



ASTRONOMY from the GROUND UP
An Educational Collaboration of ASP, NOAO & ASTC
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Demonstrating Light Pollution and Shielding

This demonstration will illustrate the effects of lighting on our view of the night sky and how shielding can reduce light pollution while at the same time making the lighting more effective. All of the materials are provided in the GLOBE at Night Leader Toolkit. This demonstration is adapted from an activity on the Paper Plate Education website:

<http://analyzer.depaul.edu/paperplate/lights.htm>

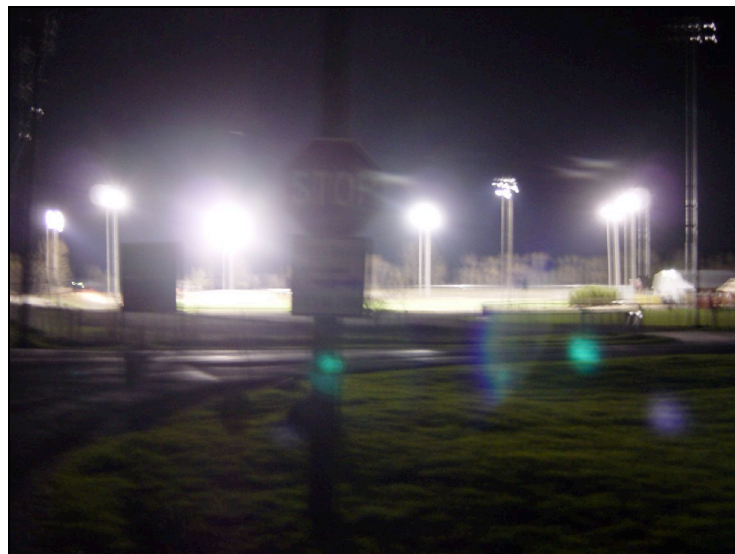
Materials

- Two “Mini-lights” (such as the Mini Maglite flashlight)
- Paper cube planetarium (cardboard cube with small hole on one side and pinhole “stars” on the opposite side)
- PVC cap or other items to act as shields
- White surface
- Optional - picture book with landscapes or city scenes, such as “There Once Was A Sky Full of Stars” by Bob Crelin
- Optional – small plastic figurines

Background – Light Pollution

There are three main types of light pollution:

- *Glare* is too much background light. Can you see the stop sign or read the sign below it in this image?



- *Light trespass* is light that spills into an area where it is unwanted. Would you be able to sleep if your bedroom window faced this neighbor's light?



- *Sky glow* is lots of light scattering off particles in the air, giving the appearance of a glowing sky. Do you see any stars in this image?



These images, as well as others illustrating the effects of different types of lighting, can be found on the Nightwise website: <http://www.nightwise.org/examples.htm>
More background on light pollution can be found on the GLOBE at Night website: http://www.globe.gov/GaN/learn_light.html

Background – Lighting

Quality lighting should:

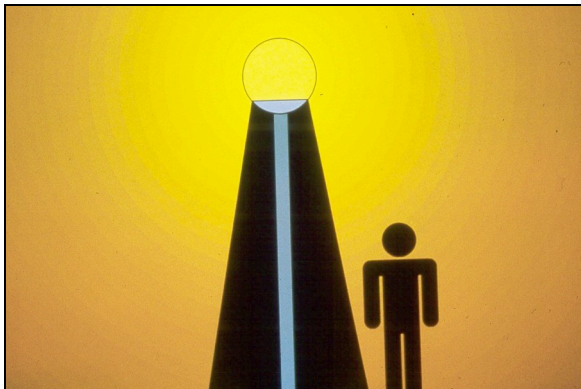
- Maximize the desired effects:
 - Good vision
 - Good night ambiance
- Minimize the adverse effects:
 - Energy waste
 - Glare
 - Light trespass
 - Sky glow

Keys to quality lighting:

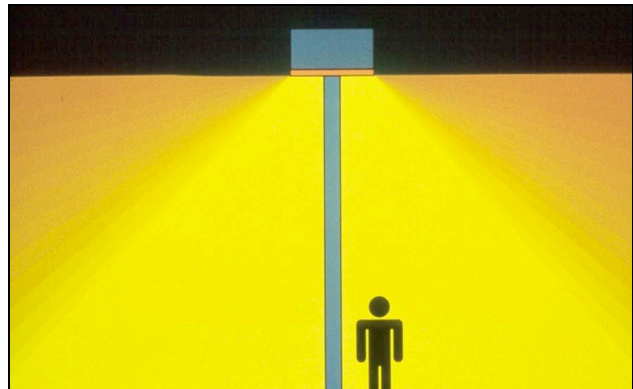
- See the effect, not the source.
- Shine the light down.
- No glare.
- Light only where and when needed.
- Don't over-light.
- Use energy efficient sources.

Shielding can maximize the desired effects of lighting by controlling the light output and minimizing the glare, light trespass, and light that travels straight up, as illustrated below.

Unshielded fixture



Shielded fixture



Doing the Activity

- Make sure you are in a very dark room with a low ceiling. Set up the activity on a table with a white surface.
- If you'd like to include a landscape or city scene as part of the demo, prop open the book to the page with the desired illustration. You could also include the plastic figurines to add some people to your scene.



- Unscrew the reflectors from both “Mini-lights” and turn on one of them (“candle mode”).
- Place the bulb top of the “Mini-light” barely into the big hole at the bottom of the white paper cube.
- With the room lights off, project the “stars” from the white paper cube onto the ceiling. Observe how many stars you can see and how bright they appear.

- Using the second “Mini-light” as a “street light”, place it on the table (in front of the landscape if you are using it) and turn it on.
- What do you notice about the number of stars?
- Now place the PVC cap (or another shield) above the second “Mini-light” to represent a shielded streetlight.
- What differences do you notice with and without the shield? How is your view of the stars affected? How does the lighting of the area directly under the lamp change?



Wrap Up

Discuss your observations and the benefits of shielded lighting. Note that shielded lighting improves our view of the stars (reduces sky glow), and is safer and more energy efficient, since it directs light down to the ground, where we want lighting rather than up into the sky. This improves the quality of life for people, animals, and plants; saves money and energy; and preserves our beautiful dark skies.

You may want to encourage participants to take part in citizen science projects to measure light pollution (see resources below) and to write letters to the local newspaper, government, and businesses to encourage the installation of shielded lighting in their community.

Resources

- International Dark Sky Association - <http://www.darksky.org/>
- GLOBE at Night - <http://www.globe.gov/GaN/>
- Nightwise - <http://www.nightwise.org/>
- Great Worldwide Star Hunt - <http://www.starcount.org/>
- Lights Out America - <http://www.lightsoutamerica.org/>
- National Park Service Dark Sky Team - <http://www2.nature.nps.gov/air/lightscapes/>