les éclaireurs

nîmes ~ the école des platanettes

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light: a tool for enhancing teaching

The école des Platanettes offers classrooms with biodynamic lighting, based on circadian rhythms and the production of the natural sleep hormone, melatonin. Our lighting is designed to either stimulate or calm down children through the change in colour and brightness of ambient lighting. In this way, light serves as a tool for enhancing teaching.

This system is underpinned by our architectural lighting business where design goes beyond the basic scope of supplying lighting. More thansimply responding to a functional need, it providesan ambiance that enhances the way in which the building is perceived, all while maintaining similar implementation costs tostandard projects.

A classroom with biodynamic lighting

project concepts

Setting: a school nestled amongst Plane trees

This project entails the demolition and reconstruction of a former school comprised of prefabs. The aim was to build a new school in the middle of the Plane trees, without harming them. From the initialproposal, the school has been conceived as a tree house: the classrooms are all located on the upper level, with a view over the trees which are almost within reach.

The school is located in a disadvantaged suburb in the south of Nîmes: a place where cars are set alight, break-ins occur andwheeling and dealing takes place. The residential neighbourhood in which the school is located hides a multitude of social problems. Embarking onsuch an ambitious project was a strong, radical step on the part of the architects and teaching body.

Classroom lighting: the result of research on circadian rhythms

Lighting at the école des Platanettes works on the principle of light based on circadian rhythms. This bio-rhythm is one of our body's biological cycles. By way of a simplified, illustrated example, one could consider that this bio-rhythm comes from our habit - formed over thousands of years - of living outdoors, working in fields, and returning to our homes in the evenings. Over a long period of time, our body has been recording the function of daylight, learning to synchronise our internal biological clock with the solar clock: cool light in the morning awakens, bright light during the day stimulates, and warm light from the setting sun starts off the sleep cycle. This warm light ends up in our homes, with a candle emitting a low energy light.

It is important to realise that, like colour, the quantity of light from the sun varies throughout the course of the day. What we see as white is, in fact, a variation of white (containing blue tones, blue-toned white, neutral white, warm white or orangey white). Although our brain does not register all these colour variances, it does register the absence or presence of blue tones. It therefore reacts to two parameters: the quantity of light, and the presence of blue tones.

In our brain, these stimuli manifest as the production - or absence thereof - of a hormone that courses through our body: melatonin. Broadly speaking, this is - amongst other hormones - the sleep hormone. How does this process work? In the morning, the blue tones of daylightenterour eyes. Our brain perceives this blue-coloured light and starts cutting off the production of melatonin. As the intensity of the light increases, melatonin decreases, until it is no longer present. As the day progresses, colours warm up while the brightness of the daylight diminishes. Our brainresumes the process of producing melatonin again. After two hours, production is well under way. Our muscles, vision, attention span... everything slackens to prepare us for sleep.

A classroom occupied by children

In dark rooms, the control rooms of nuclear power stations and clean rooms - extreme work situations where people need to remain vigilant without getting depressed - artificial lighting is used to make up for the lack of sunlight and absence of a visible solar cycle. This prevents body imbalances and the loss of bio- rhythms.
In designing lighting for the classrooms at the école des Platanettes, one of the project's key driverswas looking back at the environments in which our college courses were given, where the pale, yellowish neon lighting became unbearable by mid-afternoon, with a disastrous effect on our attention levels. We had to force ourselves to remain focused.

After researching scientific articles on the topic and considering tests conducted at an English school (on primary school pupils: the aim was to assist pupils in remaining focused throughout the day and to sleep well at night), we put forward a proposal to the client andteaching body to make use of this light principle in the classrooms.

The école des Platanettes is a far cry from the centre of a nuclear power station: it is supplied with real daylight during the day. The architecture has been designed to allow light to penetrate into both the front and back of classrooms (through skylights). Awnings have been added to limit the direct entry of sunlight, preventing it from become blinding, and the contrast between the indoors and outdoors of the classrooms has been reduced.

Artificial lighting was not considered as a stop-gap measure, but rather a means to supplement natural light: in some ways, it mimics variations in the colour and brightness of daylight. This lighting is automatic, switching on when we enter the room.

For each classroom, we have chosen PHILIPS Celino lights fitted with fluorescent HE35W tube light bulbs, 2,800K warm white and 6,500K cool white. The lights are fitted with DALI ballasts, linked to external daylight sensors (measuring the supply of daylight and adjusting the lighting according to this) as well as presence sensors. This set-up is linked to a DALI centralised management system providing the programmable features, allowing for full monitoring of the system (including an indication of the operating timeof each light, fault detection, and triggering of certain actions, etc.). Our company designed the completeoperation of the system's DALI, and drafted all of the project's detailed engineering drawings in-house.

The lights are fitted with microprismatic PMMA MLO-type optics rather than low brightness louvres for ease of cleaning and maintenance. The UGR is slightly lower, but the light effect, colour temperature readings on PMMA strips, ease of maintenance, and 24-hourlyfeatures, are,for architects, all factors that contributed towards the choice of this solution. They also constitute a teaching choice encouraging the children's attention spans to become attuned to the hues of light, to colours.

A teaching tool

This lighting, not only through its colour but also through its intensity, has an effect on children. This provides a teaching tool with a genuine impact: during the various follow-up meetings, teachers shared their highly positive experiences with us regarding the use of this tool in the teaching process.
The teacher alone decides on the ambiance to be created in their classroom. They remain in control of their own classroom and the energy they would like to infuse into it. To ensure that this system doesn't become an automated routine imposed on the classroom set-up, but rather remains a real teaching tool, we considered it crucial to be able to bypass theautomated features, putting the teacher in control and allowing them to change the ambiance according to the desired teaching scenario.

A corridor coloured through movement: using compact fluorescent bulbs and dichroic glass

For ease of set-up, we have provided pre-set scenario buttons that align to teaching situations: the need to calm down, or stimulate the children. For these two situations, specific levels and tones of light have been set, defined and approved by the teachers. These settings can then be adjusted using +/- buttons to intensify or reduce the effect.
Finally, a third button caters for video projection scenarios, or a quick nap in the classroom («we're taking a five-minute break with your arms crossed and resting on the table...»)

To our knowledge, the tool that we have developed is a firstin this regard: the linking up of such a complex system covering presencedetection, management of daylight supply and simulation ofcircadian rhythms which usually operate in isolation from one another. In this project, the challenge has been pulling them all together, while maintaining the lowest possible energy consumption and simplifying the lives of users.

A tree house...

The classrooms are designed like tree houses perched amongst the vegetation cover. The spotlight part of the project aims to reinforce the playful aspect by demarcating different areas of the school through the creation of specific light ambiances. Apart from the playful aspect, this allows for stimulation of a child's imagination, and helps them to orientate themselves within the school areas (each area has its own function, andambiance).

In this way, we have transformed the corridor, which was rather drab, into a colourful space comprised of iridescent, pink and orangey tones. To achieve this, standard light fittings have been fitted with glass filters that change colour depending on one's viewpoint (dichroic glass). This is a simple diversion from a standard light fitting.

In relaxation areas, where children take a nap, side lights project streaks of light into the rooms. Here too, it is a case of standard light fittings diverted from their original function: originally designed by the Jean Nouvel Design Studio as outdoor lights for a park in Barcelona, the light fittings are positioned to create wall lamps. Fitted with IM 20W bulbs, the light fittings are used to wake up the children: the lamp's rise in temperature intensifies the lighting, waking the children up gradually. Specific staff training has been providedon this topic as it is not easy to understand how a CDM-TC bulb works from the outset.

A living building, that sleeps at night...

At nightfall, once the classroom lights have been switched off, very low-intensity night lighting switches on automatically. Emitted by biodynamic lights, itgives the building a presence at night in the neighbourhood, with no additional cost owing toits very low energy consumption. This night lighting emphasises the building's role as a city feature.
The indoor night lighting is supplemented through lighting of the parking lot, covered playground and walls in Vers-Pont du Gard limestone, serving to reinforce the impression that the building is sitting on five stone feet. The cream-coloured limestone is bathed in subtle white tones, while the parking lot and covered playground on the lower side of the building are illuminated in cool tones.

View from the building’s forecourt: the lighting effects have not yet been switched on

Comfortable, economical lighting...

A great deal of attention has been paid to the aspect of light blinding, where care has been taken to diffuse and divert our light sources to ensure optimal visual comfort for the children and allow clear visibility in the buildings. Our lighting is managed over time, using economical energy sources which can, for the most part, be regulated. With low maintenance requirements - requiring changing of bulbs every three to five years (apart from annual cleaning of the fixtures' covers) - the entire project is based on an approach favouring high-quality visibility together with controlled energy consumption.

Comfort and quality of life for site users

Integrated into the detailed preliminary study phase, specific photometric studies allowed for a focus onsizing the lighting effect to the best effect, verifying its output and determining the light fittings' optics. These studies provided:

- room-by-room calculations, ensuring that the client's specifications in terms of lighting, uniformity and energy control requirements are met
- the drafting of calculations for a holistic conceptin order to verify the overall perception of the building's architecture (contrasts, current levels of luminosity, etc.)

The school's environment

The school's lighting environment has been remodelled in order to accommodate the new school project: the high output SHP projection lamps on street poles to the right of the intersection have been transformed into medium output symmetrical projection lamps directed towards the building's forecourt. Excluding the contract and the project's footprint, this lighting has been managed in close collaboration with the public lighting department of the city of Nîmes.

Today, the school is nestled amongst the Plane trees. It has become a new feature in the residential housing estate in the Haute Magaille suburb. Through its night-time presence, the building adds vibrancy to the suburb, becoming a new landmark. Numerous official visits and press articles have helped in ensuring acceptance of the building by residents whose children attend the school.


NÎMES
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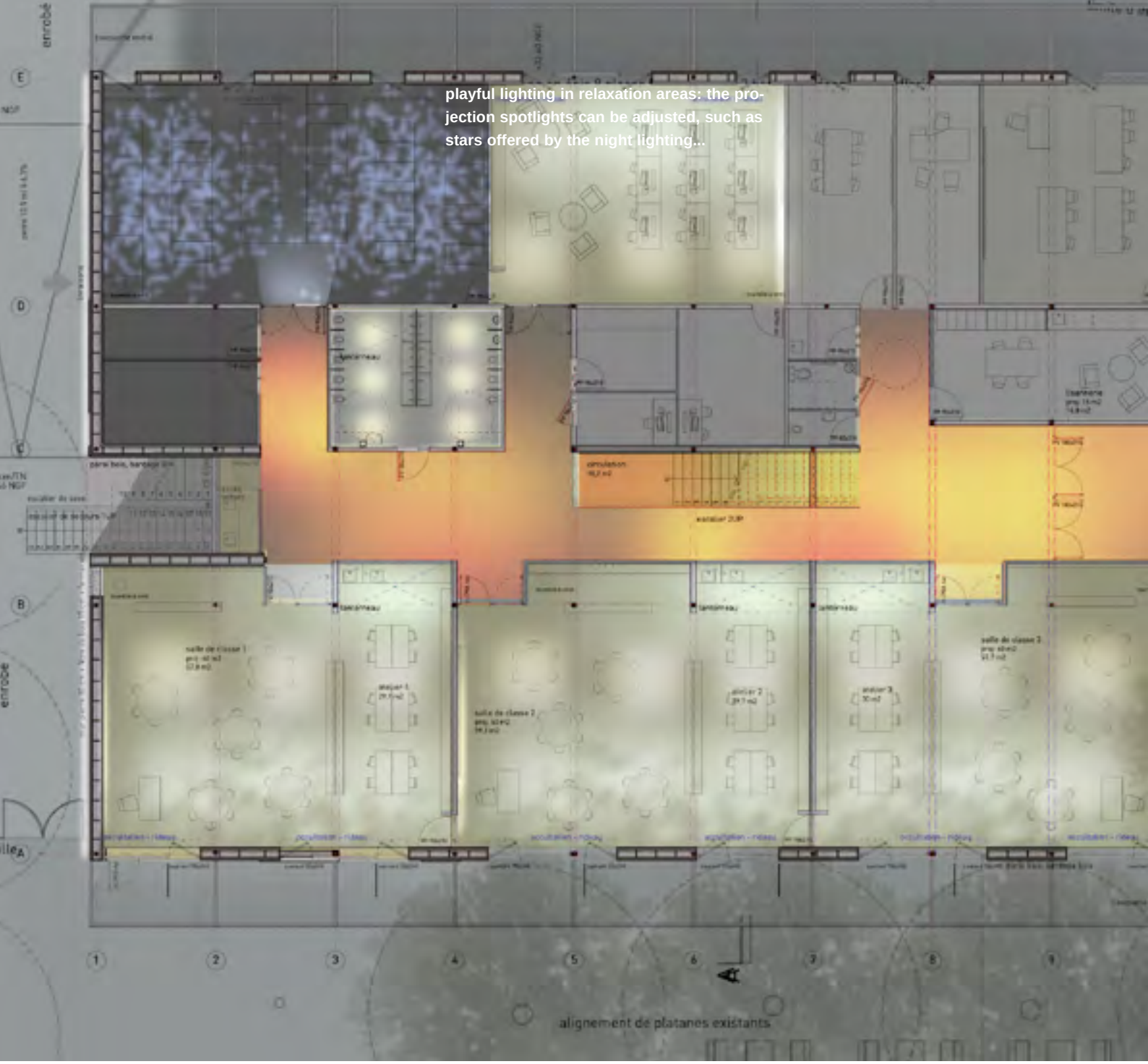
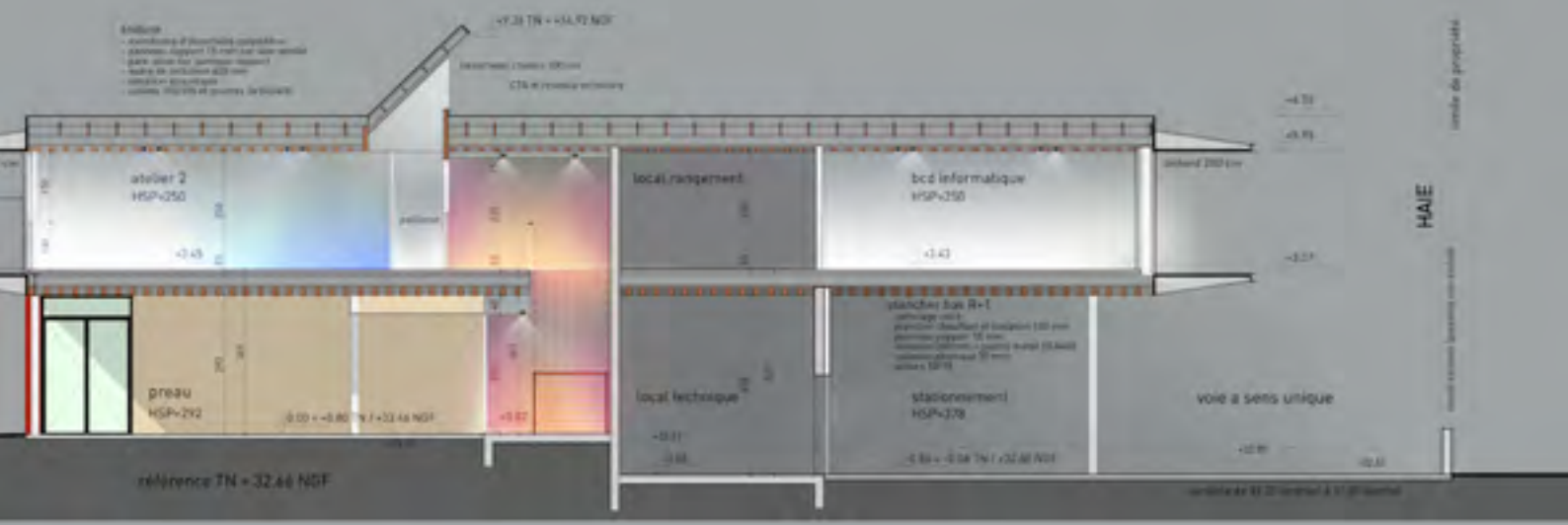

playful lighting in relaxation areas: the projection spotlights can be adjusted, such as stars offered by the night lighting...
alignement de platanes existants


RUE DES ANCIENS COMBATTA
EN AFRIQUE DU NORD
COUR

FIRST FLOOR LAYOUT



DIURNAL CROSS SECTION

LEGENDE ECLAIRAGE

EC9

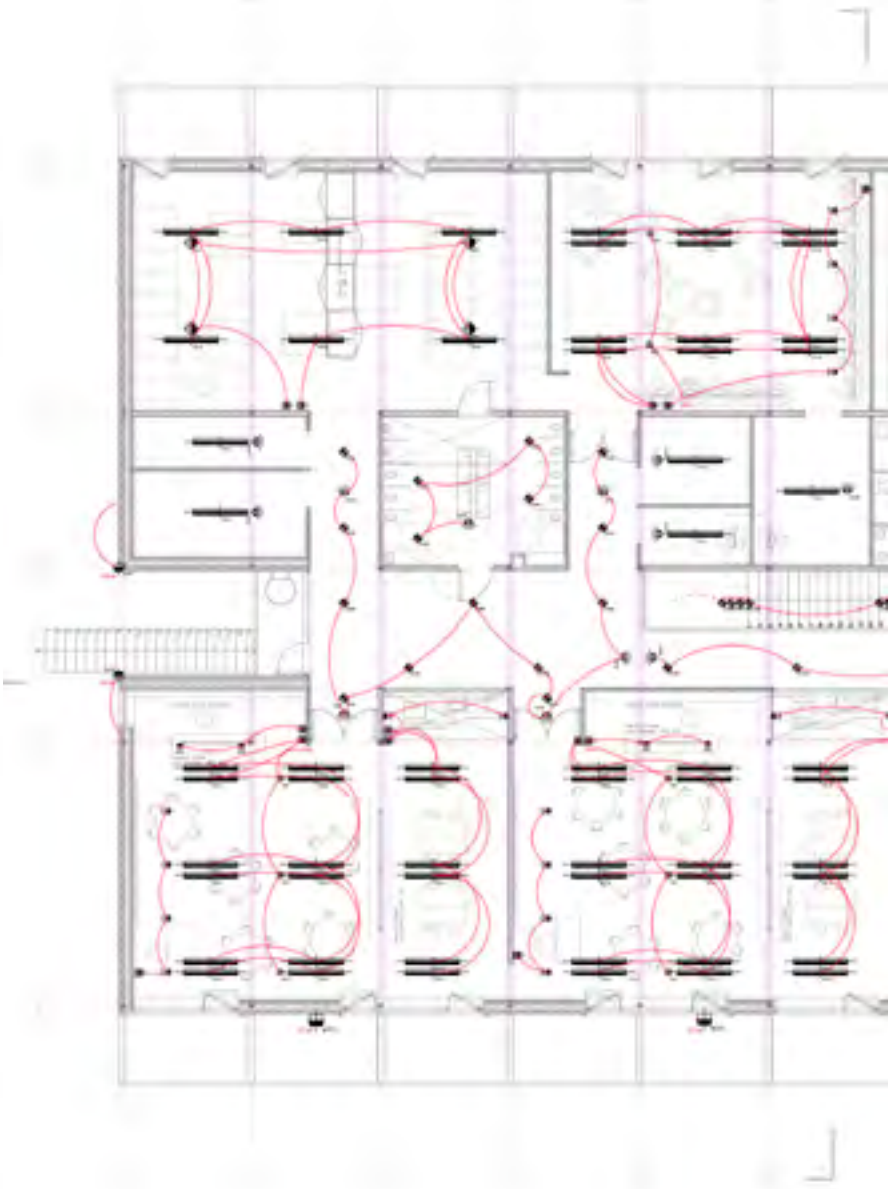
capteur de lumière du jour DALI relié à GTC éclairage DALI
pour gradation automatique en fonction
de l'apport de lumière du jour

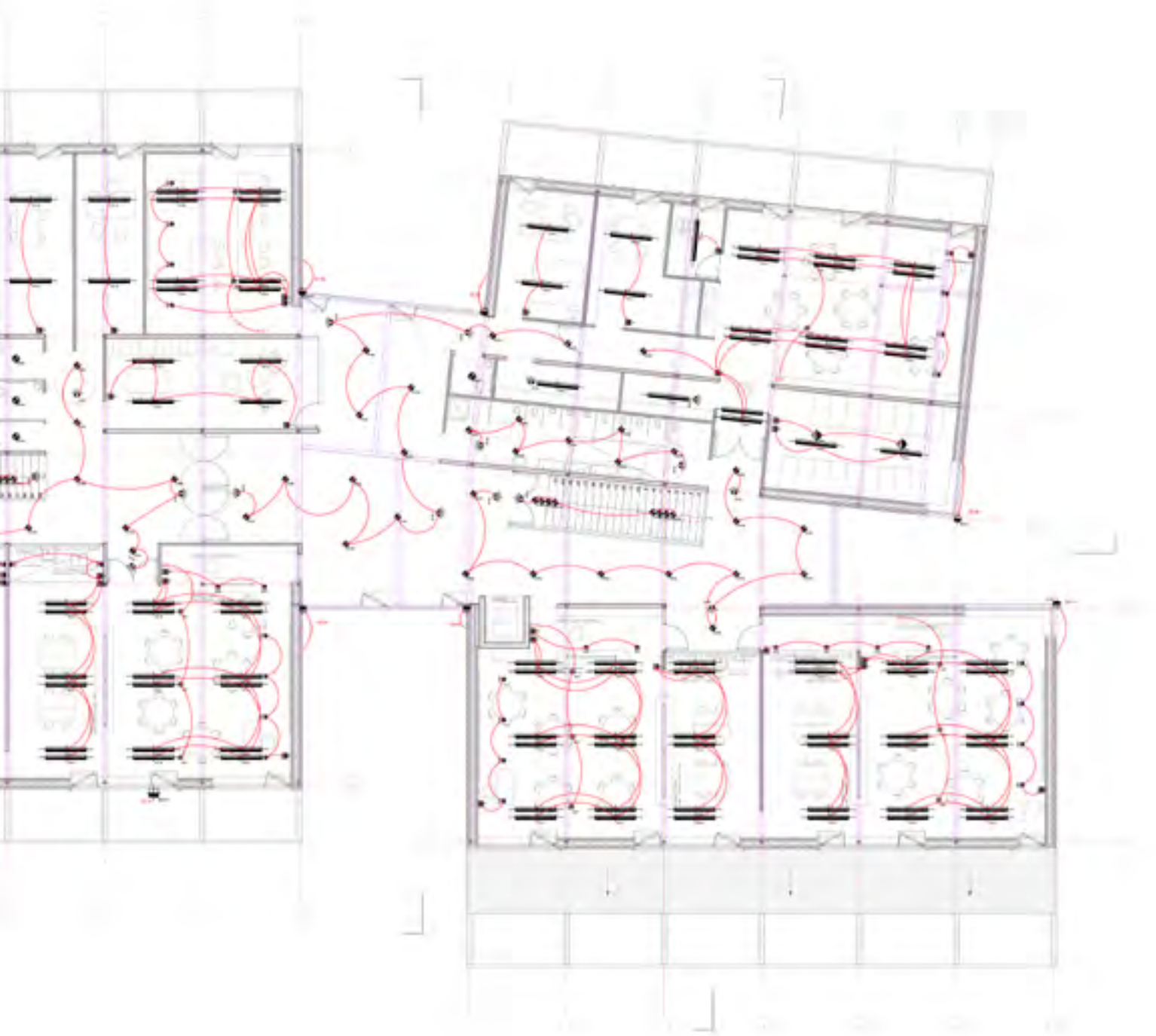
capteur de présence 360° DALI
retour vers GTC éclairage DALI

interrupteur poussoir DALI on / off / gradation
retour vers GTC éclairage DALI

panelle de commande 6 touches DALI
retour vers GTC éclairage DALI

Lustre spécial composé de 550 lampes B22 à LED
changement de couleur automatique
passage des câbles dans le plafond entre solives
alimentation directe en 220V
prévoir relais DALI à la GTC





FIRST FLOOR LAYOUT

 this button triggers cool, bright light to stimulate the children, whereas this button  triggers soft, warm light to calm the children.

 This button allows for the room lighting to be switched off almost completely for the screening of a film, to rest your headon the table for five minutes, or to do a "torch" activity for example.

In addition, a high/low touch key (on the side) allows for these pre-configured scenarios to be adjusted. To provide an example:

- if you press on  and increase it using the side button = you will make it cooler and brighter
- ifyou press on  and decrease it using the side button = you will change the ambiance which will still remain blue-ish, but less bright; if you continue, the lighting will become warm and low. Continuing willeventually switch it off.
- If you press on and increase it using the side button = you will turn the light neutral and brighter, and then cool and very bright
- If you press on and decrease it using the side button = you will turn the light very warm and lower. Continuing this will eventually switch it off.

The boardis operated through the second increase-decrease button appearing on the panel: if you press on the top, it switches on, if you press on the bottom, it switches off.

If you'd like to restore automatic mode, you press  . The central LED turns green around the button Ọ.

If you press this button  again, the LED turns red and the lights are switched off in the room Ọ. You can then leave. If you return, no need to switch the lights back on, you will be detected and the light will be managed by the automatic programme.

Finally, if you leave without switching off the lights (that's not good!), the system has been programmed to switch the lights off if no movement is detected in the room for five minutes (it can also switch over to night lighting mode - a mode programmed to allow the school to "live" in the suburb until 23h00. It consumes almost no energy and activates street lighting,providing safety for the school).

Have a good class - we look forward to your feedback on the teaching quality of this tool!

An example of an instruction sheet provided to teachers for controllingclassroom lighting

some technical concepts

Sustainable development

The école des Platanettes is an HQE building with French BBC-EFFINERGIE accreditation andenergy consumption lower than 40kWh of primary energy per m² per year. The building was classed asGold level by the Sustainable Mediterranean Buildings Association. Its architecture is considered passive, in line with RT2012 targets. Its carbon footprint has been closely monitored during construction, with a footprint of 280kg CO2/m2, while the average provided by the Environment and Energy Management Agency for a low-energy building in a standard sector is 436kg.

Its lighting makes upapproximately 19% of the building's energy consumption. This is monitored closely by a set of sub-meters for each area, covering each of the building's functions. Adjustments made to settings based on measured results forms part of a regular feedback process that is conducted each year.

The primary material used is aluminium owing toits recycling properties. Maintenance considerations have been incorporated throughout the design process in order to limit this: the choice of durable bulbs, ease of access to the sources for changing of bulbs (stairs for example), regular distribution boxes (for the re-cabling of faulty lights for example), light fittings produced by high-end manufacturers, ensuring after-sales care for their range, etc.

Our HQE and low-energy approach has also imposed certain constraints on airtightness. Specific work has been conducted on duct pathways (vapour barriers in the ceiling) and on sealing around distribution boxes. All of the detailed engineering drawings studies conducted on pathways and cabling were carried out in-house.

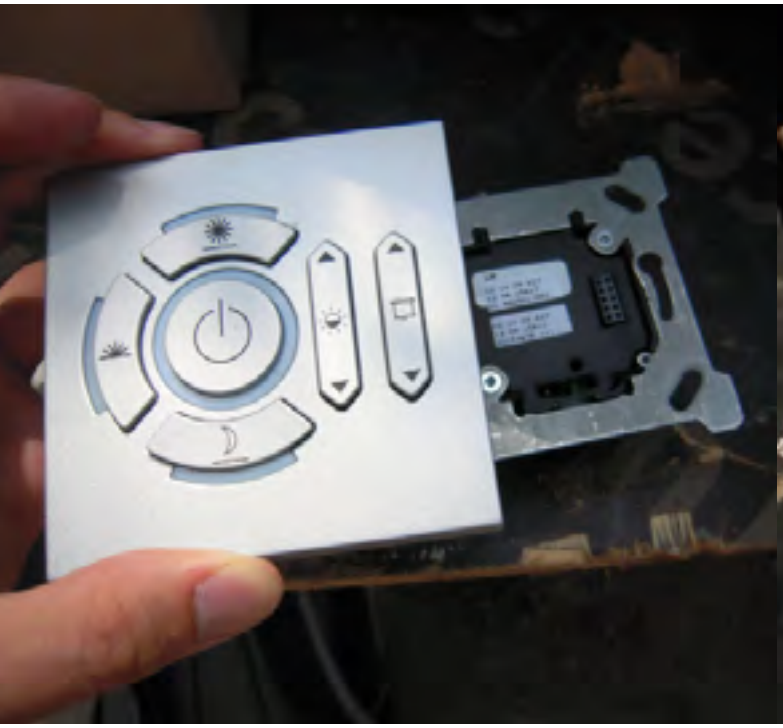
Limiting the number of source types used

To ensure ease of maintenance in this project, we focusedour studies on reducing the number of light sources. Thus, the entire lighting project is based on a limited number of lights. We have also ensured a high quality in the sources used, for both their rendering of colour and their durability.

Finally, a key point for securing the project in the long term was our negotiating a monitoring strategy with Dalkia, tasked with light maintenance, in addition to proposing a labelling system with coloured stickers on each light fitting: bright blue for 6,500K light bulbs, yellow for 2,800K light bulbs and white for 4,000K light bulbs. This strategy, implemented in the Lyon metro, facilitates the changing of bulbs.

↑ Dichroic glass on downlights

↑ Dichroic glass on downlights



↑ Classroom control button: 3 scenarios, 2 functions
↓ Checking of assembly and securing modes on the light fixture

↑ Tests for securing light fixtures on wood fibre ceilings
↓ Checking of assembly and securing modes on the light fixture

↑ Audits and feedback from teachers to the client's team

↑ Tests conducted on pole tops - special manufacturing

↑ DALI centralised management training for the DALKIA department
↓ Checking integration of presence sensors

Les Platanettes / Jean Carrièrenursery school in NÎmes
Surface area: 1750 M² - Coût des travaux : 3,05 M€ HT
Client: Ville de Nîmes / Direction de la Construction
Total indoor power installed: 1 5.5 kW
Annual lighting energy cost: 842 € HT (hors abonnement)
Power installed per surface unit: 10.28 W/m²

Project Management Team
Authorised architects: Tectoniques
Associate architects: Atelier GA
Landscaping: Itinéraire bis
Light designer: les éclaireurs
Wood and metal structure: Anglade Structures Bois
Environment Structural Design Office: Indiggo
Civil Engineering Structural Design Office: Egis
Inspection Structural Design Office: BTP Consultants
Piping layout, eco-related, CoW Structural Design Office: IGBAT
Env. Rating of Buildings ProjectManagement Support Azur
Health and Safety: SPS Sud Est

Main products and devices:
Lighting fixtures: Philips, Iguzzini, We-Ef, Bega,
Biodynamic Management and Centralised Lighting Management: Zumtobel

presentation of decorative lighting to the architect

our office

Les éclaireurs is a young, dynamic, driven office, operating in France and internationally. With an annual turnover of 800,000 $ and a solid team offering a skills set ranging from civil engineering to architecture, we are currently focusing on English-speaking countries and China, while continuing to grow our core business activity in France and Europe.

Today, our office is recognised for its expertise and ability to deliver construction projects to exacting standards while maintaining high attention to detail and future maintenance of the installations. The loyalty of our architect partners and clients bears witness to this.

Growing the network and home automation domains of our light solutions, we are constantly researching innovative solutions, and are able to realise precise, ambitious projects rooted in the technical expertise of our creations.

Our creativity has been crafted through training as well as experience gained from many different partnerships formed with artists, designers and set designers - the drivers of new architecture and civil engineering projects.

les éclaireurs is a member of:

LUCI ASSOCIATION

PLDA

Cluster Lumière MEMBRE

A C E

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