The Society of Light and Lighting

Presidential Address 2011

SLL: The Solution for Tomorrow's Lighting

Peter Raynham MCIBSE FSLL

I consider myself to be very fortunate in becoming president of the SLL at this time. This is because I will take over the society with it in very good shape and it can be said that society is running effectively and efficiently. For this I must thank the last three presidents and the executive committee and staff of the SLL. This good fortune means that during my year of office I do not have to worry too much about the organisation of the SLL but I can focus developing the role of the SLL in solving the mounting problems faced by lighting in a world where energy use is being restricted.

Before starting to look at what the SLL can contribute to the process of energy reduction it is first necessary to consider the nature of the SLL.

The SLL is a learned society, we exist as an organisation where people who work with light can meet, socialise and exchange information. The real benefit that any member of the society receives is the ability to meet and communicate with other members, as the members of the society collectively are custodians of many thousands of years experience in the field of lighting. Once this point is realised it is clear that most of the activity of the society is about making sure that this vast experience is made accessible to all of the members. As you will know, like any other society the SLL has a list of objectives, and of the seven SLL objectives it is the objective *to provide a forum where people interested in all aspects of light and lighting can come together* that I wish to focus on here.

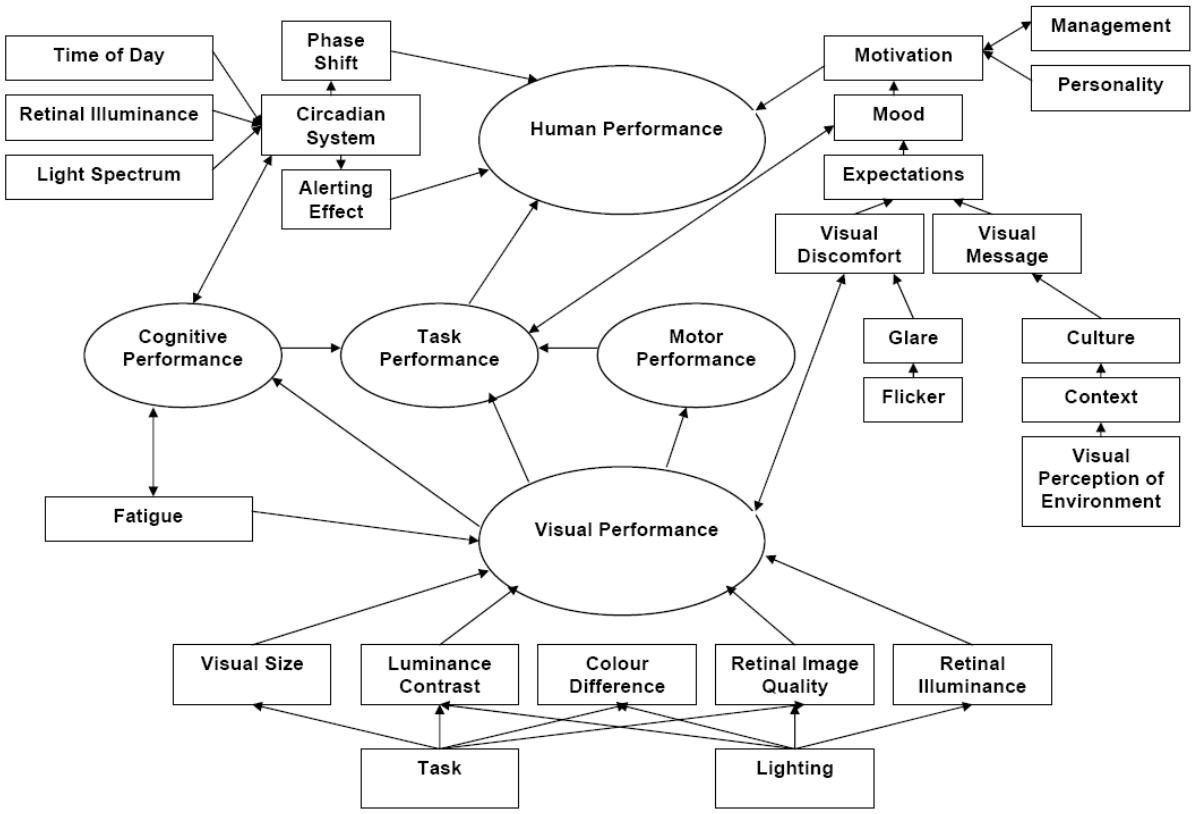
It will become clear that is critical to the success of society as it ensures the knowledge base that is necessary for all of the other aims.

This knowledge base is vital to being able to solve the most important problem facing us, how to reduce energy consumption while, still providing a well lit environment.

Let's now consider the problem at its most basic as illustrated in the figure below.

We know that light from luminaires create the lit environment, which is then observed and an impact is created in the observer. If we consider what is known about each part of this process it will help to highlight the issues.

It is easy to monitor the amount of electrical energy being used by the luminaire and given an understanding of the generating mix we can work out how much CO_2 emission is associated with the energy being used. We can photometer the luminaire and find out how much light is being emitted in different directions and whilst there may be some uncertainties in the values in general we can assess this light output to ± 2%. Then light falls onto the various room surfaces and after a series of inter-reflections generates the lit environment, in general we can calculate or measure all of the lighting parameters involved, however, there are some uncertainties involved but we still know what is going on to ± 10%. The next step of the process it that this lit environment is observed and we have to ask the question do we know what impact the lighting is having? Well to put it politely the answer is complicated. A conceptual framework of the different factors associated with human visual performance is given below; the diagram is derived from figure 4.1 in *Human Factors in Lighting* by Peter Boyce.



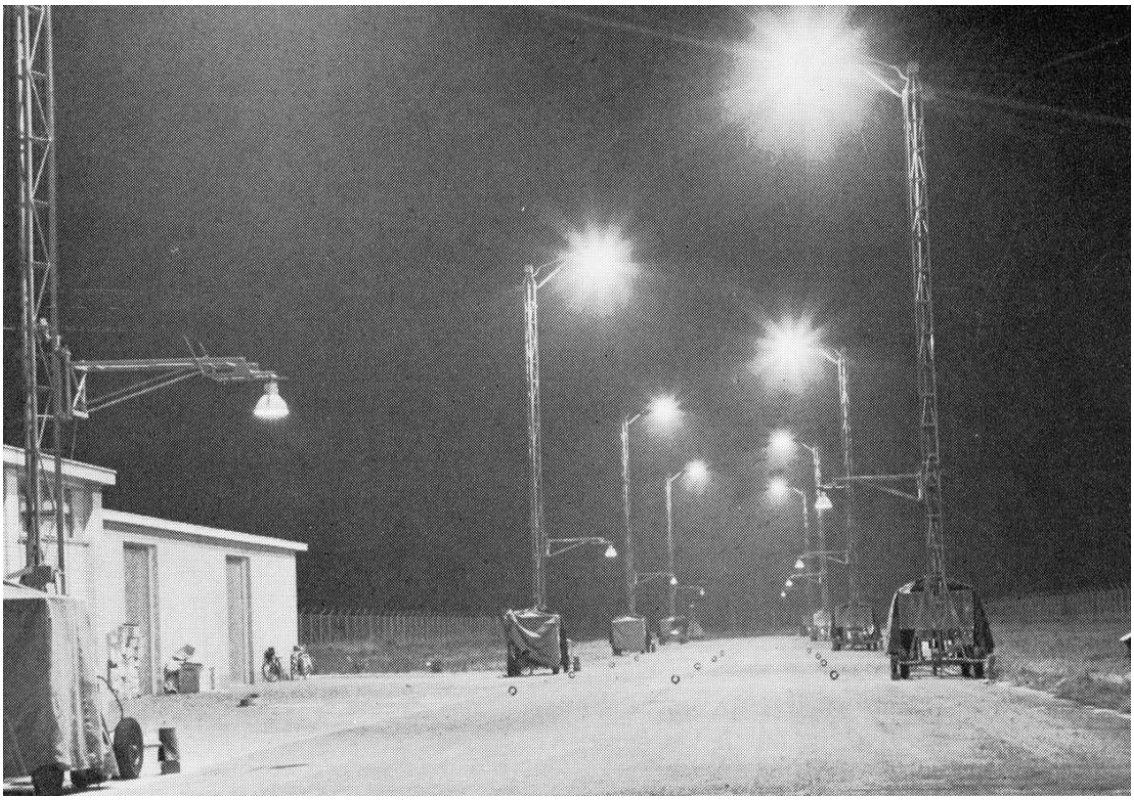
The diagram is of course a gross simplification but it does at lease provide a basis for discussing ideas about the factors involved. Towards the bottom of the diagram there are a whole series of factors that depend on the lighting and task, that impact on visual performance. The interactions here are fairly well understood we can make predictions about the ability of people to perform tasks under particular lighting conditions. In the top left of the diagram there are a number boxes that relate to the impact of light on the circadian system, in this area we are just starting to understand the processes involved but it is still not possible to fully quantify the various impacts that light causes. In the top right hand side of the diagram are a lot of more psychological impacts of lighting; however they really mixed up with a lot of other factors associated with the sociological and built environments. Thus quantifying any of the effects in this area is very difficult.

Lets now consider the impact of all this on the process of lighting engineering. At present lighting is specified so that it meets a number of light technical targets within the lit environment. In general the lighting system is optimised so that it meets those targets with minimum overall energy consumption. The problem is that there is a disconnect between the light technical targets and the impact on people in the space, this is not due to any deliberate policy, but simply because we do not understand the processes involved in human visual performance. This is not

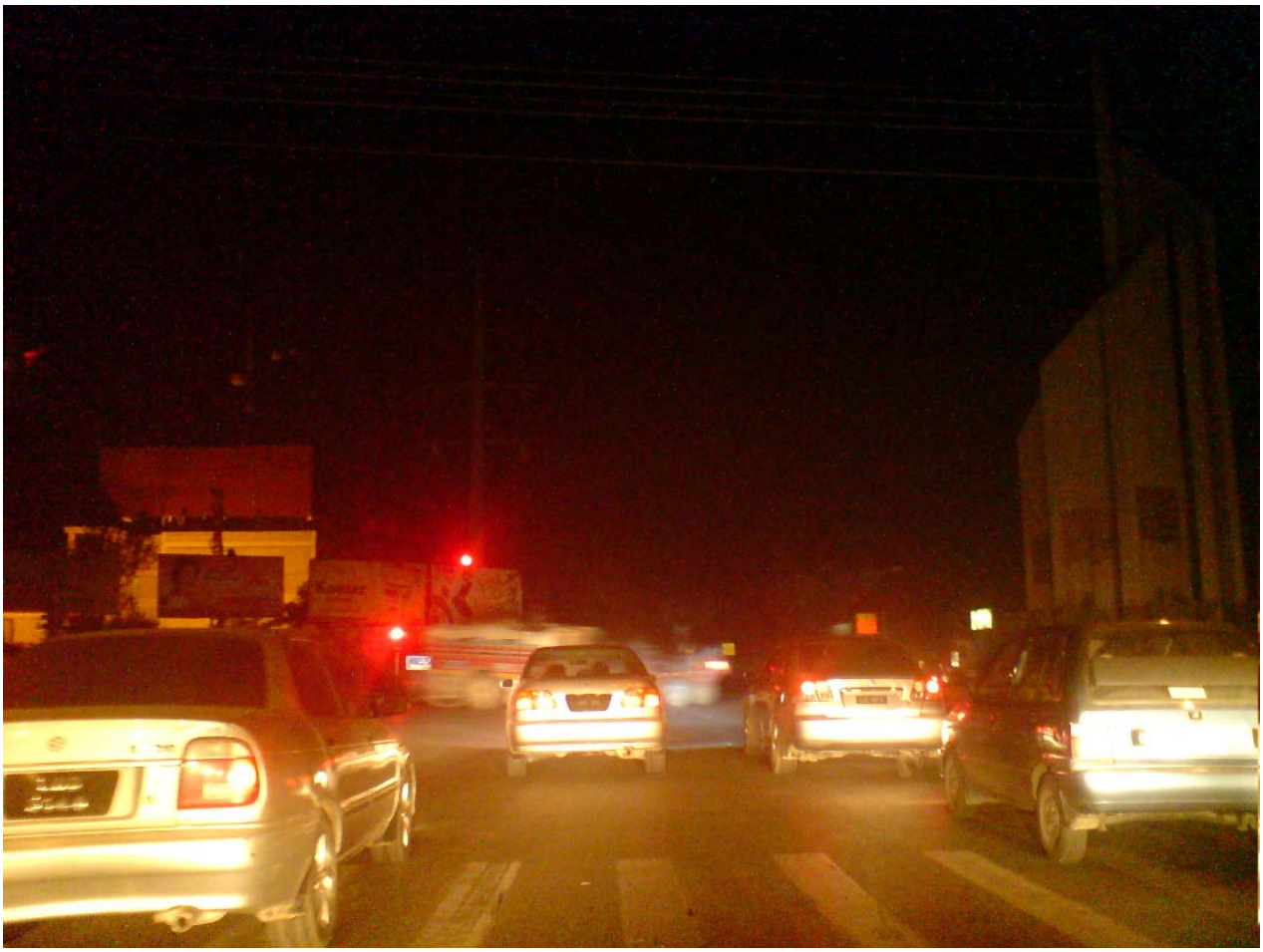
to say that the values in the SLL code are all wrong; they are tried and tested values that have been use for many years and they give results that give satisfactory lighting conditions, however, we do not know enough to say they provide the optimum lighting solution. Given the drive for energy reduction we can not sit back and just carry on with the code values for ever and for this reason there will be significant new advice on the sensible application of lighting targets in the next edition of the Code due out towards the end of this year.

The normal response to problem where we can see there is a lack of basic understanding is to call for more research. As someone whose job involves a lot of research work I quite like calls for more research; however, it is first necessary to consider how a research process might work and how that could impact on the applicability of any findings. It is often the goal of a research process to achieve a clear cut and repeatable set of findings, and to achieve this it is often necessary to remove variable elements from the environment being tested, this process is bound to reduce the value of the results even if the changes in the environment are 100% logical and justified. To illustrate the point I would like to look at two well known research projects that took place a number of years ago.

Much of the research that led to the current system of highway lighting was conducted by de Boer starting in the 1960s. The image below shows a study carried out on a test road in Belgium in 1964.

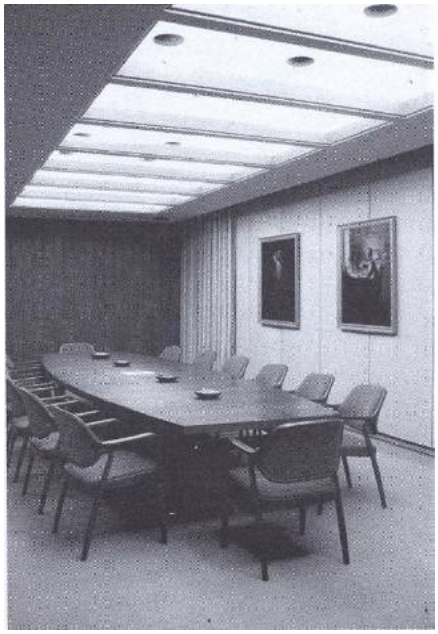


One of the key features of the test is lack of vehicles on the test road; clearly the absence of cars makes the experiment much simpler. Another point to consider is what was the traffic on Belgian roads like at the time? Then perhaps you might ask yourself how did the researchers get to work, and then you notice that there are two bicycles propped up against the hut. So we can assume that traffic density was low and thus it was a reasonable assumption to use an empty road. The image below is more recent and shows conditions on current roads.



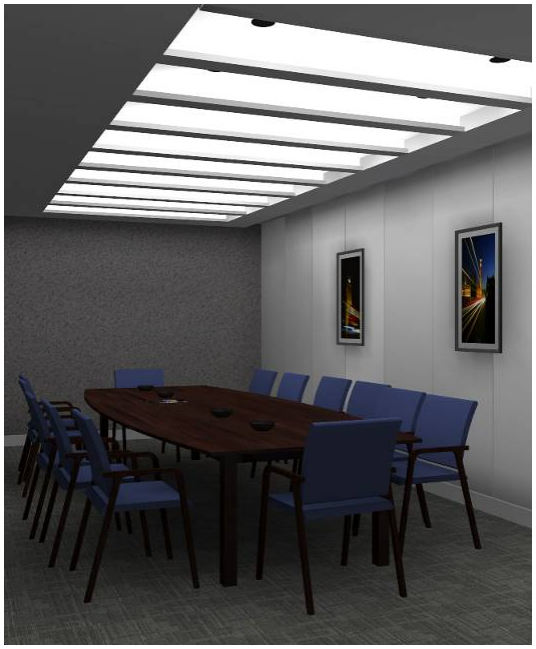
Thus it may be assumed that lighting recommendations that evolved from consideration of empty roads may well be inappropriate for current road conditions.

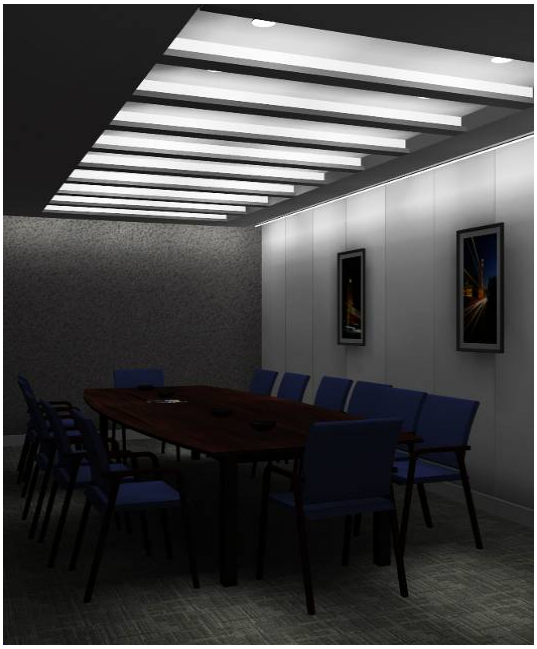
Similarly in the early 1970s John Flynn carried out research into the appearance of different lighting conditions within a board room. The study looked at a number of reactions to the different lighting conditions and the work has been used as the basis for much discussion on how to achieve various lighting effects. His study centred on a board room that was lit in a number of ways and he elicited the reactions of a number of people who made judgements about the room on twenty word pair scales in three rating category sets. The images below are photographs of the room as used by Flynn.



The image on the left shows one of the least liked lighting conditions and the one on the right one of the most liked.

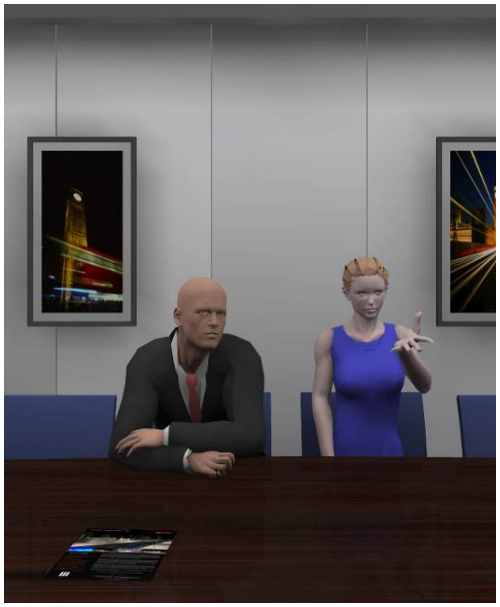
To investigate the true impact of this lighting my colleague Chris Jackson has simulated these two lighting conditions and the results are shown below.

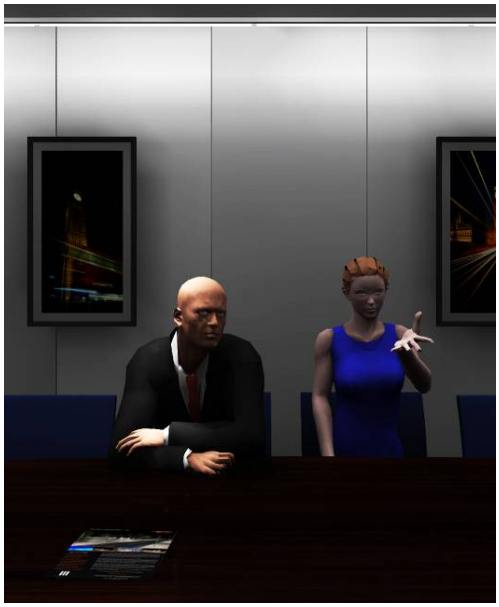




Whilst there are differences between the simulations and the photographs of the installations it is clear that the general lighting patterns are similar.

As you can see Flynn used an empty room, and you might well be thinking to yourself what the point of an empty board room is? So to see what happens when people are in the room simulations from the view point of a person sitting at the table have been generated.





As you can see the results are very different. These two examples of lighting research shows that research on its own does not always give us the basis to improve the trade off between lighting and the energy use. This is not to say that lighting research can not provide useful insights and help show the way forward, however, it is not until the new ideas have been tested in real conditions and found to be work well in a number of different circumstances that we know we have made progress.

The two research examples also have unfortunately have legacies in current lighting practice where we still have an inappropriate method for road lighting specification and a number of lighting designers who only consider empty rooms.

This now brings me back to the importance of the SLL. The members of the SLL directly have access to the results of lighting research, not only do they have access to *Lighting Research and Technology* but they also get a regular digest of the key papers in the *Newsletter*. Given their vast experience it is the members of the SLL who will know how best to employ the ideas from research in real lighting projects. Moreover, the SLL provides countless opportunities for the results of these lighting projects amongst other members of the society. Once these ideas are tried and tested they can be adopted into standards, guides and codes; this is another area where the SLL is very active.

Thus it can be seen that the SLL is key to innovation in lighting and I intend to spend my year as president promoting the SLL and it aims so that the society can grow in strength to ensure that the SLL can provide the solution for tomorrows lighting.