

Volume 3, Issue 1, Jan/Feb 2010

Newsletter

The Society of Light and Lighting
Part of the Chartered Institution of Building Services Engineers



- **Cuttle's theory: the profession responds**
- **Turrell's latest masterwork**



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Many years ago, in another life, I spent a fair amount of time as a journalist in engineering design offices. Whether it was trains, planes, cars or something more prosaic, what repeatedly struck me was the enormous chasm between the engineers and what were called stylists. It seemed self-evident that form and function were so intimately related, so mutually interdependent, that to make two departments, even two cultures out of them was demented and self-defeating.

But somehow an entrenched British tradition dictated that those who, shall we say, were hirsute in the nether regions, delivered the real goods while, in their opinion, the arty-farty lot just titivated things and made them look nice.

The situation still resonates in lighting. In one camp are the lighting engineers who are typically portrayed as the number-crunching anoraks, while in the other are the lighting designers who are perhaps viewed by the anoraks as not sufficiently rooted in engineering values.

This came up in my recent interview with Kit Cuttle, who has taught both lighting engineering and lighting design courses. 'There's practically nothing in common between these two approaches as they are taught,' he said. 'And that's wrong.'

He also observed that architects were 'getting on better with people who call themselves lighting designers' rather than lighting engineers and preferred working with them. 'I want to see lighting engineers getting involved much more. I don't see that there should be this great distinction.'

I suspect that lighting designers probably responded more positively to Cuttle's call to emphasise reflected light rather than horizontal illuminance because it is what they have been doing instinctively and through experience for many years (see Reflections on a new



light theory, p6, for a selection of opinions).

Light is invariably described as being a marriage of art and science, which of course it is, but this essential divide – also touched on by Jonathan Speirs in his recent Royal Institution lecture – remains.

It is an interesting area for debate and an issue that would be usefully addressed by whatever cooperative umbrella lighting body evolves in the next year or so. For one thing it is at the root of education and training, and how the nascent courses at the South Bank and elsewhere will develop. It is also crucial if lighting is to evolve as a properly recognised, cohesive profession.

Perhaps a good place to conclude is with lighting artist James Turrell whose latest work features on the cover (and see p11). A huge amount of engineering precision, calculation and technology went into his installation. The result is pure art.

Jill Entwistle
jentwistle@cibse.org

Nominations for officers and council

You are invited to submit further names for all positions except president, by email or letter, to reach the secretary by Tuesday 4 May 2010. In the event that there are more candidates than vacancies for any post it will be necessary to arrange a ballot at the AGM on 18 May.

Please note all nominations must be in writing and signed by the person being nominated and two proposers, who must be members of the society of any class.

The executive committee has made

the following nominations for 2010-11:

- President:** Alan Tulla (already elected)
- President elect:** Peter Raynham
- Vice president (regions):** Steve Langford
- Vice president (external affairs):** Iain Macrae
- Vice president:** Jeff Shaw
- Hon treasurer:** Cliff Shoebridge
- Corporate members:** David Holmes, Theo Paradise-Hirst, Liz Peck
- Non-corporate members:** Bob Bohannon, Helen Loomes, Karen van Creveld

Front cover: James Turrell's latest work at the Wolfsburg Art Museum (see p11)

We can look back on a very special year for the Society of Light and Lighting as it marked its 100-year milestone.

The celebrations started with the Young Lighter of the Year final at Earls Court last February, and it was great to see the enthusiasm that our young people bring not only to the competition but to lighting in general. A new crop of finalists has now been chosen (see p5) and we look forward to them battling it out at this year's Arc Show on 3 February.

As well as looking back on 100 years of achievement, the centenary also allowed us to think about the future shape of the SLL: who we are and what is important to us. This process began three years ago with the drafting of the society's strategic plan, focusing on four key areas, referred to as the four Ms – management, money, marketing and membership.

Our executive committee has focused on management in two key areas – CIBSE's resourcing for the society and our own internal management structure.

We have agreed a three-year plan with CIBSE that allocates resources from the main institution in proportion to the number of SLL members. The historic subvention has now been replaced with a grant which will increase if our numbers go up, and decrease if they go down.

This new agreement is a big step forward in helping us to manage the combined resources of the SLL/CIBSE effectively. It means greater autonomy for the SLL and recognition from CIBSE of the society's need to manage its affairs independently.

The internal management structure and succession of officers has also been an area of focus. We have made some changes to the governance document, redefining the responsibilities of officers in order to increase their effectiveness. These amendments were approved at our December meeting of council.

As I mentioned in my address to the AGM in May, marketing is the shop window for the society. Our publications and events reflect our aspirations to members and non-members alike. This is an area we can improve on. Working with the expertise that CIBSE has, including CIBSE Services, the marketing team, press office and so on, will lead to improved coordination, and an altogether better story of what the SLL is about. The new Lighting Handbook, the 12 Lighting Guides, the new Code for Lighting CD,



the Masterclass programme throughout the UK and Ireland, Ready Steady Light and Young Lighter of the Year are all valuable 'products' we have for sale.

We have a number of plans in this area: for one thing, rebranding the London Sessional Meetings and replacing them with fewer, more high-profile events, such as the highly successful Kit Cuttle lecture and the Centenary Lecture at the Royal Institution. This will mean we can provide enhanced marketing support, better venues, better catering and so on.

A key goal set out this year was to grow our membership by 100 in our hundredth year. This is one of the areas where we have most work to do. Our membership sits at around 2000, remaining more or less static. We can do better. We now have two strategies to be rolled out over the next six months. First, there will be a campaign to attract new members to the society and, second, a plan to retain existing members who have not renewed their membership.

This is an area that I think should be on all members' radar. Promoting the features and benefits of the society to colleagues or clients can make a huge contribution.

I would like to take this opportunity to thank our sponsors – Holophane, Philips and Thorn Lighting – and also all our sustaining members for the continuing support they provide to the society.

As Theodore Roosevelt said: 'Today is the day we shape tomorrow.' With a century of accomplishment behind us, I see no better place to start shaping tomorrow.

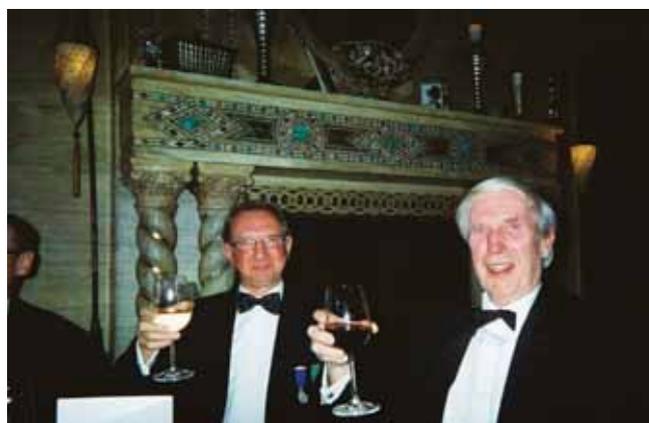
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The ultimate celebration

Exactly 100 years to the day of the SLL's founding, members and guests gathered in the gilded surroundings of the Criterion in London's Piccadilly Circus for the ultimate celebration of the society's centenary. Rather than having an official photographer, everyone was invited to record the event for themselves using disposable cameras – which may account for some unevenness in quality, but happily conveys the conviviality of the evening.

Among the guests were Miles Pinniger, Bob Venning and Lou Bedocs (right); Hugh Ogus and Peter Boyce (second row); Stephen Cannon-Brookes, Nigel Pollard and Paul Ruffles (third row); Eddie Taylor, David Rowden, Martin Lupton, Xxxxx Xxxxx and Gail Youlden (bottom row)



Reflections on a

In the last issue, author and academic Kit Cuttle outlined his controversial new approach to lighting. Here leading practitioners and academics respond to his contention that reflected light should supersede horizontal illuminance

David Loe Independent consultant



Kit Cuttle touches on a number of interesting issues relating to the lack of development in lighting design quality, a plea with which I have much sympathy. Most lighting installations aim to satisfy the basic requirements of visual function

– in other words, sufficient task illuminance with the avoidance of discomfort glare, either direct or reflected – and by using the minimum amount of electricity. All of these are of course important, but if they are prescribed without considering the lit appearance of the room then the illumination is likely to be less than ideal for the occupants. And, if I understand Cuttle correctly, this is what he feels too.

My question is, how does luminous exitance help solve this problem? My experience and research have led me to see that people like working spaces to appear visually light and visually interesting, with areas of light and shade, which indicates to them that they have appropriate functional illuminance and a pleasant working environment. These signals may be psychological, but are likely to have positive effects on health and performance. For this I believe that luminance is the best measure that we have at present. Luminance combines illuminance and reflectance which the designer can specify and measure.

A further issue that Cuttle raises is the question of functional and amenity lighting. In my view both are important, but perhaps a room should be provided with amenity lighting, which responds to the architecture and the daylighting, leaving the client, with help, to then determine the necessary task illumination for the particular application. (Bearing in mind, of course, that the two lighting elements will need to be integrated.) Perhaps this could be a better way to proceed?

Peter Boyce Author and academic



Given that visual tasks have become easier over time, there is clearly an opportunity to reduce recommended illuminances and thereby reduce the energy used for lighting, without deterioration in visual performance.

Kit Cuttle's emphasis on spatial brightness as the main design criterion seems to neglect this opportunity. I think that a better approach would be to consider how to maintain a suitable perception of spatial brightness while minimising energy consumption.

A related matter is the assumption that what people now care about is the brightness of the space. I do not believe this to be their primary concern. First and foremost, what people want from lighting in a workspace is to be able to see what they need to see, in comfort. It may be that the perception of the brightness of the space is used as a marker as to whether or not they will be able to see what they need to see anywhere in the space, but if this correlation breaks down – which it might do if the main design criterion is mean room surface exitance – then dissatisfaction will inevitably result.

The brightness of the space is important, but not as important as the visibility of the tasks. For this reason, I believe an approach in which the lighting is first designed to provide the desired level of spatial brightness, leaving any task visibility problems to be overcome solely by ad-hoc measures, is misguided.

In addition, I believe that mean room surface exitance is a crude measure of brightness perception. The range of luminances present in the space and the spectrum of the light are also important.

Having said all that, I believe Cuttle is to be congratulated on pointing out the value of mean room surface exitance as a design criterion and the implications that would carry for the type of lighting adopted.

new light theory

Bob Venning Consultant



I always find Kit Cuttle's work challenging and to some extent he is right in what he says. However, Waldram propounded the luminance design method, which never caught on, and I suspect that Cuttle's model will suffer from the same problems – lack of detail knowledge at tender stage as to the exact type of materials being used, their finish, colour and texture. All these are equally important to the design if it is to be progressed. We have always suffered the problem that architects or interior designers think about these elements far too late.

We try to integrate the lighting into the structure and finishes, and with other services. To do this means it has to be flexible enough to respond to changes to the design as the building is going up. Rarely does the designer have the luxury of designing the lighting with all the information he or she needs to hand.

Then there is the case of the office. How many people use 70/50/20 as surface reflectances? Maybe 70/25/35 would be a better estimate as there is invariably more glass wall and less solid wall than is generally considered.

I think that as a method it will go the way of the luminance design method. An interesting academic approach, but practically hard to implement.

Kevan Shaw Kevan Shaw Lighting Design



This was an excellent and well-explained proposal. Kit Cuttle's explanation clearly expresses what we all know to be the major limitations of considering lighting measured as the quanta of light falling on a surface. His well-thought out and excellently delivered paper ran so well together that it could have seemed almost too obvious or even glib. However, having read the published paper, and the comments and Cuttle's response, this really is one of those blindingly obvious ideas that we have all missed.

Using mean room surface exitance (MRSE) as a method of assessing the real appearance of a lit room has the potential to provide calculated values that have real meaning to, and a direct relationship between, a lighting calculation and visual appearance. Obviously the method requires some research to prove its effectiveness, and also refinement to enable calculation of spaces that are not box shaped or that don't have absolutely consistent surface reflectance. At a time when freshly MSc'ed lighting designers are finding it difficult to secure jobs this is an excellent PhD subject.

We are also all aware of how our existing method of working towards a target illuminance on a horizontal plane is often extremely wasteful of energy while not necessarily creating a good lit appearance to a room. MRSE appears to provide a tool that will allow us to demonstrate how to achieve an adequately lit space with the minimum of energy – a really valuable goal for lighting design now.

Kevin Poulton K Poulton and Associates, lighting industry consultant, Australia



Kit Cuttle is quite right, horizontal illuminance (Ehor) is an obsolete and out of date illuminance metric. In fact it is both meaningless and nonsensical in the 21st century.

Cuttle's thesis that the illuminance at the plane of the eye is a more relevant indicator of the visual scene to which the eye will respond, for better or worse, is long overdue. This is particularly so in the case of non-task specific areas, such as public spaces, foyers or passageways, and even if a task is particularly difficult or small in detail then perhaps Ehor or Evert could be relevant as a supplementary metric.

For decades we have had two metrics that have largely been ignored: mean cylindrical illuminance (E_{cyl}) and half-mean cylindrical or semi-cylindrical illuminance (E_{sc}). They are easy to calculate and they can be measured by means of a simple adaptor to the standard lux meter.

My own anecdotal evidence is that in public spaces an E_{cyl} of 100 lux and in task areas an E_{cyl} of 200 lux will produce a very pleasant visual environment. Obviously

other parameters, such as suitable reflectances and the UGR, must be considered. No one metric is going to be the complete indicator of a satisfactory visual environment.

We should also include the work done by Kit and Joe Lynes in the 1960s on vector and scalar illuminance. What a pity these metrics are not in common usage, especially in these days of computerised calculation methods.

At the present time when the world's focus is on energy usage and efficiency, the lighting industry should be reviewing its specification and calculation methodologies and not be stuck, as Cuttle says, 'in the 1920s or 1930s'.

I would like to thank him for raising a most important and timely matter. I hope it will be the beginning of a debate we should have had years ago. In my opinion, our lighting standards and codes, in terms of illuminance recommendations, are archaic and should be revised.

Peter Raynham

Lecturer at the Bartlett, UCL



In the introduction to his paper Cuttle goes through the previous stages of the lighting profession where we have learnt to predict and control how much light a given installation will create and know how much light to provide for a particular task. He then correctly points out that we are providing more than enough light for our visual tasks and what we are really doing is lighting so that spaces look sufficiently bright. He then goes on to develop some ideas about the importance of luminous exitance and then uses Sumpner's principle to show how simple changes in room reflectances can have a big impact on the amount of light that bounces around the space.

His proposal that mean room surface exitance should be the key parameter for lighting designers is a little questionable. Clearly the amount of light coming from room surfaces is important to our perception of lightness

within a space but it is a long way from being the be-all and end-all of lighting design. The problems are twofold. First of all the concept carries no information about the light pattern within the space, and tells us very little about the way objects will appear in the space. These two factors are intimately linked and, coupled with the direct distribution from the light sources, can make a big difference to the way a space appears.

What Cuttle's paper does do is provide a wake-up call to everybody who slavishly follows the schedule of the SLL Code without thinking about the distribution of light in the space, or worrying about the lit appearance of a space. The paper is very thought-provoking but it leaves us with more questions than answers.

Nick Hoggett

Partner, DPA Lighting Consultants



This theory is not only really interesting, but challenges current thinking in a way we need to do more often. Cuttle's methodology of considering the exit luminance from a surface is a totally valid and appropriate way of approaching lighting design. I have said for many years now that lux is a meaningless unit of light as far as human emotion is concerned. I think it is excellent that Cuttle has started to formalise some analytical data to support this method.

I believe that what he is suggesting is actually not new at all, and is in fact exactly the approach that we take to our work and have done so for many years, but we do it more instinctively than mathematically. When we are briefed for a project, once we understand the basic structures and usages, some of the first questions we ask are about the colour and texture of the materials that will be used.

His method, which I support, needs excellent knowledge of the materials and colours of surfaces, therefore, which it's often difficult to fix at the early stages of a project. If the wrong assumptions are made, spaces could be left over or underlit. This is the case with any lighting design approach, but perhaps more so when using only exit luminance. Cuttle's desire to engage architects to understand the importance of defining room surfaces early is an excellent goal. Other factors such as the introduction of furniture into a space also have greater relevance with this design philosophy, which is why it is so important to understand everything about a space when considering the lighting.

We do, however, have to ensure that the lighting solutions we conceive are not so rigid that they leave building owners and users with inflexible spaces, limited by the original colours. We have to ensure that a reasonable level of flexibility is achievable to allow for future changes.

I am not sure how feasible it will be to generate meaningful values for real projects using exit luminance because room surfaces are far more complex than just a single colour in a lot of instances. I can give many examples of this, but will quote two. First of all, what about a wall that is partly panelled, partly painted and then has a substantial

part of its area covered with artwork? What about a room that has a highly decorated historic ceiling, where some parts are light, others are dark, some reflective and some not?

To adopt Cuttle's method and link it back to finite numbers will be an immensely complicated challenge, and one that I suspect will prove impractical to implement in anything other than simple rooms in terms of their surface treatments. Cuttle has quite rightly reiterated that this method is not just for the workplace, but for all building types and this again, in my opinion, is absolutely correct. We should consider the brightness of surfaces that humans experience as being of prime importance, rather than designing to standards related to task.

I am also sympathetic to Cuttle's opinion that many tasks can be carried out in relatively low light levels, and certainly lower than some current standards call for. However, again I think the subject is complex and issues such as duration of task need to be considered carefully. We want to use light to invigorate, enliven, stimulate, excite, relax or calm as is appropriate for that particular circumstance, at that particular moment in time. To achieve this needs human consideration as well as mathematical solutions.

Another area that Cuttle discusses which I entirely agree with, and talk about regularly, is how by lighting the surfaces that we need to light and not lighting other surfaces, tremendous savings in energy can be achieved.

To conclude, I completely support Cuttle's design philosophy using exit luminance as the primary factor to evaluate the quantity of light needed on a surface. But I do believe the complexities of most interior and external spaces, together with the aspirations of using light creatively, will make it very difficult to produce finite values that produce a definitive code for such an approach. It would, however, be fabulous if Cuttle could develop his approach further, as I believe it has great merit and is better than the current methodologies generally employed.

On the road to efficiency

Comparing sources on the highways and lighting for an ageing population. Alan Tulla distils the latest LR&T

One particular feature of lighting technology is that light sources are constantly improving and finding new applications. As a consequence, lighting practitioners need to keep up to date with research. Some areas of application move faster than others. The lighting of offices, for instance, has been partly driven by VDT technology. On the other hand, the lighting design of roads has been fairly constant until just recently. The introduction of long-life metal halide lamps with only slightly lower efficacies than HPS, coupled with metal halide's effectiveness for mesopic vision, means that sodium sources no longer rule. Two papers compare the effectiveness of these sources in relation to highways and exterior lighting.

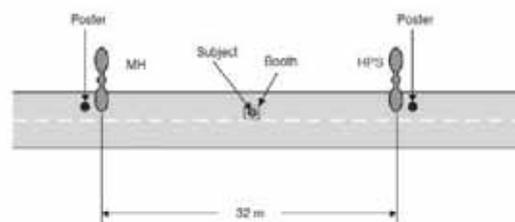
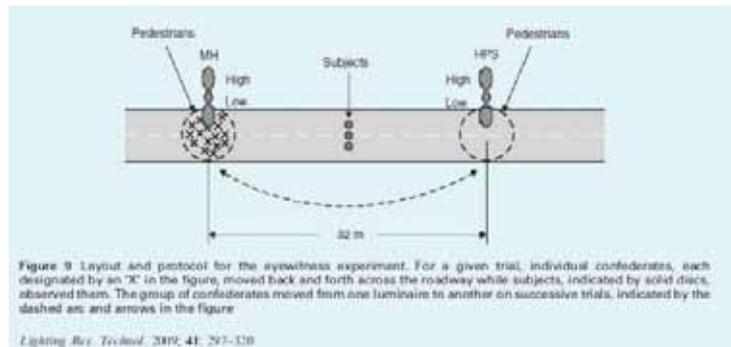
The paper by Rea et al compares the qualitative aspects of the light from metal halide and high pressure sodium lamps in outdoor situations. The criteria for comparison include acceptability for social interaction, facial recognition and eyewitness identification. Trials were done in actual streets. At equal photopic light levels the experiment demonstrated that MH was reliably seen as both brighter and safer than HPS. However, in terms of acceptability for social interaction and facial recognition, the results were less clear. There is a vigorous discussion at the end of the paper with comments by Peter Raynham and Steve Fotios.

The second paper by Fotios and Cheal examines laboratory experiments concerning obstacle detection using different light sources. Obstacle detection is also measured against the illuminance and the age of the observer. Paving slabs of different heights were tested under HPS and MH sources at 0.2, 2.0 and 20 lux. Predictably, there was little difference between the sources at 20 lux. At lower levels the better S/P ratio of the MH lamps produces better detection.

While the tabloid press moan about the GLS lamp being banished, it is worth remembering that some countries still continue with them. There is an interesting paper from India exploring the optimum inventory of GLS lamps to maintain well-lit offices. The paper by Agrawal and Menon then develops a rule of thumb for quickly estimating the number of lamps to be held in stock.

Three papers (all from the University of Technology and Economics, Budapest) concern lighting for older adults, between 66 and 84 years. Older subjects are rarely included in experimental work so these investigations should be of particular interest to those lighting designers working in countries with an ageing population, for example the UK and mainland Europe. The effects investigated include those of dynamic lighting and blue versus red light.

Finally, Malcolm Richards reviews an excellent book on lighting for driving. ■



LR&T Vol 41 No 4 Contents:

- Editorial – *RH Simons*
- Several views of metal halide and high pressure sodium for outdoor lighting applications: *MS Rea, JD Bullough, Y Akashi*
- Obstacle detection: a pilot study investigating the effects of lamp types, illuminance and age: *S Fotios and C Cheal*
- Replacement rate of filament lamps in an organisation: a rule of thumb. *DC Agrawal and VJ Menon*
- Psychophysiological, performance and subjective correlates of different lighting conditions: *L Izso, E Lang, L Laufer, S Suplicz and A Horvath*
- Effects of dynamic lighting on the visual performance of older adults: *L Izso, L Laufer and S Suplicz*
- Psychophysiological effects of coloured lighting on older adults: *L Laufer, E Lang, L Izso and E Nemeth*
- Book review: 'Lighting for driving: roads, vehicles, signs and signals' by Peter Boyce. Reviewed by *Malcolm Richards*
- Correction: Lighting for subsidiary streets – investigation of lamps of different SPD. Part 2, Brightness. *S Fotios and C Cheal*

The weaker specs

Mark Sutton-Vane on why lighting professionals have to fight for their specifications

Recent events, from the near collapse of the banking system to revelations that a number of MPs have been less than punctilious with their expenses, show how easy it is to allow bad practice to go unquestioned. And, of course, it also happens in lighting.

Possibly the most infuriating and shoddy practice we encounter as lighting designers is the curse of 'spec busting'. The habit of ignoring design specifications and substituting fittings in order to pocket the difference is so widespread in design and build that it is now regarded as inevitable.

So what's going on and does it really matter? More important, what can we do about it?

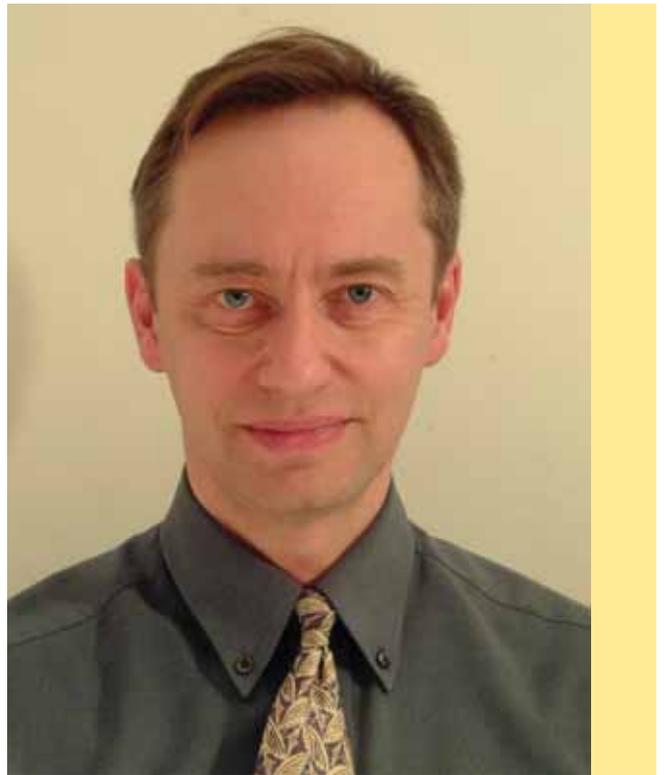
As we all know, spec busting happens well into the design process. Long before it takes place, the client will have paid a lighting designer to find the best possible scheme to satisfy all criteria including the budget. Fittings and suppliers will have been specified because the lighting designer knows that they will perform as they should and will deliver value to the client.

So when a contractor – who is not a lighting designer – tries to create 'savings', the client should be asking who, exactly, is going to benefit? Are they real savings, or might using a cheaper, probably inferior fitting from a no-name source with an unknown inventory just possibly cost a bit more in the long run? And if so, who is going to pay? Not the contractor, that's for sure.

Spec busting in lighting sits somewhere on a line with, at one end, paying for a silk lining in a jacket and finding that it's just nylon, and at the other bulking out baby food with 'cheap' chemicals. Most of the harm is commercial or monetary, and some is hard to quantify. A first-rate scheme can end up looking – and performing – like a third-rate scheme, and by subverting the lighting design the contractor wastes at least part of the lighting consultant's fee. On top of that, whatever the contractor succeeds in skimming off comes out of the client's pocket. It amazes me that clients put up with this and I can only think that they do so because they lack confidence.

It's perfectly reasonable for anyone commissioning a building, especially someone who has not done so often, to look to the experts for advice. The unexpected is to be expected with all building projects and there are times when unforeseen groundwork, for example, means that genuine cost savings have to be made further into the build. This is an example of when modifying the specification is legitimate. This is also when contractors can really be helpful, as the good ones often are, by using their knowledge to come up with practical solutions.

All too often, however, clients pay the price for being unable to distinguish between the genuinely independent advice of a lighting designer and the covert sales talk of a contractor, or supplier, dressed up as lighting consultancy. The flip side of this is where a domestic client falls prey



'The habit of ignoring design specifications and substituting fittings in order to pocket the difference is so widespread in design and build that it is now regarded as inevitable.'

to the audio-visual 'consultant' who persuades them to install a fantastically complex and expensive integrated control system, when what they really wanted would work perfectly well off a light switch.

So, how do we put a stop to spec busting? The first thing to remember is that a contractor has signed a contract to purchase and install specific equipment. Deviating from this should not be a matter of course. Under a traditional building contract that just can't happen and it should not in design and build. But while clients have a responsibility to use a proper contract it is also down to the lighting designer or lighting engineer to police it on their behalf.

Mark Sutton-Vane is principal of independent lighting design consultant Sutton Vane Associates ■

Space odyssey

Inside lighting artist James Turrell's most ambitious museum installation

The largest-ever museum installation by lighting artist James Turrell is now on show at the Wolfsburg Art Museum in northern Germany. The monumental Wolfsburg Ganzfeld Piece – 12m high and encompassing an area of 700 sq m – comprises two rooms, Viewing Space and Sensing Space, that merge into each other. Both are completely empty and flooded with slowly changing coloured light. Viewers are plunged into a world made of pure light, an experience that Turrell has described as 'feeling with one's eyes'.

Around 30 other exhibits are also on display, including models of rooms inside Turrell's ongoing magnum opus, Roden Crater in Arizona, and installations from each of his main bodies of work: among them a new version of Wedgewerk V and Spinther, 2007, from his Tall Glass Pieces. The exhibition also includes a selection of prints, etchings and photographs.

The science behind the art of the main installation is largely down to Zumtobel which has provided all the luminaires and control systems. The Tall Glass project is also a collaboration between the company and Turrell.

A total of 250 Hilio LED light lines and 24 Olympus LED spotlights fitted with more than 30,000 LEDs were used for the Ganzfeld Piece, allowing more than 65,000 different brightness levels and millions of different colours, controlled by a DMX control system.

Tall Glass, a frosted white glass panel backlit by more than 15,000 LEDs, creates similar perception effects. The individual light points are not visible, dissolving into hundreds of millions of colour impressions with flowing transitions,



Photos: Florian Holzherr

'Viewers are plunged into a world made of pure light, an experience that Turrell has described as "feeling with one's eyes".'

rendering a picture that never stands still. Five different LED colours are used: red, green, blue, yellow, white and bright white, and each LED can be controlled separately, to more than 65,000 brightness levels each.

According to Zumtobel, this allows the creation of colour impressions and sequences that are 'unprecedented in terms of colour intensity and saturation'. LEDs of the same colour were carefully selected to ensure that they had identical characteristics in terms of spectral quality and light quantity. A five-channel control system was specially developed for the project.

The exhibition runs until 5 April 2010. For more information, visit www.kunstmuseum-wolfsburg.de ■

2010

19 January

LG5: Lighting in education

Speaker: Iain Macrae

Venue: Thorn Lighting

83 Great Portland Street

London W1

Time: 1.30pm for 2pm

20 January

How to specify lighting:

office lighting

Speaker: Barrie Wilde

Venue: CIBSE

London SW12

(see Mid Career College)

21 January

Using the Society of Light

and Lighting Code

Trainer: Peter Raynham

Venue: CIBSE

London SW12

(see Mid Career College)

28 January

Lighting Masterclass

Speakers: Chris Wilkes,

Steve Langford, Anthony

Martindale, Iain Macrae

Location: Leicester

Time: 10am-4pm

3 February

Young Lighter of the Year final

Venue: The ARC Show 2010,

Earls Court 2

Time: 4.30pm-6.30pm

3-4 February

The Arc Show

and IALD Enlighten Europe

Conference

Earls Court 2

www.thearcshow.com

16 February

Residential lighting

Speakers: Benedict Cadbury

and Rebecca Weir

Venue: Darwin Biochemistry

Lecture Theatre

Darwin Building, UCL,

Gower Street, London WC1

Time: 5.30pm for 6pm

17 February

Joined Up Lighting

Sponsor: Se'lux

The new Part L: will it really

reduce carbon emissions?

Speakers: David Bleicher

and Iain Macrae

Venue: BDP, Brewhouse Yard,

London EC1

Time: 2.30pm



3-4 February: The Arc Show, Earls Court, venue for the Young Lighters final

25 February

Lighting Masterclass

(see 28 January)

Location: Portsmouth

Time: 10am-4pm

11 March

Lighting Design Awards

Venue: London Hilton,

Park Lane, London W1

www.lightingawards.com

16 March

Trotter Paterson Lecture:

Mesopic Vision

Speaker: John Barbur

Venue: Darwin Biochemistry

Lecture Theatre

Darwin Building, UCL,

Gower Street, London WC1

Time: 5.30pm for 6pm

25 March

Lighting Masterclass

(see 28 January)

Location: Oxford

Time: 10am-4pm

11-16 April

Light+Building

Venue: Frankfurt

www.light-building.messefrankfurt.com

20 April

Optical materials

Speaker: Peter Thorns

Venue: Thorn Lighting

83 Great Portland Street

London W1

Time: 1.30pm for 2pm

29 April

Lighting Masterclass

(see 28 January)

Location: Telford

Time: 10am-4pm

12-14 May

Lightfair trade show

and conference

Venue: Las Vegas Convention

Center, Las Vegas

www.lightfair.com

18 May

AGM, presidential address

and awards reception

Venue: Royal College of Physicians

11 St Andrews Place,

Regent's Park

London NW1

Time: 6pm-9pm

27 May

Lighting Masterclass

(see 28 January)

Location: London

Time: 10am-4pm

9-10 June

Guangzhou International

Lighting Exhibition

Venue: Pazhou Complex,

Guangzhou, China

www.light-building.messefrankfurt.com

Lighting Masterclasses:

Masterclasses are kindly sponsored by Holophane, Philips and Thorn. For venues and booking details, see www.sll.org.uk

Mid Career College: the

college runs various courses across the whole spectrum of lighting and at sites across the UK. Full details at:

www.cibsetraining.co.uk/mcc

LIF courses: details from John Huggill, 0208 529 6909, or email training@lif.co.uk