



NRC Publications Archive Archives des publications du CNRC

IES Light and Behavior Symposium synopsis Boyce, Peter R.; Veitch, Jennifer A.

This publication could be one of several versions: author's original, accepted manuscript or the publisher's version. /
La version de cette publication peut être l'une des suivantes : la version prépublication de l'auteur, la version
acceptée du manuscrit ou la version de l'éditeur.

Publisher's version / Version de l'éditeur:

Lighting Design + Application, 45, 1, pp. 65-66, 2015-01-01

NRC Publications Record / Notice d'Archives des publications de CNRC:

<https://nrc-publications.canada.ca/eng/view/object/?id=459c667d-06ff-442e-9dfe-3422f43172ff>
<https://publications-cnrc.canada.ca/fra/voir/objet/?id=459c667d-06ff-442e-9dfe-3422f43172ff>

Access and use of this website and the material on it are subject to the Terms and Conditions set forth at
<https://nrc-publications.canada.ca/eng/copyright>
READ THESE TERMS AND CONDITIONS CAREFULLY BEFORE USING THIS WEBSITE.

L'accès à ce site Web et l'utilisation de son contenu sont assujettis aux conditions présentées dans le site
<https://publications-cnrc.canada.ca/fra/droits>
LISEZ CES CONDITIONS ATTENTIVEMENT AVANT D'UTILISER CE SITE WEB.

Questions? Contact the NRC Publications Archive team at
PublicationsArchive-ArchivesPublications@nrc-cnrc.gc.ca. If you wish to email the authors directly, please see the
first page of the publication for their contact information.

Vous avez des questions? Nous pouvons vous aider. Pour communiquer directement avec un auteur, consultez la
première page de la revue dans laquelle son article a été publié afin de trouver ses coordonnées. Si vous n'arrivez
pas à les repérer, communiquez avec nous à PublicationsArchive-ArchivesPublications@nrc-cnrc.gc.ca.



IES Light and Behavior Symposium Synopsis

Peter R. Boyce¹ and Jennifer A. Veitch²

In April 2014 the Illuminating Engineering Society held its second research symposium on the topic of "Light and Behavior". Behavior is the output produced by people in response to physical and social stimulation. Lighting can certainly change the physical stimulation experienced by people so it is certainly one of the many factors that affect human behavior. Whereas the effects of lighting on visibility are well understood, how lighting changes human behavior is not; however, it is widely believed that different lighting conditions can influence work performance, individual comfort, safety, health and well-being and the overall quality of life.

In an innovative format, speakers representing the design and research perspectives discussed their approaches to lighting for education, outdoor environment or healthcare applications. The designers presented examples of the issues they face in designing for the application and the researchers discussed the latest findings relevant to the application. The organizing committee developed this format to provide a clear connection between design and research, with both parties taking something away from their glimpse into the other's world.

The design of educational facilities was addressed by Charles Thompson, principal of Archillum Lighting Design. He took it to be self-evident that lighting in schools should support learning and for that to occur it was necessary for there to be multiple connections between students and teachers, between the inside and the outside, between the classroom and the rest of the school. To achieve that aim and to ensure comfort, when he designs lighting for schools he pays attention to daylighting provision, brightness distribution, glare minimization and the flexibility and ease of use of controls.

Then, Professor Arnold Wilkins from the University of Essex, UK, introduced the topic of disturbance produced by flicker and high contrast patterns. Flicker can cause discomfort and worse even when it is not detectable. Therefore, care should be taken to select lighting equipment that meets the latest stability standard. High contrast patterns can also cause discomfort and worse when they cover a large area and depart from the characteristics of patterns found in nature. Avoiding strong patterns goes against the common practice of using such patterns to stimulate children.

The last presentation on education was given by Dr. Mariana Figueiro from the Lighting Research Center. She described the circadian characteristics of teenagers, who usually belong to an owl-like chronotype, tending to go to bed late and awake late. Having to go to school early in the morning ensures that they arrive sleep deprived, listless and grumpy. To overcome such problems, classrooms should be designed to ensure that there is sufficient daylight at the beginning of the school day as this will suppress the concentration of the hormone melatonin and advance the circadian rhythm of teenagers.

Opening the outdoor lighting session, Randy Burkett of Randy Burkett Lighting Design used case studies of the Martin Luther King Memorial in Washington DC and the City Garden in St Louis, MO, to show how lighting could be used to create drama, support orientation and wayfinding and heighten the sense of safety and security after dark. To achieve these effects requires the careful control of glare, the judicious use of a range of brightnesses to provide a hierarchy with enough contrast in the scene to be interesting but not so much as to be threatening, and the lighting of vertical surfaces to define the boundaries of the space.

Considering the other extreme of outdoor lighting was Nancy Clanton of Clanton and Associates. Her concern was with the inadequacy of current lighting standards based on roadway illuminance for ensuring the visibility of targets for drivers and for making the sidewalks appear safe to pedestrians. For target visibility what matters is the size and contrast of the target. For the perception of safety, illuminance alone is not enough.

¹ Independent Consultant, Bridge, near Canterbury, UK.

² National Research Council of Canada, Ottawa. Address correspondence to jennifer.veitch@nrc-cnrc.gc.ca

This point was confirmed by Professor Jack Nasar from the University of Ohio. He focused on what features of the outdoor environment contributed to a fear of crime, made wayfinding easy and ensured aesthetic appeal. To minimize fear of crime, lighting should provide well-lit vistas and avoid sharp contrasts, glare and dark spots. For easy wayfinding, lighting should provide differentiation between routes and highlight destinations. For aesthetic appeal, the requirements are a sense of order with moderate novelty and complexity.

Professor Steve Fotios from the University of Sheffield, UK, then addressed the questions of what the amount and spectrum of light should be for pedestrians on residential streets at night. There is no doubt that streets with higher illuminances are seen as safer but how high an illuminance is necessary? As for light spectrum, a light source with a better colour rendering index influences perceptions of safety through its effects on people's appearance and tends to produce a perception of greater brightness at the same illuminance.

Taken together, these presentations identified the main problems with current practice in lighting the outdoor environment. At one extreme is the artistry of the lighting designer applied to a significant site while at the other are routine designs based on code recommendations that are inadequate in both the variables considered and the evidence to support those recommendations. Somewhere between these two extremes should be an approach that satisfies the desires of people using the streets at night for an interesting but safe outdoor environment.

The session on healthcare facilities was opened by John D'Angelo from New York Presbyterian Hospital. He described hospitals as cities in their own right. His hospital covers six buildings, has 6,000+ physicians and about 1.5 million outpatients per year. The priority is the patient experience. Aspects of lighting necessary for a good patient experience are daylight and good quality electric lighting, the ability for the patient to control the lighting in their rooms, and darkness at night.

Following this, Thomas Albright of the Salk Institute addressed visual neuroscience for lighting design. His main theme was that it was light falling on the eye that allowed the visual system to identify borders, color, brightness, texture, motion and distance and it was this ability that allowed people to construct a model of the world around them and hence to recognize objects, navigate spaces, focus attention, communicate visually and generate emotions.

Finally, Lone Madrup Stidsen of Aalborg University, Denmark, discussed the difference between the lighting requirements of patients and staff. Patients rarely have any difficult visual tasks so their concern is with a pleasant lighting atmosphere which means a pattern of illumination similar to their home. This can vary across cultures. Conversely, staff do have visually demanding tasks and need enough light to carry them out

Throughout the symposium and in the closing session there was ample opportunity for discussion and audience input, which contributed to the report of the proceedings and suggested actions for industry, designers, and researchers. The most important conclusion is that we are at the end of the beginning of understanding the link between lighting and behavior. Except for visibility, for which quantitative models exist, we have only a qualitative understanding of some of the relationships between specific lighting conditions and specific behaviors. That is, we know the direction in which behavior changes when lighting conditions change, but generally do not know the magnitude. Further, most of this work is confined to offices and streets and, even there, the effects on behavior are relatively unexplored.

This limited knowledge of the relationship between lighting and behavior occurs not because the effects are difficult to explore, given access to the required settings, but mainly because lighting research has not been sufficiently funded. This is a pity because although such research is likely to be costly, the financial benefits for some applications are likely to be huge. For example, establishing that providing daylight in hospital wards leads to better patient outcomes would be well worth the investment. Moreover, as advances in light source and controls technologies take care of reducing energy-efficiency, what will differentiate one product or service provider from another will be demonstrated effects on occupants – knowledge that we need to develop now. By inspiring the designers, researchers, and manufacturers in attendance, it is hoped that this symposium will have catalyzed new activities that will enable lighting to play its rightful role in the environments where we live, learn and heal.