

Lighting, attention, and sense of safety in mesopic outdoor situations

Exploring urban lighting factors in pedestrians' alertness and perceived safety

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The arousal, alertness & anxiety triad

Research on street lighting for pedestrians has traditionally focused on minimal required illuminance for various visual performance tasks (e.g., obstacle detection and face recognition [1,2,3,4]). However, it is not only pedestrians' visual performance that is important for safety, but also their general attentiveness to the environment. Despite this, the psychological concepts related to the individuals' attention, such as alertness, arousal and anxiety, have not been considered in street lighting research to date.

"Mere ability to discern surface irregularities, vehicles, pedestrians or obstacles on the street or sidewalk does not insure safety unless the reaction to these stimuli is normal." [5]

Pilot study: Alertness and perceived safety after sundown

We performed a one factor (4 street sections) within-subject quasi-experimental field study, a conceptual replication of the Burt study [5], using modern day reaction time equipment and self-report measures for assessing alertness, arousal and perceived safety. Participants walked alone, after dark, along four streets with different lighting conditions.

Hypotheses:

- 1) Responses will be faster and more accurate on the streets with lower uniformity of illuminance than on the streets with high uniformity of illuminance.
- 2) The perceived safety will be lower on the streets with lower uniformity of illuminance than on the streets with high uniformity of illuminance.

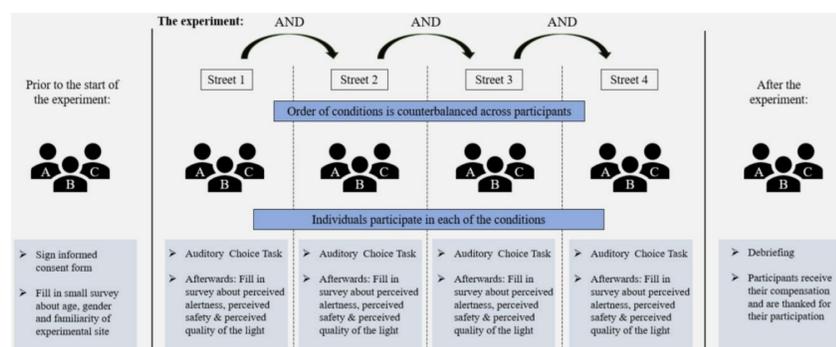


Figure 1: The experiment procedure

Performance measures

- Auditory Choice Task – response time and accuracy

Subjective measures

- Stanford Sleepiness Scale – subjective alertness / sleepiness
- Perceived environmental safety
- Activation-Deactivation Adjective Checklist – perceived energetic and tense arousal
- Lighting quality appraisal

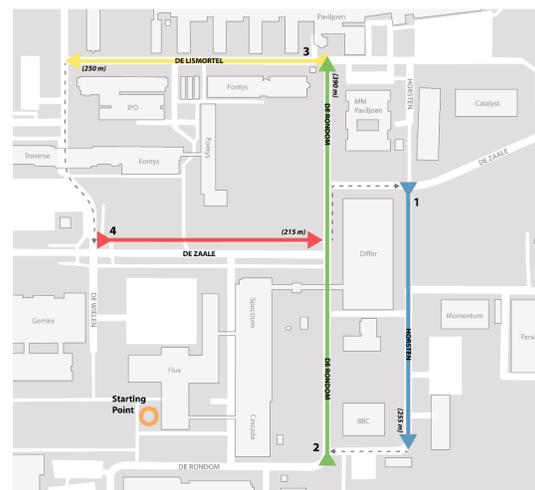


Figure 2: Four test streets on the university campus were selected. Lighting conditions were assessed with a measurement grid for each street with LMT pocket-luxmeters and the luminaires were measured with JETI specbos 1211-2 spectroradiometer. The experiment took place after sundown, between 22nd of April and 5th of May. Participants started between 21:00 and 22:45hrs.

Twenty-nine participants attended the experiment. We managed to partly replicate Burt's [5] findings about the positive effect of non-uniform lighting on pedestrian's attention. Although people responded, on average, faster on Street 4 (red), which had the lowest uniformity, no causal claims are possible in a quasi-experimental field study.

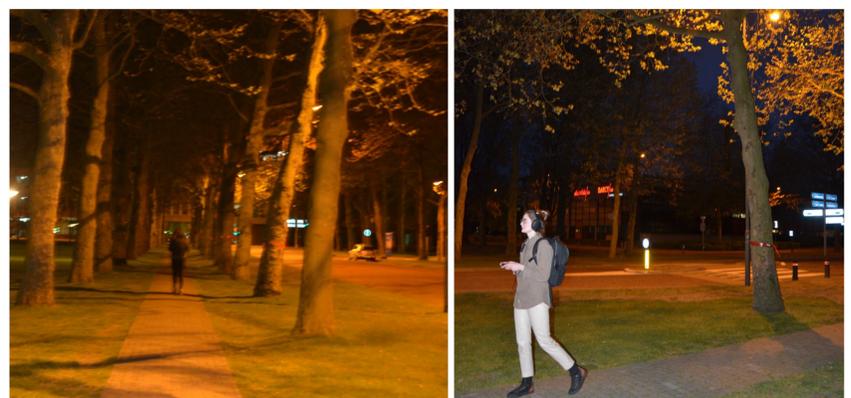


Figure 3: Photos from the experiment

Next steps

Our next experiment will be conducted in a virtual reality environment. It will follow by and large the setup of the field experiment, but with independent light manipulation and object arousal measures as additional dependent variables via heart rate (variability) and electrodermal activity.

LIGHTCAP

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