Intelligent Dynamic Street lighting & Perceived Personal Safety

L. van Rijswijk, A. Haans, & Y.A.W. de Kort

Eindhoven University of Technology, Eindhoven, the Netherlands

Lighting, energy and safety perceptions

Street lighting is associated with energy waste and luminous pollution. Luminaires based on Light Emitting Diodes (LEDs) can reduce a city's energy consumption, but only to a certain extent. Further savings can be achieved by dimming the lights during certain parts of the night, but there is a tradeoff between energy saving and feelings of safety (see Fig. 1). Such tradeoffs can be avoided by integrating sensing technologies to recognize the number, type, and location of road users. The resulting system can adapt continuously to the environment and provide lighting only when and where it is needed most (i.e., intelligent selective dimming; see Fig. 1). As such these *intelligent dynamic street lighting* systems offer a promising solution to avoid energy consumption and luminous pollution without affecting people sense of perceived personal safety at night.

Such solution, however, raises important new questions. For example, we need not only consider how much lighting people need in order to feel safe, but also when and where people benefit most from street lighting (e.g., in their immediate surroundings or in the road ahead?). In other words, implementing intelligent dynamic street lighting requires a better understanding of how lighting affects perceived personal safety at night.
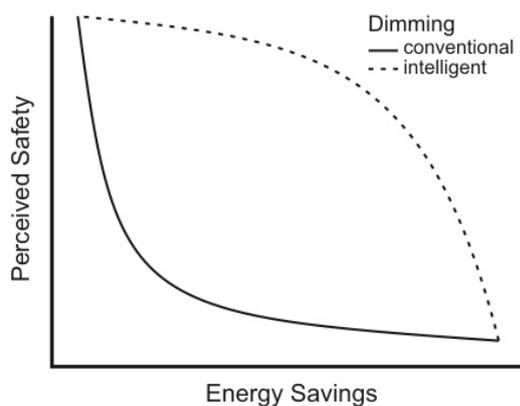

Fig. 1: The energy-safety tradeoff in road lighting

Research goals

The main goal of the current project is to understand how street lighting affects pedestrian's sense of safety at night. What, for example, is the relationship between the objective characteristics of street lighting and the psychological determinants of perceived personal safety? A specific secondary goal of the project is the translation of research findings and theoretical insights into requirements and implications for designing intelligent dynamic road lighting systems.

Research strategies

To meet the project goals, we combine user evaluations of different street lighting scenarios (i.e., system behaviors) with psychological experimentation. Controlled manipulation of lighting and street characteristics, either in virtual or real environments (e.g., test bed *the Zaale* on the university campus) allows us to test various dynamic lighting scenarios (e.g. changes in lighting distribution, illuminance, or color temperature) with respect to pedestrians' appraisal of them in terms of perceived safety. Important theoretical insights may also be gained from user observations in real or virtual settings (e.g. involving eye-tracking to learn more about users' scan paths and the relevant objects and areas that should be lit), or from testing specific motivational, cognitive and affective mechanisms through which road lighting possibly affects perceived safety (e.g. need for control, emotional states such as fear, or travel goals).

Acknowledgement