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Human observers can perceive intensity and direction differences of the illumination on objects and in scenes. They also have a sense for the light diffuseness. Reviewing studies into light diffuseness perception and practical lighting guidelines we encountered the problem that there is no agreement on how to describe and measure the light diffuseness, complicating comparisons. We found a large variety of metrics relating to visual effects of light diffuseness, including contrast, shape expressing, material expressing, and atmosphere effects. Moreover, many metrics appeared to be application-, context- or even object-specific.

We compared four approaches and propose a normalized metric for light diffuseness, ranging from 0, meaning fully collimated light (a beam with zero spread), to 1, meaning fully diffuse or Ganzfeld illumination. We tested our metric using simulations, measurements on the Debevec luminance maps using a cubic and tetrahedron shaped meter, and measurements in real scenes using a cubic shaped illuminance meter. We also tested the influence of scene properties (lighting, geometry and furnishing) and variations over scenes. We compared the optical data against psychophysical data from our own and other studies, and against practical lighting guidelines.

We found that our cubic meter method using our metric give robust measurements of light diffuseness. Measurements in real scenes fell in a wide range of 0.1 – 0.9. We found extremely strong effects of furnishing. Such material-lighting interactions in scenes / architectural spaces are not well-understood and form a challenge in practical lighting design. Most practical guidelines have in common that they concern a broadband range centered slightly above medium diffuseness or hemispherical diffuse light (overcast sky). The psychophysical data contract to narrow bands, depending on the type of scene (varying per experiment), suggesting a template representation of light diffuseness that depends on the overall appearance of a scene.

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