang Zhao, Kavita Bala, and Steve Marschner. 2015. Matching real fabrics with micro-appearance Models. ACM Trans. Graph. 35, 1, Article 1 (December 2015), 26 pages.

Impact on Spatial Perception

- Black mesh allows object to be rendered with minimum interference
- Same side as camera: Shows depth of object
- Opposite side: visible specular reflections and anisotropic highlights

Color Bleeding

- Perceived color of a surface is locally affected by nearby objects that are colored
- Caused by reflection of colored or indirect ("bounced") light

Ben-Artzi, A., Egan, K., Durand, F., and Ramamoorthi, R. 2008. A precomputed polynomial representation for interactive BRDF editing with global illumination. ACM Trans. Graph. 27, 2, Article 13 (April 2008), 13 pages.

Impact on Spatial Perception

- Clearly identifies objects on top of the surface
- Establishes an object's location relative to other objects
- Reflectance allows inference about object's texture

Human Perception

- Common misconception that distance, space, color, etc. are physical quantities that are static
- They are actually perceptual quantities that change based on the environment
- Light is a universal percepter, that allows the quantities to be viewed at a clearer level depending on the amount of light

Impact on Spatial Perception

- Depends on the amount of illumination
- Emphasizes proper distortions, change of color, difference in spatial geometry, etc.
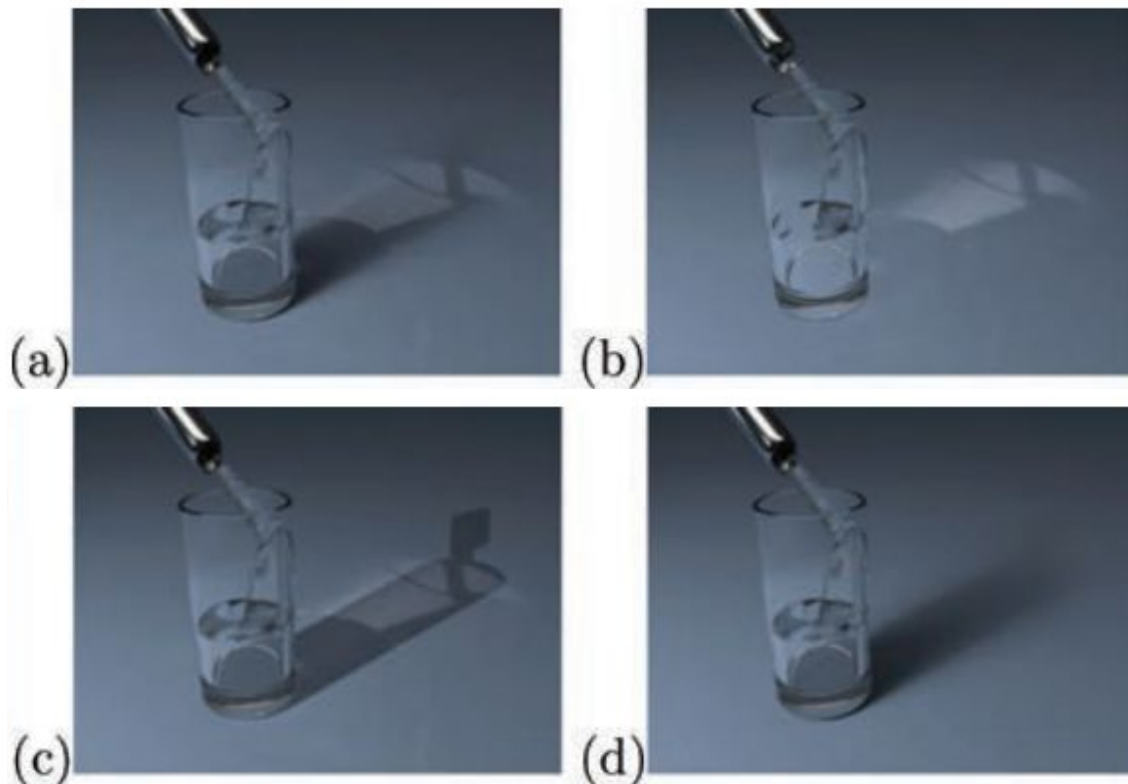
Subsurface Scattering

Jimenez, J., Sundstedt, V., and Gutierrez, D. 2009. Screen-Space perceptual rendering of human skin.
ACM Trans. Appl. Percept. 6, 4, Article 23 (September 2009), 15 pages.

Impact on Spatial Perception

- Darkly shaded areas show depth of parts of the object
- Higher subsurface scattering provides softer look

Shadows

(a)   Gold Standard
(b)   No Shadows
(c)   Hard Shadows
(d)   Soft Shadows, No Caustics

Bojrab, M., Abdul-Massih, M., and Benes, B. 2013. Perceptual Importance of lighting phenomena in rendering of animated water. ACM Trans. Appl. Percept. 10, 1, Article 2 (February 2013), 18 pages.

Impact on Spatial Perception

- Shadow direction provides information about object location relative to the light
- Identifies depth/height and capacity

Future Work

- Read some more papers
- Add the new findings to our report

Any Questions?