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# Prehension and qualification of chromatic and lighting environment. Study case – Païmio Sanatorium, Alvar Aalto.

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## Abstract

The case study presented in this paper aims to define the chromatic and luminous character of the Sanatorium Païmio, designed by the architect Alvar Aalto, in order to identify the architect's designs. For it, I based my exploratory work on the development of a chromatic and luminous "identity card" which lists the different colors and lighting modes used. The study is divided into three phases: a color observation, a light observation and the observation of interactive movements. This study highlights the work carried out by the architect on the behavior of chromatic atmospheres under different light and their influence on human reactions, ensuring the most favorable viewing and rest conditions for patients who were staying in his sanatorium. thanks to the combination of the fields of physics, aesthetics, physiology and psychology.

**Keywords:** *Color & light design, Interdisciplinarity, Interior design, Therapeutic environment.*

## INTRODUCTION

The Finnish architect Alvar Aalto, designed in 1932 the Païmio sanatorium, welcoming patients suffering from tuberculosis. This place was supposed to allow patients to enjoy complete rest in optimal conditions. As convalescence can last several years in most cases, the architect wanted an environment conducive to the spirit of community between patients and caregivers; this thanks to the design of facilities and spaces accessible to all, comfortable and aesthetically pleasing. In addition, he designed an architectural composition which aimed to make it itself active during the convalescence of patients, in a functional and biodynamic desire. A very detailed program thus made it possible to match each wing to a particular type of space according to the health needs of patients. For it, the color was one of the major elements in the design of this building, in addition to the particular attention paid to the exposure of each wing according to the different uses.

In fact, one of the founding principles of Alvar Aalto's work at the Païmio sanatorium is the therapeutic application of color. Through the use of various types of psycho-sociological effects, he associated the design of moods with the associations of ideas, both subjective and objective, conveyed by the collective representations associated with colors. For example, a patient may experience a sense of warmth through the use of warm colors. It is a principle that is based on an individual's sensitivity to colors, induced in particular by education and cultural affiliation (Dérivé, 1968). It is with this in mind that the architect decided to rely on Western codes, identifiable and recognized by most of the patients present. But colors also played a major physiological role that did not depend only on these cultural representations. Inspired by chromotherapy, according to which the colors can have a therapeutic action, the polychromy of the sanatorium was to participate in relieving the ailments of the patients by the particular choice of the radiations of certain colors (Kent, 1947) (Dérivé, 1968) in a inspiring work involving the principle of chromotherapy, also called the physiotherapeutic principle according to the experiments carried out between the 19th and the 20th centuries, in particular for the treatment of measles (Chatinière, 1900) or smallpox (Rehns, 1904).

## MATERIAL AND METHOD

The purpose of the following case study is therefore to define the chromatic and luminous character of Sanatorium Paimio. The study is divided into three phases. 1 / Color observation consists of the identification of color samples of architectural elements (floors, walls, joinery, stair railings and balustrades) from photographs and optical matching compared to the colors of the NCS color chart. The same work was carried out on the furniture (tables, chairs, lights). The main spaces are also represented (outdoor environment, reception hall, dining room, meeting room, bedrooms, corridors, stairs) and reproduced in the form of maps to identify the socio-styles used. 2 / The light observation made it possible to identify the different artificial lighting modes used as well as the types of lighting, supplemented by the natural lighting methods. 3 / The observation of interactive movements consists of the observation of all the chromatic variations, according to the principle of reflection of light, and their mutual influences on our perception.

Not having been able to have personal experience of this place, the study was carried out on the basis of the photographs collected. A margin of error is therefore inevitable but considered acceptable; the challenge being to translate a thought and not to develop a reproducible frame of reference. Thus, the chromaticity values identified in this study can, reduced to their spectral property, present a difference of 1 to 2 nm with the original colors for colors ranging from blue to orange, and up to 6 nm for purple. and reds, values corresponding to the threshold of differentiation of the hues in wavelength of the human eye (Wright et al, 1934 as cited in Treméau, 2016). Regarding the lighting data, I was unable to collect the elements relating to the characterization of the light sources. Only the different types, artificial lighting and natural light, were observed. In addition, the photographs did not allow me to identify the nature (matte or gloss) of the paints used or the light reflectance value of the colors used.

## RESULTS

### Phase 1 – Color observation

We observe a large polychromy built around thirty-five shades (figure 1). It falls into four categories of color effects: warm, cool, neutral, and achromatic. We also observe a complementarity between certain colors of the furniture elements, between a blue-green and red, associated with a play of neutrals and punctuated by the use of darks.

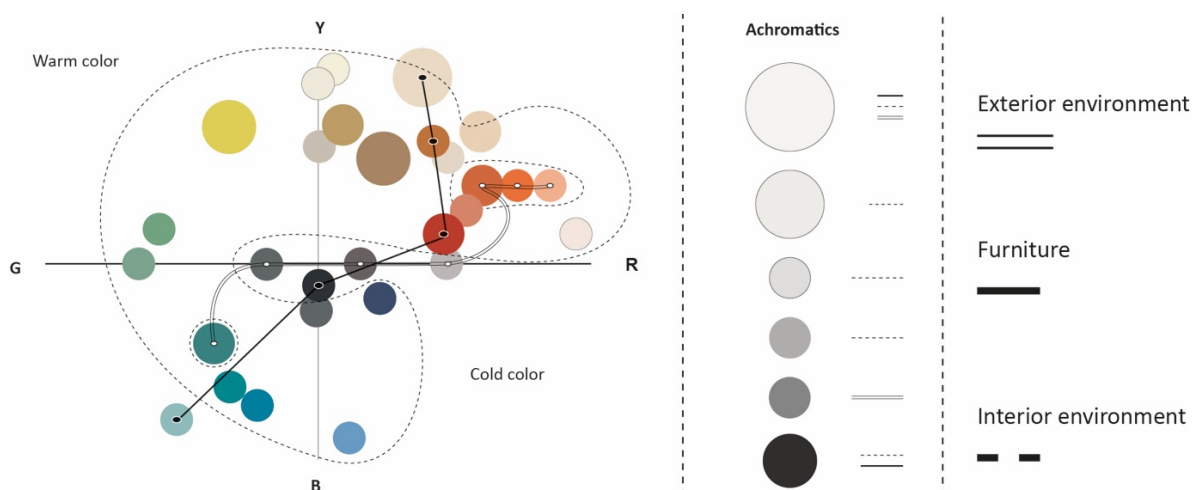


Figure 1: Cartography listing the colors used in the sanatorium program.

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In addition, we observe a majority of warm and achromatic colors, representing almost a third of the colors (table 1). Light colors are mostly used and are the only ones used for warm colors. These nuances are distributed between the exterior, interior and furniture elements. The colors used for the interior environment represent more than half of the shades used for this architectural program.

- Color	Exterior		Interior		Furniture		Total	
	Light -	Dark -	Light -	Dark -	Light-	Dark -	Light -	Dark -
<b>Warm -</b>	6%	-	19%	-	5%	-	30%	-
<b>Cool -</b>	3%	-	5%	1%	2%	-	10%	1%
<b>Neutral -</b>	2%	3%	17%	2%	-	2%	19%	7%
<b>Achromatic -</b>	6%	-	19%	3%	3%	2%	28%	5%
<b>Total</b>	17%	3%	60%	6%	10%	4%	87%	13%

Table 1: Chromatic distribution according to tonality and clarity according to the previous mapping.

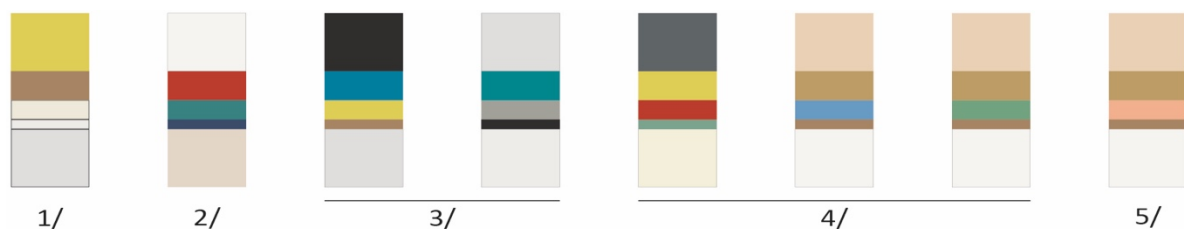


Figure 2: Set of combinations identified according to families of atmospheres previously observed.

Thus, with these color combinations, there are five families of ambience in interior spaces (figure 2): 1 / natural (analogous composition of warm and gradient colors), 2 / dynamic (strong contrasts and predominantly warm colors), 3 / modern (cool colors, strong contrasts), 4 / relaxed (complementary to contrasting colors, neutrals associated with a tonic), and 5 / romantic (neutrals associated with a tonic).

### Phase 2 – Light observation

There are two types of dominant openings intended to capture natural light, the zenithal and lateral opening. On the facades, there are window-bands and large openings completed by a configuration of multiple leaves. We also observe frames with small footprints, except for large openings, as well as roof openings.

	Bedroom	Common area	Passage area	Dining room
<b>Opening</b>	Casement window.	Skylight, window banner, casement window, glass facade.		Glass facade.
<b>Lamp</b>	Wall lamp, portable lamp.	Portable lamp, hanging lamp.	Wall lamp, hanging lamp, recessed lamp.	Hanging lamp.
<b>Lighting</b>	Task lighting, Mood lighting.	Task lighting, Mood lighting.	General lighting, Mood lighting.	General lighting, Mood lighting.

Table 3: Directory of openings, lighting and type of artificial lighting according to the needs of use.

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Regarding artificial lighting, we observe different types of luminaire allowing the production of general lighting (recessed and suspended luminaires), ambient lighting (wall lamps and suspended luminaires) and by task (localized additional light thanks to floor-standing luminaires and portable lamps).

### Phase 3 – Observation of interactive movements

We observe variations in the perception of colors according to four modalities, reflection of exterior elements, interaction with furniture, between two opposite walls, one of which is white, and between two different opposite walls (table 2).





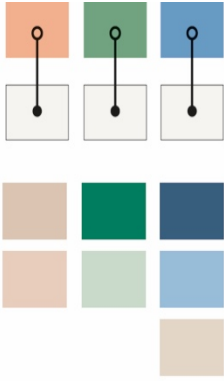
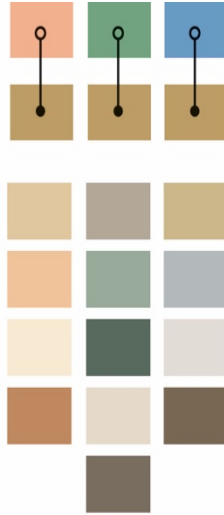
Reflection of exterior elements	Interaction with furniture	Interaction between opposite walls including one white	Interaction between opposite walls of different colors
  			

Table 2: Directory of the different types of chromatic variations resulting from the influence of light reflection on the built environment.

Reflection of exterior elements concerns the impact of the chromatic reflection of blinds when they are deployed. The blinds, blue-green and orange, slide in warmer tones, also operating this slide on the paintings and interior furniture. Blue turns green, neutrals turn blue and pink-orange, dull ones slide towards warm pastels. The interaction with the furniture leads to the observation of many nuances, induced by the shadows cast by the furniture, the reflectance of the floors and / or walls. If the chromatic cast remains present, we can observe a shift towards lighter, darker shades and up to a neutralization of the original color but without distortion of its tonality. Only saturation and clarity are impacted. The interaction between two opposite walls, one of which is white, leads us to observe the lightening of the original color, to tend towards neutralization of it. Conversely, taking physical distance leads to a darkened perception of this tone. Finally, the interaction between two different opposing walls leads to the observation of a play of chromatic complementarity. In the case of the projection of blue on brown, the complementarity of these two colors calls for the brown to become dominant and to cancel the projected tonality; only the nuances of this dominant are perceptible to us, from the lightest to the most downcast, from the most saturated to the most neutral. On the contrary, for a projection of green on brown and rosé on brown, leading to similar associations, the perception of green and rosé are preserved, only undergoing a slight neutralization. We will therefore observe a variation in their saturation, but also in their degree of clarity.

## **DISCUSSION**

The chromatic combinations that we have previously observed can thus reflect an architect's desire to generate a harmonious chromatic scheme, which can generate a general feeling of well-being, comfort and serenity. The colors observed for the external environment create a dynamic landscape through the use of complementary colors. They generate a strong visual imprint, accompanied by achromatics. They could also refer to Western hygienist representations, thus echoing the care provided in the establishment. Neutrals may have been used in order to attenuate the signal effect of the complementary without negating their function as spatial cues and uses.

Thanks to this polychromy, the architect designed multiple atmospheres. The use of cold colors, in the minority and applied to the bedrooms, allowed him to create a peaceful, calm and relaxing atmosphere. On the contrary, warm colors and neutrals refer to comfortable and warm living spaces. Yellow, mostly used in the lobby and meeting spaces, may have been used for its soothing properties on nervousness (assuming nervousness in patients arriving at this facility). Achromatics, for their part, offer spaces for breathing in an atmosphere punctuated and structured around color. The broken complements make it possible for them to neutralize the natural force of the combination of complements to the product of a slight dynamic because indeed “in a case of simultaneous perception [...] a tone turns towards the complement of the opposite tone” (Dumond, 1957). On the contrary, the discordant harmony will accentuate the signal effect and make it possible to emphasize the spatial landmarks. Beyond its modalities of association, polychromy also makes it possible to generate various universes, according to the use given to the spaces, recalling the systems of sociostyles (Kobayashi, 1992) anchored in the collective imagination, according to the needs conveyed by the spaces. actions carried out in the areas concerned. The natural atmosphere induces a comforting image and an impression of serenity conducive to reassuring users, especially when entering the premises, while waiting to take exams or receive treatment. Modern atmospheres, inducing an impersonal image, emphasize the functional character of the spaces. The relaxed atmospheres offer a welcoming and joyful image of these living spaces. The romantic atmosphere is considered ideal for rooms that need to be calm, restful, conveying tenderness and kindness. The dynamic atmospheres are also intended to be joyful and welcoming while encouraging action.

But the sensitive dimension of color cannot dispense with its connection to light, which notably contributes to the development of visual perceptions. Light, whether natural or artificial, can thus be designed to strengthen chromatic qualities but can also lead to their evolution through the reflection of colors on each other. These interactive movements thus make the place active and tend to reveal multiple spaces over the days, the meteorological conditions playing a major role by then modifying the nature of the natural light available and causing variations in the perception of colors. But natural lighting above all improves the well-being and comfort of users, particularly in care practices (Déoux et al, 2011). The different openings then have the role of filtering, conducting and distributing the light in order to maximize its capture. The combination of zenith and side openings then offers optimal autonomy in terms of natural lighting. This combination allows an important light contribution and this throughout the seasons. It also provides optimal exposure to the cyclical rhythm of natural light, known today for its benefits on the circadian rhythm, or biological process, of patients (Zielinska-Dabkowska et al, 2017). But constrained by natural light conditions, it is necessary to use artificial lighting to compensate for natural light variations and thus produce quality lighting, free from the constraints of natural light. The use of different types of luminaire then corresponds to specific functionalities and makes it possible to meet different needs, in particular through the production of general, ambient and task lighting. General lighting is used to ensure the movement of users in corridors and

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passageways, as well as the performance of routine tasks in common rooms. This type of lighting is characteristic of a uniform, diffuse and homogeneous distribution of light, notably thanks to the use of large recessed and suspended luminaires offering direct lighting. Ambient lighting, on the other hand, offers light dedicated to a momentary activity and qualifying a small space. This type of lighting is found in all types of interior spaces. The use of wall lights and suspended lights are thus conducive to the production of localized and diffused lighting. The projection of light, thanks to indirect, semi-direct, semi-indirect and mixed lighting, towards clear surfaces thus ensures the diffusion of a soft and even light. Finally, task-based lighting, or supplemental lighting, results in additional localized light thanks to mixed lighting, combined with general lighting, allowing the execution of tasks requiring a high and focused level of lighting. . Mainly seen in common areas and bedrooms, free-standing fixtures or portable lamps provide this directional light that can be adjusted as needed. Thus, if a well-designed lighting is therefore defined by a sufficient quantity of light and the choice of a device that eliminates visual discomfort by glare, it is advisable to choose and combine lighting modes adapted to the needs and thus make the secure interior space conducive to comfortable living.

## **CONCLUSION**

The social role of lighting should be considered as a factor of good living, just like that of chromatic atmospheres, thanks to the combination of "physics, aesthetics, physiology and psychology" (Dérivé, 1964). It is also a question of being concerned with the behavior of the chromatic atmospheres under the light and their influences on the human reactions, because using the light, it is not only to illuminate, it is to ensure the conditions of vision and of rest the most. favorable, in this case study, to patients staying in the sanatorium..

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