Comfort Management

In some offices our employees are suffering, the common symptoms are headaches, eyestrain, low mood, poor concentration, unhappiness at work, even a feeling that they are misunderstood.

Many of these symptoms may be affected by light, more specifically it is suggested these symptoms are directly affected by the following: -

Looking at digital screens
Reading without pausing to rest your eyes
Activities involving extended focus
Being exposed to bright light or glare
Straining to see in very dim light

So directly poor lighting could lead to lower performance by our most valuable asset, our people.

Traditionally we have used the construction ratio to justify why people are so important.

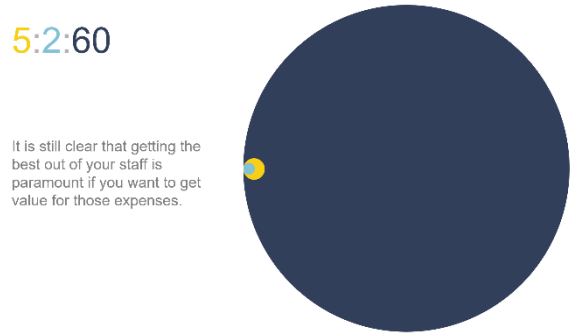
What do we mean by the construction ratio?

The first part of this ratio is construction cost. To save here you might design using cheaper products, lower quality or shorter lifespan. Or you could use products that are easy to purchase and that make the installation and commissioning easier.

The second part of the ratio is about maintenance. For every £/€ spent on construction, the ratio suggests we spend five on maintaining the building.

Simple and easy replacement of building components is one was to save, but ensuring the luminaire operates effectively for a long time is even better. Or it could be through long service intervals, for instance using one-piece designs that remove the need for cleaning or accessing the inside of the luminaire.

The final part of the ratio is about our people, our employees. The cost of your staff over the lifetime of a building is significant, originally suggested at two hundred times the construction cost. Staff cost varies as part of the business operating costs, but examples in the EU show staff costs are around 90% of operating costs for a typical office.



Fundamentally though this ratio has proved to be wrong. Recent research rejects this and suggests a ratio 1:0.4:12 is more realistic[1].

But what is clear is that getting the best out of your staff is paramount if you want to get value for money in business.

Lighting at work is one of the vital tools that contribute people doing a great job, even Richard Branson recognizes this "If the person who works at your company is 100 percent proud of the brand and you give them the right tools to do a good job, and they are treated well, they're going to be happy".

So we have a number of problems in offices, it could be out of date lighting or even modern and high glare lighting, and we know poor lighting contributes to poor comfort for employees and affects performance.

To correct for this mistakes, first we have to think about lighting in office spaces being more than just the luminaires or simply lighting the desk.

I would recommend a lighting framework, perhaps twelve ways of thinking about light, the people and the space.

Maybe you can find more, or split it into less. But certainly you shouldn't ignore any of these.

For the purposes of the masterclass we worked through only a few of the performance and comfort issues. Past Masterclasses already covered Efficiency in great depth.

So what's the first key learning about Illumination? Fundamentally it's about lighting the important surfaces in a space within the view of your staff; the walls; the displays; the desk, book, keyboard, screen; the face; the surround of the task for our colleagues and the camera perhaps.

We can simplify this for you into three aspects to consider.

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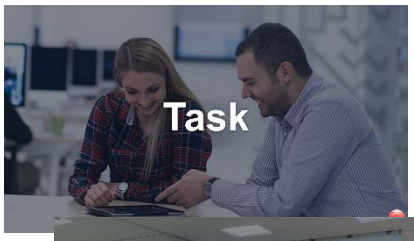
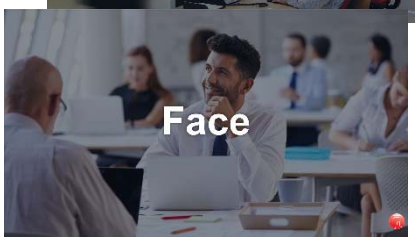
[1] EXPOSING THE MYTH OF THE 1:5:200 RATIO RELATING INITIAL COST, MAINTENANCE AND STAFFING COSTS OF OFFICE BUILDINGS Will Hughes, Debbie Ancell, Stephen Gruneberg and Luke Hirst School of Construction Management and Engineering, University of Reading, PO Box 219, Reading, RG6 6AW, UK





First, the Task. The light onto a surface where an activity is being undertaken or performed.

Second the Space, the light that reveals the surroundings in which the task is being performed.

Finally the face, the human element, the light that reveals expression and body language, because communication is vital to people and that is about revealing the right visual stimuli.

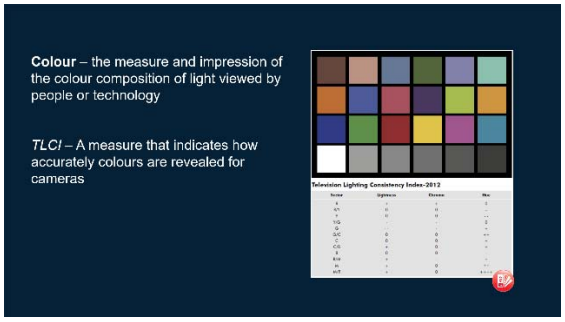
Good communication is about sending and receiving messages, 80% of which are visual, so good lighting for the human rather than our equipment should be the priority. Good Vertical illuminance is important throughout our office space, including break out spaces and conference rooms where communication is the primary activity. It's also important to see the facial expressions of our colleagues, against a balanced background (including both colour and light) as this will determine how well our message is received.

So light for communication should incorporate all these elements, the task, the space and the face.

Light has to reveal our face, with just the right amount of shadow so we can read expression, across a room, across a video feed and perhaps across many faces. The light needs to reveal and balance the back ground surfaces, so that contrast in not too high. At the same time we are likely to be reading or taking notes and our lighting has to allow us to see our notebook or use our touch screen.

With the increase in connected devices used in offices, we have to think about a few new measures current in the market to do with colour and contrast.

Firstly colour. Defined as the measure and impression of the colour composition of light viewed by people and by technology.



We can argue about Ra, Rf, Rg and CCT, we've had these discussions. But let's introduce TLCI, Television Lighting Consistency Index. A measure of the ability of light to provide good camera images without the need to balance or adjust the camera. It's a property of the light source and the optical effect on the spectral output. We can generate it simply for all light sources using free software. But why include it?

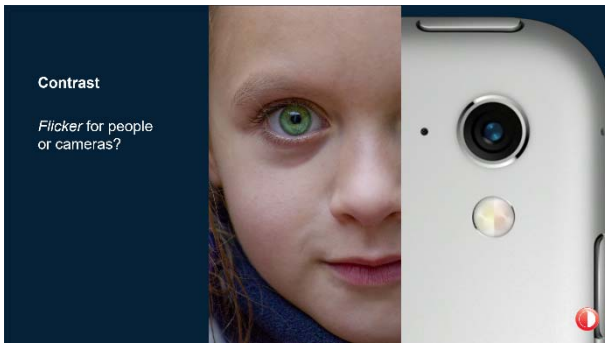
Communication in offices, and indeed at home or the "coffee shop" office, needs good light colour quality. Given that the camera takes, processes and transmits the image that we see across our smart device, it's important to know that we are creating the best quality image in the first place. At least we should make it easy for the camera to reproduce what is being seen.

Our second problem is flicker. The variation of contrast through time. Something I can't show in a written article.

Remember that time and movement impact our ability to detect flicker. Our eyes don't focus on one spot. The eye builds up a picture by constant movement, research suggests this Ocular Micro Tremor (OMT) can be as high as 120 movements per second. There is no clear conclusion as to why, but OMT may be used to calibrate or compare or provide finer resolution for the brain. Flicker that is slower than this may confuse our vision.

Poor flicker is detectable especially as you move your eye quickly across a room.

The question we face is how to define flicker limits so people do not suffer ill effect. Research doesn't agree, even with recent recommendations. There is evidence that the eye can detect transitional effects of flicker up to 800Hz, but single receptors in our eye do not act alone, hence we still need to investigate a precise recommendation. It's also not clear if frequencies above 200Hz actually make it to the brain. Currently standards from Public Health England recommend >15% flicker factor (FF), IEEE1789:2105 suggests 100Hz at <3% FF for no observable effect but then also a 162Hz minimum. What if we can detect and process flicker up to and above 800Hz?



When we consider technology, say a typical modern camera, <6% FF is normally acceptable for slow motion, so in the case of flicker the human centric approach is still more demanding.

Is it really a question worth controlling it for cameras? Given that camera images are often displayed by technology that sits often at 60Hz should we even care?

Screen manufacturers know there is a problem, or perhaps have recognised an opportunity. Projection standards for years sat at 60Hz, recently 100 or 120Hz. Now monitors are produced with refresh rates as high as 240Hz and the public are reportedly impressed with the image quality and comfort levels.

If display screen produce improved comfort we should consider lighting, camera and display in our future office comfort.

It's worth noting that as we near 100% PC saturation, our technology is becoming more user friendly but more of a challenge for lighting. In flicker it might be the interference between lighting frequency and screen refresh rates. What is clear is that tablet and smart phone use continues to grow. 81% of Office staff reportedly use hand held devices such as Smartphones and tablets in daily work. For the first time in 2015 there were more users with mobile devices globally than those with access to a desk top PC. More and more of these are used in team environments, sharing content in ways we couldn't at the turn of the century.

The transition has been fast and most staff now use modern software on modern high brightness screens. Even the recommendations such as Lighting Guide 7 have caught up.

However, staff incidents of back problems are still increasing and ergonomics will be a driver away from simple laptops and poorly positioned screens to lighter more mobile devices, a clear benefit to our health.

This trend requires clever lighting, great modelling, light to the task, space and face, reduced glare and also controls that allow you to adapt the lighting to the situation.

If we light from above and direct light down we get harsh shadows under the eyes, around the mouth, nose and chin. Often this form of lighting gives rise to a dark background and difficulty to read the face.
Modern optics designed to lift the face and the space should give less shadowing and a lighter back ground by avoiding a harsh cut off and deliberately playing light to the walls.

Looking at the three images you can agree the one on the left would leave you struggling to talk to the person. He looks aggressive, even angry, you might want to avoid him which is not a good thing in office environments.

By the time we get to the right hand image we have lifted his face to one that we can read easily. Now the anger has been revealed as concentration, listening intently to you, thoughtful even. Much more a person you would like to hold a conversation with.

We have done this by considering light to the important three aspects. In this case the task is clearly seeing his face, but the space behind him being can't be ignored either.

If we light only for the desk surface our light and view will be focused on the desk. Our colleagues will be poorly revealed and the walls often dark. Overly intense light sources, luminaires, skylights or windows will give rise to glare and low levels of staff comfort.

If done correctly, with carefully designed luminaires then our comfort levels during conversation can be high.

We've known for half a century that glare can be a problem to us either directly or via reflection. Modern trends to glossy screens can pose a problem, especially as we tend to use them at odd angles. But the very fact that we can move tablets easily and that most business laptop screens are matt finish means the intensity of the luminaire is less of a problem than before, especially when the luminaire is designed with this in mind.

With so many office staff using smart devices at work, and many more doing so socially, it's true to say always being connected is already part of our culture.
Organisations that invest in communications technology and collaboration strategies have been shown to retain staff and reap the rewards of greater productivity and innovation.

Add to this the trend in data growth. Global mobile data traffic grew a staggering 74% in 2015 over the previous already data hungry year.

Cisco suggest that mobile data traffic grew 4000 fold over the last 10 years and 400 million fold over the last 15 years. More than half a billion mobile devices were connected in 2015. Who know where these trends will be next year?

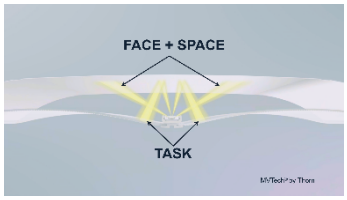
What is clear is that people still need to communicate and to share.

If we can get the right lighting conditions in our offices, our work life should be more rewarding, our communication less difficult, our understanding more clear and the symptoms of many office staff reduced or removed completely. Great lighting is key to this and great luminaires are a part of great lighting.

Control of brightness of the light source and across the luminaire (recessed or surface) is vital to controlling glare both for the eye and the computer screen.

Whilst recessed luminaires cannot add light directly to the ceiling, the flow of light they generate and the reflected light within the space makes a difference. Using a combination of recessed, surface or suspended luminaires designed to light the Task, Space and the Face, we can meet the most demanding of customer needs.

Modern luminaires need to hide the light source or at least mitigate its brightness to comfortable levels. We can do that with careful LED positioning, controls and optics. We did it with other light sources, LED should be no different. The balance of brightness across a luminaire and onto the ceiling is every bit as important now as it was. We shouldn't forget the lessons learned in the past with modern, by that I meant LED lighting.



Controlling the brightness of the luminaire, creating soft luminaire profiles, controlled brightness, blending to the ceiling all these things are still key to great lighting design.

If we want great offices to work in, lighting for good modelling to the face, lighting to the Task, the Space and the Face is where we should start. Controlling glare for people and the tools they use is an integral part of that.

It is part of what I call Comfort Management, a combination of efficient optical design combined with good design practice balancing the light for task, space and face and providing just the right balance for the people we value most at work, our staff.

This masterclass was written and presented by Iain Macrae on behalf of Thorn Lighting, a sponsor in partnership of the Society of Light and Lighting. Iain has since set up his own lighting consultancy.