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Lighting in Residential Roads: What do we need to perceive?

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1. PERCEIVED SAFETY

As a pedestrian walks along a road visual information contributes to decisions as to how confident they feel about continuing with the journey. At night-time, road lighting enhances visual capabilities and thus has an influence on the visual information that is gathered. Road lighting in subsidiary roads is designed primarily to meet the needs of pedestrians and a stated aim is to provide a sense of security, or, reduce the fear of crime. While several studies have suggested that lighting affects perceived safety it is possible that this is exaggerated by the procedure with which it is measured.

Review [1] of the past studies (Table 1) which have investigated the impact of road lighting on perceived safety reveals mixed results. Knight [2] investigated the effect of a change in lamp type and found significant improvements in ratings of perceived safety when changing from high pressure sodium (HPS) lamps to metal halide (MH) lamps, the MH lamps giving lighting of a whiter appearance. The studies by Nair et al [3] and Atkins et al [4] do not suggest that a change in lighting affects perceived safety, but since neither study identifies the changes that were made to the lighting it would not be possible either to implement their findings nor to consider whether the changes were of sufficient magnitude to expect a change in perceived safety.

There are a number of problems with this body of work. These studies used a before-and-after design: what is not known is the extent to which the change in lighting informed judgements, rather than the change in particular characteristics of the lighting. Positive affect may also be a response to the high initial illuminance of new lighting – lighting is installed with a high initial illuminance (i.e. a high light level) to offset the expected lumen depreciation with time. Field studies are extremely difficult to design and as a result it is difficult to avoid weaknesses that might significantly bias the outcome. Perhaps more importantly, it is also possible that fear of crime recorded in surveys is as much a methodological artefact as an empirical reality. Farrall, Jackson and Gray [5] suggest that the traditional survey methods consistently over-emphasise the levels and extent of fear of crime. A combination of poor question wording, the

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desire to cooperate with surveys, and media and political interest in the fear of crime may have contributed to a scenario in which the fear is continually recreated both socially as a topic for debate and at the individual level: surveys in this situation may not merely measure fear, they may actually create and recreate it. The effect of methodology on reassurance measures can be seen from a review where in only 15 of 64 sets of interviews was there no mismatch – different answers were obtained depending on the nature of the methodology.

This paper presents the ideas behind two parallel projects currently investigating perceived safety and pedestrians on roads in residential areas, one project investigating the impact of environmental features and the second investigating interpersonal reactions. The aim of this work is to identify how judgements of perceived safety are made; what kinds of visual information are sought to inform these decisions? This will in turn allow a better understanding of what needs to be lit and thus the characteristics of that lighting that might aid perceived safety.

2. ENVIRONMENTAL FEATURES

The first project aims to place the effect of lighting in context by the consideration of other attributes such as spatial features, familiarity with an area and the presence of other people, thus to give a holistic picture of the pedestrian experience. Test participants have been asked to take photographs of roads along which they would, or would not, walk alone at night-time, and these photographs will then be used as the target of discussion during a follow-up interview: Figure 1 shows a sample of the photographs received during a pilot study. This approach was adopted to avoid priming test participants with the assumption that lighting would influence reassurance and would also allow for environmental impacts beyond lighting to gauge the relative impact of lighting. During the interview the test participants are encouraged to discuss walking at night-time in general, to discuss reasons for their choice of photos, and finally to discuss the scenes in a standard set of photographs.

3. INTER-PERSONAL JUDGEMENTS

The second project examines how lighting affects judgements made about other people on the road. Previous work in the lighting community has focussed primarily on whether facial recognition is affected by the spectral power distribution (SPD) of the lighting. Review of the results reveals a mixed opinion, with some studies suggesting lamp SPD affects recognition whilst others do not. Fotios & Raynham [6] suggest this is due to differences in methodology and that an improved procedure is

required. Furthermore, there is a need to highlight that facial recognition is not the only requirement, lighting needs also to aid judgements of the intent of other people. This is a more difficult task because intent may be judged by many behaviours including posture, gait, facial expression, clothing and acoustic clues. Initial experimental work is exploring the quality of visual information about a person that can be gained at different distances and the interpersonal distances that are considered comfortable.



Figure 1. Sample of images received from the pilot study test participants, presenting areas considered to be safe (left) and not safe (right) in which to walk alone at night-time.

REFERENCES

- [1] Unwin, J., and Fotios, S. 2011. Does lighting contribute to the reassurance of pedestrians at night-time in residential roads? *Ingenieria Iluminatului*, 13, 2, 29-44.
- [2] Knight, C. 2010. Field surveys investigating the effect of lamp spectrum on the perception of safety and comfort at night. *Lighting Res. Technol.*, 42, 3, 313-330.
- [3] Nair, G., Ditton, J. and Phillips, S. 1993. Environmental improvements and the fear of crime. *Br. J. Criminology*, 33,4, 555-561.
- [4] Atkins, S., Husain, S. and Storey, A. 1991. The Influence of Street Lighting on Crime & Fear of Crime. Paper 28, Crime Prevention Unit. London.
- [5] Farrall, S., Jackson, J. and Gray, E. 2009. *Social Order and the Fear of Crime in Contemporary Times*. Oxford University Press: Oxford.
- [6] Fotios, S. and Raynham, P. 2011. Lighting for pedestrians: Is facial recognition what matters? *Lighting Res. Technol.*, 43, 1, 129-130.

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Table 1. Summary of the methods used in past studies of perceived safety in residential roads [1].

Study	Independent variables	Method	Measurement	Outcome: did lighting affect reassurance?
Akashi, Rea and Morante, 2004	Change from 3.4 lx HPS to 2.8 lx fluorescent lighting.	Before and after surveys of nearby residences.	5 point rating scale: strongly disagree (-2) to strongly agree (+2) with statement <i>I feel secure while walking on the sidewalk</i>	Yes. Significant increase in feelings of security after change from HPS to fluorescent lighting. (p<0.01)
Atkins et al, 1991	Unspecified <i>relighting</i> .	Before and after surveys.	Nine point rating scale: very safe to very unsafe.	Reported effect for females may be capitalising on chance. Insufficient data to support statistics
Herbert & Davidson, 1994	Change from LPS to HPS lamps; change in illuminance unclear.	Before and after survey of householders	Not reported	Trend for an improvement in reassurance but no statistics
Knight, 2010	Change from HPS to MH lighting. Netherlands: 16.5 lx HPS to 14 lx MH. UK: 9.1/12.7 lx HPS to 8.9/12.6 lx MH.	Before and after surveys, and after only survey of nearby residents	Five point rating scale: Very safe (1) to very unsafe (5). <i>Does the lighting here make you feel safe or not?</i>	Yes. Higher ratings of perceived safety after change from HPS to MH lighting (p<0.01)
Morante 2008	Change from HPS to induction and MH lamps. Street 1: HPS 8.7 lx to Induction 2.7 lx. Street 2: HPS 3.2 lx to 3.1 lx MH.	Before and after surveys of residents living on or near street.	5 point rating scale: strongly disagree (-2) to strongly agree (+2) with statement <i>I feel secure while walking on the sidewalk</i>	Yes. Higher perceived safety under MH and induction lighting
Nair et al, 1993	Unspecified <i>improvements</i> to lighting	Before and after survey of householders	Not reported	No
Painter, 1994	Change of lamp type of illuminance. Before, LPS, 3.0 lx; after, HPS, 10.0 lx.	Before and after survey of pedestrians on street	Yes/No response	Trend for an improvement in reassurance but no statistics. Lamp and illuminance effects confounded