

# 338: The Poetics of Sacred Light - a comparative study of the luminous environment in the Ronchamp Chapel and the Church in the Monastery of La Tourette

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## Abstract

In Le Corbusier's religious buildings, light, sound, colour, rhythm and space are the key architectural elements which introduce visitor to a sense of inner harmony resulting from a state of spiritual transformation. This spiritual transformation can be most vividly experienced in the Ronchamp Chapel and the Monastery of La Tourette. The aim of this paper is to investigate the luminous environment of these two sacred structures through a comparative study which was conducted qualitatively and quantitatively. Much can be learned by studying the master's buildings which were built with daylight as the primary light source. Detailed analysis of the master's work would provide valuable insights and data which can be applied to the more routine design of the luminous environment.

Keywords: poetry, architecture, daylight

## 1. Introduction

### 1.1 History

In Le Corbusier's professional career, he was responsible for three religious buildings: the pilgrimage chapel at Ronchamp and the Dominican monastery of La Tourette which were built during his life time. The parish church of saint-pierre, Firminy which was completed in 2006, 41 years after his death by French architect José Oubrière, Le Corbusier's student for many years. This paper focuses on the investigation of the luminous environment in Ronchamp and La Tourette.

### 1.2 Le Corbusier and Light

Light was fundamental to Le Corbusier's architectural thinking. In *Vers une Architecture* (Towards a New Architecture), he wrote: "Architecture is the skilful, accurate and magnificent play of volumes seen in light." [1]. Throughout his career, he developed and refined his daylighting strategies. "I used light abundantly, as you may have suspected; light for me is the fundamental basis of architecture. I compose with light." [2]. In order to understand the poetics of sacred light in Ronchamp and La Tourette, the luminous environment had been analyzed qualitatively and quantitatively.

## 2. Methodology

The qualitative analysis of the luminous environment is based on the author's subjective perception of the effect of light in different spaces. Following the footsteps of Le Corbusier, the study began with an exploration of the immediate subjective experience of the monastery through tonal sketches with an aim to identify Le Corbusier's lighting language (Logic and meaning) and vocabulary (means – daylighting systems). The sketches show an approach, through drawing the selected spaces, a process of

understanding the meaning and effects of light. The typological summaries of various daylighting systems were included in the analysis of the distinct luminous environments identified in the course of sketching. This method was inspired by Urs Büttiker's study on the light and space of Louis I. Kahn's architecture [3]. The subjective appreciation of the spatial experiences in Ronchamp and La Tourette was supported by quantitative on-site monitoring. Spot measurements were conducted in selected spaces.

## 3. The Luminous Environment of the Ronchamp Chapel

### 3.1 The poetics of sacred light in Ronchamp Chapel

As explained by Henry Plummer, Ronchamp Chapel is a cinematic vessel and the interior is composed as a great wheel of mutations [4]. Le Corbusier created a series of spatial dramas which light inter-acts with the form and the material and animates the space by creating different moods at different time of the day and in different seasons.

Ronchamp is a system of curved and partly tilted convex and concave walls covered by a shell that rises from the centre of the interior space (Fig.1). The altar, a vital core of the chapel located next to the east wall is emphasised by the harmony of light entering at intervals. It is lit by the shafts of light through the south east corner of the chapel which are regulated by the *brise-lumière* above the eastern door. This baffled light draws attention to the altar side of the chapel and the choir wall which is pierced by a number of small apertures admitting starry light to enclose the square opening where the statue of the Holy Virgin is embedded.



Fig 1. Exterior View of Ronchamp Chapel - from Lau, 2000

There are also rays of light pierce through the thin gap between the east wall and the massive roof and makes the roof appears to “hover”. The relative strong light coming from the south east corner of the chapel is balanced by the light penetrating through the orthogonal openings at the north east corner and accentuating the outline of the elements it contains: altars, cross and candelabra (Fig.2).



Fig 2. Eastern View of Ronchamp Chapel (photo & sketch) - from Lau, 2000

On the south side, the graded light falling on the splays of the wall openings regulates the luminous environment in the nave. The light intensity alters with the movement of the sun and is strongest in the early afternoon, especially at the base of the south wall which contains human size splayed apertures. The size of the windows, as well as the depth and the direction of the splays, varies from one opening to another, thus sunlight is admitted at different angles and with varying degree of brightness at diverse points along the south wall creating a constantly changing luminous environment in the nave from dawn to dusk.

The coloured glass in the splayed windows along the base of the south wall filters and softens the incoming light, creating coloured shadows in delicate hues on the roughly plastered surface. These shadows change as the light becomes brighter or grows dimmer as the sun migrates in the sky (Fig.3).



Fig 3. South wall with deep splayed windows (photo & sketch) – from Lau 2000

The light falling in the three side chapels, with one located at the south west corner and two twin towers

positioned at the north wall framing the visitors' entrance is regulated by the *bris-lumière* which is instrumental in defining the interior volumes. Light entering through the periscope-shaped semi-circular shaft is subdued by the blades of the light shield. The filtered light with reduced light intensity is softened as it travels down the grainy wall surfaces arriving at the austere stone of the altar.

The design of the light shield allows the direct sun rays penetrating through the single light slot at the top and mingles with the diffused light filtering through the light blades below creating a twilight mood at certain times of the day (Fig.4)



Fig 4. North Elevation and the light tower facing north– from Lau, 2000

The three side chapels are lit differently with the south-west tower bathed in a relatively constant north light, while the twin towers at the north side with one facing east and the other facing west capture the rising and setting sun. The inside wall of the side chapel with the light tower facing east is covered with a deep carmine red which works dramatically with the rising sun and evoke a great sense solemnity.

The typology of light in Ronchamp can be broadly categorised into two types: the collective (the main chapel) and the individual light (the three side chapels). The collective and individual light co-exist under the massive roof, but separate from each other by the curved walls (Fig.5).

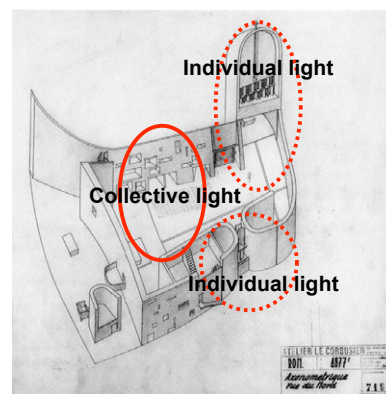


Fig 5. Axonometric view of Ronchamp showing the collective and individual light zones- from Danièle, 1997 & Lau 2000

### 3.2 The quantitative study of the sacred light in Ronchamp Chapel

The light distribution patterns obtained from the spot measurements taken on site reveal that Le Corbusier introduced a minimum of two light sources from

opposite directions to light the nave (Fig. 6). The asymmetrical balance of light created by this lighting technique enhances visual perception by eliminating excessive brightness contrast associated with a single opening in dimly lit space which normally leads to glare. This also accentuates the three dimensional quality of the space and form (i.e. altar, cross and candelabra).

The luminous environment in the central nave under overcast sky conditions is characterised by uneven distribution and low average Daylight Factor which is about 1% (average Daylight Factor around 0.6% & Uniformity Ratio: 0.23). Four high brightness zones were identified in the central nave with the highest brightness zone found close to the south wall with splayed windows (daylight factors around 6%). The two entrance zones under the vertical windows with *bris-lumière* at the south east corner and the gap between the back to back twin towers at the north side of the chapel are the intermediate brightness zones with daylight factors (around 4%) while the orthogonal openings at the north east corner of the chapel produce the third brightness zone (daylight factors around 2%) (Fig. 6).

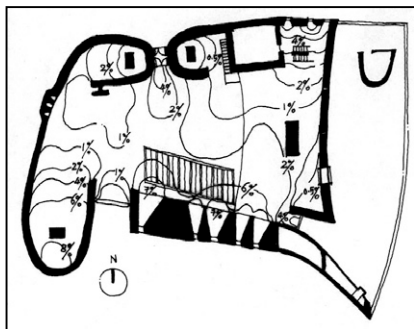


Fig 6. Daylight Factor contour map in Ronchamp - from Lau 2000

The three side chapels have their own distinctive luminous environment under overcast sky conditions. The south-west side chapel capturing most daylight through the north-facing periscope (the biggest one) is the highest brightness zone inside Ronchamp chapel although the light source is concealed and the north light is baffled by the light blades (average daylight factors around 8% and the maximum daylight factors around 10%). The light intensity gradually reduces towards the central nave (daylight factor reduce from 8% to 1%). The west-facing side chapel having an intermediate daylight factor of 2% which is closer to the light levels measured in the nave. The west light brought in by this side chapel balances the relatively strong north light admitted by the north facing tower at a right angle. This is especially significant in the late afternoon when the sun sets.

The east facing side chapel with the interior wall painted red has very low daylight factors (0.1% to 0.5%). This is mainly caused by the low surface reflectance of the curved red wall (around 24%) which is about 1/4 of the reflectance of the white wall (around 88%). This wall reflects little light down the

light tower to the altar, but it tends to help emphasize the candle light in this side chapel.

Although the geometry of the light towers and the illuminance patterns identified in the three side chapels are similar, but the light intensity and ambience created by the light periscopes are never static. Le Corbusier deliberately manipulated the orientation, the size of the light periscopes and the effect of the internal reflectance (i.e. colour and texture) on light penetration to achieve unique contemplative atmosphere in the three side chapels. It is evident that there are two distinctive types of luminous environment in Ronchamp chapel: the dynamic and static light co-exist under the mushroom roof.

#### 4. The Luminous Environment of the Monastery of La Tourette

##### 4.1 The poetics of light in La Tourette

It was soon after Ronchamp was completed that Le Corbusier was asked to design the Dominican Monastery of La Tourette. After having contacted Maurice Novarina, an architect based in Lyons in 1950, at the suggestion of Couturier, the Dominicans put forward Le Corbusier's name in 1952 for the construction of a monastery at Eveux-sur-l'Arbresle, about thirty kilometers from Lyon (Fig.7).



Fig 7. The exterior view of the Monastery of La Tourette - from Lau, 2000

Colin Rowe pointed out the important features in La Tourette are the distinctions of emotional tone which the different levels of the living quarters support. As he described: "There is a movement from the brilliance and lateral extension of the refectory and chapter house (chapel), through the more sombre tonality of the library and the oratory, up to the relative darkness and lateral closure of the cells. There are the progressive degrees of concentration and intimacy" [5].

The author's observation of the variation in spatial experience, fenestration treatment, illuminance level and luminance patterns led to a conclusion that the luminous environment in La Tourette could be classified into three distinctive types as shown in Figure 8:

- 1) Individual light
- 2) Collective light
- 3) Sacred light



Fig 8. Light classification in La Tourette - from Lau, 2000

This subjective observation echoes a study conducted by Ramond Cole et al in 1993, which described the luminous environment based on individual realm, communal realm and sacred realm [6]. Form, aperture, color, texture and light are the key architectural elements that define the three luminous environments. In this paper, the author presents the qualitative and quantitative study of the sacred light.

#### 4.2 The poetics of sacred light in the Church of La Tourette

The church in La Tourette is a space of chilling gravity, force and discipline which the Oeuvre Complète describes as 'of total poverty'. The austerity, the emptiness and the darkness do not distract, but rather force one into one's inner being, to the possible connection with God within. Entering from outside, the church seems a stark cavern. It stops you in your tracks – to adjust to the low light levels and to comprehend the space. The contrast – the dialectic between inside and outside, sacred and profane, the outer world and the inner world is pronounced [7].



Fig 9. The church interior showing Four types of openings at the east end of the church (photo & sketch) - from Lau, 2000

The form of the church fit perfectly into Couturier's idea of a real church: a flat ceiling on four concrete walls without ornaments and decoration. The church sits on the east-west axis, allowing the altar to receive the rising sun. The layout of the church is simple, with the choir stalls occupying the western end; a few public seats at the eastern end and the altar standing between on a raised plinth. The sacristy is located immediately south of the main altar and the crypt to the north. The width of the nave was defined by the necessity of having two rows of stalls on each side and in the middle a space large enough to permit two monks to lie down completely head-to-head in prostration on the floor [8].

Le Corbusier allowed little light entering the church, but he balanced and apportioned it with care. All openings are precisely modulated and carefully positioned. At the eastern end of the church, the darkness is punctuated by four types of openings: a floor-to-ceiling baffled light slot; three light-cannons over the wall between the crypt and the church; two slots that separate the piano-shaped crypt from the main body of the church; and three small punctures around the confessional (Fig.9).

The area under the three light-cannons is perceptually the brightest part of the church (Fig.10). The north altar with the tabernacle rests under the white light-cannon. The light from the light cannons spills into the church, creating a lower, lateral lighting while leaving the upper part of the church in shadowy light. There is a noticeable increase of luminance from the black light-cannon to the white one. This high brightness zone is balanced by the floor-to-ceiling light slot and the light sparks from the three small punctures on the east wall, thus the excessive luminance contrast is reduced. The sidelight coming from this slot also enhances the modelling of the parishioners and the space and form in the eastern end of the church.



Fig 10. The north altar under the white light-cannon - from Lau, 2000

The enclosure of the sacristy is dimly visible in silhouette, with the inclined wall separating the church and the sacristy stopping short to the ceiling, inviting the light to spill into the church. Its form is revealed by the directional light coming from the seven light-guns oriented to allow direct sunlight into the nave at noon on the equinoxes.

The western end of the church, devoted to the Dominican brothers is designed for procession from the ceremonial door, along the central axis of the nave to the choir stalls. This procession is lit by three light sources: an angled skylight, a horizontal slit on

top of the west wall and two sets of horizontal openings on the north and south wall. In the morning, a moving light beam is projected onto the west wall with its black organ chamber. On a clear day, the patch of light is a focused sunbeam registering the morning hours of the day. Under overcast sky, a soft-edged scallop of light falls on the wall. In the afternoon, the west wall recedes into darkness. The slit separating the west wall and the roof was a later addition by Le Corbusier to 'create a glow of light in the darkness high up in the nave' [9]. It signals the upper limits of the wall and the presence of the ceiling.



Fig 11. View to the western end of the church - from Lau, 2000

The colored, horizontal light openings are cut obliquely through the walls above and behind the choir stalls – four on the north and three on the south. The brightly painted sloped sills of the windows obscure the actual opening, hold the light within it and re-radiate the colored light over the stalls to provide illumination for the Dominican brothers to read 'without dazzling the opposite stalls' [10](Fig.12).

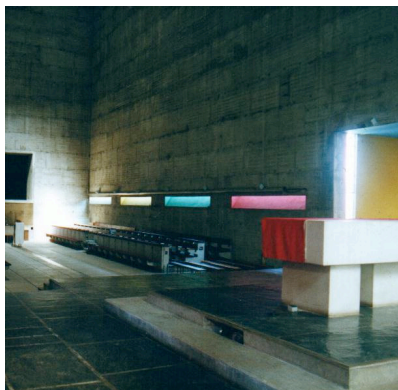


Fig 12. The light slots on the north wall - from Lau, 2000

#### 4.3 The quantitative study of the sacred light in the Church of La Tourette

The isolux contour map indicates the daylight distribution patterns in the church of La Tourette is similar to that in Ronchamp Chapel (Fig.6&13). The average horizontal illuminance contour map indicated an uneven horizontal distribution of light (especially at the eastern end of the church) with four distinctive light zones, and most daylight is distributed over the north side of the church. The low uniformity of 0.01 also suggests the same result. The overall illuminance is low (average horizontal illuminance: 77 lux) with a light zone close to the light slot at the southeast corner of the church, as well as two light

zones below the horizontal openings on the north and south wall at the west end of the church. The north aisle and the adjacent crypt benefit from the high illuminance produced by the light cannons (average horizontal illuminance: 661 Lux). The choir at the western end of the church benefits from the significant daylight contribution from the angled skylight and the horizontal openings. With a symmetrical arrangement, the horizontal openings produce a relatively even light distribution at the western end of the church. Here again, Le Corbusier intentionally introduced a minimum of two light sources to create dynamic balance of light and to bring out the three dimensional quality of the interior space and form. As in Ronchamp Chapel, both dynamic and static luminous environment co-exist here (Fig.13).

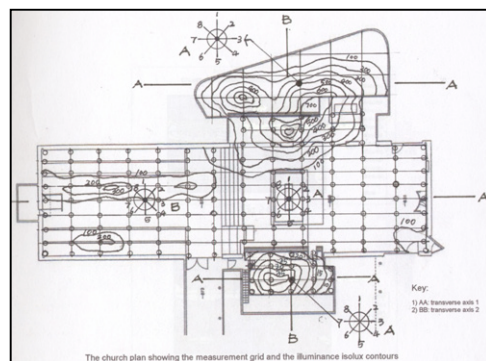


Fig 13. The daylight illuminance contour map in the church of La Tourette – from Lau 2000

### 5. Comparative analysis of Ronchamp Chapel and the Church in the Monastery of La Tourette

#### 5.1 The Lighting language of the sacred realm

In Ronchamp Chapel and the church in La Tourette, Le Corbusier used similar lighting language and vocabulary to define space, to create distinct luminous environment, and to evoke spiritual emotion. In terms of light language, asymmetrical balance of light was introduced to the eastern end of the two structures to create a dynamic luminous precinct, while symmetry of light was introduced to the opposite end to produce a rather calm and contemplative atmosphere.

The key to the sacred light in Ronchamp and La Tourette lied in the careful control of the balance of light and brightness adaptation in the visual field. Apart from the utilitarian role, light as an intangible matter had been used, together with color and form, as visual cues to attract or direct one's attention, to signify importance and to guide one's movement. For creating a relatively stable luminous environment for contemplation, direct sunlight penetration was normally restricted. The deliberate effort to exclude sky glare by using concealed light sources, to stabilize the incoming light and to create contemplative luminous environments through different daylighting apertures was the lighting technique repeatedly used by Le Corbusier.

## 6. Conclusion

Comparing the positioning of the openings and the geometry of the daylight apertures in Ronchamp Chapel and the church in La Tourette, it was evident that Le Corbusier used similar lighting strategies in the sacred realm (Fig.14): Firstly, the symmetry of light was achieved by introducing a minimum of two light apertures at the corners of the space (or the two sides of a space), and this was further enhanced by light tower, skylight or light catcher on the roof. Secondly, direct front light was avoided to reduce the flat silhouette effect, while sidelight was the preferred lighting option for better modelling of the space and form (see Fig.2 & Fig.9).

Thirdly, for creating the sacred luminous environment in Ronchamp and La Tourette, numerous methods for controlling daylight had been developed by Le Corbusier to evoke the spiritual emotion. Light catcher (light towers in Ronchamp, light cannon and light gun in La Tourette), light slot (light slot with shading blades in Ronchamp and light slit in both Ronchamp and La Tourette), and skylight are the three basic lighting vocabularies (means) used to control daylight penetration.

Inside these two sacred structures, although one is secluded from the outside world, the building envelope acts as a solar clock to register the 24 hour day and the luminous environment created by the combined effect of different daylight apertures reminds one of the passing time, the movement of the sun and the constantly changing cosmos beyond. The dynamic luminous balance resulting from the co-existence of both homogenous and non-homogenous light patterns contribute to poetics of the sacred light.

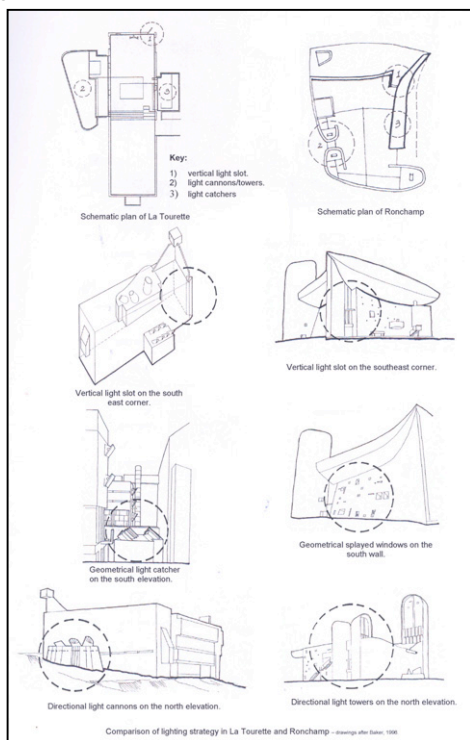


Fig 14. Similarity of the lighting strategy in Ronchamp and La Tourette - from Lau, 2000

## 7. Acknowledgement

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