

# A novel approach to identifying pedestrian gaze behaviour

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## 1. Background

Design criteria for residential street lighting in the UK (see Table 1) are currently based on inappropriate evidence (Fotios & Goodman, 2012).

**Table 1. Current, potentially inappropriate, design criteria illuminances for residential streets in the UK**

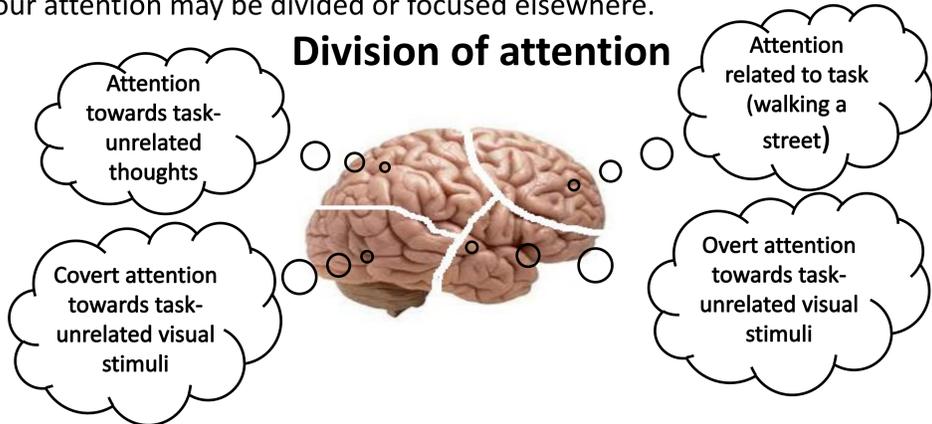
Road category	Minimum average illuminance (lux)
S1	15.0
S2	10.0
S3	7.5
S4	5.0
S5	3.0
S6	2.0

Research is underway to better understand street lighting requirements from a human vision perspective. One aspect of this involves understanding where people look when walking a street at night, and what the important visual tasks are performed by pedestrians.

## 2. Visual attention

Eye tracking can be used to determine what people look at during a task such as walking down a street (e.g. Davoudian & Raynham, 2012). However, our gaze behaviour may not always reflect what is significant as our attention may be divided or focused elsewhere.

### Division of attention



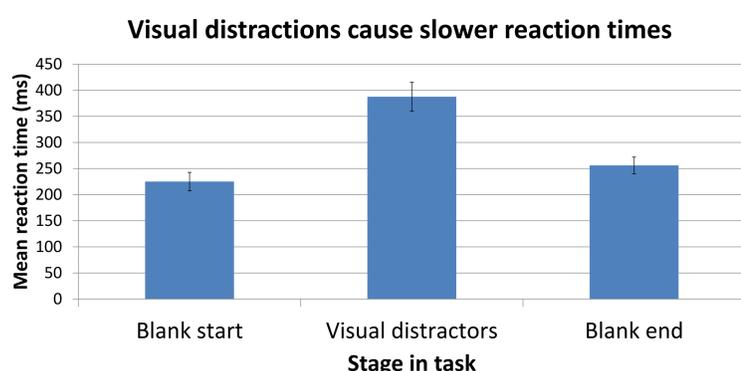
## 3. Dual task

A dual task paradigm involving eye tracking and a concurrent cognitive task can highlight significant visual behaviour. Significant reductions in performance of the cognitive task may indicate a redirection of attentional resources to something visually significant or distracting.

A reaction time task requiring a response to an auditory stimuli (pressing a trigger button every time a beep is heard) was believed to be an appropriate dual task. This was confirmed in a pilot study [see Box 1] which demonstrated visual distractions impair reaction times.

### Box 1 – Pilot study

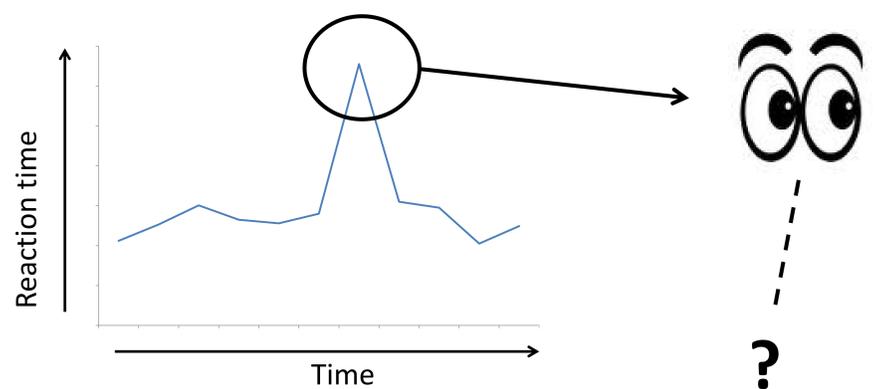
A pilot study was carried out to demonstrate that visual distractions can lead to impaired performance in a cognitive task (responding to an auditory stimuli). Reaction times were significantly longer during periods in which visually distracting images were presented to participants on a computer screen, compared with when the screen was blank.



## 4. Pedestrian gaze behaviour

An eye-tracking experiment has recently begun in which participants are asked to walk a short (10 minute) route whilst wearing eye-tracking equipment and carrying out a reaction time task:

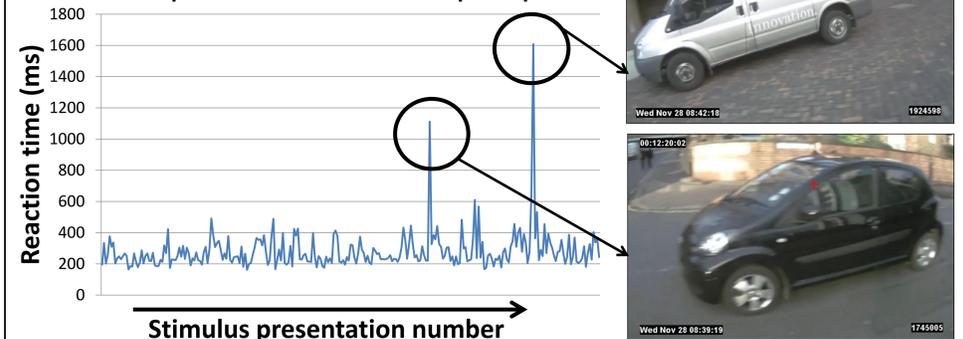
- Each participant walks the route during daylight hours and hours of darkness
- Participants also carry out concurrent reaction time task. This involves responding to an auditory stimuli (beep) by pressing a trigger button. Intervals between stimuli are randomised between 1 and 3 seconds.
- Mean reaction time calculated for each participant and significantly slower than mean instances identified
- These impaired reaction times linked to eye-tracker video to determine what the participant was looking at, at the time



## 5. Initial results

The experiment is in early stages at the moment. However, initial results suggest reaction time dual task is a useful method for identifying significant gaze behaviour. For example:

Example reaction time data from participant



Significant gaze behaviour identified as instances when reaction time > 2 standard deviations above mean. In the above example these occasions tallied with fixations on fast-approaching van in pedestrian area (top picture) and an approaching car at a road junction (bottom picture).

## 6. Conclusions

Results from the pilot study and initial results from the main study suggest a dual-task paradigm involving a reaction-time task can identify significant gaze behaviour and visual distractions. This method may allow stronger conclusions to be drawn about what the important aspects of the visual environment for particular tasks being undertaken. For example, in the current research it is hoped this method will help us better understand what the crucial visual tasks performed by pedestrians are on residential streets at night.

### References

- Fotios, S., Goodman, T. (2012). Proposed UK guidance for lighting in residential roads. *Lighting Research and Technology*, 44, 69-83.  
 Davoudian, N., Raynham, P. (2012). What do pedestrians look at at night? *Lighting Research and Technology*, doi: 10.1177/1477153512437157, published online by Sage Publications on 8 February 2012.