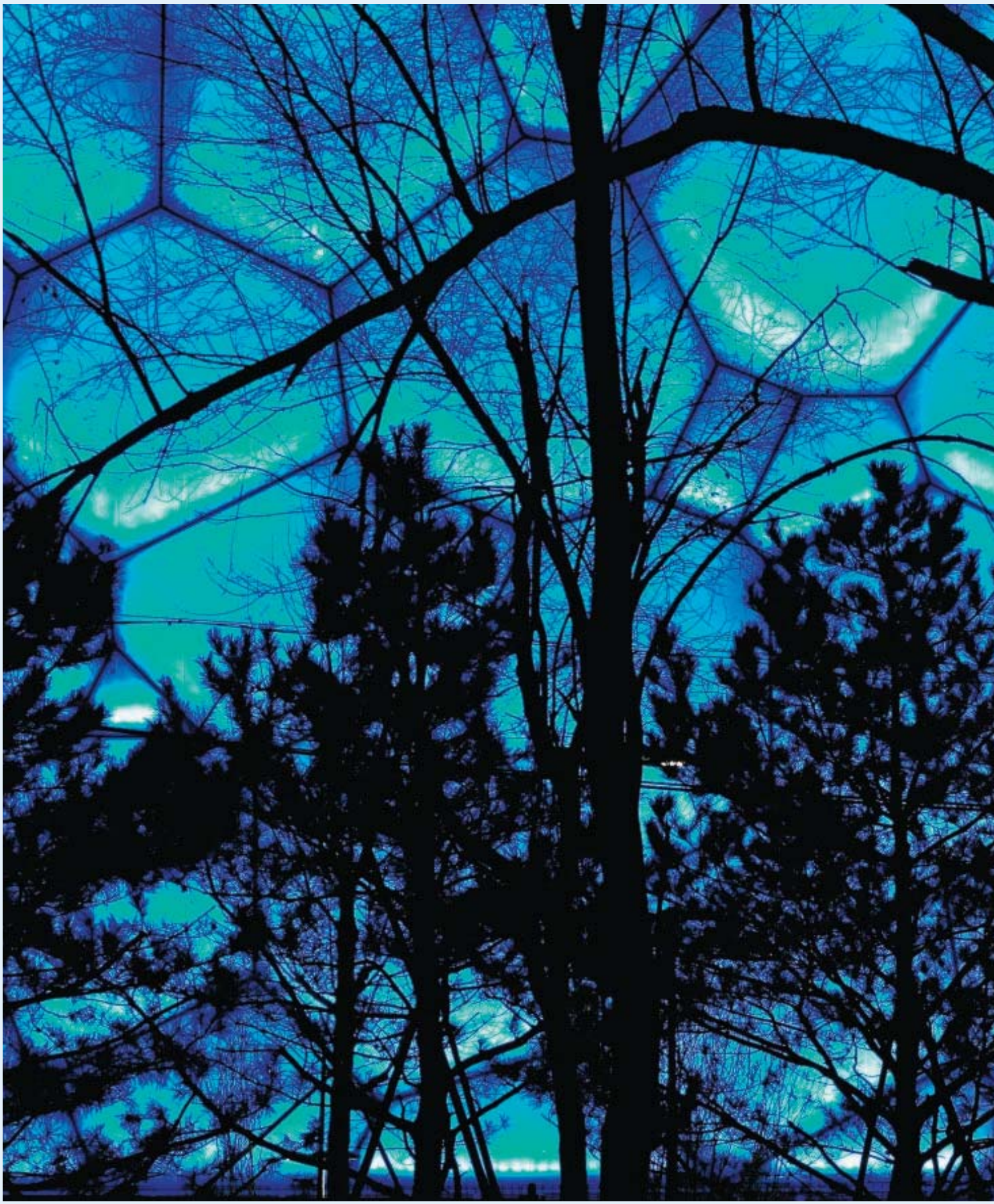
BLUE SHIFT

As the urban environment becomes more chromatic at night, one colour seems to dominate

WORDS: Lora Kaleva and Colin Ball
PICTURES: As credited

The audacity of Richard Rogers's 1986 Lloyds Building was compounded by Imagination's bold blue lighting for the exterior



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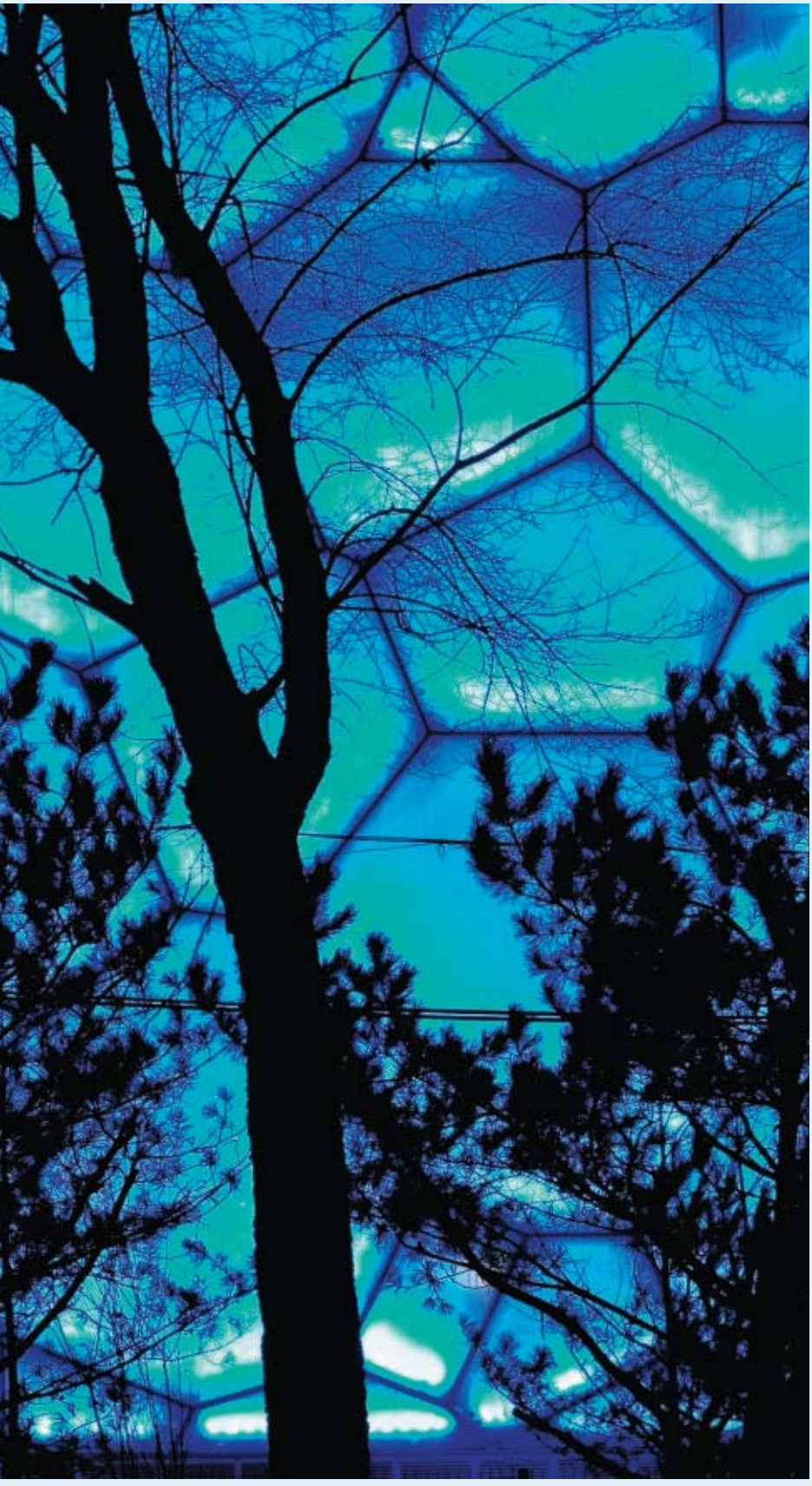

It is regularly debated within the lighting community whether to use colour at all in certain projects. The vast majority of lighting designers agree that coloured light in any form is not appropriate for historic architecture. This agreement, however, conflicts with archaeological evidence which reveals that Greek temples and Gothic cathedrals were once covered in saturated colours. And yet if any colour can be seen dominating in our night-time environment, it is blue. Why?

Many designers talk about emotional response to light and colours. Maybe lighting designers use so much blue because of the positive emotions it elicits. Blue is found pleasant, calming and restful. It is also the top colour in studies about colour preference.

We strongly associate colour with corporate identity. If we mention Coca Cola red, we know exactly what colour we're talking about. Companies are well aware of this and take full advantage of the fact. They also exploit colours and emotional associations: green for natural, black for masculine, and so on. Company logos and company identity colours go hand in hand.

Colours used at night-time often signify the occupier of the building. In my experience, whenever a client or public body is asked to select a colour, blue is usually the only colour that has gained universal consent. Most corporate logos are either blue or red.

This answer describes the process of how the colour was determined, yet it does not answer the 'why'. Why do clients agree on blue, why do magazine editors select the blue image in preference to the others, why is it the favoured corporate colour of the client?

It is worth beginning with a look at the cultural and historic background. Humans have used colours from the very beginning – first to paint themselves and their attire, and then, uniquely, to paint manmade objects. In the early civilisations all the way to the Renaissance colours were not used for their aesthetically pleasing properties, but for their meaning and symbolism. Every colour carried a meaning, which was commonly understood. As mysticism governed life, so did colours symbolise gods and unearthly forces. Nothing in humankind's surroundings was placed arbitrarily. Jewellery was a protective amulet, tomb decorations told stories, colours were thought to heal the body. Even abstract patterns had a definition associated with gods, life and death. The colour palette of early human beings was simple – bright primary colours, black, ▸

Blue was the natural semiotic choice for Arup's National Aquatics Water Centre, or Water Cube, for the Beijing Olympics in 2008

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white and gold. Even in remote and unconnected cultures the palettes are very similar.

For centuries the value we have given to blue is second only to gold, especially in Western culture. There is a surprising wealth of information and depth of history over our relationship with the colour. Some of the oldest artefacts in the British Museum are Sumerian, dating from around 4000BC, and covered in lapis and gold. The Egyptians painted their tomb and temple interiors cobalt blue and covered them in stars. Gothic cathedrals continued the habit 2000 years later and with no previous knowledge of the tombs in Egypt.

From an economic point of view, history shows us that the blue pigment ultramarine (the name literally means 'from far over the sea') was the most difficult to produce until the 18th-century invention of Prussian blue, and therefore highly valued. So much so, it was usually contracted separately from other colours used in medieval paintings. Ultramarine was made from the rare stone lapis lazuli which could only be found in Afghanistan.

In the past 20 years there has been a similar case with lighting. Before the invention of the blue LED, blue light was the most expensive to achieve, through a doubling of cost and power consumption. To produce blue light required 12mm-thick blue glass filters with only four per cent transmission. Today a blue LED is cost and power equivalent to the other colours.

Nowadays we still surround ourselves with colourful objects. Everything coming from the factory is given a colour. The choice is wide, but for the most part, these colours are meaningless. While every colour historically and in nature has a meaning, with the

Above: the Standard of Ur in the British Museum is around 4500 years old and was found in a royal tomb in the ancient city of Ur. The scenes of war and peace are depicted using the precious lapis lazuli as a backcloth

Previous pages: Bruce Nauman, Natural Light, Blue Light Room, 1971, Installation View, 2016

Overleaf: Disseny Hub design museum in Barcelona, Spain, lighting by artec3 Studio

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modern manmade environment almost nothing has. Back in the early days of humanity interpreting nature’s colour-codes meant survival. Today we don’t need this skill any more and humans are taught to ignore those signals. This has dulled our response to colours, but not obliterated it completely. People still see meaning in colours, where no meaning was intended, they do find colour attention-catching and to a degree they get emotionally aroused.

Humans are almost unique among mammals in having a highly developed colour vision. Our close relatives – monkeys and apes have it as well. Some fish, reptiles, insects and birds also can see colours. Most other animals can’t.

Colour vision must have been essential for our evolutionary survival, for the ability to develop. Probably not surprising as most important messages in nature are colour-coded: ripe fruit, poisonous mushroom, prospective mate are all messages that would have been impossible to interpret without being able to see colours. Nature’s colourful displays are not a thing designed for aesthetic beauty, but are specifically chosen to act as visual signals. And whatever the complexity, signal colours usually have three functions: they grab attention, they convey information and they affect the emotions of the viewer.

New research is showing that coloured light can affect the limbic system, the area of the brain that is associated with emotions. A series of studies from Ohio State University has linked chronic light exposure during the night to depression in hamsters. Blue light had the strongest effect, closely followed by white light. The hamsters with the least evidence of depression were sleeping under red light or no light at all.

Researchers from the University of Liège, in Belgium, have found that the spectral quality of ambient light influences how the human brain processes emotional stimuli. According to their studies, blue light amplified the emotional response in several areas of the limbic system when compared to green light. So the lit environment can have a direct impact on the user’s mood, which makes it all the more important to consider when and where to use colours.

A significant visual signal with primates is skin tone modulation. Skin tone displays emotions, a phenomenon reflected in our language: blushing with embarrassment, reddening with anger or paling with fear. It has been hypothesised that the human being’s trichromatic (red, green, blue) colour vision has evolved specifically to help us read these signals and recognise emotional, socio-sexual or threatening signals among the other members of our species. Our photosensitive receptors are especially attuned to ▸

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perceive variations in haemoglobin oxygen saturation and haemoglobin skin concentration, which determine skin tone modulation. Furthermore it has been noted that all trichromatic primates are bare faced or have patches of skin exposed, allowing skin tone to be read.

Even more fundamentally, light is energy and as such has a profound effect on our biological systems. Papers published at Jefferson University in Philadelphia are currently leading a body of evidence to show that melatonin suppression is directly associated with blue wavelengths of light. Results of these studies are already being used by NASA to assist astronauts in regulating sleep. But while several independent studies have shown that exposure to these wavelengths can increase alertness during the day, it has also been found that red light is just as effective in increasing brain activity. So it appears that melatonin suppression is not necessarily needed to have an impact on alertness.

Researchers have also observed that there are certain physiological reactions that seem to occur on exposure to coloured lighting that are common irrespective of culture or race. There is an impact on neurological responses, on the autonomic nervous system and, as mentioned, on the hormonal activity.

The colour red can raise blood pressure, pulse rate, respiration and perspiration, and excite brain waves. There is more muscular tension and greater frequency of eye blinking. Blue effects are somewhat opposite: lower blood pressure and pulse rate, less skin response and a slowing down of neurological responses. Reactions to orange and yellow are similar to those provoked by red, but not as strong, and reactions to purple and violet resemble those to blue. Green is found to be the most neutral.

In photopic vision the eye is most sensitive to greenish-yellow (ca 550nm) light. Psychologists Ferree and Rand suggest that yellow illumination is most comfortable for the eye followed by orange-yellow, yellow-green and green. Deep red and violet are more uncomfortable and blue is very difficult for the eye to focus on and will cause objects to appear blurred and as if surrounded by a halo.

The reason that the eye has trouble concentrating on blue is that there are no blue-sensitive cones in the fovea centralis – the source of our acutest vision. The closed packed green and red-sensitive cones in the fovea produce the best resolution, as the eye focuses most ▸

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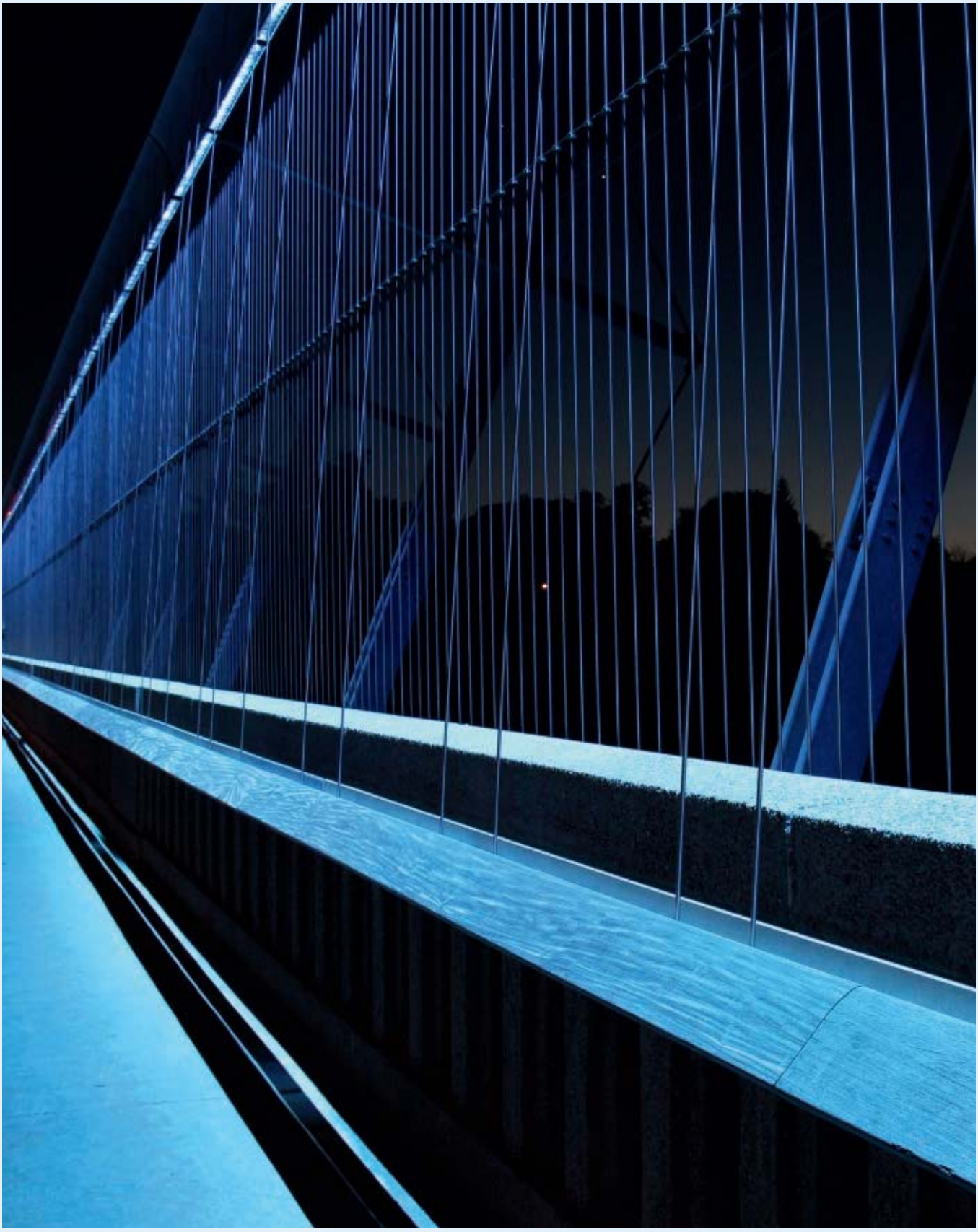
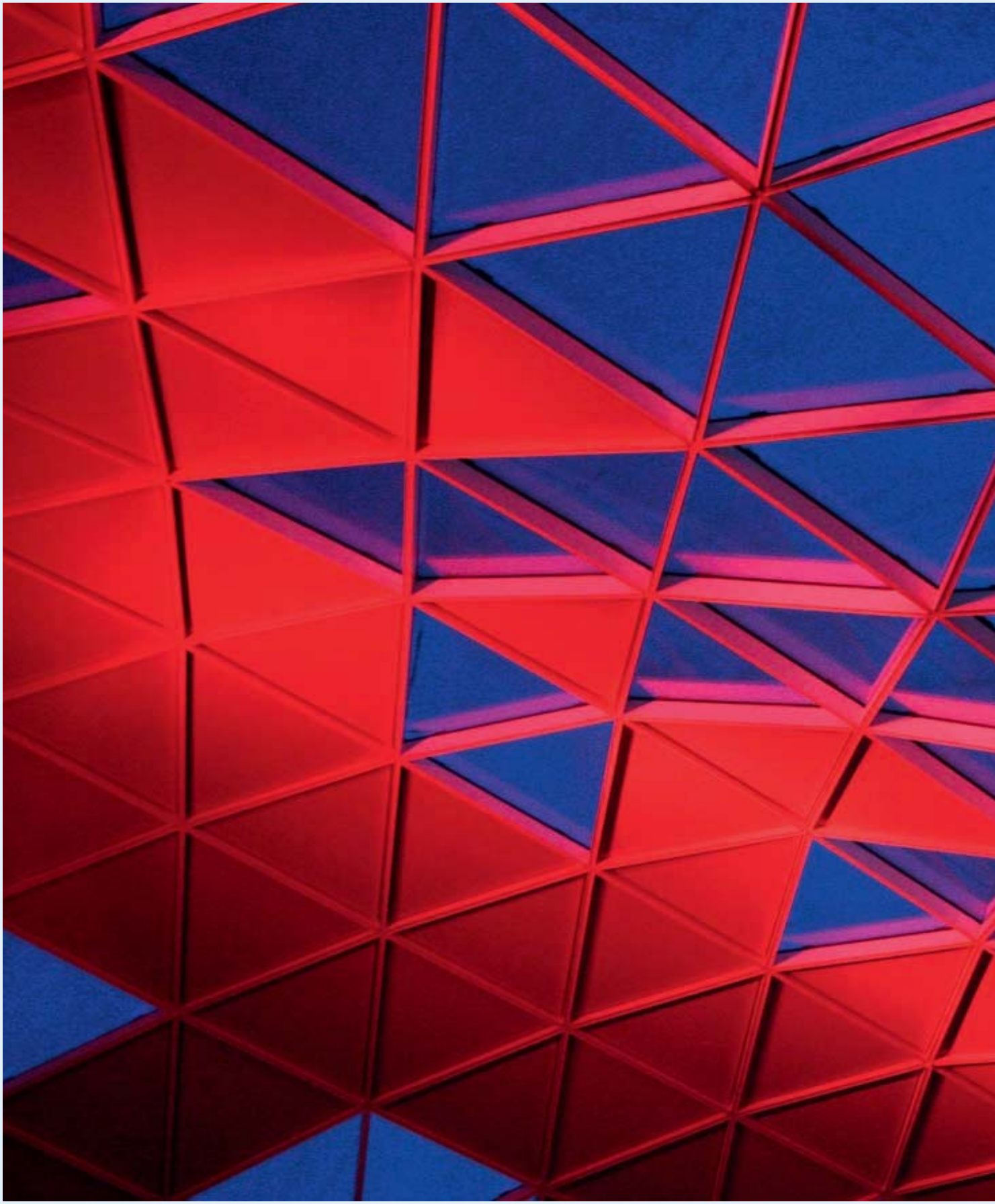
The 1918 Prince Edward, or Bloor, Viaduct is the longest bridge in Toronto. A suicide prevention structure called Luminous Veil was added in 2003 and lit by GVA Lighting with 600 RGB fixtures, here seen in the blue state



GVA Lighting



of the light entering it into the fovea. Blue-sensitive cones also consist of around two per cent of the total number of cones and are thus a minority. Finally, the refractive index of blue light is different from red and green, and short wavelengths tend to scatter in the eye and not always hit the cone-packed central region of the retina. It is this clouding that produces a humming, dynamic effect that is so palpable.

In a room filled with reds, golds and blues it is only the blue that will appear to hang in the air, an effect used by lighting designers now, but also by the builders of the Sultanahmet (Blue) Mosque in Istanbul, St Francis Basilica in Assisi and Chartres Cathedral in France.

There is one final effect that needs to be considered, which is precisely what the brain does when it receives information from the eye that separates the object from the lighting. Only two per cent of our visual information is derived from the eye, the rest is constructed by the brain. It is becoming apparent that language defines this process and could be directly affecting how colour is actually seen. Recent studies published by Essex University on the Himba Tribe of Namibia demonstrate that a unique or differing linguistic structure of colour actually changes how the person sees – they cannot see different colours that we can, but can see colour differences that we cannot. Which demonstrates that while blue has a unique visual property it is perhaps also dangerous to assume that the way any colour is actually seen is something universal.

Clearly there are properties to blue that are unique due to biology, physics and culture. It is these that underscore the reasons why many of our clients choose this colour in the first place.

However, it is interesting to note that since we started our research the London Eye, the capital's landmark giant Ferris wheel on the River Thames, has turned from blue to red, as British Airways' ownership transferred to Coca Cola. This is not the only example. Just as blue has been a dominant colour for the past decade it is apparent that as trends change we might be seeing more saturated red – the other colour that also has a unique set of properties in low light. That's the topic of our next paper: red shift. □

● *Lighting designer Lora Kaleva and lighting director Colin Ball of BDP have conducted research into the application of blue light, the results of which have been presented at international lighting conferences. Details of the research sources cited are available on request*

Left: London's Westfield shopping centre by BDP, one of several projects that may presage a red shift