DEN DULK Leo (interview van Jean-Luc Capron door –), “Vanaf de andere kant beginnen. Onderzoek naar licht en kleur in de gebouwde omgeving”, *[inst]ALLLICHT – Licht-magazine voor professionals*, Covordia Publishing, Deventer, 2009, pp. 10-13.

Starting from the other end: Lighting design and research with a different approach

[English version]

by Leo den Dulk

The new light sources are LEDs that have different characteristics from conventional light sources. Therefore, a fundamentally different approach has become necessary in the design of luminaires and their use in the built environment. It is also an opportunity to fundamentally rethink the approach of daylight and artificial.

Jean-Luc Capron argues that this angle, starting from the other end as it were, also carries great value when lighting questions in general are tackled, since the answers it provides have been found to be very useful. He proposes to address lighting in a design process that integrates human factors, which means, with the user as the origin and purpose. “This means that you start in the minds of people and end with people in mind”, he states. “Built environment is a concept that has two meanings: first the building, the space, construction and other physical properties; the second is based on the conception we have of the world”. Another aspect of his approach concerns the order in which lighting research and design takes place. Usually, there is a kind of split between the electrical components, such as the light fixture and source, and the physiological aspects of vision, with a gap between the two, where architecture is. On the contrary, a continuous process which starts from the user's perception, goes from the human brain to the eye to the lit object, and ends with the light fixture and source. Lighting manufacturers and designing engineers are often surprised by this approach. Jean-Luc Capron relates that: “Meeting again the electrical engineers who did measurements, with a goniophotometer, of luminaires designed with the help of a specifically designed software that compute optimal photometry and lighting reflectors by this approach, they made this remark: Oh yes, you are the one who starts from the other end!’” If it is a common reaction to his line of reasoning, it is also noted that it works! Indeed the computed reflectors have a very high efficiency and get even better results because they are specifically designed for a special purpose in a specific space. As a result, he is consulted by companies producing light sources and fixtures to look at design questions from a human factors oriented approach.

LED: the dialectic of progress

A question from which should always begin the design of architectural lighting and lighting fixtures is, what is the object to be illuminated? Which includes the characteristics of its surface, as its reflection factor, color, ... orientation of its rough edges: "Lighting a sheet of paper, taken alone, is fairly simple, but when the object is located in one place, we must also take into consideration the specifications of this space. That is to say, plunge hic et nunc [here and now, in Latin language] in that place. Only then can we begin to think about a lighting strategy. To exemplify his approach, Jean-Luc Capron quotes the draft of a light sculpture which he currently works on and shall energize the Place Saint-Lambert in Liège (Belgium) for the holiday season. In this project, the spatial aspect of the design is obviously very important. The first parameters are the dimensions of space and angles of view from which this "Christmas tree" will be perceived. This determines the size of the tree, but also how will be materialized balls that decorate a traditional Christmas tree. The option chosen is to dematerialize the balls into colored reflectors, lit by LED spots integrated into the base. About LED Jean-Luc Capron says: "When you want to use these light sources, one is faced with a problem, that is to obtain photometric data. The development of LED light sources is so fast that their specifications might be different, even a few months later. It is a rather strange situation: we now have software that can perform calculations and simulations very sophisticated, however, the data included in standardized data files, such as the Eulumdat or IES files, includes proportionally very little information, regarding for example the light spectrum. However, Jean-Luc Capron is convinced that this situation might change in 3 to 5 years ahead: "products should change to a less frenetic pace and a number of technical data will be standardized."

New opportunities

More knowledge about LED is necessary to be able to handle its characteristics that make it different from conventional light sources. A deeper knowledge of LEDs is required before being able to manage the features that make it different from conventional light sources. One of the features that greatly influences how they can be used is the greater intensity of color saturation. The limits of conventional light sources is that it is quite impossible to really lit a surface like a wall of dark red bricks. And, due to the subtractive synthesis process, you could never get a colored surface with a hue complementary to the color of the lit surface. “If for instance you lit that surface with a conventional green source, what you would see is a color that is a subtraction of green from dark red. With LED on the other hand you can lit almost any surface with almost any colour and get the colour you were intending, or so” said Jean-Luc Capron. Only surfaces with a very high reflection factor, such as plastics, are difficult to lit with LEDs. Another property of LEDs is that when an object is illuminated simultaneously from two slightly different angles by two light sources of different colors, the shadow of one of two sources will be the color of the other and it will appear much more saturated than the combination of the two. This effect can be used intentionally, because with the LED it has a distinct color the shadow, even if darker. Yet, more experiments are needed to determine how this effect can be exploited in practice. Therfore, *in situ* experiments, such as those conducted in the course Color and Built Environment (colored light module) taught by Jean-Luc Capron, will help to acquire a better knowledge of the photometric and colorimetric characteristics of light emitted by the LED.

Daylighting, or the dynamic of light

Daylighting is another area in which Jean-Luc Capron conducts research and projects. In the project for the Mediatheque of Anzin (France), he worked on architectural design with the architect Ph. Caucheteux and was in charge of the lighting design. As in France the HQE (high environmental quality) regulation ask for environmentally friendly buildings with a special concern for comfort of the users, natural lighting is an important aspect. "In a library, daylighting participates to meet functional needs for lighting, but can also create special atmospheres," says Jean-Luc Capron. "Therefore, the structure of this building has been designed to modulate the intake of natural light. Linear skylights are opened between pairs of beams supporting the roof, which were positioned and sized to prevent sunlight entering directly in the reading rooms. The vertical surfaces of the beams act as reflectors, providing indirect light and limit glare discomfort.

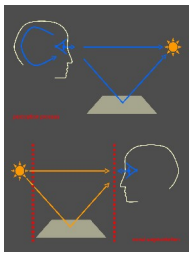
One of the most interesting aspects of the natural light is that it changes constantly with the hours and seasons. This is perfectly revealed by the famous modernist architect Hans Scharoun (1893-1972) in its design for the Deutsche Staatsbibliothek in Berlin (1964-1978). Subtly sophisticated zenithal lighting devices diffuse natural light without causing glare, while preserving temporal variations of light. Jean-Luc Capron who made a survey of illuminance levels, says: “When you're sitting in the library you're not disturbed by the, yet important and frequent, light levels fluctuations. These variations of light intensity and color temperature keep our senses aware. Thus the natural light gives all the quality to this library as a living-space. When we compare windows types, the differences can be significant in quantity but also quality of transmitted light, which has an impact on the physical and psychological comfort of users. Even on cloudy, daylight reveals the position of the sun and changes in intensity and color temperature are perceptible, indicating the passage of time through the hours, depending on the day and seasons. It is a basic biological human need to stay in connection with the temporal dimension of light."

Enlivening irregularities

Even seemingly unimportant factors can greatly influence the quality of lighting. The interaction of light with natural materials it passes through or over which it reflects the fact literally vibrate. When, at the occasion of the 3rd VELUX Daylight Symposium, Jean-Luc Capron discovered the former Van Nelle factory in Rotterdam, he noted with enthusiasm that the architects who made the renovation of this building, chose to use drawn glass, rather than float glass. And it makes a real difference to the quality of light! "In the glass of old window panes, there are many imperfections, such as bubbles and patterns formed during the solidification of the glass, which you also notice when you are looking through it. Such imperfections refract and even diffract the rays of natural light entering the room, which, with temporal variations, generate effects similar to those resulting from light reflected on a water surface in movement. On the other hand, the quality of modern glass is so perfect that you even

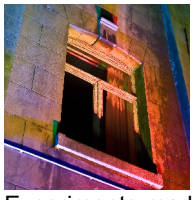
notice its presence when you look through it." Researches done on these phenomena, under the direction of Jean-Luc Capron, with various types of glass panes and other transparent or translucent materials with irregular features, such as a ‘water drop’ pane and then monitoring what effects this had on the dispersion of daylight coming from North or South, with sunny or overcast weathers, and the resulting reflections on the surfaces behind the pane. And Jean-Luc Capron to conclude: "In every case study perceptible variations were found that makes light to come alive, thus enlivening the space it is entering. Such results make applied lighting research a tremendously fascinating field. And no doubt, there is much more to come!”

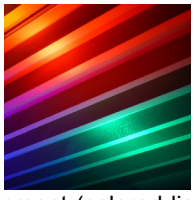
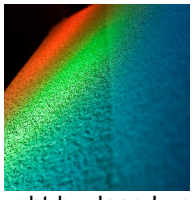
Jean-Luc Capron is an architect, who held a master and doctor of engineering in architecture, from the University of Tokyo (JP). He is Associate Professor at the Université Catholique de Louvain (former Institut Supérieur d'Architecture St-Luc Bruxelles) and Lecturer at the Université de Mons (BE). He teaches courses about the interface between human factors and built environment, and more especially the relation between space light and color. He is conducting researches and writing about these topics, and is a founding partner of Hic et nunC dealing with lighting and color design – www.hic-et-nunc.eu.



Two approaches of lighting: the usual segmentation between light source and human factors, and the perception process proposed by Jean-Luc Capron, with the user as the starting point of lighting design.

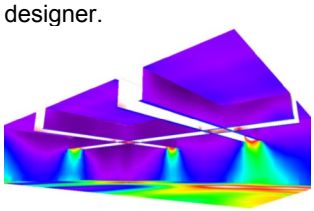
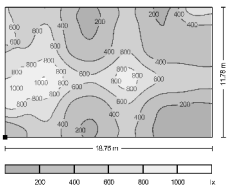
When Jean-Luc Capron design a "Christmas tree" lit by LED spots for a large public open space, the points of view from which it will be perceived determine the spatial characteristics of this lighting-sculpture.

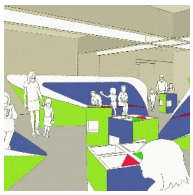


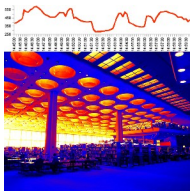



Experiments made as part of the course Color and Built Environment (colored light module) taught by Jean-Luc Capron, with the technical support of Philips Lighting, that reveals the specificities of LED light.

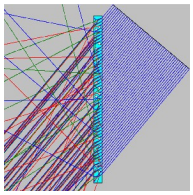
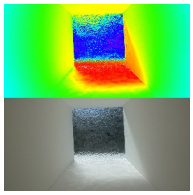
Building structure designed to modulate the intake of natural light for a project for the Mediatheque of Anzin (France) done by the architects Philippe Caucheteux and Jean-Luc Capron, acting also as lighting and furniture designer.





Measures of illuminance at the Berlin State Library [Staatsbibliothek zu Berlin], by the famous architect Hans Scharoun, show the temporal dynamics of natural light during a lap of 15 minutes, that gives "live" to the building.

Researches on the effects of light generated by translucent materials show that from a light perception point of view, the interest of glass panel with non planar surfaces and non homogeneous material.