

## A Light Pollution Simulator

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### Abstract

In the framework of the Dark Skies Rangers project, we have developed a light pollution simulator aimed at demonstrating the impact of artificial light on the observation of the night sky. The simulator illustrates a nocturnal countryside scenery, with a house on one side and a small hill on the other. A young observer is sat next to a tree on top of the hill, while several stars of different brightnesses—as well as the Moon—can be seen in the night sky. The user is able to place and adjust up to seven exterior lighting fixtures in the pathway that separates the house and the hill. The lamps can have different configurations, depending on the type of shielding and height of the lamp post. Regarding the shielding, the lamp can be (a) unshielded, allowing the light to be sent upwards and hence strongly affecting the visibility of the stars, (b) half-shielded, sending light sideways and downwards, partially affecting the observation of the night sky, or (c) fully-shielded, only allowing light to be sent downwards and thus not affecting the observation of the celestial bodies. There are two possible heights for the lamps, allowing us to demonstrate that in some cases small lamps are enough to illuminate the path. The Moon can be in a crescent, quarter or full phase, also differently affecting the visibility of the surrounding stars. Several sounds are automatically reproduced depending on the configuration of the exterior lighting fixtures. If it is dark enough, the user can hear crickets chirping and owls hooting. However, if the scene is too illuminated, then the user will hear birds singing, as if it were dawn. Two mini games were embedded into the simulator. The first one intends to illustrate intelligent systems of illumination. When all lamps are fully shielded, double-clicking on the observer turns off all the lamps and causes the observer to go home. As the observer walks, the lights along the path will turn on when she passes below them, only to immediately turn off once she has moved on. In the second game, the user is invited to find a frog that is hiding somewhere in the scenery. This is achieved by placing a lamp in

several positions of the pathway while paying attention to the ambient sounds. Finally, there is an option to estimate the cost of illuminating the path based on the number of lighting fixtures and the type of lamps used. The simulator was developed in JavaScript using React/Redux. It is open source and freely available as a lab for the Graasp digital education platform. It is intended to raise awareness of the importance of using efficient illuminating systems and preserving the night sky and, thus, to be used as a resource for education and outreach.