Leonardo glass cube
Glass architecture is light architecture. When glaskoch built a glass cube for its Leonardo brand, it was designed both as a world of experience and a corporate symbol. It features an organically formed interior finished entirely in white, perfect for modelling using the exclusivity of light.
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At the end of the 19th century, the German poet Paul Scheerbart once wrote, “Ohne einen Glaspalast, ist das Leben eine Last”, which roughly translates as “Without a glass palace, life becomes a burden”. Leonardo must have thought along the same or similar lines when the glass cube neared its completion. Opting for a plain and organically inspired use of forms, 3dlux was given to give Leonardo, as a brand, a spectacular architectural look, creating something in the small town of Bad Driburg that would have made any large-city proud.

Another example of brand architecture is found in the beautiful city of Munich. This time it is BMW that has built for itself and its customers a special experience. Coop Himmelb(l)au translated the dynamic brand values of BMW into static architecture. The new Event and Delivery Centre seems an outward expression of the innovative and creative engineering skills of BMW and its products.

A somewhat different self-image is portrayed by the architecture of the Buddha Tooth Relic Temple in Singapore. This five-storey building has been built in the traditional style of the Chinese Tang Dynasty, a period that is regarded as the ‘golden age’ of Buddhist art in China. Even the spotlights were provided with ornamented covers matching their surroundings to ensure an inconspicuous integration as possible.

The Light and Technology section of this issue introduces the Emanon projection spotlight with Gobosetator. This new range of spotlights was devised to apply the methods and effects used in stage lighting to architecture. It allows for the first time to integrate dynamic effects effortlessly into a wide range of applications and ensure system compatibility. The Emanon spotlight is an important lighting tool particularly in places where architecture and entertainment intersect.

The general service lamp is set to be banned and replaced by energy saving lamps. While this may be a crucial step in the private sector, neither the general service lamp nor the energy saving equivalent figure much in the professional arena. A good reason to have a closer look at the really important lamps. Our focus in this issue is on the difference between colour temperature and colour rendering and how the different lamps perform in terms of these two aspects. As we find out here, the difference is rather significant, even warm white light can leave us looking rather pale.

In conclusion, we have provided some impressions of the Light+Building trade fair. Counting a total of 165,000 visitors, this fair has once again surpassed all expectations. Accordingly, the interest in our ERCO stand was impressive. We would like to thank you very much for your visit and already look forward to meeting you again at the next trade fair in 2010.
Barcelona

The new Gallery of Modern Art is part of the Queensland Art Gallery and is the largest institute of modern and contemporary art in Australia. The exhibition rooms combine wallwasher lighting with flexible accents provided by Optec spotlights mounted on a grid of tracks within a suspended ceiling.

Vienna

The avant-garde jewellery shop at the fine shopping address of Kohlmarkt 4 is only 2.8m wide, but makes compensation in length by stretching 30m. The display cabinet extends through the room like a band illuminated by integrated Starpoint directional luminaires. Additional accents from the ceiling are provided by flush rimless Skim directional luminaires.

Cracow

On this square in the historic old part of Cracow, Axi walklights ensure good visibility of the flat steps. LED technology makes this an energy-efficient, low-maintenance and significant, economic solution.

Lüdenscheid

So much gain for such small effort. Little patients at the children’s hospital in Lüdenscheid benefit from the redesign by KKW in Altena. TFL wallwashers make the hallways appear friendlier, while Compact 100 downlights with compact fluorescent lamps in the new playroom provide pleasant, economic lighting.

Children’s hospital Lüdenscheid
Architects and lighting designers: KKW Architekten, Altena

Wuppertal

This magnificent Wilhelminian staircase is enhanced in appearance by sophisticated lighting. Trion uplights for fluorescent lamps are mounted on the pillars as section luminaires for washlighting in the vaults.

District Court, Wuppertal
Lighting design: Bettina KAES, Martin Weiser/明亮 concepts mbh in˝. arch. Witold Opaliński

Palermo

The Galleria d’Arte Moderna has found a new home in the former monastery, Sant’Anna alla Misericordia. The ERCO tracks suspended in the carefully renovated historical building are provided with Quinta spotlights to ensure an optimal presentation of the collection.

Galleria d’Arte Moderna
“Sant’Anna”, Palermo
Lighting design: Adriagna Illuminazione, Alcamo

Museo del Prado, Madrid

The Prado, without doubt one of the most significant museums in the world, was extended and renovated by Spanish architect Rafael Moneo, who maintained a low-key style. Again, the designers opted for ERCO to provide the lighting and combined Panzac spotlight with Optec floodlights on tracks.

Museo del Prado, Madrid
Architect and lighting designer: Estudio Rafael Moneo, Madrid
www.museodelprado.es

Berlin

The Berne Art Museum had its old section completely redesigned with new lighting, and all in time for the big Fentland/Hoell exhibition from 9 April to 10 August 2008. Even rooms without skylights now have optimally balanced horizontal and vertical illumination thanks to the combination of Optec wallwashers and Hi-trac indirect luminaires.

Art Museum, Berne
Interior design: Ulrich Zickler, Stuttgart
Lighting design: Institut für Tageslichttechnik, Stuttgart
www.kunstmuseumbern.ch

Ludenscheid

The idea by Lumas of using affordable photo art editions to address new collector levels has proven a recipe for success. Lumas is expanding and the Düsseldorf-based branch has been professionally fitted with ERCO tracks and Optec spotlights.

Lumas Edition Gallery, Düsseldorf
Lighting design: Altenfeld & Schmitz, Bochum
www.lumas.de

Galleria d’Arte Moderna
“Sant’Anna”, Palermo
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Architecture and lighting designers: Blum Projekt­stelle Lewicki, Flat, mgr int. arch. Piotr Lewicki, mgr int. arch. Witold Opaliński

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Barcelona

Located in the business quarter on Avenida Diagonal, this hotel appeals to design-conscious business travelers. In the lobby, Parscan spotlights with Optec floodlights on tracks within a suspended ceiling.

Hotel NH Constanza, Barcelona
Architects: Manuel de Solá Morales, Madrid
Additional accents from the ceiling are provided by flush rimless Skim directional luminaires.

Vienna

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Nedoluha jewellery shop, Vienna
Architects and lighting designers: bpo Architektur, Vienna
www.nedoluha.at

Madrid

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Architects and lighting designers: bpo Architektur, Vienna
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Bright prospects

The image shows a modern bakery interior with bright lighting, steel structures, and equipment. This is indicative of a well-lit and functional workspace, ensuring that the bakery operations are efficient and professional.

Martin Braun BackForum, Hannover
Photo: Thomas Pflaum, Castrop-Rauxel
www.martinbraun.de

Architect: Ackermann & Raff, Tübingen
Electrical designer: Ingenieurbüro Meinhardt Fulst, Vienenburg
General contractor: ARGE Wallbrecht-Schuppert, Hanover
Electrical implementation planning / management: Keydel Bock Ingenieure, Göttingen
Leonardo glass cube  

Corporate architecture as an expression of brand vision: in the mix of curved, organic shapes, a glass cube transcends into light and shadow, reflection and transparency.

The relationship between metropolis and periphery in the information age has been examined in a variety of coexisting theses. While some postulate the equalisation of opposites between centre and province by the Internet as a non-specific location, others favour a concentration of the “creative industries” in metropolises as the only place providing a proper general setting. Rather than examining the theory, however, let’s look at the practice, by taking as an example the small town of Bad Driburg on the fringes of the Teutoburg Forest, a decentralised location typical of a German industrial area characterised by mid-sized companies.

This is where glaskoch B.Koch Jr. GmbH & Co. KG is based. Only experts would know the company by this name. Generally, it’s better known by its product brand, ‘Leonardo’, the label of the glasses, vases and glass giftware that have been selling so well in retail stores as well as in the company’s own and in franchise shops since 1972. In 1991, Leonardo took over as market leader in giftware and glasses in Germany. According to the company profile, some 80% of the German population is familiar with the brand, though with a Mediterranean feel to the products it may be a simple mistake to consider its origins to be from that region. As design-oriented articles, however, this is probably a compliment.

In any case, the Leonardo glass cube will rectify this perception. It represents a spectacular piece of corporate architecture that will position the brand and put Bad Driburg on the architectural map. The intuition behind this purposeful step came from a young entrepreneur who has led the family-owned business with its rich tradition since 2005. Oliver Kleine is Managing Director of glaskoch and initiator of the glass building project. They devised a building for whom the glass cube was its first permanent home. Kleine understands the significance of corporate architecture for staff and customers of his company. “The glass cube is proof of the fact that we truly live our vision,” Kleine explained in an interview. “It positions the brand by architectural means and combines the core values of Leonardo.”

The company had its new flagship built right next to its existing premises on the ‘greenfield site’ of an industrial area in Bad Driburg, designed by a team that could produce an extensive portfolio of visionary interior designs, media environments and temporary buildings. Wiesbaden-based architects and designers 3deluxe used their vast experience gained in trade fair and event projects and decided on an unusually wide range of light components: delicate, fine structures through digitally abstracted photographs for the glass facade, to filter the daylight and react in ever different ways to the varying contrast ratios. The curved wall surfaces of the centre are uniformly bathed in light from Lightcast lenses wallwashers to achieve the effect of architecture shining from the inside. Backlit gauze curtains provide further modulation options. Carefully placed slots and gaps in the centre walls constantly cast a hint of daylight into the exhibition rooms. The ambient lighting and the accentuating exhibition lighting comes from artificial light sources. Mainly recessed directional luminaires in the ceiling, along with some spotlight track systems. Light installations with fluorescent lamps and cold-cathode sources, some dynamically controlled, make up the component of a decorative, atmospheric play of brilliants.

In this futuristic environment the visitors, customers and staff of the company are welcomed by a brand world that includes showroom and shop, a training room section for seminars and conferences as well as the ‘Design Lab’ for product development and a ‘Chill Zone’ with bar. Oliver Kleine anticipates around 50 to 100 visitors per day. “Each month, we will set up new programs and put on exhibitions, events, seminars and trade fairs,” the young entrepreneur announced. “The glass cube represents active architecture, something is constantly going on.”

The structure consists mainly of two contrasting elements, a cuboid envelope and a free form of undulating white walls that snake through the interior. In terms of lighting, the designers at 3deluxe used their vast experience gained in trade fair and event projects and decided on an unusually wide range of light components: delicate, fine structures through digitally abstracted photographs for the glass facade, to filter the daylight and react in ever different ways to the varying contrast ratios. The curved wall surfaces of the centre are uniformly bathed in light from Lightcast lenses wallwashers to achieve the effect of architecture shining from the inside. Backlit gauze curtains provide further modulation options. Carefully placed slots and gaps in the centre walls constantly cast a hint of daylight into the exhibition rooms. The ambient lighting and the accentuating exhibition lighting comes from artificial light sources. Mainly recessed directional luminaires in the ceiling, along with some spotlight track systems. Light installations with fluorescent lamps and cold-cathode sources, some dynamically controlled, make up the component of a decorative, atmospheric play of brilliants.

Architects and lighting designers: 3deluxe, Wiesbaden  
Photos: Thomas Mayer, Neuss

www.leonardo.de
The organically shaped path system made of white concrete elements spreads across the lawn around the glass cube like some neuronal network. Grasshopper projectors for metal halide lamps with spot reflectors virtually draw the visitor into a synaesthetic experience.

The faint printing on the windows of the facade using high-resolution digital images are but a membrane in a continuum of organic shapes that virtually draws the visitor into a synaesthetic experience.

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The principle of using wallwashing for uniform illumination of the core of a building featuring glass architecture to give it the impression of shining from the inside out was first used by the American lighting designer Richard Kelly in places such as the foyer of the Seagram Building.

The faint printing on the windows of the facade using high-resolution digital images are but a membrane in a continuum of organic shapes that virtually draws the visitor into a synaesthetic experience.

The building rises some 7m above the ground and extends about 4m down below to provide a clear height inside of up to 10m. The Lightcast lens wallwashers for metal halide lamps HT-CE 70W are powerful enough to ensure uniform lighting even on walls at such a height. Directional luminaires provide accent lighting on the ground, which is already generally illuminated by the diffusely reflecting light from the wallwashers. An energy-efficient design solution where vertical illumination is crucial for the impression of brightness.

3deluxe company profile
3deluxe was established in Wiesbaden in 1992 as a group of designers comprising Andreas and Stephan Lauhoff as communication designers, interior designer Nikolaus Schweiger and designer Dieter Brell. Since 1999, system modern gmbh with industrial engineer Peter Seipp at its helm has been responsible for the development, production and management of the joint 3deluxe projects.

The characteristic, organically-inspired use of forms by 3deluxe has now become as distinctive a style in an international context as has the virtually extended room concept or the significant graphic design that redefines the interface of two and three-dimensionality.

Today, 3deluxe collectively consists of an interdisciplinary team of some 30 people experienced in the fields of architecture, interior design, and art, graphic, media or product design. Based on this wide range of competence, 3deluxe develops integrated design solutions that convey coherent aesthetics and include graphic appearance, special media effects and architecture.

www.3deluxe.com
As economic, powerful tools with excellent glare control for ambient lighting, the architects universally opted for Lightcast recessed ceiling luminaires for metal halide lamps. The remaining elements of the lighting concept with exhibition lighting as focal glow and a number of original, specially designed lighting and luminaire objects for ambient luminescence, are chosen on the same basis of efficient visual comfort.

The changing daylight conditions dramatically transform the character of the architecture, its illumination giving it a specific appearance at night.

The glass cube includes facilities for testing and introduction of product presentation concepts for the company’s own shops and for retail, using both Optec spotlights and Parabellum pendant downlights.

Gauze curtains play a major role in the lighting concept for the glass cube – some backlight using fluorescent lamps with dynamic colour changes to produce a interplay of transparency and volume.

Luminous and illuminated architectural elements, uniform accent lighting, the designers at 3deluxe used many different types of light and lighting tools to achieve the required atmospheric quality.

The products from Leonardo with their highly reflective surfaces benefit particularly from brilliance effects produced by directed light from Optic spotlights for metal halide lamps. These are mounted on ERCO’s wing rail, which is recessed in the plasterboard ceiling.

The glass cube provides an unusual and unique setting for all kinds of events and exhibitions.

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The influence of visualisation techniques on lighting design

For designers images are the medium from which they gain inspiration, develop concepts and visualise ideas. Designers use various image representation options, such as Erich Mendelsohn’s use of sketches, Ben van Berkel’s data visualisation or Frank Gehry’s use of cardboard models combined with 3D scanners and CAM software. This raises the question of how far the result of the design process, i.e. the architecture itself, actually follows from the design techniques used. This dependency becomes even more complex when, in addition to the spatial factor, the dimension of light is considered, as is the case with lighting design. This essay compares the images and visualisation techniques used in the design process of the two disciplines: spatial design and lighting design.

**Art history**

Leonardo da Vinci clearly distinguished between two qualities of light: “Luce”, the pure light of a light source, and “Lume”, the light on a body. Tintoretto, in his painting of the Last Supper, used rays of light to add the plexus when, in addition to the spatial factor, the dimension of light is considered, as is the case with lighting design. This essay compares the images and visualisation techniques as used in the design process of the two disciplines: spatial design and lighting design.

In his painting of the Last Supper (1530-34) Tintoretto not only showed the light reflected on solid bodies but the otherwise invisible - rays of light, which added a symbolic representation of light to the scene.

Since the 1960s, the American landscape architect Lawrence Halprin invented a visual code for the new technology of programmable water-effects. On the Fort Worth spring fountain, Halprin arranged each of its three groups of water jets in a separate diagram for light, water and sound and then set their intensity in relation to time. In a separate diagram he superimposed all three groups, combining them into a single orchestral piece.

Bernard Tschumi considered cinematic montage to be a combination of images, motion and action. In his project for the National Studio for Contemporary Art in Toulouse, he combined photographs in a pictorial language of a chronological cartoon stripe. The huge steel roof construction was a transparent surface on which and opens up several lines, layers, and dimensions of looking at architecture.

**Lighting didactics**

The field of lighting began as a technical task for an engineer, predominantly in industry. Then as early as the 19th century architects were already using a new epoch of architectural lighting. He used this to clearly depict the relationship between light and architecture and to accentuate the artistic dimension and significance of light, or rather luminaires. In his 1974 book “Das künstliche Licht in der Architektur” (Artificial light in architecture), Hans Gabriel took the contrast of forms, consisting of just a few surfaces and contours, and set this against a black background to explain clearly how a skyscraper is perceived at night. The highly evocative representation gave excellent comparability for different lighting situations. They proved to be ideal as they were largely independent of specific locations; unlike photos which are inevitably highly detailed.

Even today, Norman Foster prefers impressionistic illustrations that continue the traditional illustrations that add dramatic effects to add dramatic effects. Helmut Jacoby – in his 1974 book “Das künstliche Licht in der Architektur” (Artificial light in architecture) – stated that the concept drawing runs the risk of being limited to symbols and of no longer conveying the spatial lighting effect. The time-related dynamics of light, as opposed to spatial sequences, requires a visual language that can convey the colour change in a musical score and to create sequences of pure or mixed colours. In the 1960s, the American landscape architect Lawrence Halprin invented a visual code for the new technology of programmable water-effects. On the Fort Worth spring fountain, Halprin arranged each of its three groups of water jets in a separate diagram for light, water and sound and then set their intensity in relation to time. In a separate diagram he superimposed all three groups, combining them into a single orchestral piece.

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**Scenographic diagrams**

To represent complex relationships and concepts and for the visualisation of spatial and temporal dynamics, both architects and lighting designers have started to use information graphics. The range of graphics extends from spreadsheet software through to artistic collages. The result is that the concept drawing runs the risk of being limited to symbols and of no longer conveying the spatial lighting effect. The time-related dynamics of light, as opposed to spatial sequences, requires a visual language that can convey the colour change in a musical score and to create sequences of pure or mixed colours.

In order to give better expression to aspects such as light distribution and luminance forms, John Flynn augmented photos with drawings in his book “Architectural Lighting Graphics” published in 1962.

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The advent of digital media has not only increased the speed of image production but has also given rise to a new, though initially unconsidered, understanding of light and also to a different way of using light— as dictated by the characteristics of the hardware and software. Computer simulation allows experimentation with lighting effects, without the constraints of real luminaires, and allowing the development of new architectural lighting designs. Even if this approach is less committed to reality, it can nevertheless stimulate the imagination and become a valuable tool in innovative designs. This puts the lighting designers in the challenging position of having to point out to the architect the possible inadequacies of his or her notion of using light to solve visionary ideas. When looking at the countless video walls of recent times, one can see the development of progress. As with the computer screen illustrated pixel structures can now be seen over the entire building facade. Buildings or surfaces that portray dynamic, illuminated spaces are created using digital networking. As a result, movement now becomes the most important design parameter, whereas in the past the focus was on bringing out the changing use of daylight and artificial light to solve visionary ideas. The simultaneous use of different functional sequences and motion progressions in a building is vividly illustrated by the animation produced by Diller & Scofidio for the design of the Eyebeam Museum of Art and Technology in New York. Time-lapse images, from the point of view of four users in parallel, show the changing use of daylight and artificial light over 24 hours. The launch of YouTube has made visualisation and communication via film part of everyday life. It will presumably exert at least as great an influence on lighting design as has digital image processing. Film will become a design tool and establish itself as a means of evaluating dynamic lighting concepts. Completely rendered films with a high degree of realism in terms of indirect light and reflection are currently only used on special occasions because the spatial dynamics for precise lighting simulations require considerable computer power.

Outlook

This brief review of the history of digital visualisation has shown how the picture quality initially lagged behind that of classical, hand-drawn illustrations. The degree of detail within an area and especially within the surroundings is now starting to be comparable with earlier, analogue times. To create enhanced virtual images and to indicate geographical location, digital illustrations are increasingly featuring references to the surroundings or photos of people.
Many methods and effects used in stage lighting, then applied to shops and shop windows, presentations or trade fair stands, find their way into architecture. The time was right to develop, from scratch, a new range of spotlights for this area of application. A system designed to consolidate the progress made in lighting technology over the past few years and one which creative designers could use effortlessly to implement the principle of “tune the light”. Lighting equipment which would enable the creation of scenographic effects, similar to that used in stage and production, is now available in everyday applications. This new range of spotlights called Emanon comprises a striking, integrative housing design for highly differentiated lighting equipment. Standard fixtures embrace spotlights for low-voltage halogen and HIT lamps through to such ERCO specialties as LED varychrome spotlights and the technically exclusive DALI-controlled Goborotator. In the Emanon range, the projection spotlights with Goborotator are an innovative highlight. Through the use of independently controllable rotating gobos, the projection effects created are totally fascinating. The character of these projections can range from slow moving, subtly atmospheric effects to stimulating, highly dynamic focal points. The Goborotator can be used with two metal or glass gobos and with colour filters or structured glasses. There is now virtually no limit to the development of a scenic imagination. The direction and speed of rotation are controlled using either the rotary switch directly on the spotlight or via the ERCO Light System DALI and its integrated Light Studio software; a convenient tool for the operation of the Goborotator. Low-noise toothed belt drives, elastic motor bearings, long-life lamps, and a fanless, thermally efficient design ensure reliable continuous operation for all architectural applications.

The extensive range of gobo projection options can be controlled via the Light Studio software. Speed, direction of rotation and different dynamic progressions can all be adjusted to suit specific lighting requirements.

The projection spotlight with lens system means that precise images can be produced. The three lenses provide a narrow beam light distribution for a maximum of two gobos.

The projection spotlight with optical imaging system has a wide beam angle for soft-edged lighting effects. Both projection spotlights are also available with a Goborotator.

The projection spotlight with varying structures as accessories. Since each gobo has standard dimensions, a wide variety of gobos can be added from other suppliers.

The gobos are easily exchanged. After removing the front part of the housing, the Goborotator attachment is tilted to the side. The gobos can be exchanged for other motifs without tools, by simply removing the fixing springs.
Colour temperature

Human beings perceive light both through brightness and colour. Throughout the entire range of white light, the hues are specified in terms of colour temperature. Designers make use of this attribute to create the required atmosphere. In this way they can determine whether rooms or objects have warm or cool tones, e.g. through the use of a blue bias.

Colour temperature is measured by the Planckian curve within the triangle of the CIE standard colourimetric system. This curve of the Planckian radiator represents the ideal source of thermal radiation. It changes colour in relation to temperature and with increasing temperature, the light colour shifts from the red area to the blue area.

A simple example is the filament lamp, which when dimmed emits light in the warm red range, and with increasing temperature, when operated at full output, the red proportion is reduced and the light appears white. Colour temperature is specified in degrees Kelvin. Since the Planckian radiator is an idealised body, the chromaticity coordinates of actual light sources such as high-pressure discharge lamps are not necessarily positioned directly in the curve. Consequently, a cluster of straight lines with similar colour temperatures has been identified to represent light colour temperatures. The section of the Colour range which contains the Planckian curve and the cluster of straight lines of chromatically similar locations which have similar colour temperatures, the warm white (ww), neutral white (nw) and daylight white (dw) ranges are shown.

The section of the Colour range which contains the Planckian curve and the cluster of straight lines of chromatically similar locations which have similar colour temperatures, the warm white (ww), neutral white (nw) and daylight white (dw) ranges are shown.

The result is that two different light sources with the same colour temperature data can differ slightly in terms of hue since they are found in different locations along the straight line.

In practice, the colour is classified as warm white (ww) <3300K, neutral white (nw) <5000K, and daylight white (dw) >5000K. Warm white lamps emphasise the red and yellow spectral range, while daylight white light accentuates blue and green, i.e. cold colours. Colour temperature is useful as a design characteristic when presenting objects and merchandise. In nature, below the blue sky we experience considerably colder light colours (and extremely high illuminances) of between 10000 and 26000K.

Warm light colours usually have lower illuminances such as the light of a candle at 1900K. When a filament lamp is dimmed the colour temperature reduces from 2800K to around 2000K which in-turn produces a light colour similar to that of a candle. On the other hand, when dimming fluorescent lamps, the light colour remains constant, the result being that the atmosphere which is created in rooms where the light is dimmed is very different depending on which type of lamp is used.

Since the eye does not respond to differences in colour temperature in a linear way, a difference of 500K in the warm white range appears to be richer in contrast than the case with a daylight white light colour. This is why lamp manufacturers offer warm white light colours with more subtle gradation than lamps which have higher colour temperatures.

Comparison to the warm white accent lighting from halogen lamps, the daylight coming from above is cooler and bluer.

Colour rendition

The visible colours of illuminated objects come from the interaction of light and the colours of the object. If the perception of coloured surfaces is important in a particular visual environment, then the individual spectral ranges of the white light should be consistent, i.e. provide colour rendition of high quality.

The colour rendition of a light source is assessed by how much the colour of an object deviates from that beneath a reference light source, irrespective of whether this is a thermal radiator or daylight. The colour impression is determined using a scale of eight or fourteen body colours (Ra or Rf). The result is shown using the colour rendition index where the optimum is 100. Lower values indicate a correspondingly poorer colour rendition. Grading is also often used, where Grade 1 (Ra 80–100), for example, is considered to be required for museums, shops or prestigious rooms.

The colour rendition quality depends on the light spectrum of the lamp. The continuous spectrum of filament lamps produces excellent colour rendition. Band spectra of fluorescent lamps and discharge lamps, on the other hand, have a lower colour rendition index. Some types of lamp are offered with different colour rendition qualities, where superior colour rendition usually comes at the expense of luminous flux and luminous efficacy.

Two light sources which have the same light colour can produce different colour renditions if their light spectra are inherently different. This perceptual effect is known as metamerism.

Thomas Schielke

The colour rendition quality is crucial for the perception and differentiation of colours. Highly demanding environments, such as in textile shops, require a colour rendition index R<sub>a</sub> > 90.
Buddha Tooth Relic Temple and Museum

Since May 2007, the island city of Singapore has gained an additional attraction. In the historic centre of Chinatown, a Buddhist cultural centre has been set up – the “Buddha Tooth Relic Temple and Museum”, in short: BTRTM.

The five-storey building has been built in the traditional style of the Chinese Tang Dynasty (618 – 907), a period that is regarded as the “golden age” of Buddhist art in China. The complex is seen as having a dual role, functionally both as a museum containing a collection of valuable exhibits and as a thriving cultural site and centre of the Buddhist community of Singapore, whose members are predominantly of Chinese descent.

The centrepiece of the building is the “Sacred Buddha Tooth Relic Chamber” on the fourth floor, home to the sacred object after which the building is named: a tooth relic of Buddha, housed in an ornate stupa. Believers donated 420 kilograms of gold to construct this 3.6 metre tall shrine. Buddhist texts tell of Buddha’s legacy – four wisdom teeth and forty other dental relics play an important role in the dissemination of the Buddhist faith. Monks open the shrine in a daily ceremony, giving believers from all over the world the opportunity to worship.

The third floor houses the Buddhist cultural museum. There are both rare paintings and valuable sculptures which illustrate the various phases of Buddha’s life. The roof terrace provides a picturesque garden landscape with its own orchid hybrid (Dendrobium Buddha Tooth) and an impressive Tibetan Buddhist prayer wheel. The driving hall in the basement fulfils a social function, serving vegetarian food completely free of charge. The Nagapuspa (Tooth) and an impressive Tibetan Buddhist statue are on the fourth floor, home to the sacred object after which the building is named: a tooth relic of Buddha, housed in an ornate stupa. Believers donated 420 kilograms of gold to construct this 3.6 metre tall shrine. Buddhist texts tell of Buddha’s legacy – four wisdom teeth and forty other dental relics play an important role in the dissemination of the Buddhist faith. Monks open the shrine in a daily ceremony, giving believers from all over the world the opportunity to worship.

The second floor is for events, drama productions, and drama productions. The Tang Shop provides believers and tourists wishing to acquire a memento with devotional objects and replicas of items from the museum collection, while the Lotus Heart Tea House on the second floor is most inviting for a refreshment break. All staff members are instantly recognisable in their specially designed gowns – styled after the Tang Dynasty, which enhances the comprehensive approach to the overall design concept.

The “Uniquely Singapore” promised in tourist brochures is a melting pot of various Asian cultures: dynamic, full of contrast and multi-coloured; boasting the best of the East and West as it brings the past and future together. The primary aim of the designers of Lighting Design Partnership was to create an illuminated landmark in this competitive environment. The projecting eaves, the roofscape and the entrance area of the Temple are thus dramatically illuminated, making the intricate and skilful craftsmanship in all parts of the building readily discernible even at night.

The lavish interior design, emulating the traditional motifs, patterns and structural forms of the Tang Dynasty, almost rivals the actual exhibits. The dominant surfaces are of wood, gold and red lacquer. The lighting designers responded to this with a concept of consistently directed light and well proportioned shadows. This not only guarantees good visibility and visual comfort but it also ensures that each area has the required ambiance to support the contemplative needs of the visitors.

A fundamental decision was made to use ERCO lighting equipment with low-voltage halogen lamps throughout the entire building. This light source is specially suited for the illumination of sacred rooms for various reasons: it is simple to dim which makes it easy to provide lighting control for the various lighting scenarios. Because of its small size, it means that the luminaires can also be of compact dimensions and still have high cut-off angles – a key factor in places such as this, where integration of the lighting needs to be especially discreet. The brilliant, warm tones of the light harmonise nicely with the materials of the exhibition, ideally reflecting the magnificent colours of the exhibits, garments and oblations.

The lighting of the central stupa is integral part of the lighting concept. A fundamental decision was made to use ERCO lighting equipment with low-voltage halogen lamps throughout the entire building. This light source is specially suited for the illumination of sacred rooms for various reasons: it is simple to dim which makes it easy to provide lighting control for the various lighting scenarios. Because of its small size, it means that the luminaires can also be of compact dimensions and still have high cut-off angles – a key factor in places such as this, where integration of the lighting needs to be especially discreet. The brilliant, warm tones of the light harmonise nicely with the materials of the exhibition, ideally reflecting the magnificent colours of the exhibits, garments and oblations.

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The main hall of the Temple, the “Hundred Dragon Hall”, is used by Buddhist priests to celebrate their traditional rituals. The magnificent pillars are modelled on the Tang Dynasty of 8 AD, a period that is regarded as the “golden age” of Buddhism in China. The central stupa is illuminated under the light of black TM spotlights for 100W/12V low-voltage halogen lamps mounted on 3-circuit track, which is installed flush with the ceiling. Their narrow beam spot characteristics are ideal for precise accentuation of the intricate craftsmanship. The locally produced casing of perforated metal integrates the functional lighting tools in the decorative surroundings.

Lighting design: Lighting Design Partnership, Singapore
Photos: Joe Lynch / Das Fotoarchiv, Singapore
http://www.btrts.org.sg

An exotic phenomenon even for Singapore: the winning melting pot of many Asian cultures: the new, five-storey Temple designed in the traditional style of China.
The Avalokitesvara hall with the statue of the six-armed Bodhisattva Cintamani Avalokitesvara is also fitted with double-focus downlights integrated in the panelled ceiling to provide glare-free ambient lighting.

A distinctive feature used in the concept is the double-focus downlight technology; the ellipsoidal reflector makes the luminaire ideal for rooms which have high ceilings and where uniform illuminance levels are required from a restricted number of luminaires. The small light aperture diameter of just 112mm and a cut-off angle of 40° ensure that comfortable viewing is created. The lightcast double-focus downlights fit inconspicuously with the lavishly decorated, panelled ceiling to discreetly illuminate the room.

At around 4.5m, the statue in the Hundred-Dragon-Hall is an instant eye-catcher. It depicts the Maitreya Buddha, who in the Buddhist faith is the anticipated great universal teacher.

The periphery is lined with Quadra lens wallwashers. Their vertical lighting defines the circumference of the hall and effectively draws off the countless Buddha statuettes dedicated to their respective donors.

A filigree and flexible system of 3-circuit track and Pollux spotlights with transadapters for 50W/12V low-voltage halogen lamps provides the lighting in the museum and the section for changing exhibitions on the 2nd and 3rd floors of the Temple. The Vari-reflector of the Pollux allows a narrow to medium-sized beam (approx. 11°-24°), the range of variously sized exhibits is accurately illuminated. The potentiometer on the transadapter enables individual dimming of each spotlight. Thanks to perfect glare control, the surroundings remain dark, providing a rich contrast.

The special lens-reflector system of these wallwashers provides uniform wall lighting – from a compact design for small ceiling apertures of just 133 x 157mm in the version for 50W QR-CBC low-voltage halogen reflector lamps.
BMW Welt, Munich

A whirlwind of glass and steel will be the characteristic feature of the BMW brand image over the next few years. The lighting of the Event and Delivery Centre beautifully balances the theatrical effects with efficient visual comfort.

Stage, museum, promenade, and forum: a highly complex and multifunctional building such as BMW Welt makes specific demands on the lighting concept.

While throughout the space functional demands interfere with scenographic requirements. Furthermore, the lighting needs to fit within a complex building services system allowing efficient operation of the building with a roof-integrated photovoltaics power station and intelligent coolable and heatable facades.

The lighting concept for the BMW Welt was developed by the designers of the Bonn-based office ag Licht. The team around Klaus Adolph and Wilfried Kramb received their inspiration from the cloud metaphor: “In addition to its functional task, the light in this building also needs to fulfill an emotional component. The architectural image conveyed and used as a guideline for the design is that of a cloud. Thus it seemed only natural to adopt this same concept for the lighting,” explains Wilfried Kramb.

“From underneath a cloud never has a uniform, homogeneous colour or surface – it ‘lives’.”

As the technical basis of the lighting concept, the lighting designers devised a uniform grid of mounting slots across the entire ceiling soffit. These contain the lighting tools for both ambient lighting and for accentuation of the vehicles, objects or specific zones in the room. The light slots are covered by a louvre grid that shields from view and glare. To minimise the loss of light, these louvres can be tilted by section.

Whether for the light slots as a universal element or the multitude of other lighting solutions throughout the building, the designers at ag Licht created an exciting synthesis of architectural and stage lighting. The BMW Welt uses the best tools from both worlds. Light lets the technical and the fantastic come together. White, blue and other colours are possible, like the Bavarian summer sky and of course, the corporate colours of BMW. Pure pleasure from a sensational experience, a corporate architecture and multitude of attractions grouped around its central purpose, that of ceremonially handing over new vehicles to customers. BMW Welt meets this challenge with an open, flexible space and usage program. Underneath the gigantic roof construction hides a double cone and with an appearance of hovering in mid-air, it gives its shape and support from only twelve pendulum trusses. It’s system consists of an upper and a lower grillage layer with a basic grid of four by five metres. In-between these layers are diagonal bars linking the two-grillage layers to form a spatial supporting framework.

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MK

Stage, museum, promenade, and forum: a highly complex and multifunctional building such as BMW Welt makes specific demands on the lighting concept.
In areas with normal ceiling heights such as the Technology and Design Studio, Parscan spots provide accentuating light. These spots have a particularly high light quality and ensure excellent visual comfort due to special glare protection measures.

The concept of light slots in the hall ceiling solves a multitude of different lighting tasks in the huge interior of the BMW Welt. Ambient and accent lighting, different object distances through offset levels and special effects such as coloured light or movable light cones. From the bridge, the ceiling area is illuminated by colour changing spotlights. The result: a lively, animated impression of the room.

In the eye of the storm: The double cone fascinates due to its dynamic construction. It has space for public events such as free jazz concerts. To set the scene for architecture and events, the Stella spotlights are combined with stage spotlights that feature technology such as colour change or moving heads.

Behind the scenes: In addition to entertainment, the BMW Welt also includes areas for conferences and business meetings offering a more sober décor. Cove lighting, the rhythmic beams of the Parscan spotlights, narrow beam Lightcast downlights and daylight from the light wells give these corridors of the Business Centre an atmospheric quality.

The ceiling section shows how the Stella spotlights are integrated into the hollow of the roof construction to provide a uniform ceiling surface. The cover grids also protect from glare and give the ceiling surface a dynamic internal structure.

The different areas of use underneath the roof of clouds join to become an architectural landscape which includes the spacious, lively transit areas as well as peaceful islands for relaxation.

Stella spotlights for metal halide lamps are powerful and efficient and as versatile as stage spotlights in terms of visual comfort, low maintenance and energy efficiency, yet meeting the requirements of architectural lighting.

The technical design of the Stella spotlights by Franco Clivio integrates seamlessly into the detailed aesthetics of the building. Glare-free and precise, the position of the rotatable spotlights can be fixed to present the latest BMW models in just the right light.

Welcome to the BMW Welt! The Event and Delivery Centre has become a first-rate visitor attraction. Together with brand experience, it provides a public space with restaurant and cultural events and is open 360 days a year.

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How many cities in recent years have become defined by the character of their architecture? As the largest city of the Spanish Basque region, Bilbao has managed to do just that. Frank O. Gehry, when speaking of the Guggenheim, coined the popular phrase “Bilbao effect”, emulated by city fathers all over the world.

Bilbao, however, is more than just Guggenheim. Aside from its legendary Pintxos, as the local tapas variants are called in Basque, there is much more to discover. In terms of architecture, Biblioteca Foral de Bizkaia, Bilbao

Long gone are the days when stockrooms of libraries and museums were hidden from view. They now tend to be shown off to full advantage. A case in point is the new glass annexe of this library in Bilbao, proudly displaying its contents, while additionally serving as a paradigm of vertical illumination.

Architecture and lighting design: IMB Arquitectos (Gloria Iriarte, Eduardo Múgica and Agustín de la Brena), Bilbao

Photos: Thomas Mayer, Neuss

http://bibliotecaforal.bizkaia.net/

A lighthouse of literature and regional culture: as an illuminated glass cube, the new annexe of the Biblioteca Foral de Bizkaia is a characteristic feature of the city at night.

There is the Calatrava airport and the metro by Lord Foster, an office tower by Cesar Pelli is currently contributing to the city skyline, and next to these famous imports are marvellous buildings designed by native architects. Such as the extension and renovation of the regional library of the Biscay province designed by the architectural firm IMB (Gloria Iriarte, Eduardo Múgica and Agustín de la Brena). Steeped in history, the old building dates back to 1890 and once housed the province administration. After its rededication as a library in the 1920s, the architects were commissioned in 2003 not only to extend this facility, which was bursting at its seams, but also to devise a design and appearance that was fit for the 21st century. The existing building was carefully restored both inside and out. The utilisation concept was altered and a futuristic cube made of glass and steel added to the old part, signalling renewal even from far off. The new six-storey stockroom that stores and shows the valuable contents of the library like a giant display cabinet.

Lifting this glass mass on concrete stilts allows the cube to hover while creating additional space beneath for a recessed glass sub-level, the new entrance and exhibition area. Also new at the back is the administration wing, a rectangular tower clad in natural stone slabs providing firm support. It is separated from the old building by a narrow void. Large windows in the former end wall of the old building forge interesting visual links.

During the day, the glass skin of the new stockroom reflects the surrounding buildings. Quotes on culture and peace projected onto the facade in various languages of the world produce a fine structure on the window surfaces and create a link to the function of the building as a place of cultural understanding. The specific content, the rows of shelves with books and magazine volumes, are but secret exhibits behind the reflections.

One of the fascinating aspects of transparent architecture is its ability to camouflage itself during the day like a chameleon blending in with its daytime surroundings. Only then to use clever lighting concepts in the evening for a brilliant appearance; glass architecture is light architecture. One detail to consider by the designers was that glass itself, as transparent material, cannot be illuminated like a solid wall. A proven trick here, regularly applied by American lighting design pioneer Richard Kelly in places such as the foyer of the Seagram Building in New York, is wallwashing inside the building. This technique produces illuminated vertical surfaces that shine through the glass facade onto the outside lighting up the building itself like a lantern.

The designers of the Biblioteca Foral de Bizkaia also used wallwashing to turn the reflecting cube of the stockroom into a six-storey illuminated bookshelf. To achieve this impression, the ceilings of the individual storesys were provided with square recessed ceiling wallwashers using ERCO’s TFL wallwashers between facade and bookshelves. Mounted at a distance of around
The wallwasher lighting with its vertical illuminances lets the glass cube shine from the inside out, while providing functional and glare-free shelf lighting enabling library staff to find books quickly and easily.

As a leading regional institution, the Biblioteca Foral de Bizkaia houses a multitude of valuable historical books, specifically on the history of the Basque region or by local Basque authors and publishers. These are now appropriately stored in the new stockroom.

Economic lighting for the administration and traffic zones: Lightcast downlights and surface-mounted Cylinder downlights for the base of the stockroom, Lightcast downlights in many of the traffic zones, and T16 light structures in the reading and study rooms.

The concrete stilts lift the cubature of the stockroom up into the air. Underneath, the designers created a fully glazed new entrance and exhibition area.

Around the base of the stockroom, surface-mounted Cylinder downlights produce a light carpet around the solidium which adds to the hovering effect. Outside, the designers opted for Site wallwashers.

Architectural lighting allows the designer to give the building a different look at night, in stark contrast to its appearance by day, thus developing a fascination of its own.

90cm to the shelves as the surface to be illuminated, with a centre distance of 116cm and fitted with compact fluorescent lamps TC-DEL 26W RE, the mean vertical illuminance totals a highly uniform 77 lux. Thanks to the extraordinary efficiency of lamps and luminaires, this formidable effect of the building at night is both economical and energy-efficient.

Yet even in less prominent places of the building, ERCO’s products master a wide range of lighting tasks: e.g. Site wall luminaires for the outdoor area, surface-mounted Cylinder downlights for the base of the stockroom, Lightcast downlights in many of the traffic zones, and T16 light structures in the reading and study rooms.

The concrete stilts lift the cubature of the stockroom up into the air. Underneath, the designers created a fully glazed new entrance and exhibition area.

Economic lighting for the administration and traffic zones: Lightcast downlights and surface-mounted Cylinder downlights with compact fluorescent lamps ensure efficient visual comfort.

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Backlights

Light + Building 2008

Beaming faces of the top executives at Messe Frankfurt: for the fourth time in a row, this year’s attendance at Light + Building (11–16 April 2008) exceeded target figures and set new records with 165,000 visitors, including 66,000 industry experts from abroad. This immense interest was also reflected at the ERCO stand, which was completely dominated by the new Spherolit technology: an eye-catching light panel combining 369 Spherolit reflectors as RGB pixels with digital projections cast against a dynamic coloured background. We would like to take this opportunity to express our thanks to all visitors for their overwhelming interest and to our ERCO employees who helped to make our trade fair presence such a great success!

On the opposite wall, Emanon spotlights, projectors and Goborotators fitted with Spherolit reflectors, demonstrate their scenographic qualities.

Fascinating eye-catcher: the light panel was designed and programmed by architect and scenographer Aksel Karcher, Berlin (www.electricgobo.de).

The ERCO Management – visibly delighted by the successful trade fair presence (from left to right: Dr. Dirk Stahlschmidt, Kay Pawlik, Tim Henrik Maack, Mark Oliver Schreiter).

New products such as Midipoll, the completely glare-free bollard luminaires with advanced LED lamps, demonstrate the ERCO concept of ‘efficient visual comfort’ in a very graphic and tangible form.

Trade fairs tend to double as job markets. Employees of the ERCO Personnel Department were present in Frankfurt to talk with candidates and provide relevant information.

The light panel was designed and programmed by architect and scenographer Aksel Karcher, Berlin (www.electricgobo.de).

Top level shop talk: the Light + Building has become a key trade fair date in the diaries of lighting designers throughout the world.

While the trade fair in Frankfurt is still in full swing, ERCO’s lighting developers in Lüdenscheid are already at full stretch working on innovations for next time – see you in Frankfurt in 2010!
In May 2008 the Aquatic Centre, one of the last masterpieces designed by architect Harry Seidler, was the first building in Australia to receive an IALD Award of Excellence. Efficient and striking, a row of Parscoop floodlights for metal halide lamps illuminates the roof of the centre, which is shaped like a giant wave.