Reducing Energy Consumption and Light Pollution by Redirecting Light
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In 2017, 66 billion dollars were spent on lighting in the United States alone, accounting for approximately 17% of total US electricity consumption. Of that, 32% of it was used for outdoor lighting. At least 30% of all outdoor nighttime lighting was emitted into the sky, translating to more than 6.3 billion dollars and 23 billion pounds of carbon dioxide (to produce the electricity) wasted. This light waste is what causes light pollution, which has harmful impacts on the environment, astronomical observation abilities, and even human health. This project aims to save energy and reduce the effects of light pollution by redirecting light downward to useful areas.

Using upcycled materials, the team constructed a series of adaptable prototypes that reflect light downward instead of upward, thus saving energy, money, and light. These prototypes consisted of various shapes aimed to simulate a wide variety of light fixtures. Testing was done with different angles and different materials, such as aluminized mylar and black paper. The team also tested lights without any prototype in order to gauge exactly how effective the prototypes were.

Based on the findings derived from testing the angles and reflective materials, the team found that the most effective angle to reflect the light was 135 degrees for the long lightbulb design, and 90 degrees for the single, round bulb design. However, it was also evident that variations in angles each had their strengths, as smaller angles generally focused the light into a very small space, while larger angles allowed the light to cover a bit more area. Therefore, adaptability in the final design was deemed optimal. In addition to the angle measurement, the team tested different materials. Upon finding no significant difference between the performance of aluminum foil and upcycled aluminized mylar from chip bags, the team decided to use the aluminized mylar. Besides the fact that it was very effective in reflecting light, the aluminized mylar was also appealing because the material is quite sturdy in comparison to aluminum foil, and because aluminized mylar is non-recyclable.

In the end, our final design was an adjustable light shield made of aluminized mylar from chip bags. The accordion fold provides adaptability, making this one prototype adjustable to many different light fixtures and many possible configurations for use.

In the future, the team aims to make a design that is fully adaptable to any type of light and light fixture. In addition, the inclusion of a blue light filter is a possibility, as blue light is a leading contributor to light pollution and many of the health effects that come along with it.

With this design, redirection of light allows for more efficient usage of artificial light, reflecting light only to areas of necessity. The design uses upcycled materials to help minimize waste, and creates a cost-effective solution to save energy and reduce the effects of light pollution.