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Laboratoire Langage Traitement Automatique

# SPATIALITIES AND COLOR

International Online Symposium

27th March 2025

# SC'25___Book of Abstracts

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The 1st International Symposium on Spatialities and Color - SC'25

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# WELCOME ADDRESS

**The 1st International Symposium on Spatialities and Color - SC'25**

Dear colleagues,

Warm greetings!

Welcome to the 1st International Symposium on Spatialities and Color - SC'25, which will be held online on Thursday, March 27, 2025. The organizing committee expresses its heartfelt thanks for your valuable contributions to this scientific event.

To mark International Color Day 2025 (ICD 2025), the section 'Spatialities and Color' of the open-access online Encyclopédie Numérique des Couleurs (ENC - https://encyclopedienumeriquedescouleurs.com/) proposes in its inaugural symposium to delve into the study of color as it manifests within spatial dimensions, concentrating on three « colored » human environments characterized by assertiveness, integration, and plurality, drawing upon the theoretical framework of Sloterdijk's spherology. A program of three keynote lectures and nine presentations aim to further a comprehensive understanding of spatialities and color by exploring the dimensions of colors across a holarchical spectrum of material, immaterial, and ambient spaces. They explore the interconnectedness of human experience, color, and space as a form of resonance and engagement. Whith its rich program, SC'25 will serve as a dynamic forum for delegates from multiple disciplines to exchange novel concepts, share practical expertise, and develop global networks for future research and collaborations in the field of spatialities and color.

We are very grateful to everyone who has agreed to contribute to the success of our symposium. May your SC'25 experience be both rewarding and fruitful. We look forward to your participation in future events. Your ongoing support is greatly appreciated.

Best regards,
Symposium Co-Chairs
Verena M.SCHINDLER & Faten HUSSEIN

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# CALL FOR ABSTRACTS

**The 1st International Symposium on Spatialities and Color - SC'25**

On the occasion of the International Color Day (ICD), the section "Spatialities and Color" of the Encyclopédie Numérique des Couleurs (ENC), an open access online color encyclopedia (https://encyclopedienumeriquedescouleurs.com), is hosting its first symposium.

While color has been extensively studied (Roque, 1997; Caivano, 2006; Doherty, 2010; Schindler, 2017; Serra, 2019; Environmental Color, 2023; Engler, 2023), space remains a polysemous concept whose definition is difficult to grasp insofar as it acquires all its richness by being determined through the nature of the relationships that humans establish with it. Shaped by social relations, a space conveys lived experiences (Thibaud, 2015). As such, the term "space" is no longer used, but rather "spatiality". By spatiality, the spatial dimension of social actions is referred to. This notion questions the way in which a user relates to space on a daily basis (Lévy and Lussault, 2013). Widely used in the current vocabulary of geography, spatiality focuses on how individuals interact with and shape the spaces around them (Lussault, 2007).

"Spatialities and Color" investigates color through the prism of spatialities, focusing on three "colored" human universes that are at once assertive, integrative and plural, with reference to Sloterdijk's spherology. (Sloterdijk, 2011, 2014, 2016). Sloterdijkian spherology describes an onto-spatiality that manifests itself in three types of experienced or lived spaces: (a) macrospheres as a global space defined by a terrestrial integration into an inhabited space; (b) microspheres as a human space characterized by a dynamic structure of cohesion devoid of true spatial dimensions; and (c) atmospheres that define a plural space, a kind of reticular structure of phenomena and ambiences. The boundaries between these universes interweave, intersect or dissolve as spatial processes unfold and practices take hold.

We therefore propose a holarchical vision of spatialities at the crossroads of material spaces (materialities: architectural, urban, territorial, landscaped, geographical, etc.), "quasi-spaces" (immaterialities: poetic, digital, artistic, psychological, semiotic, etc.) and ambient spaces (phenomena: luminous, sonic, olfactory, aerodynamic, thermal, etc.) in order to examine a situated perception of color. There exists thus a threefold relationship between human experience, color, and the surrounding space, which can be defined as a resonance, a mode of existence in the world, and a specific type of engagement with it, where subject and world interact and shape each other (Rosa, 2018; see also Griffero, 2014; Böhme, 2017).

This symposium proposes a series of presentations exploring the many dimensions of color intrinsically related to different concepts of spatiality/space, with the aim of producing a general understanding of "Spatialities and Color". Contributions will highlight the nature of the relationship between the space under consideration and the color being studied. They may also address the evolution of color and space over time.

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# CALL FOR ABSTRACTS

**The 1st International Symposium on Spatialities and Color - SC'25**

## TOPICS

Welcome are scholarly contributions from all disciplines including, but not limited to:

**1. Materialities –** Physical, concrete, and tangible spaces that surround us and constitute the basis of research in Design Sciences: Architecture, Urbanism, Landscaping, Environment, Territories, Art, Design, Creation, Lighting Design, Scenography, Space Science, Practice.

**2. Immaterialities –** Abstract and intangible spaces of ideas, concepts, information, and relationships in the Humanities and Social Sciences: Philosophy, Psychology, Sociology, Anthropology, Culture, Aesthetics, Semiotics, Poetics, History, Epochs, Contexts, Time, Performance, Virtual Reality, Transparency, AI, Mobility, Theory.

**3. Ambient Spaces –** Sensory spaces at the crossroads of the perceptible and physical worlds: Atmospheres, Phenomenology, Senses, Sensations, Synesthesia, Multisensoriality, Perception, Emotion, Memory, Consciousness, Experience, Communication.

## ABSTRACT SUBMISSION

All submissions must be sent via email in a single Word document entitled "Last Name 2025 SC Symposium" to ecd.studygroup@yahoo.com no later than 14 March 2025 and include the following items:

**1)** an abstract (500 words)
**2)** a short bio
**3)** your full name and pronouns, email address, and professional affiliation. Please use "2025 SC Symposium" in the subject line of the email.

Participation is free. No organizational registration is required. Presentations should be given in English and not exceed 15 minutes.

## SYMPOSIUM WEBSITES

http://www.aicecd.org/index.php?article_id=5&clang=2 - please see References here
https://encyclopedienumeriquedescouleurs.com/appel-a-contribution/

## CALENDA FRENCH&ENGLISH CALLS

https://calenda.org/1236862

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# SYMPOSIUM COMMITTEES



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# SYMPOSIUM PROGRAM

https://www.encyclopedienumeriquedescouleurs.com/

**The 1st International Symposium on Spatialities and Color - SC'25**

**27th March 2025**

**9:00 - 9:15 CET**

**Welcome Session**

Introduction to the Symposium: Verena M.SCHINDLER & Faten HUSSEIN
Introduction to the Encyclopedia Project: Cecile CROCE & Ramzi TURKI

**Session Chair: Verena M.SCHINDLER**

**9:15 – 9:45 CET**

**KEYNOTE 1**

**Juan SERRA**, Material and immaterial colors in interaction - Regarding a homage to the square by J. Albers at RIT, Universitat Politecnica de Valencia (Spain)

**9:45 – 11:00 CET**

**SESSION 1. MATERIALITIES**

Color and the Physical, concrete and tangible spaces that surround us and constitute the basis of research in Design Sciences

**Stig EVANS and Jonathan GILHOOLY,** Colour conundrum – Origins of a parlour game, (UK)
**Margarida GAMITO,** UrbanCroma - Chromatic planning methodology, Universidade de Lisboa (Portugal)
**Anna REZENDE,** The complexity of the creative process in urban color design - Strategies and possibilities**,** University of São Paulo (Brazil)
**Q&A**

**Session Chair: Juan SERRA**

**11:00 – 11:30 CET**

**KEYNOTE 2**

**Imène SLAMA et al.**, What about spatialities and color? University of Sousse (Tunisia)

**11:30 – 12:45 CET**

**SESSION 2. IMMATERIALITIES**

Color and the Abstract, intangible spaces of ideas, concepts, information, digitalization, and relationships in the Humanities and Social Sciences

**Hadjer BELKACEMI et al.,** The role of Artificial Intelligence in preserving and enhancing the color and spatiality of desert heritage,University Mohamed Kheider (Algeria)
**Mariam LIMAM,** Spatiality and color in the perceptual experience of quantum art installations, Université du Québec à Montréal (Canada)
**Beatrice SARTI et al.,** On the need for spatial component in describing color vision deficiency**,** University of Milan - Aerospace Medical Institute (Italy)
**Q&A**

# SYMPOSIUM PROGRAM

**The 1st International Symposium on Spatialities and Color - SC'25**

**27th March 2025**

**Session Chair: Faten HUSSEIN**

**12:45 – 13:15 CET**

**KEYNOTE 3**

**Andreas RAUH**, Dust atmospheres - Perceptions shaping spatiality, Faculty of Human Sciences in Würzburg (Germany)

**13:15 – 14:30 CET**

**SESSION 3. AMBIENT SPACES**

Sensory spaces at the crossroads of the perceptible and physical worlds

**Zélia SIMÕES,** The humanisation of industrial landscapes - Atmospheres of light and colour, Universidade de Lisboa (Portugal)

**Emmanuelle PERRAUDEAU,** Ecstatic color - The case of A.V. Janssens' stained-glass windows, Université Paris 8 – Vincennes Saint-Denis (France)

**Stine LOURING,** You make me feel like dancing - How coloured illuminations make us move in space, Aalborg University (Denmark)

**Q&A**

**14:30 – 15:00 CET**

**Wrap Up Session**

Reflections on the Future of the ENC SC Section

# TOPIC 1.

# MATERIALITIES ABSTRACTS

# Material and Immaterial Colors in Interaction

## *Regarding a Homage to the Square by J. Albers at RIT*

Juan SERRA[1], Michael MURDOCH[2], Mekides ASSEFA[3]

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***Abstract.*** When a group of uniform colors interact on a flat surface, they can be interpreted as being material or immaterial finishings, opaque or transparent, having different spatial positions. These phenomena were experienced by Joseph Albers (JA) in his artwork, particularly his Homage to the Square series, with over 2,000 paintings experimenting with color interactions. At Rochester Institute of Technology (RIT) campus, JA created one of his rare large-scale Homage to the Square murals titled Growth, with two opposing murals in the lobby of the administration hall.

We developed a detailed study of JA's artwork Growth, and based on archival research and on-site observations, interpret how its geometric composition and color interactions create material and immaterial effects and make possible different spatial layering interpretations.

The composition of Growth follows the structural principles of JA's previous works, using four nested squares arranged to create illusions of depth. Three variables affect the spatial perception of these colors: (1) the inherent layering effect of each color that appears to be on a different illusory depth level, (2) the opacity vs. transparency of some squares that seem material or immaterial, and (3) the interpretation of the colors as solid squares vs. frames with central openings.

In the northern mural, colors appear as overlapping opaque squares, with the central yellow seemingly closest and the darkest orange furthest, while in the southern mural, colors appear to be a sequence of nested frames with a recession into the wall. These effects align with traditional color theories: lighter, saturated colors advance, while darker, muted colors recede. Nevertheless, other possible color interpretations of transparent colors overlapping opaque surfaces make this initial understanding of optical color depth perception richer and less obvious. Moreover, the squares in Growth align their geometric vanishing points with the real architectural perspective, creating a "mock-up" that integrates painted and built environments. Therefore, these flat colors

painted on a wall appear to have spatial connotations that go beyond 2D and interfere with the evaluation of distances and size of a real 3D interior architecture.

Building on JA's principles, we also tested at RIT Munsell Color Lab, how color influences spatial perception in interior design using VR. We designed experiments where participants judged room sizes and wall distances based on color variations, revealing slight significant differences in perceived spatial size due to color. An interesting finding was that rooms with light ceilings and dark floors appeared taller than those with reversed color schemes in a composition with nested squares, following JA's.

Our study confirms that color interactions influence spatial perception, both in Josef Albers' large-scale murals and in virtual interiors. JA's Growth successfully demonstrates that color depth perception is contextual rather than absolute. While the VR experiments highlight how color composition affects spatial interpretation. Future studies could further explore these effects to enhance architectural design.

***Keywords: architecture, color, Albers, square, space, layer***

## Selected References

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# Colour Conundrum

## *Origins of a parlour game*

Stig EVANS[1], Jon GILHOOLY[2]

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***Abstract.*** Colour Conundrum was fabricated by artists Stig Evans and Jonathan Gilhooly, for the purpose of exhibition. The two artists share an interest in the instability of visual perception, and its potential for illusionistic or deceptive manipulation. In his practice, Gilhooly has deployed some of the objects, strategies and concepts of 'secular' magic (conjuring) as a means of examining how the effects of the magic illusion might position the viewer in relation to a set of beliefs about the world. Evans' work investigates concepts of visibility and perception; he uses colour to explore our visual acuity, how we perceive, represent and respond to it, through its historical, chemical and physical - but also its immaterial - nature.

The two artists developed the idea for a visual 'parlour' game, broadly based upon popular 19th century optical devices such as the Stereoscope and Praxinoscope, and more specifically upon residual evidence of the work of Victorian polymath Charles Albert Keeley. The aim was to provide a live platform for the appraisal and evaluation of such historical devices within a contemporary cultural context in which the visual has become simultaneously dominant whilst increasingly relinquishing its representational function as guarantor of the 'real'. This was predominantly a piece of practice-based research whose methods grew out of the artists own creative practices, as well as from background research into some of the scientific and quasi-scientific developments of the late 19th and early 20th century, in which positivist explanations of visual phenomena overlapped with forms of display and performance that were driven by pedagogical and entertainment imperatives. The London 'Royal' Polytechnic and the Egyptian Hall were just two such sites wherein the visitor would have been afforded "the means of obtaining a general knowledge of the processes by which the wonders of art and manufacture are produced" (During 2002). Johannes Itten's treatise on *The Elements of Colour* - in particular his ideas regarding luminosity and contrast - were also instrumental in providing a backdrop and conceptual impetus for the project. Nineteenth-century optical devices are cited by Jonathan Crary (1990) in his book *Techniques of the Observer* as a means of articulating what he describes as the emergence of a new "observing subject who is both the historical product and the site of certain practices, techniques, institutions, and procedures of subjectification" during the first half of the 19th century. This new, observing subject is therefore an embodied, rather than a

passive, observer, but also one who becomes enmeshed in newly forged "arrangements of forces out of which the capacities of an observer are possible" (Crary 1990). Keeley's own interest in the spatial, experiential capacities of colour, can be seen as an adjunct to the assemblage of optical instruments that were frequently deployed as both phantasmagoric spectacle and scientific explication, in London venues during the late 19th century.

***Keywords: colour, Victorian era, parlour game, illusion, magic***

## References

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# UrbanCroma

## *A Chromatic Planning Methodology*

Margarida GAMITO[1,2,3]

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3. Study Group on Environmental Colour Design – AIC, International Colour Association
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***Abstract.*** This presentation is about UrbanCroma, a chromatic planning methodology developed during the research for a PhD thesis (Gamito 2012), and then, inserted as research work in a postdoctoral applied investigation (Gamito 2022) which main aim was to test and validate it. The main purpose of UrbanCroma was the elaboration of chromatic plans for Urban Furniture, allowing the full performance of its functions. Likewise, the chromatic plans defined by the application of this methodology, transformed Urban Furniture in a factor of inclusivity, as its elements become more visible and legible, standing out from the surrounding built or landscape environment. Also, Urban Furniture becomes an identification and orientation factor, since its elements will constitute harmonic chromatic sets that contribute to the identification of the neighborhoods or urban areas and, by their variation, constitute orientation landmarks throughout the landscape.

In order to achieve these purposes, UrbanCroma was applied in two municipalities in the Lisbon neighborhood, with similar characteristics. In each municipality, three different localities were chosen, encompassing social neighborhoods, traditional settlements and modern building urbanizations, allowing the application of UrbanCroma to a wide range of neighborhoods and the comparison between the two case studies. In every case study, the application of the methodology started by the choice of sample areas, which encompassed the most representative zones of the case study, applying there the new methodology to all furniture elements, in order to increase their potentiality as relevant issues for city color planning. In these intervention areas, every present color in the built or landscape environment was recorded, taking into account the changes due to climatic variations and the non-permanent colors, whose presence has enough relevance to be considered as environmental colors.

However, the colors that need to be recorded in the chromatic survey of the different urban areas are often outside the physical range, which prevents a measurement in the traditional way. Thus, due to this difficulty and in order to

establish the proportionality of the colors present in each neighborhood/urban area, the UrbanCroma Module - MUC - was created (Gamito 2022) . This Module, which corresponds to the area of a wall with the height of one floor and is wide enough to encompass a door and a window, includes subdivisions that allow the evaluation of dimensions of smaller areas. The application of this module to the facades, in the appropriate scale, allows the definition of the percentage each color is present in every building and, in sum, in each street and urban area.

The collection of these colors, which were registered on files and maps in order to create a database for the identification of all environmental colors, enabled the establishment of the local dominant colors, which, along with the contribution of local history and culture, constitute the scientific basis upon which very comprehensive and scientific chromatic plans for urban furniture were established.

Besides the main application, the research results proved that UrbanCroma could be applied whenever there is a need to establish chromatic harmonies or contrasts in interior and exterior spaces, and when there is a need to highlight or integrate any element in the environment.

***Keywords: UrbanCroma, color methodology, environment, chromatic plans, inclusivity***

## References

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# The Complexity of the Creative Process in Urban Color Design

## *Strategies and Possibilities*

Anamaria REZENDE[1]

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***Abstract.*** The German philosopher Peter Sloterdijk, in his foam theory Spheres III (Sloterdijk 2009), allows us to relate the characteristics of spatialities to the experiences lived within them. This article presents a chromatic project for an urban space and discusses the complexity of the design process, which connects the community, material spaces, quasi-spaces, ambient spaces, and the universe of color.

For Sloterdijk, the world is not monospheric but multispheric. This perspective dialogues with the construction and structuring of an urban chromatic project, which involves multiple layers of language, spatiality, and community – interlinked spheres within the same foam. Each element of the project is unique, mutable, and fragile, forming a dynamic and malleable whole, whose richness manifests in the interaction of its colors and combinations.

Color, through contrasts, values, saturation, tones, and proportions, complements spatial perception by revealing forms, depths, and planes (Petit et al. 2018). As a psychophysical phenomenon, environmental color is perceived along with variables such as textures, materials, and visual boundaries, establishing a communicative relationship between the individual and the physical environment (Suárez et al. 2018). In the urban space, color reflects anxieties, desires, and cultural identity, contributing to the construction of a sense of place (Suárez et al. 2018).

The experimental process of a chromatic project will be presented, incorporating color cartographies, the use of 3D models, and augmented reality for visualization and prototyping. The creative process was grounded in the theoretical contributions of Peter Zumthor (2006) and Juhani Pallasmaa (2011), who emphasize the synergy between theory and practice, as well as the importance of sensory perception in architecture and design.

For chromatic analysis, semantic image panels are used (Bestley and Noble 2013) to identify dominant colors and create chromatic palettes. These palettes were organized based on qualitative and quantitative relationships (Cassidy 2008). The project development followed five methodological stages, based on the studies

of Hanington and Martin (2012), Kumar (2012), and Friis (2015). The first four—Collection, Comprehension, Concept, and Communication—were guided by Friis' (2015) Co-Creation Cards, while the final phase incorporated the verification of the project using Augmented and Virtual Reality.

The results reinforce that chromatic intervention projects in urban spaces are complex processes. Just as Sloterdijk proposes a multispheric vision of reality, where spheres interact unpredictably and interdependently, the chromatic design process also emerges as a dynamic system. Each color choice, materiality, and sensory perception is not isolated but responds to interconnected layers of meaning, atmospheres, and urban experiences.

In this context, the development of a chromatic project goes beyond the simple determination and application of palettes: it becomes a field of tensions, adjustments, and experimentations, where color acts as an articulating element between space, its inhabitants, and its collective identity. This approach leads us to rethink the role of the designer not as a mere applier of aesthetic solutions, but as a mediator of forces that structure spatial experience, navigating a fluid, sensitive, and open-ended creative process – just like Sloterdijk's foam bubbles, which touch, change, and coexist in a delicate balance.

***Keywords: urban color design, spatiality and atmosphere, chromatic design process, color narratives, augmented reality in urban design***

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# TOPIC 2.

# IMMATERIALITIES ABSTRACTS

# What about spatialities and colour?

## *A literature review*

Imène SLAMA[1], Ichraf AROUA[2], Wiem ALIMI[3], Nadia BOUZGARROU[4]

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***Abstract.*** Spatiality is a paradigm that refers to "a geography of social practices" and explores how people interact with their environment and the space that surrounds them. In this human interaction, colour plays a key role as a spatial mediator. It influences the way in which spaces are perceived and lived. Colour also has an impact on different spatial experiences; it affects human emotions, reactions and interactions. Thus, each experience is seen and experienced differently depending on individual cultural and social background. This is what shapes different spatialities and colour experiences.

This paper focuses on the relationship between spatialities and colour. What are the concepts, methodologies and tools that can be employed to study the correlation between spatialities and colour? How do they redefine the integration of colour as a spatial mediator through its materiality, immateriality, and ambient dimensions? The aim of this paper is to establish a theoretical framework related to the theme of colour and spatialities and to evaluate its relevance. The methodology is based on a literature review of research papers published by the International Colour Association (AIC) over the last ten years. Criteria were defined to classify the literature review into three main topics: materialities, immaterialities and ambient spaces.

Results demonstrate that there are many relevant concepts related to colour and spatiality, such as polychromy, chromatic identity, colour as emotional material and supergraphics. Chromatic identity is the most recurring concept in the literature review (44% of scientific papers). It emphasizes the importance of color in creating space identity that reflects the social and cultural context. There is also an interesting diversity of methods and tools from different disciplines such

as environmental psychosociology, architecture, urban planning, history, etc. The most defined method is colour analysis (22%) and Jean-Philippe Lenclos' "Geography of Colour", which showcases how colour evolves as a living material reflecting the variety of identities and heritages. Among the tools, the chromatic palette (45%) is the most recurring, followed by the chromatic plan and the chromatic survey. They contribute to the analysis of users' colour experiences, their preferences, perceptions, and emotions. Thus, colour is a material that shapes emotions.

This theoretical background demonstrates the important role of colour in material spaces, quasi-spaces (immaterial) and ambient spaces. Diversity and complexity of concepts, methods and tools in scientific papers endorses the idea that colour goes beyond its aesthetic role to play an emotional, social, ambient and even therapeutic role.

***Keywords: spatialities, colour, materialities, immaterialities, ambiances***

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# The Role of Artificial Intelligence in Preserving and Enhancing the Color and Spatiality of Desert Heritage

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***Abstract.*** Color is a fundamental element of desert heritage, shaping the perception of architectural and natural landscapes. However, climatic factors, such as solar radiation, wind erosion, and humidity, accelerate the fading and transformation of colors over time. The challenge of preserving these chromatic identities necessitates innovative approaches beyond conventional conservation methods. Traditional restoration techniques often struggle to accurately replicate the original pigments due to the lack of precise documentation and the complexity of natural color degradation. In response, Artificial Intelligence (AI) is emerging as a transformative tool that enhances color preservation through advanced computational analysis and digital restoration. This study examines the role of AI in analyzing, restoring, and enhancing the colors of desert heritage. By integrating AI-driven digital documentation, spectral imaging, and deep learning techniques, it becomes possible to accurately map and reconstruct historical color schemes. Machine learning models analyze faded pigments, predict original hues, and generate precise virtual restorations that maintain the integrity of heritage sites. AI algorithms trained on extensive databases of historical artifacts help detect underlying pigments that are no longer visible to the human eye. These models reconstruct missing colors based on contextual analysis, ensuring that restored hues align with the original aesthetic and cultural significance of the site. Advanced AI-powered image processing enables automatic detection of color alterations over time, allowing conservationists to track degradation patterns and apply preventive measures. Predictive analytics assess environmental risks, such as pollution and climate fluctuations, and forecast their potential impact on heritage color stability. By leveraging AI-enhanced color monitoring, heritage professionals can implement data-driven strategies to prevent further chromatic loss and develop long-term conservation plans. Additionally, AI-driven visualization tools, including augmented reality (AR) and virtual reality (VR), provide immersive reconstructions of heritage sites, offering researchers and the public an interactive exploration of historical color compositions. These digital restorations help bridge the gap between past and present, allowing audiences to experience heritage sites as they originally

appeared. Such engagement fosters a deeper appreciation for desert heritage and promotes awareness of the importance of color conservation. Ethical considerations play a crucial role in AI-assisted color restoration. The accuracy of AI-generated colors depends on the quality of the training data and the interpretation of historical records. Ensuring that AI models respect the authenticity of cultural heritage while enhancing visual perception remains a key challenge. Collaboration between conservationists, historians, and AI specialists is essential to refining these models and preventing digital misrepresentation of historical color palettes. By bridging traditional conservation techniques with AI-enhanced methodologies, this research highlights the importance of digital tools in safeguarding the color legacy of desert heritage. The findings contribute to broader discussions on spatial perception, materiality, and the role of technology in cultural sustainability. AI not only aids in preserving the past but also provides new avenues for experiencing and understanding heritage through innovative digital platforms. As AI continues to evolve, its applications in heritage conservation will become more sophisticated, offering enhanced precision in color analysis and restoration. Ultimately, integrating AI into heritage preservation practices ensures that the unique.

***Keywords: artificial intelligence, desert heritage, color preservation, digital restoration, spatial perception***

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# Spatiality and color in the perceptual experience of quantum art installations

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***Abstract.*** Quantum art is an artistic approach inspired by the concepts of quantum physics. These concepts, such as state superposition, entanglement, and indeterminacy, have revolutionized the classical perception of reality and the world around us. Quantum art is now an expanding field of experimentation, explored in painting, sculpture, digital art, and virtual reality. It is part of a broader reflection on perception, reality, and consciousness. In essence, quantum art emerges from the convergence of science and art, where artists visually and experimentally translate abstract concepts from quantum physics. Artists associated with this "movement" (Morales 1990) play with the deconstruction of space, transforming its perception from tangible materiality to a fluid and fluctuating immateriality, where traditional spatial references dissolve. They often use light and color, optical illusions, algorithms, or dynamic interactions to represent simultaneous multiple states, superimposed realities, or phenomena invisible to the naked eye, leading us to ask the following question: how do contemporary immersive artworks use light and color to recreate a dynamic spatiality inspired by quantum principles?

This question addresses the perception of ambient space in these artistic productions. Through a corpus of contemporary quantum artworks, we aim to examine how color and light structure, alter, or dissolve space in resonance with the paradoxes of quantum physics, thus shaping a new perception of reality.

We will focus on Quantum Memories by Refik Anadol (2020), Quantum Chaos by Paul Thomas (2022), and Silent Fall by A.A. Murakami (2021). We believe that the interaction between color, light, optical illusions, and spatiality in these immersive works does not merely represent quantum principles but enacts them sensorially. These installations become ever-evolving ambient spaces, where the boundary between void and fullness, fixed and fluid becomes porous, and where the spectator plays an active role, just like the observer in a quantum system.

To validate this hypothesis, we rely on the theory of immersive installation as a site of sensory experience, according to the aesthetic and phenomenological approach of Alain Alberganti (2013). The author adopts a dual perspective: understanding the aesthetic mechanisms of installation and exploring how it is experienced by the spectator in relation to space. Alberganti examines how immersive installation generates a global sensory experience, where elements

like color and light transform space, highlighting the central role of the spectator's body, which "inhabits the space" and becomes a key actor in the interpretation and construction of the artwork. This approach will allow us to link immersive spatiality to the optical properties of light and color (iridescence, transparency, luminescence) in the spectator's experience, explaining how ambient space becomes fluid, evolving, and interactive. These notions of perpetual movement and transformation resonate with quantum aesthetics and probabilistic principles, notably those of indeterminacy and quantum superposition (Heisenberg 1927) as well as quantum decoherence (Zeh 1970).

Thus, by establishing a link between immersive spatiality and quantum principles, this approach opens new perspectives on how contemporary art explores space as a field of experimentation, where light and color act as modulating forces, introducing a dimension of uncertainty and continuous transformation, mirroring the quantum world.

***Keywords: spatiality, color, quantum art, installations, perceptual experience***

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# On the need for spatial component in describing color vision deficiency

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***Abstract.*** Color deficiency is a visual anomaly that results in an altered perception of colors that affects approximately 8.5% of the male population and about 0.5% of the female population (Birch 2012; Hunt 2016). This condition generally arises from the malfunctioning of one (rarely more) of the three types of retinal photoreceptors, called cones (Melillo 2017).

So far, color vision deficiency has been described based on the principles of classical colorimetry, which focus on pointwise color information (Judd 1943). In fact, both diagnostic methods and color blindness simulators rely on this approach. According to these colorimetric models, individuals with a specific type of dichromacy (protanopia, deuteranopia, and tritanopia) perceive all colors along a given confusion line in the CIE xyY color space as identical. This reflects the reduced ability to discriminate certain wavelengths due to altered spectral sensitivity. This principle has been fundamental in designing various diagnostic tests, such as Pseudo-Isochromatic Plates (PIP) like the Ishihara test, the Anomaloscope (Birch 1982), and the Farnsworth-Munsell Color Vision tests (Farnsworth 1943). Similarly, many color vision deficiency simulators have been developed, including Viénot (Viénot 1999), Vischeck (Brettel 1997), Coblis-V1 (Coblis V1), Coblis-V2 (Coblis V2), Machado (Machado 2009). These simulators accept RGB images as input and map them to the color space corresponding to the dichromatic vision of interest using a suitable pixel transformation matrix. This matrix can be obtained with different methods and can be dependent on several factors such as the spectral sensitivity functions used, normalization factors and spectral power distribution of the RGB primaries of the chosen color space. These differences result in significant variability across simulators, leading

to inconsistencies in their outputs. More importantly, all these simulators operate on a pixel-by-pixel basis, disregarding the spatial processing mechanisms of human vision. By ignoring these factors, current simulators provide only a limited and simplified representation of how color-deficient individuals perceive the world. This highlights the need for new approaches that incorporate the spatial dimension of color vision.

Color vision in fact cannot be fully explained by retinal mechanisms alone since it has been proved that spatial interactions play a significant role in color perception: current research supports in fact that spatial comparison throughout the visual pathway is fundamental for color perception (Becatti 2025), and shape recognition appears to reinforce this spatial mechanism through edge detection and gradients' compensation (McCann 2017).

Even though the role of spatial processing in vision has been widely demonstrated, only a few studies provide evidence of this phenomenon in color vision deficiency (Eschbach 2014; Rizzi 2014; Eschbach 2021; Eschbach 2022). These studies demonstrate how small changes in spatial or contextual features can significantly impact the performance of color-deficient observers.

This contribution aims to raise awareness within the scientific community that color perception - both in color-normal and color-deficient observers - cannot be studied solely with a pointwise approach but must be examined within a broader spatial context that accounts for the complex interactions occurring throughout the visual system. This consideration becomes even more important when studying color vision deficiency, where the limited existing research has yet to capture the full extent of spatial effects on perception.

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***Keywords: color deficiency, color blindness, dichromacy, color in context, spatial processing in vision.***

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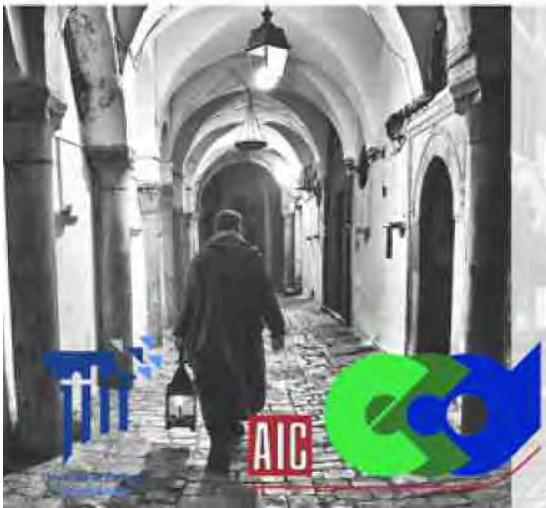
# TOPIC 3.

# AMBIENT SPACES ABSTRACTS



# Dust Atmospheres

## *Perceptions Shaping Spatiality*

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***Abstract.*** The grey of dust bunnies in today's room corners arises from a mixture of differently sized, coloured, material particles – an almost uncountable number of primarily textile fibres that only become clearly visible under a microscope. On a larger scale, the various dusts in indoor and outdoor spaces are the condition for the possibility of colour (Soentgen 2022, also Amato 2000); one might think, in physical terms, of sunsets, Sahara or pollen dust deposits in cities, dust in workshops, or in the cobwebs of attics.

This physical-material dimension directly points to a material-aesthetic dimension: Humans are surrounded by the (material) qualities of these spaces in natural and architectural environments and are present in these environments in two ways: with their where-being and their how-being (Rauh 2018). These spaces become emotionally tinged atmospheres in this relationality, similar to meteorological atmospheres, surrounding and shaping people and materials (Böhme 1995, with an aesthetically sharpened phenomenological perspective long before Sloterdijk's elaborations). In these atmospheres, everything that is sensually perceived – everything visual, auditory, tactile, olfactory, gustatory – becomes a perceptual material whose materiality is aesthetically effective, felt-bodily perceived, and in a special way shapes the respective space (Rauh 2018).

My contribution aims to highlight the connection between the meteorological/physical and felt-bodily/aesthetic sphere of 'atmosphere' (and partly 'landscape') using the paradigmatic material 'dust'. The discussion is based on concepts of atmospherology (Böhme 1995, Griffero 2014, Böhme 2017) and new materialism (Hoppe & Lemke 2023, Ingold 2007) – in the sense of the holarchic relatedness of phenomena and materialities.

It becomes clear that in design contexts of atmospheric spatialities, colour plays a significant role (also due to ocularcentrism). The spatial situation is not a passive background: The use of colour makes atmospheric offers for embedding, in which the material, coloured in a certain way, can also become a non-human actor. However, various factors (such as repurposing and recoding) can also lead to the coloured individual elements becoming a grey of a structural-unstructured togetherness. This does not require a comparison with the small (dust) or the large (atmosphere) – it also becomes clear in our everyday perception of

'landscape' that and how elements of perception shape the specifically sensed spatiality.

Artistic examples show the role of colour in atmospheric settings such as in ways of landscape. And they will also show that dust is a material paradigm of an everyday material that is always and everywhere present and is perceived in different qualities depending on the quantity (Rauh 2024). In its material composition, it indicates that random colour mixtures lead to colour indifference. In its inconspicuousness, it points to the atmospheric relationality that must be repeatedly highlighted in practice-oriented perception theories. And in its fundamental presence, it refers to the aesthetic-atmospheric perception that encompasses the senses and the entire felt-body, sensing the space even before it is shaped by social actions.

***Keywords: atmosphere, dust, landscape, materiality, perception***

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# The Humanisation of Industrial Landscapes

## *Atmospheres of Light and Colour*

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**Abstract.** Throughout the history, the industrial activity in the territory has created an economic, technological, physical and social reality, that is reflected in the landscapes through specific constructions, objects and atmospheres. These structures or elements are themselves pieces of history and culture that transform the morphology and memory of the places where they are located (Mumford, 1934 [2018], Giedion, 1948 [2013]). However, the technological advances as well as the obsolescence of machinery and procedures, continually forces to replace, reuse or maintain the structures or elements, in order to respond to new functional, productive and human needs. Light and colour are cohesive "representations" that reinforce the values and significances of an industrial landscape and affect consciously or unconsciously the human being. As these elements interact in a complex way, they function as instruments for mediation and construction of our space experience (Fridell Anter and Klarén, 2017; McLachlan, 2022). This leads to an emergent interest in analysing and interpreting how the 'resonance of materials', spatially arranged, contribute to the notion of 'humanisation of industrial landscapes' and 'healthy landscapes / workplaces' with a specific 'atmosphere' (Pallasmaa, 2014; Böhme, 2017, Robinson, 2021). This understanding and research into the transformation of the industry atmosphere, towards a more humanised and holistic approach, provides an opportunity to change theoretical and practical paradigms. Therefore, the 'humanistic principles' (Aalto, 1982), which are difficult to measure, include several characteristics that are related directly or indirectly to the human being in all its dimensions. A 'productive' humanised space avoids physical, psychological and sociological uncomfortable symptoms. Wilson (1953), Frieling, (1982), Birren (1988), Mahnke (1996), among others, identified attributes that contribute to: the enrichment of the human being experience with the space and the qualification of the industrial atmospheres. Interdisciplinary and transdisciplinary planning principles also emphasise the spatial experience and the sensory interaction of light and colour. This led to the creation of the 'Human.LightColour' (Humano.LuzCor) methodology, which is based in the observation and critical analysis, in the selected examples of the following principles: environmental, spatial, functional, social and sensorial. Purposing to reinforce the importance of raising awareness in order to rediscover the

relationship between built and lived space in its different dimensions: physical, social and emotional, the aim of this presentation is to highlight a generation of international architects and colour-light consultants whose work contribute to the development of an interdisciplinary knowledge of light and colour. Moreover, it will focus on urban and rural contexts providing insights from both perspectives and illustrating the significance of spatial and material practice through the logistical challenges of the site. Although, such an approach involves an element of risk, suggest that it is possible to enhance an atmosphere that led through various stimuli to a 'sensitive world', where space and objects have practical, aesthetics, and symbolic meanings. This scope of knowledge expressed in different disciplinary areas in a constant interrelationship and with diverse definitions that are not always in agreement, permeates human perception and the way of existing, from objective and subjective domains that are related to its needs.

***Keywords: industrial landscapes, humanisation, health-wellbeing, atmospheres, light-colour***

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# Ecstatic color

## *The case of Ann Veronica Janssens' stained-glass windows*

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***Abstract.*** "[...] and suddenly the sensitive [world] takes hold of my ear or my gaze, I give a part of my body, or even my whole body, to this way of vibrating and filling the space that is blue or red" (Merleau-Ponty 2006, 256). In the Saint-Vincent Chapel in Grignan, pierced by monochrome stained-glass windows created by Belgian artist Ann Veronica Janssens, it is here an ultramarine blue, there a fluorescent green, a deep amber, or a powdery pink that are filling and making the religious space vibrate. Regarding her work in the chapel, the artist herself mentions what she calls a "song of colors," an "energy," an "intense, vibrant color movement," as it happens (Janssens 2024). It is as if the glass paste monoliths, despite their massive materiality, were pulled out of themselves to project into the sacred space, through the color they radiate. Developing his concept of atmospheric ecstasy in his Aisthetics (2020), Gernot Böhme presents, theoretically, a very similar idea. Ecstasy refers, in his own words, to the way things "move forward us in the perception" (Galland-Szymkowiak, 260), or, more simply, "catch our eyes" (Böhme 2020, 167). After a rigorous aisthetic fieldwork (Rauh 2017), we can affirm that in the case of the chapel, color is initially a mute promise, discretely ecstatic. Color is first still imprisoned in the solid rigidity of the sculpted and dull outer glass, and in the thickness of the architecture. Upon entering, the phosphorescent green floods the lines and arches of the building, dissolves its molding, and creeps in the stones as if by capillarity. Like a splash of paint, the color liquefies and hugs the space while literally metamorphosing it into a fantastic world. Further, the ecstatic presence of the stained-glass windows is continually confirmed, despite the increasing physical proximity to the artwork, which now seems more graspable than ever. Paradoxically, it is precisely here that the colors most subtly "atmospherize," and even especially those that are less vivid and pigmented. The slightly pinkish stained glass diffuses an almost imperceptible light, or only through a "nonchalant" glance (Theys 2014), like deferred. The hues of the outside sky seem to be captured by the glass membrane and then intensified in the building: the chapel is the world, the world is the chapel. The color "overwhelms us," and "we even find ourselves [breathing] it" (Craft 2016, 28). All matter and boundaries are dissolved (Janssens 2004, 108), as color evaporates into a final and gentle sublimation. The effect on the visitor is both physical (effects of movement, weight, brilliance), emotional uncanny, delight (Louring Nielsen 2020), and perhaps even cognitive, in terms of

an existential experience – as a sort of immanent transcendence, maybe (Palstrom 2020).

***Keywords: atmosphere, color, perception, matter, light***

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# You make me feel like dancing

## *On how coloured illuminations make us move in space*

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***Abstract.*** Light and colour are fundamental to the creation and experience of space. Whether consciously or not, architecture, landscapes, and urban design deal with light and colour by giving shape and form to our lived environment for us humans to perceive – ultimately setting a starting point for our experience and being in space (Lam 1977; Charalambous and Djebbara 2023). As such light and colour not only hold potential to attune spaces – the effect goes for bodies too.

This presentation seeks to unfold the attuning potential of coloured illuminations to evoke shape and form beyond space, by addressing the human body and how it moves in lit space. For this purpose, the presentation draws on a lab experiment including video recordings, biometric sensor data, descriptive observations and interviews, retrieved from 26 people moving in four scenarios of coloured illuminations (Nielsen et al. 2021).

The experiment was carried out from an overall analytical attention towards light as a generator of atmosphere and the human body as multisensory and felt. This attention is predominantly founded on a theoretical conceptualization of atmosphere as experienced from and constituted by bodily presence, as argued by architect Juhani Pallasmaa (2012) and two prominent philosophers of atmospheres, Gernot Böhme (2013) and Hermann Schmitz (2011).

The methodological approach of the experiment is defined as 'body-sensory' – which generally positions within a phenomenologically informed sensory ethnographic methodology, inspired by phenomenologists Maurice Merleau-Ponty (1964) and Hermann Schmitz (2011), and anthropologist Sarah Pink (2015).

Eventually, the analytical attention and body-sensory approach of the lab experiment served as means to comprehend and collect data on the atmospheric potential of coloured illuminations to attune the human body, from an overarching phenomenological investigation of peoples' bodily presences, sensory experiences and bodily movements in different colours of illumination.

Data analyses revealed that both how people sensed their bodies and how they moved depended on the scenario of the coloured illumination, e.g. feeling "sharp and clear" in a "dead" space while moving in a hard manner (white), "calm and

introverted" in a "cold" space while moving in a coherent manner (blue), "happy and content" in a "supportive" space while moving in a soft manner (amber) and "grounded" in a "dense" space while moving in a downwards manner (red).

This presentation thus argues for how the attuning potential of coloured illuminations go beyond giving shape and form to our lived environment, by also attuning the human body towards particular modes of movement. In this regard, the presentation ultimately highlights the attuning power of coloured illuminations to influence human perception, experience and behaviour in space.

***Keywords: light, colour, atmosphere, attunement, body movement***

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