MC 2020 Proceedings of 10th Masters Conference: **People and Buildings**
Online, 18th December 2020
Network for Comfort and Energy Use in Buildings: http://www.nceub.org.uk

Encouraging more walking: Effects of gender and street brightness on reassurance at night

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Abstract: Walking has significant benefits and opportunities and is encouraged by governments and non-governmental organizations. This study aims to determine the effect of street brightness on personal perceptions of safety which causes a reduction on walking activities at night, particularly for women. 9 pictures of streets in the city of Sheffield in the United Kingdom, were manipulated to be dim or bright. These images were presented in a survey to 210 participants with questions about perceived safety walking down streets at night.
The result showed that people generally lack reassurance with the dim streets. The rate of perceived reassurance increases significantly at bright streets. Despite women feeling safer in bright streets compared to the dim streets, women felt less safe than men in both the dim and bright streets. The participants, in particular women, stated that the most important aspect in selecting a route at night is quality street lighting. When looking at the physical activities of participants, women and men have a similar rate of walking activity at night, although women feel less safe than men. The results show that women tend to walk more than men and women can be more active at night by walking if good lighting is provided on the streets. By providing quality lighting on streets, people can be encouraged to walk and cycle at night.

Keywords: Walking, lighting, brightness, gender, streets, safety

1. Introduction

The Intergovernmental Panel on Climate Change (IPCC, 2014) shows that the earth's surface has reached the highest temperature in the last 30 years. Yin et al. (2015) and Ritchie and Roser (2017) have shown that one of the highest contributors to worldwide air pollution and climate change emissions is the transportation sector, especially those that work with fossil fuels such as cars. Lackner, (2003) and Song, (2016) inferred that decreasing fossil fueled transportation is important to alleviate greenhouses' effect.

According to the Department for Environment, Food and Rural Affairs (DEFRA 2013), walking and cycling are the most eco-friendly approach with zero carbon emission while the other transportation systems such as car, bus or underground systems, release greenhouse gasses. Walking and cycling activities are then, one of the most suitable solutions to mitigate the climate crisis and the high rate of emissions of greenhouse gases to the atmosphere. Instead of using vehicles, by using cycle and pedestrian routes, people can improve their mental and physical well-being and contribute to protect the environment with zero carbon emission.

This study aims to determine the effect of street brightness on personal perceptions of safety which causes a reduction on walking activities at night, particularly for women. While people generally feel safe walking and cycling in the daytime, they have some concerns about walking and cycling the nighttime. Fotios et al. (2015) believe that road lighting should serve the pedestrian so that they feel safe at night. Lighting is a crucial factor in encouraging walking and cycling. Fotios et al. (2019) proposes that road lighting is the main criteria to decide

walking activity after dark for perceived safety. With the correct lighting design, people can tend to walk or cycle in streets safely lowering total energy consumption.

2. Literature Review

2.1. Physiological Issues on Street Use

Loewen et al. (1993) described the physical features which influence people's perceived safety in the street: light, open space, and availability of access. Loewen et al (1993) defined open space as a safe place which does not provide a hiding place for offenders. According to Loewen et al (1993) experiment, both men and women feel safer with open spaces and places which have refuge, than in other types of spaces

A study by Greene M. et al. (2003) shows that when the view of objects and people increases, perceived reassurance increases correspondingly. Fisher and Nasar (1992) explained that to define a place as a safe, the place should provide an escape to victims, minimum prospect, and limited concealment to offenders. Haans et al. (2012) explain that the adequate lighting on street makes physical factors such as perceived prospect, escape routes, concealment, visible to pedestrians. By providing adequate lighting, people can use walkways and cycleways safely and the more people who walk and cycle on streets at night, the more streets will be perceived as safe.

2.2. Effect of Lighting on Perceived Reassurance

By encouraging walking at night as much as daytime thanks to lighting, car-free development can be improved. Therefore, lighting is a crucial issue to develop car-free areas. Nasar et al. (1993) showed that to provide reassurance and perceived safety, lighting on streets plays the biggest role. In this context, if quality and adequate lighting are provided to streets, people can tend to walk and cycle. This conclusion is also supported by Uttley et al. (2020), who showed a significant decline in the number of cycling activities on streets with poor road lighting between daylight and night-time. Nevertheless, Uttley et al. (2020) has shown that with efficient controlled lighting, the number of cycling at night tends to increase.

Fotios et al. (2019) propose that pedestrians feel safer in daylight time than night-time. Darkness decreases the visibility of objects. When users face a lack of visibility, reassurance and perceived safety of people decrease. Nasar and Jones (1997) concluded that road lighting prevents blind points, however, the lighting may create a shadow for offenders to hide. With intelligent dynamic lighting on streets, pedestrian perceived safety can be increased.

3. Method

A survey was sent out to staff and students who are studying or working at the University of Sheffield with approval from university staff and using university approved channels. 210 responses from students and staff that were subscribed to the volunteers list were received. The number of participants based on gender was 35 male participants, 1 non-binary participant, 1 person who prefers not to say and 173 female participants.

All images in the survey were manipulated by adjusting their contrast and brightness using Adobe Photoshop. In the survey, 9 pairs of the same image of a street in the city of Sheffield were manipulated to be dim and bright. These altered images of the same street were used to remove the effect of other factors such as alleys, shops, bins, or the presence of people, as these would have affected the participants' opinions when rating the perceived safety of the street.

4. Results

4.1. Rate of Street Safety

In terms of assessment of perceived reassurance, nine images were examined separately. Fig.1 shows that perceived reassurance is higher at bright images than dim images. The highest ratio is image 8 with a ratio of 4.04 in the bright section. This image shows a main street with mainly surrounding educational areas with both dim and bright sections. The lowest ratio is image 6 which shows the underpass for both dim and bright sections.

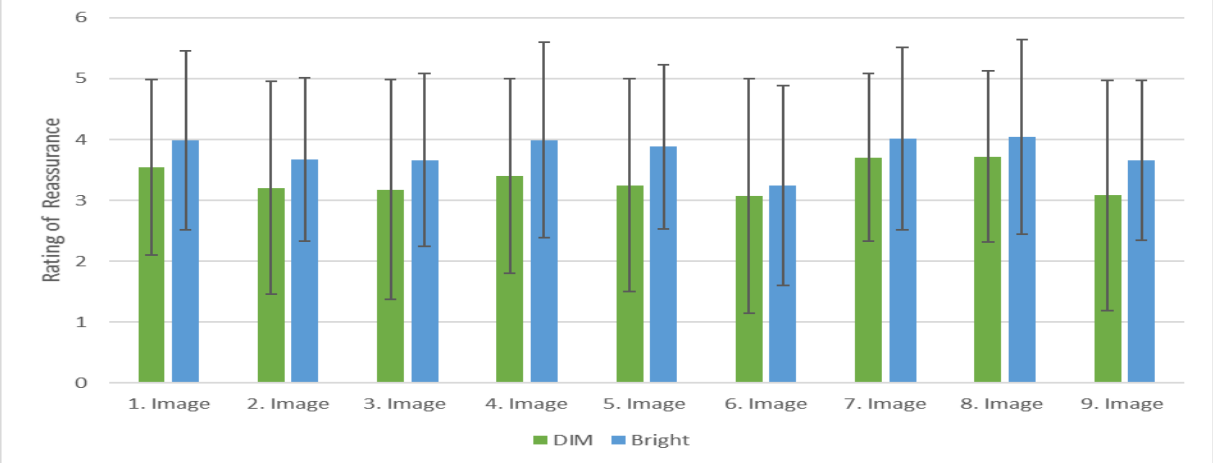

Figure 1. General comparison between dim and bright images. Reassurance rating was calculated by averaging the ratings on the three questions for each image

To understand lighting effects on gender, responses of men and women were compared in Figure 2 for bright and dim sections separately. The average safety rating of nine images in dim and bright sections was calculated. Figure 2 shows that perceived reassurance of males is higher than females on both dim and bright sections with reassurance ratings of 3,65 and 4,01 respectively, while reassurance on females in dim and bright streets are 3,27 and 3,74 respectively. Additionally, the graph shows that the increase in reassurance with the brighter streets is slightly greater for women compared with men.

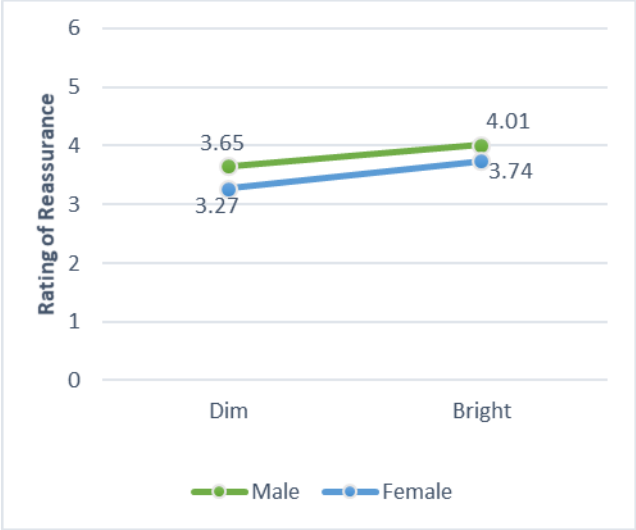

Figure 2. Average perceived reassurance on gender-based on dim and bright streets. Reassurance rating was calculated by averaging the ratings on the three questions for each image"

4.2. Lighting Effects, Gender Differences on Reassurance

For all images and both dim and bright streets, the rating of reassurance of males is higher than females. Figure 3 shows the difference between men and women in reassurance rating for images of bright and dim streets. The difference between male and females in dim streets is more than bright streets. In bright streets, the gap between males and females decreases.

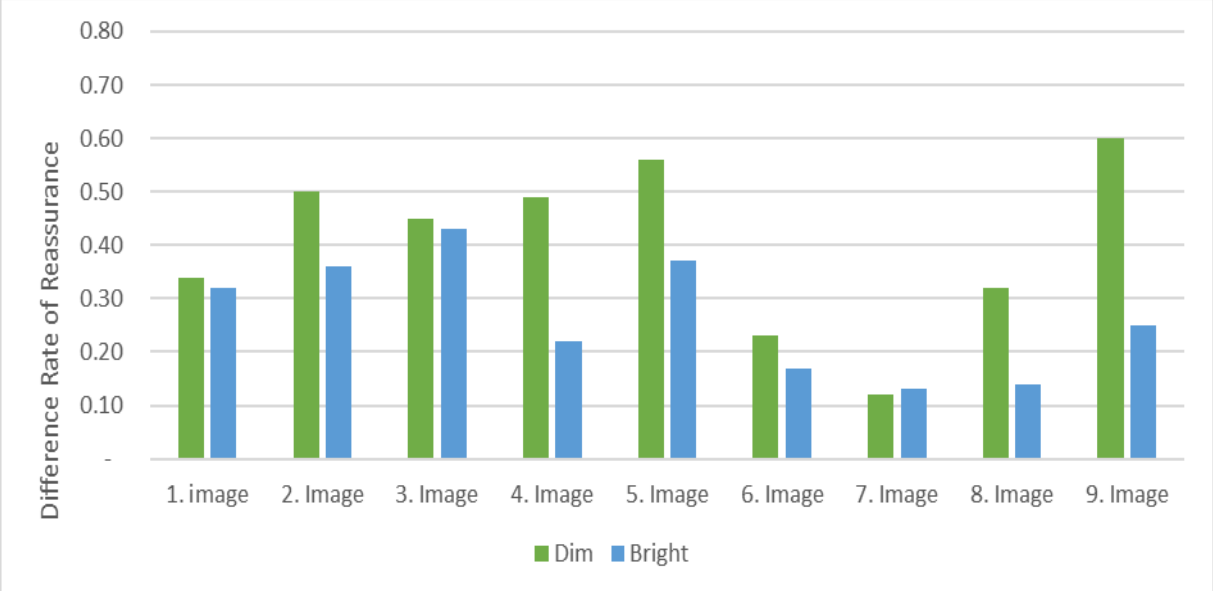

Figure 3. Difference between men and women in reassurance with the brighter and dim streets.

4.3. Aspect of Women and Men on Walking at Night

Survey participants were asked about their walking activities and perceived reassurance when walking at night. Figure 4 shows that around 50% of the participants have not walked at night last week. 52% of females have not walked during the last week while almost 50% of males have not walked. In addition, no participant has walked every evening.

The data shows that there is not a big difference in walking activity between men and women. This shows that women have similar walking activity levels as men, even though women feel less safe.

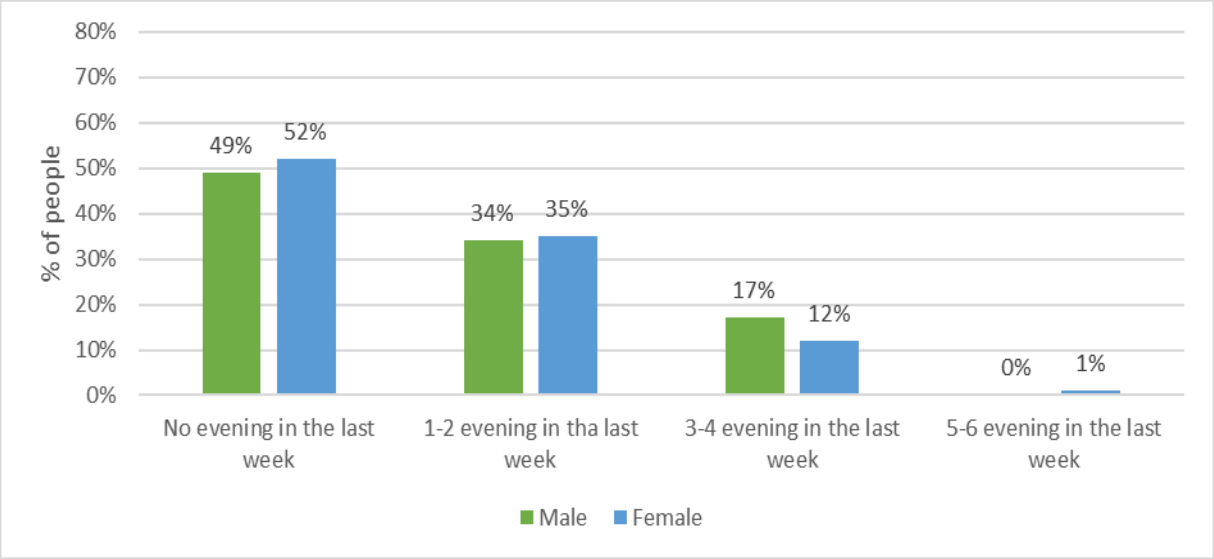

Figure 4. Walking activity in the last week at night based on gender

Figure 5 shows route selection criteria for night walks distributed by gender. Looking at the responses of females from the highest ratio to the lowest ratio is 94%, 83%, 38%, 29% and 9% for good street lighting, presence of other people, the fastest route, the most direct route and a route with good quality pavements respectively.

When looking at the response of 35 males, the highest rate is for good street lighting with 80%, the second-highest ratio is for the most direct route with 54%, with 51%, the presence of other people and the fastest route have the same ratio whereas a route with good quality pavements has at least ratio with 23%.

The bar chart provides the percentage of females who prefer good street lighting and presence of other people at streets more than males, while the percentage of males who prefer the fastest route, most direct route and a route which has good quality pavements.

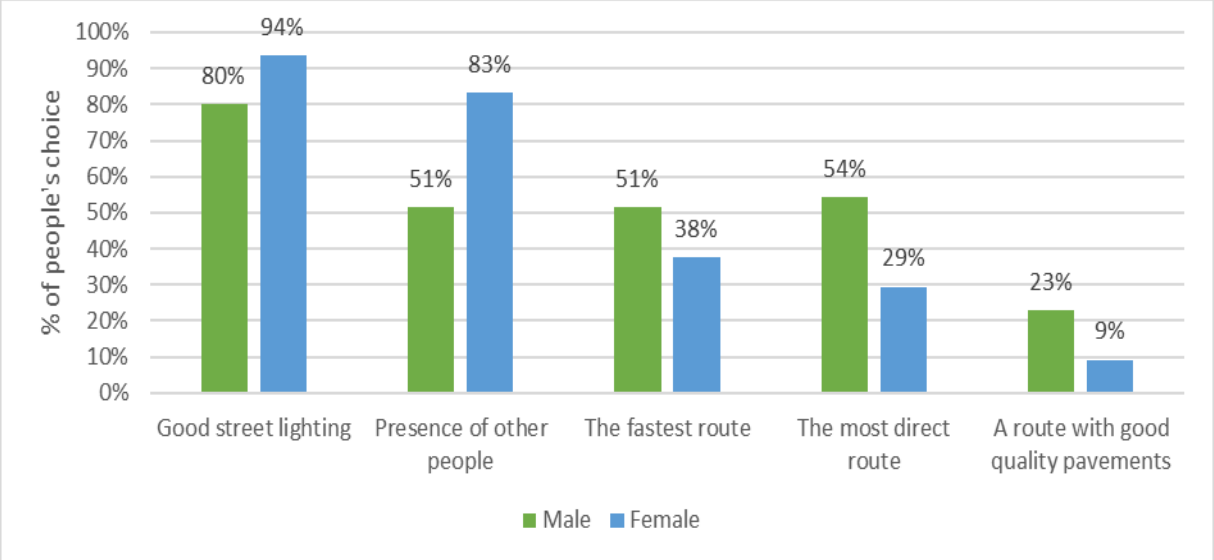

Figure 5. Route selection criteria for walks at night.

5. Conclusion

The study sought to confirm three main issues on walking down streets at night. First, in terms of perceived reassurance, there is a strong impact of lighting when walking down a street at night and secondly, darkness can affect men and women differently from their willingness to walk. The results indicate that women feel less safe walking down a street at night than men. Lastly, the quality of lighting on the streets can make women more willing to walk at night.

All the results in the study support that the impact of lighting is quite strong when taking a local journey. Good lighting at street level is the most preferred criteria to take a route at night. The survey results also show that increasing brightness gives reassurance to people.

Although women feel less safe than men at night, women have similar rates of physical activities during the week. The study indicates that by increasing brightness, the perception of safety can be increased and the number of people on streets at night can increase, this will in turn, increase the perception of safety.

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