



# LIGHT SYMPOSIUM

LIGHT AND ARCHITECTURE  
MULTISENSORY EXPERIENCES

DECEMBER 6<sup>TH</sup> - 7<sup>TH</sup>, 2018

REIULF RAMSTAD/NO FELIX DAGENAIS + LOUIS-XAVIER GAGNON-LEBRUN/CA  
COLLIN BALL + RICHARD GROVE/UK FRIDA ESCOBEDO/MX MYRIAM ARIES/SE  
ERIK GARDELL/SE ELLEN KATHRINE HANSEN/DK VERONIKA MAYERBOEK/AU  
MARIE CLAUDE DUBOIS/SE LINNAEA TILLET/US MARIANA FIGUEIRO/US  
JAN RYDEN/SE KYNTHIA CHAMILOTHORI/CH AGNE MILKEVICIUTE/LT  
GIORGIA CHINAZZO/CH CRISTINA GIL VENEGAS/CO

## Welcome to the Light Symposium 2018!

We are glad that you are taking part of an inspired audience of architects, designers, engineers and companies to discuss the latest thoughts, ideas and knowledge in the lighting field.

**Light and Architecture: Multi-sensory experiences** reflects our interest in theoretical and applied knowledge about light and lighting in the architectural context. It highlights the importance of a multidisciplinary design approach which includes all senses in order to cover the environmental factors affecting perception and health in architecture.

We hope you will enjoy this two inspiring and intense days!

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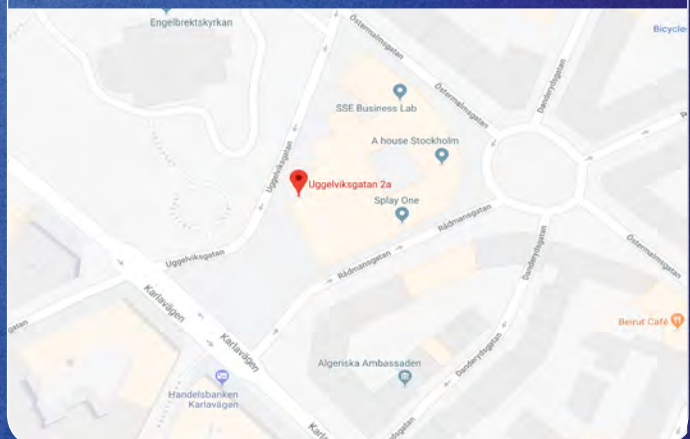
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**Venue: A-House Uggelviksgatan 2A, Stockholm**

**WiFi: Verkan Password: uggelviksgatan**



Thursday  
6/12  
morning

Architecture

- 08:30-09:00 Registration
- 09:00-09:20 **Federico Favero and Per Franson**  
Welcome Light Symposium 2018
- 09:20-10:05 **Keynote Frida Escobedo**  
Light: architect and painter of spaces
- 10:05-10:35 **Erik Gardell**  
Light and architecture
- 
- 10:35-10:55 Break
- 
- 10:55-11:25 **Jan Rydén**  
Color, beauty & texture: the quality of light in urbanism
- 11:25-11:55 **Reiulf Ramstad**  
Sensory memory
- 11:55-12:15 **Agne Milkeviciute (LSPC18)**  
Crisis of Window. Lost Purpose of Daylight Opening
- 12:15-13:45 **Lunch and exhibition**

Thursday  
6/12  
afternoon

Architecture  
and  
Perception

- 13:45-14:15 **Ellen Kathrin Hansen, PhD**  
Designing with light – a multidimensional design element
- 14:15-14:45 **Marie Claude Dubois, PhD**  
Daylight in the dense city
- 14:45-15:05 **Kynthia Chamilothoni (LSPC18)**  
Façade design and our experience of space
- 
- 15:05-15:30 Break
- 
- 15:30-16:00 **Linnaea Tillett, PhD**  
What keeps me up at night
- 16:00-16:30 **Closing Panel Discussion**
- 
- 18:30-23:00 **Dinner Party (separate booking)**



Friday  
7/12  
morning

Health  
and design

09:00-9:50

**Keynote**  
**Colin Ball + Richard Grove**  
Resonance

09:50-10:20

**Prof. Myriam Aries**  
Daylight knowledge to enhance healthy  
lighting in architecture

10:20-11:00

**Keynote Prof. Mariana Figueiro**  
Light and Health: overview of research and  
applications

11:00-11:20

Break

11:20-11:40

**Giorgia Chinazzo (LSPC18)**  
Indoor environment as a multi-sensory  
experience

11:40-12:10

**Veronika Mayerboeck**  
Lighting beyond senses

12:10-13:30

**Lunch and exhibition**

Friday  
7/12  
afternoon

Design

13:30-14:00

**Atomic 3 (Felix Dagenais + Louis-  
Xavier Gagnon-Lebrun)** Living connections

14:00-14:20

**Cristina Gil Venegas (LSPC18)**  
Light as a tool to structure urban planning:  
a socially oriented approach

14:20-15:00

**Akademiska Hus**

15:00-15:20

Break and bubbles

15:20-16:20

**Light Collective**  
Projection of Perfect Light films

16:20-16:50

**Closing Panel Discussion**

16:50-17:00

**LSPC18 Award and farewell**





**Architecture**  
6th December  
09:20-10:05

## Keynote Speaker **Frida Escobedo**

Frida Escobedo, Taller de Arquitectura  
Mexico City

### **Light: architect and painter of spaces**

Frida's work focuses largely on the reactivation of urban spaces that are considered to be residual or forgotten, through projects that range from housing and community centers, to hotels, galleries, and public art installations. In addition to her practice, Frida Escobedo has taught at Columbia University's Graduate School of Architecture, Planning and Preservation and Harvard Graduate School of Design. She is the recipient of the 2016 Architectural Review Emerging Architecture Award, the 2017 Architectural League Emerging Voices Award, and in 2018 was selected to design the 18th Serpentine Summer Pavilion in London.

"...it's about what you can create with simple things"

Picture credit Dezeen.com

***"Light is a constructive  
principle of our existence"***

*Bo Ansell, 2010 Index*



**Architecture**  
6th December  
10:05-10:35

## **Erik Gardell, Architect**

Skälsö Arkitekter, Gotland and Stockholm

### **Light and architecture**

He is one of the founders of Skälsö Arkitekter ([www.skalso.se](http://www.skalso.se)), which launched in 2012. Skälsö Arkitekter was developed out of the work on the Bungenäs Detail Plan (2010-2012). Skälsö Arkitekter has received several awards for careful renovation in Visby city centre, Ung Svensk Arkitektur, Mazagine Arkitektur's Award 2017 and Villapriset 2017 for the "Bunker 104"-project. The firm has exhibited together with Bruno Ehrh at Gotland Art Museum during summer 2017 and at La Biennale architettura di Venezia 2018. Skälsö Arkitekter is also nominated for the "Mies van der Rohe award 2019".



**Architecture and Perception**  
6th December  
10:55-11:25

## **Jan Rydén, Researcher and writer**

Stockholm

### **Color, beauty & texture: the quality of light in urbanism**

Jan Rydén has been a researcher at KTH Architecture, as well as guest teacher and lecturer there and at several Swedish art colleges. He has studied at the Royal Institute of Art in Stockholm (2002-2008), as well as at the architecture program at the Royal Institute of Art. His artist book "Allborgarrätten: The Right to the City as a Swedish Tradition" was published in 2016 (Arvinius+Orfeus). The municipality of Knivsta is located between Stockholm and Uppsala, just north of Arlanda Airport. The new town of Alsike is to house approximately 4000 people centered around a new railway station. Sustainability goals are set very high. KTH Architecture Lighting Design is the designated research partner when it comes to both natural and artificial light.

"I am interested in the qualitative aspects of light in relation to both architecture and urbanism: questions of colour, beauty and textures."





**Architecture**  
6th December  
11:25-11:55

## **Reiulf Ramstad**, Architect

Norway

### **Sensory memory**

Reiulf Ramstad started his own practice in 1995 and has since been awarded with multiple awards and earned a reputation for creating bold, simple architecture with a strong connection to the Scandinavian context. Today his office has grown to 25 employees with 4 associated partners, together designing a wide range of projects with various scale, program and budget.

Reiulf's architectural education took place in Venice after realising he would never reach the top as a ballet dancer. This spring he went back to Venice for the biennale's celebration of Utzon's 100 jubilee and in November opened the exhibition "No Nordic" at the Utzon centre in Aalborg. The firm is currently working on a second book, another exhibition "Remoteness" in Paris as well as following through two competitions, a small public "grain house" in Denmark as well as a large scale high rise building in central Oslo, amongst many other projects.



**Architecture  
and Design**  
6th December  
11:55-12:15

## **Agne Milkeviciute**, Architect and Lighting Designer LSPC18 speaker

Lithuania

### **Crisis of Window. Lost Purpose of Daylight Opening** (extended abstract available in the appendix)

My educational background consists of architectural studies in Vilnius with some time spent in Valencia as an exchange program and recent year spent studying architectural lighting design at KTH in Stockholm. My practical background is also international - I worked as an architect in Lithuania and Ireland for more than three years exploring differences in various regions' architecture and design and now continuing doing that here in Sweden in field of architecture and light. Alongside I also work as freelance architect with various scale projects around Europe. I truly enjoy my work and appreciate the possibility to shape different environments for the benefit of humans.

"I am interested on the phenomenon of window loosing it's primary functional purpose [inside-outside connection in terms of view and daylight] and becoming more decorative element of the facade."





**Design**  
6th December  
13:45-14:15

## **Ellen Kathrine Hansen**, Ass.Prof. AAU

Denmark

### **Designing with light – a multidimensional design element**

Dr Hansen is a leading person in the field of transdisciplinary design research and teaching within Lighting Design. She has more than 20 years of experience driving projects within the field of developing new architectural potentials through integration of daylight and lighting technology. Her projects are based on combining knowledge and skills from technical, artistic, humanistic and industrial environments. In 2012 Dr. Hansen left the window industry to start up a new Master of Science programme and research platform at Aalborg University in Copenhagen. The program and research group combines architecture, engineering and media technology in a human centric approach to lighting solutions that seek to improve our built environment with applied knowledge of lighting design. Researchers, industrial business partners and students in Lighting Design team up here to solve relevant societal problems.

“Light as a multidimensional design element has so many potentials to be explored”



**Architecture**  
6th December  
14:15-14:45

## **Marie Claude Dubois**, Ass.Prof. Lund University

### **Daylight in the dense city**

People in industrialized countries spend 90% of their time indoors. Their life is thus much affected by the conditions determined by buildings in which they dwell and work. The low levels of daylight indoors, together with an increase exposure to electric lighting and digital devices at night may result in a disrupted circadian cycle (night-day cycle). Medical research shows that a disrupted circadian cycle is linked to many modern illnesses and dysfunctions such as depression, diabetes, heart problems, sleep disorders, ADHD, obesity, etc. With increasing urban density, it becomes more difficult to provide adequate levels of daylight indoors, with the risk that humans will definitely lose their connection to natural cycles. This conference will first show examples of increasing density in Swedish cities. The relation between shadow angle and daylighting will be illustrated through one Master study. A research about residential building typology of different times and daylighting will then be presented. In conclusion, the author will provide some guidelines for maximizing daylighting indoors in the Nordic context.

“In a world which is increasingly urbanized, daylight remains the last trace of the natural world into our every life.”



## **Architecture and Perception**

6th December  
14:45-15:05

**Kynthia Chamilothoni**, PhD candidate at EPFL

LSPC18 speaker

Greece/Switzerland

### **Façade design and our experience of space: the joint impact of architecture and daylight on human perception and physiological responses**

(extended abstract available in the appendix)

Kynthia graduated with honors from the Technical University of Crete with a Master's degree (Dipl-Ing) in Architectural Engineering in 2014, receiving the Limmat Stiftung Excellence Award for her academic performance. Kynthia joined the Laboratory of Integrated Performance in Design (LIPID) at the École polytechnique fédérale de Lausanne (EPFL) in 2015 as a PhD candidate, and is currently in her fourth year in the Doctoral Program EDAR "Architecture and Sciences of the City"

"Even though there is substantial evidence of the positive effects of daylight access on occupants, we have limited knowledge on how the façade geometry and the spatial composition of the resulting sunlight patterns in a space affect its occupants. Could a simple change of the façade change the way we perceive a space?"





**Sustainability**  
6th December  
15:30-16:00

## **Linnaea Tillett** , PhD

New York

### **What Keeps Me Up At Night**

Combining an acute aesthetic sensibility with insights from social science, Dr. Tillett crafts highly nuanced lighting programs that delight, improve sustainability, and engage issues of safety and security. A pioneer in the field of landscape lighting design, her innovative approach incorporates a thorough understanding of the perceptual, behavioral and psychological effects of light.

Dr. Tillett has extensive experience lighting museums and cultural campuses, connective corridors waterfronts, bridges and underpasses and urban parks, including outdoor sculpture collections, skating rinks and adaptive reuse of parking lots. Some of her projects include the Menil Collection Campus in Houston, TX, New York City's historic Battery Bosque, Princeton University's Arts and Transit campus, and the groundbreaking 3.6 mile Syracuse Connective Corridor. She has collaborated with leading landscape architects, architects and artists including Maya Lin, Toshiko Mori, Michael Van Valkenburgh Associates, Nelson Byrd Woltz, Gustafson Guthrie Nichol, and Olin Studio. She has lectured extensively including, most recently, at Sveriges Arkitekter's 2017 Oyster Seminar.

"Use as little light as possible. Preserve the imaginative possibilities and the natural habitats of the creatures we share the night with."





**Design**  
7th December  
9:00-9:50

## Keynote Speakers

**Richard Grove** MIOA BEng(Hons), Head of Acoustics and

**Colin Ball** - IALD MSLL ILP BSc(Hons), Lighting Director

BDP United Kingdom

## Resonance

Just as Louis Kahn described architecture as being 'Between Silence & Light', Richard and I have worked closely together to make the occupant within the space the most important element of our work with every design regardless of its typology. This presentation is a result of the dialogue between our different disciplines of Light and Sound and how each communicate the material and form of our environment to aid health and comfort of all that experience our spaces.

Richard leads the Acoustics team in BDP's Environmental Design Studio in London. He has worked in the field of acoustics since 2005, analysing and advising on acoustics and vibration designs in multi-discipline projects for a wide variety of sectors. Richard's interest in the effects of sound on people and their environments began at an early age through a love music, mathematics, and buildings. Fusing these interests together has allowed Richard to balance the artistic and mathematical aspects of sound, with the aim of improving the daily lives of people through good acoustics.

Colin leads the London office of BDP's award winning Lighting Team. His current work involves developing innovative techniques for lighting within World Heritage venues plus Carbon Exemplary projects for cutting edge science institutes. From a background education in architecture Colin has worked as a Lighting Designer for 23 years joining BDP in 2011. Colin lectures worldwide on how Light is represented from historical, religious and psychological perspectives in architecture and contemporary art. An organiser of a London Light & Film Festival Colin also delivers talks on parallels of Lighting between Films, Theatre & Architecture.

"In recent years we've discovered whether using Light or Sound we've found that we both address Resonance and Harmonics in startlingly similar ways. Essentially we design comfort for people within spaces."



**Health**  
7th December  
9:50-10:20

## **Myriam Aries, Ph.D.**

Prof Lighting Science JTH  
Holland/ Sweden

### **Daylight knowledge to enhance healthy lighting in architecture**

Even though daylight and electric lighting are not physically different, they have different qualities. When designing healthy (electric) lighting for the built environment, the question is if daylight should be substituted or mimicked. Input for designing and implementing intelligent dynamic lighting solutions will be discussed as well as ways to research and test the design and implementation in test beds.

Her expertise lies mainly in the field of (day)light application, visual comfort, and human light and health demands in the built environment. Myriam holds an MSc in Building Technology from the Delft University of Technology and a PhD in Building Physics/ Lighting from the TU/e. During a post-doctoral fellowship, she continued her work with light and health within the lighting group of National Research Council Canada. She further expanded her academic expertise in the field of daylight application, visual comfort, and human light and health demands at the TU/e. Since July 2016, Myriam works in Sweden where she is building a group for research and education studying the comfortable, energy-efficient, and functional interaction of (day)light within and between architectural environments. It includes the understanding and impact of dynamic lighting environments on humans as well as the spillover effects from one environment to another.

“If one really wants to say how light affects humans, one needs to see the whole picture.”

***“The question is not what you look at,  
but what you see”***

*Henry David Thoreau*





### Health

7th December  
10:20-11:00

## Keynote Speaker **Mariana Figueiro**, Ph.D. Prof.

Director Lighting Research Center  
Troy, New York, United States

### **Light and Health: overview of research and applications**

In addition to enabling us to see and navigate in the space, light can promote entrainment of circadian rhythms to the local time on earth and promote. An overview of the latest field and lab research on the non-visual effects of light will be presented and design tips on how to implement this research in energy-effective and aesthetic pleasing ways will be discussed.

Dr. Figueiro is well known for her research on the effects of light on human health, circadian photobiology, and lighting for older adults. She holds a bachelor's in architectural engineering from the Federal University of Minas Gerais, Brazil, and a master's in lighting and a doctorate in multidisciplinary science from Rensselaer. Her master's and Ph.D. dissertation research focused on the human circadian response to light. She is the author of more than 80 scientific articles in her field of research. Her research is regularly featured in national media including The New York Times, The Wall Street Journal, and Scientific American. Dr. Figueiro has also brought attention to the significance of light and health as a topic of public interest through her 2015 TEDMED talk

"Today, many people think of light as just another architectural detail, and lighting solutions have tended to be designed for the limited range of things that people do in a particular space. We are looking at a future in which the light we receive will become more personalized, customizable, and tailored to our own individual needs. My research explores how this new approach to lighting can improve sleep and mood, reduce depression, and enhance our alertness and feelings of vitality."





**Perception**  
7th December  
11:20-11:40

**Giorgia Chinazzo**, PhD candidate at EPFL  
LSPC18 speaker

Italy/ Switzerland

**Indoor environment as a multi-sensory experience**  
(extended abstract available in the appendix)

Giorgia earned her B.Sc. and M.Sc. degrees in Building Engineering from the Politecnico di Torino, graduating with honors in 2012 and 2014, respectively. In 2014, she also obtained a double M.Sc. degree in Building Engineering from Politecnico di Milano, by attending the Alta Scuola Politecnica. Her research interests and competences are centered on human comfort and perception in buildings, daylight, energy efficient strategies and sustainable design.

"The presentation will explore visual and thermal interaction effects on human responses in buildings, focusing on daylight as the visual stimulus."



**Design**  
7th December  
11:40-12:10

**Veronika Mayerboeck**, Lighting Designer

Austria

**Lighting beyond senses**

This lecture explores the interconnectivity between light, movement and space. Presenting different works introducing the topic of vision and movement as a key to our sensory experience, the major focus is "LIGHTSCORES" a wearable sensor tool that translates motoric input into sound. This playful tool is used for mobility training of visually impaired children, physiotherapy and neurorehabilitation. Up to now her studio „ALLES oder Licht“ realizes lighting design for museums and cultural buildings (Künstlerhaus Vienna, KHM Vienna, Sammlung Essl Klosterneuburg, Raimundtheater Vienna a.o.) or for particular artwork (World Court triptych H. Bosch, Academy of Fine Arts Vienna) and exhibitions (Heydar Aliev Center Baku, Pact Zollverein, Albertina Vienna, a.o.).

As lighting designer and architect I am very curious how far the „act“ of observing and perceiving our environment already has changed nowadays. What is "touching" us visually?"



**Design**  
7th December  
13:30-14:00

## Félix Dagenais and Louis-Xavier Gagnon-Lebrun

Atomic3, Canada

### Living connections

Stories, in the broadest sense of the word, shape the meaning and momentum of everyday life. Thousands of years ago, sitting around a campfire, people were telling stories to try to make sense of the chaotic world they lived in. This warm light was bringing them together day after day, human connection being essential to our survival. Communities were built around public places like this campfire. In the past decades, our public places have somehow been forgotten, due the type of urban development aiming toward more private spaces. And people now prefer to connect in the virtual world, through social network, thus contributing even more in the disappearance of the public.

With over twelve years of experience in the performing arts, director Félix Dagenais and lighting designer Louis-Xavier Gagnon-Lebrun founded ATOMIC3 to push their artistic development beyond the walls of the theatre, inventing new ways to tell stories and spark the imagination. ATOMIC3 is a multimedia studio that brings together artists and designers from all backgrounds, to create unique immersive experiences where light, video, music, architecture, and new technologies plunge visitors into the heart of the story, and the heart of the work. Whether interactive or contemplative, ATOMIC3's creations transform the public space to reach out to people in their daily lives. The works invite them to open up to others, work together, and see the world and their environment with new eyes.

Since 2011, ATOMIC3 has created many interactive light installations for the public space, including permanent artworks at the new Canadian Embassy in Paris, the new international jetty at Montréal-Trudeau Airport, the illumination of the Jacques-Cartier Bridge in Montreal as well as a dozen touring installation presented in North America as well as in Europe.

"It is more and more important to make the cities inviting, so we can meet our fellow citizens face to face and experience directly through our senses. Public life in good quality public spaces is an important part of a democratic life and a full life."  
- Jan Gehl





**Design**  
7th December  
14:00-14:20

**Cristina Gil Venegas**, Lighting Designer  
LSPC18 speaker

Colombia

**Light as a tool to structure urban planning:  
a socially oriented approach**  
(extended abstract available in the appendix)

Cristina Gil Venegas is a Colombian architect interested in urban planning in the nighttime scenario and urban spatial transformations, by understanding these concepts from a socially-oriented approach and developed around people's diverse ways to dwell. She is keen on how urban environments around the world are influenced by culture, location, lifestyle, and technology. Cristina believes in participative work between designers, technicians, and citizens; this with the aim to construct qualitative indicators and use them as the main tools to develop urban interventions.

"This research is about the proposal of a guideline to develop the analytical tools for various design stages in nighttime urban planning"

**Architecture**  
7th December  
14:20-14:50

**Erik Westin, Anna Martin, Akademiska Hus**,  
Property manager

Sweden

Akademiska Hus provides high quality property management with a focus on resource-efficiency and long-term sustainability. With a well-planned strategy for issues such as premises requirements and energy supply, combined with strong know-how of knowledge environments, we manage our properties so that they maintain high long-term standards.

To us, property management is an umbrella term for all technical and financial operations carried out during a building's lifespan. During the property management process, we develop the quality and content of our services to meet customers' changing needs.

Akademiska Hus currently manages over 3.2 million square metres of rentable area consisting of 45 percent educational premises, 35 percent laboratory premises and 20 percent other premises.



### **Design**

7th December  
15:20-16:20

## **Light Collective**

**Martin Lupton and Sharon Stammers, UK**

### **Perfect Light movies**

It is said that all good documentaries start with a question. We are not saying that we have made a good documentary but we have definitely asked a question...

The development of light and lighting has always been about the search for the "Perfect" Light. Unlike any light source development before, LEDs have superseded all other sources and potentially rendered them obsolete. Is LED therefore the Perfect Light? Are we in the middle of the greatest revolution since the invention of the light bulb?

Our film asks lighting designers around the globe for their thoughts, memories and opinions on light sources, lighting design and how they would define the Perfect Light.

Supported by Citizen <https://www.google.com/>

***"Light can change everything"***

*Prof. Dr. Thomas Römhild, 2010 Index*



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## **Abstracts LSPC18**

### **Agne Milkeviciute**

**Crisis of Window. Lost Purpose of Daylight Opening**

### **Kynthia Chamilothoni**

**Façade design and our experience of space: the joint impact of architecture and daylight on human perception and physiological responses**

### **Giorgia Chinazzo**

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### **Cristina Gil Venegas**

**Light as a tool to structure urban planning:  
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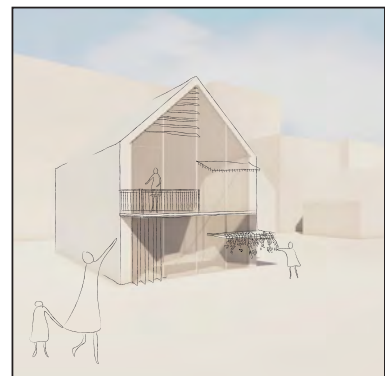
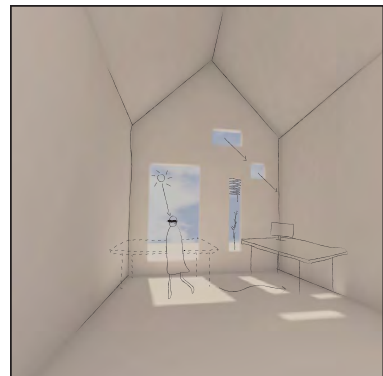
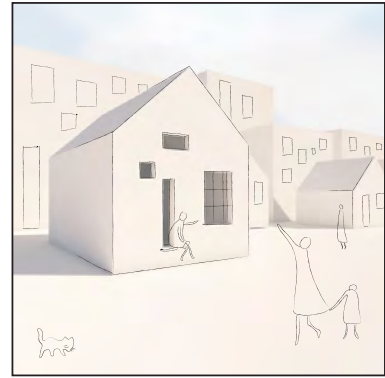


# Master's Thesis: Crisis of Window. Lost Purpose of Daylight Opening

Architect/ Lighting Designer Agne Milkeviciute  
2018 | KTH ALD | Tutor: Malin Alenius

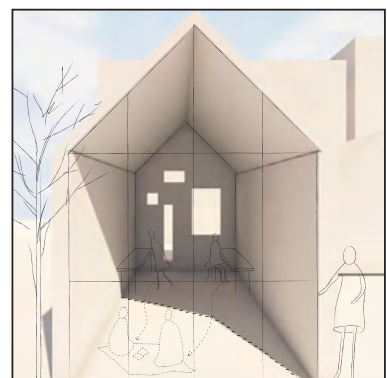
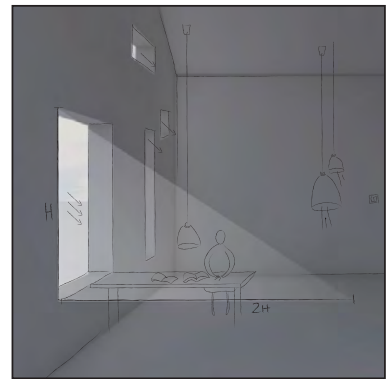
## ABSTRACT

This paper concentrates on problematic field of architectural education and practice related to window role in architecture. Phenomena of window loosing it's primary functional purpose [inside-outside connection in terms of view and daylight] and becoming more decorative element of the facade. The original meaning of window meets light and view provision in any building as it's main purpose. However, in office architecture which constitutes the biggest commercial construction sector - attention to interior-exterior connection is mainly based not on daylight and view functions. Motivation for choosing specifically office building typology as a case study target comes from the fact that work environment is a place where people spend second largest amount of time after their home. However, significant difference is that in work place they do not have ability of personal choice of working space. Here comes the collision of different interests – most of the office building design is based on power and identity representation required by the client, where architects intention is to highlight that through the exterior expression by implementing his/hers personal ambition. Meanwhile the person who will actually use the building and will be directly affected by opening values - is left over behind the boundary of decisions' making. Natural light is considered to be one of the figures to affect employees' performance and well-being. Nevertheless, it seems that there is a big opposition between architect's and space user's perception of window role.



The detailed evaluation of case studies demonstrated in this paper allows to analyze if window figure in office typology architecture still corresponds to its original meaning and how estimation of window role from different perspectives can be brought to conclusion which results in more suitable and sustainable daylight opening planning for both sides. Case studies' analysis reveals that understanding of natural light qualities and view composition through the window is excluded from many architects' background and not used accurately in project development. The aim of this research is not only to prove problematic conclusion of window purpose topic, but from the personal perspective as a professional architect and lighting designer suggest easy ways and encourage architects to evaluate natural light and view possibilities by easily navigable manners while keeping the identity of architecture and facade. Those manners are based on visual examples and written rules to be followed in everyday practice. 5 core guidelines are expressed in a way to be easy used by architect without lighting education and special lighting software skills. Suggestion is to analyze proposed light and view conditions in graphical manner as this tool seems resembling to architects' practice.

This paper and steps followed through it shows that even the most expensive and innovative daylight systems are useless when fundamental mistakes are made through the process of architectural planning. Ignorance to window as equivalent part of architecture and forgetting capacity of light as 'building material' often results in elementary architectural mistakes affecting the user of the space, even though there is simple way to avoid that.





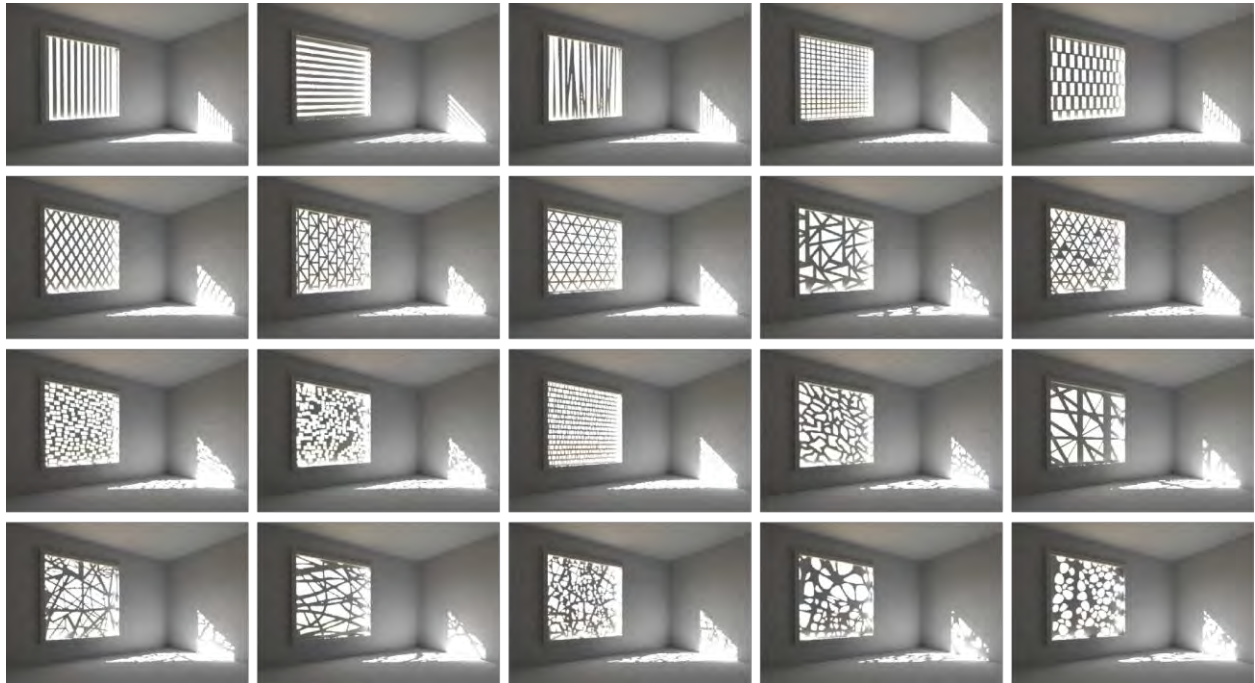
# Façade design and our experience of space: the joint impact of architecture and daylight on human perception and physiological responses

Kynthia Chamilothoni

PhD Candidate, Laboratory of Integrated Performance in Design (LIPID),  
École polytechnique fédérale de Lausanne (EPFL)

Advisors: Prof. Marilyne Andersen, Dr.-Ing. Jan Wienold

Daylight has an undeniable impact on our spatial experience, which has been broadly acknowledged in architecture [1]–[4]. However, current lighting practices and metrics tend to limit sunlight penetration, a trend that can lead to monotonous light landscapes [5]. Although daylight characteristics such as contrast and luminance variation [6]–[10], as well as their spatial distribution [11], [12], have been repeatedly linked with impressions of interest in lighting research, we have limited knowledge on how the façade geometry and the resulting sunlight patterns affect perception. This work investigates the architect's intuition on how façade geometry can impact occupant perception and compares this intuition with the evaluations of people experiencing scenes with different façade geometries.

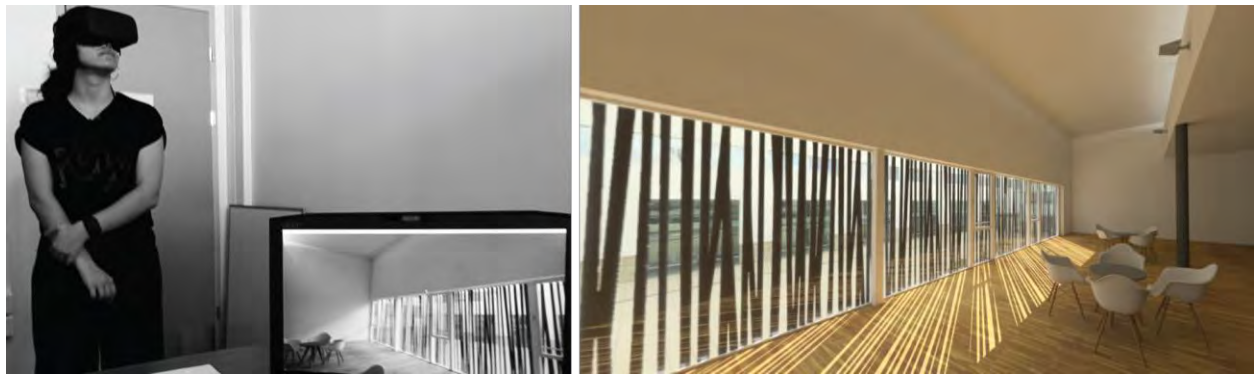


**Figure 1.** The façade patterns used in the paper-based survey on architects' intuition, based on façades of existing buildings. The patterns have the same perforation ratio and were shown in a random order.

Following an extensive review of architectural case studies, 20 façade patterns from existing buildings were selected and adjusted to a 40% perforation ratio, shown as one of the most preferred [13]. These patterns were applied to a sample scene and rendered with *Radiance* [14]. The resulting renderings (**Figure 1**) were used in a survey where 80 architects working

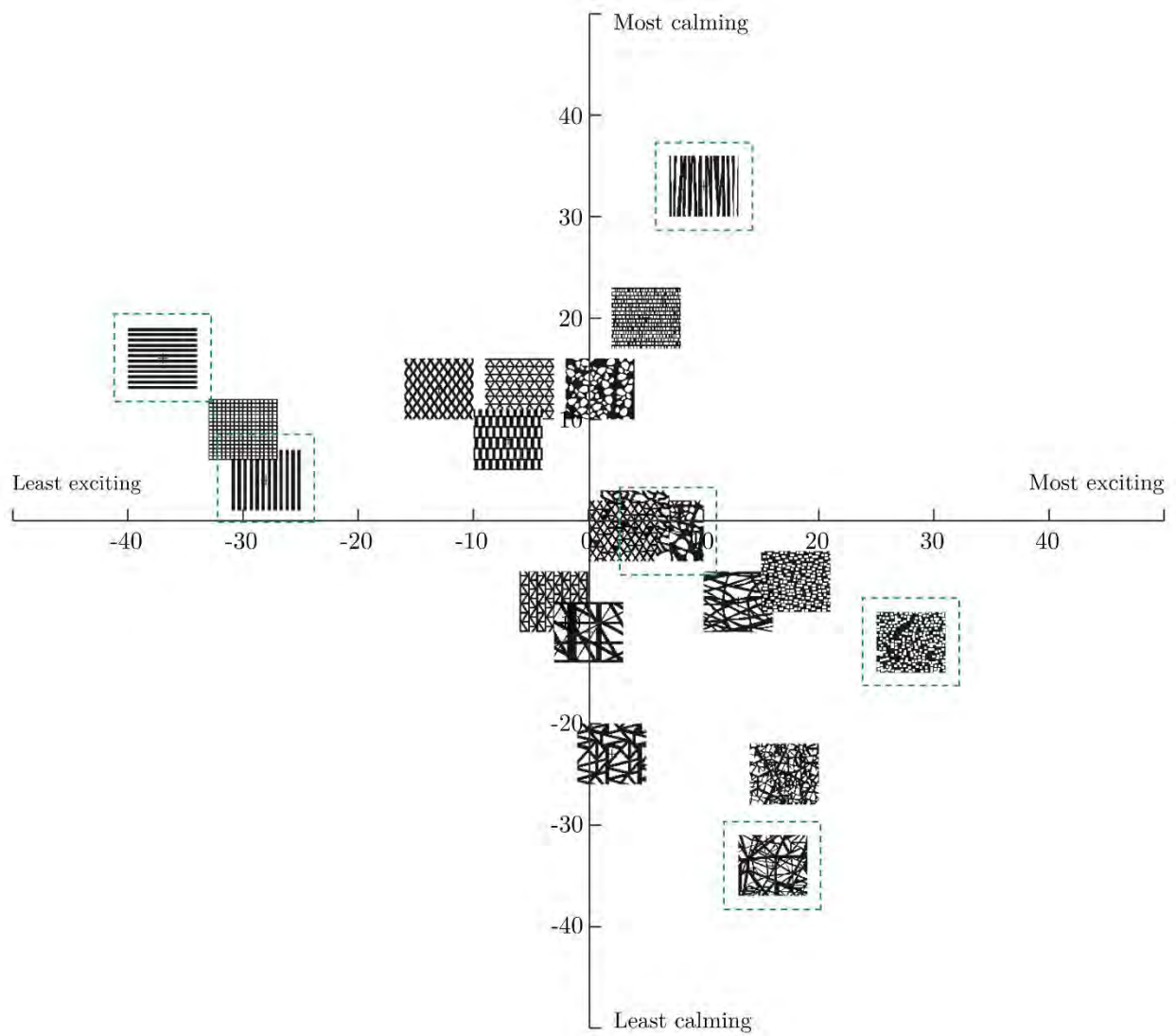
in Switzerland indicated three patterns at a time which would make a space the *most exciting*, the *least exciting*, the *most calming*, and the *least calming*.

Patterns exhibiting great consensus regarding their potential to affect spatial experience were selected to further investigate occupant perception (**Figure 3**). Six patterns were applied to the 3D model of an existing building and were used to create omni-directional stereoscopic scenes, following an existing workflow which combines the use of physically-based renderings with projection in virtual reality [15]. The scenes were shown in an experimental study in VR using the Oculus CV1 headset, where 80 participants who have lived at least 2 years in Switzerland saw in random order all six façade variations, under two variations of clear sky, with furniture corresponding to social or working activity (**Figure 2**). The participants' subjective evaluations (such as how *exciting* and *calming* the space was perceived) and physiological responses (skin conductance and heart rate) were recorded using a questionnaire and an Empatica E4 bracelet [16], respectively.



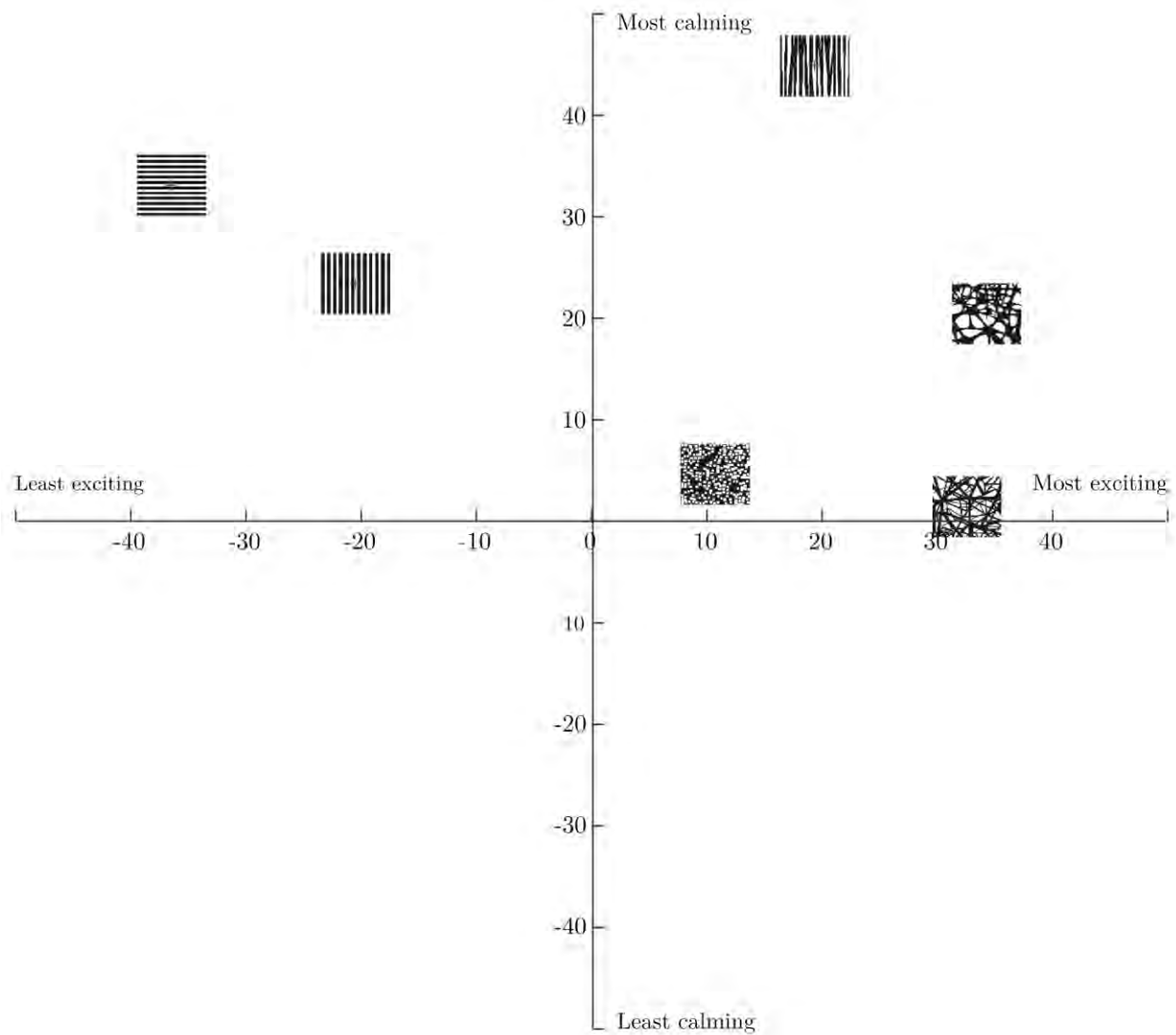
**Figure 2. Photograph of a participant experiencing an immersive scene in VR (left) and indicative screenshot of such a scene where a subset of patterns selected from Figure 1 were applied to the façade of a simulated space.**

The assessments of the architect's intuition show a high agreement, with cases of patterns chosen by 38-49% of the architects (**Figure 3**). In the experimental study, the direction of participants' evaluations is in agreement with the architects' intuition in the case of low complexity patterns, and differs in cases of high complexity patterns (**Figure 4**). This indicates cases of discord between expert and non-expert perception, and motivates further systematic study. Initial results from the heart rate measures reveal different responses between patterns, and highlight the potential for further research. Upcoming work will focus on the detailed analysis of the experimental results to investigate their relation with previous findings by the authors on the effect of façade characteristics on subjective and physiological responses [17], [18], and broaden our understanding on the complex effects of daylight and architecture on people.



**Figure 3. Distribution of the 20 patterns in the dimensions of calming and exciting based on the survey of architect's intuition, corresponding to the difference between how often a pattern was selected as the most and least representative pattern in each dimension. The highlighted patterns were used in the immersive scenes in VR.**





**Figure 4. Distribution of the subset of patterns from Figure 3 in the dimensions of *exciting* and *calming* based on difference between the percentage of responses where each pattern was evaluated in the positive range (>5) and the negative range (<5) on a rating scale from 0 (Not at all) to 10 (Very) in the experiment in virtual reality.**

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## **Indoor environment as a multi-sensory experience: visual and thermal factor interactions**

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**Related tracks:** PERCEPTION, ARCHITECTURE

### **Abstract**

In our daily lives we are exposed simultaneously to multiple sensory stimuli, such as visual, thermal, acoustic and olfactory. Experienced together, they shape our perception of the environment and determine our comfort. In indoor environments, stimuli are affected by construction features such as material, openings, form, size and colour. However, standards and guidelines for the design of buildings, together with the majority of scientific investigations on indoor factors, focus on independent stimuli, considering visual, thermal, acoustic and air quality issues separately. The problem lies in the fact that multiple sensory stimuli, other than affecting our general perception and comfort when experienced in combination, can result in cross-modal effects, whenever a stimulus influences a non-related perception. It could happen, for example, that a sound affects people's thermal perception or that the thermal environment influences the perception of the indoor air quality. To further the understanding of cross-modal effects, it is therefore necessary to study multiple indoor stimuli in combination.

With a particular focus on visual and thermal stimuli, this contribution investigates the interactions between daylight and temperature. First, daylight transmitted through coloured glazing (henceforth referred to as "coloured daylight") and then different illumination levels of daylight are investigated, in combination with indoor temperature levels. To explore both cross-modal perceptions, the study focuses on the effect of daylight (both "coloured daylight" and daylight levels) on thermal perception and on the effect of temperature levels on visual perception of daylight.

For the investigation, two experiments were conducted in a semi-controlled test room, able to set specific temperature levels and with the possibility to apply filters on the South and the North openings. In the first experiment, filters were coloured (blue, orange, against a reference neutral one with similar transmittance levels), while in the second one, filters were neutral with different transmittance levels. Figure 1 illustrates the visual conditions of the two experiments. More than 200 people participated in the experiments and were asked to indicate their visual and thermal perceptions by replying to questionnaires, while they were exposed to different combinations of visual and thermal stimuli. Each experimental session lasted approximately 3 hours, in which two participants at a time experienced all the levels of daylight (colour or quantity) in a randomised order across participants, while exposed to a constant temperature. Three temperature levels were tested between participants.





*Figure 1: Visual stimuli used in experiment 1 (coloured daylight) and in experiment 2 (quantity of daylight).*

Results from both experiments showed that cross-modal effects do occur between daylight and temperature, with temperature influencing visual perception, and colour and quantity of daylight affecting thermal perception (e.g., people exposed to blue daylight were significantly colder and less comfortable compared to those exposed to orange and neutral, with  $p < 0.05$  after linear mixed-model analysis). These findings highlight that indoor factors should not be considered in isolation and that researchers and designers should see the indoor environment as a whole, with all the sensory stimuli simultaneously contributing to shape our multi-sensory experience.

## **ABSTRACT**

Paper title: Light as a tool to structure urban planning: A socially-oriented approach

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Bio: Cristina Gil Venegas has an MSc in Architectural Lighting Design given by KTH Royal Institute of Technology in Sweden. She is a Colombian architect interested in urban planning and bottom-up initiatives for urban spatial transformations in the nighttime scenario. She understands those concepts from a socially-oriented approach, which must be developed around people's diverse ways to dwell. Also, she is keen on how urban environments around the world are influenced by culture, location, lifestyle, and technology.

Cristina believes in participative work between citizens, planners, designers, technicians, and government; this with the aim to construct qualitative indicators and use them as the main tools to develop urban interventions.

## Abstract:

**How can light positively influence and encourage pedestrians' engagement and interaction with the urban environments at night?** In this Master Thesis, I questioned how to develop nighttime urban planning from a socially-oriented approach (figure 1.1). In order to answer this question, I studied different evidence such as two publications, three lighting designers' and a lighting studio' approach; three case studies analyses, two of them located in Colombia (Cartagena and Medellin) and one in Sweden (Stockholm); and my own qualitative observation and quantitative measurements studied between April and May at Norrmalmstorg and Biblioteksgatan in Stockholm, Sweden (figure 1.2). From that review, I propose a Guideline consisted of three stages: (1) **Main dimensions**, (2) **lighting attributes**, and (3) **lighting systems** in urban planning (figure 1.3). In general, this guideline is a framework to develop the analytical tools for various design stages in nighttime urban planning.

### **SOCIALLY-ORIENTED APPROACH PEDESTRIANS' PERSPECTIVE**

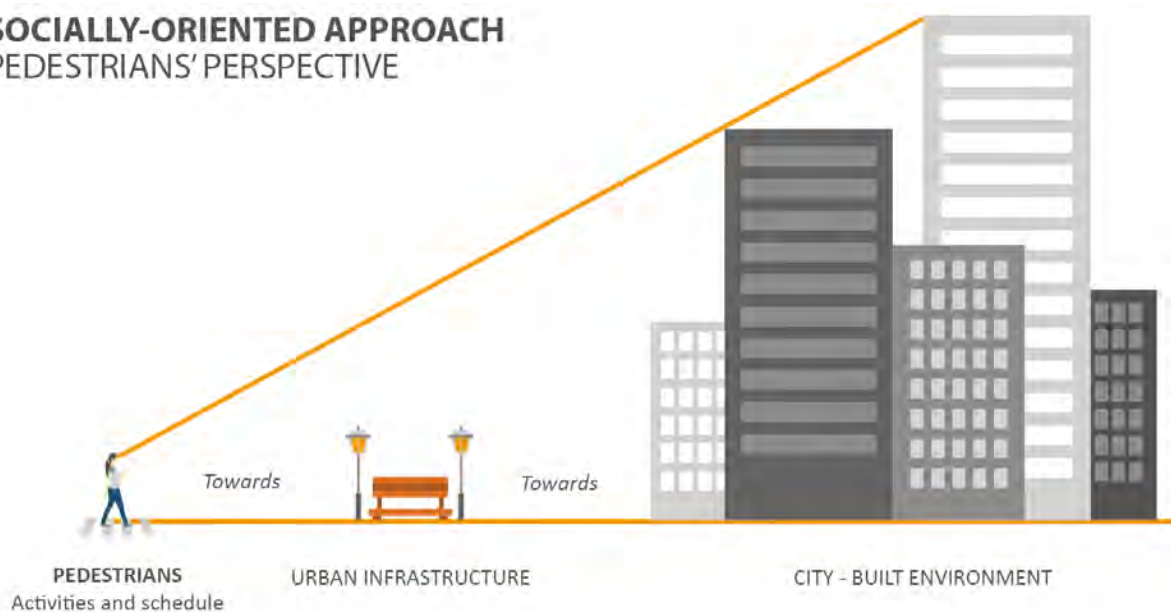


Figure 1.1 Socially-oriented approach to urban planning based on pedestrians' perspective - For this research, the urban infrastructure is studied from pedestrians' perception and scale, towards the city | Scheme: Author



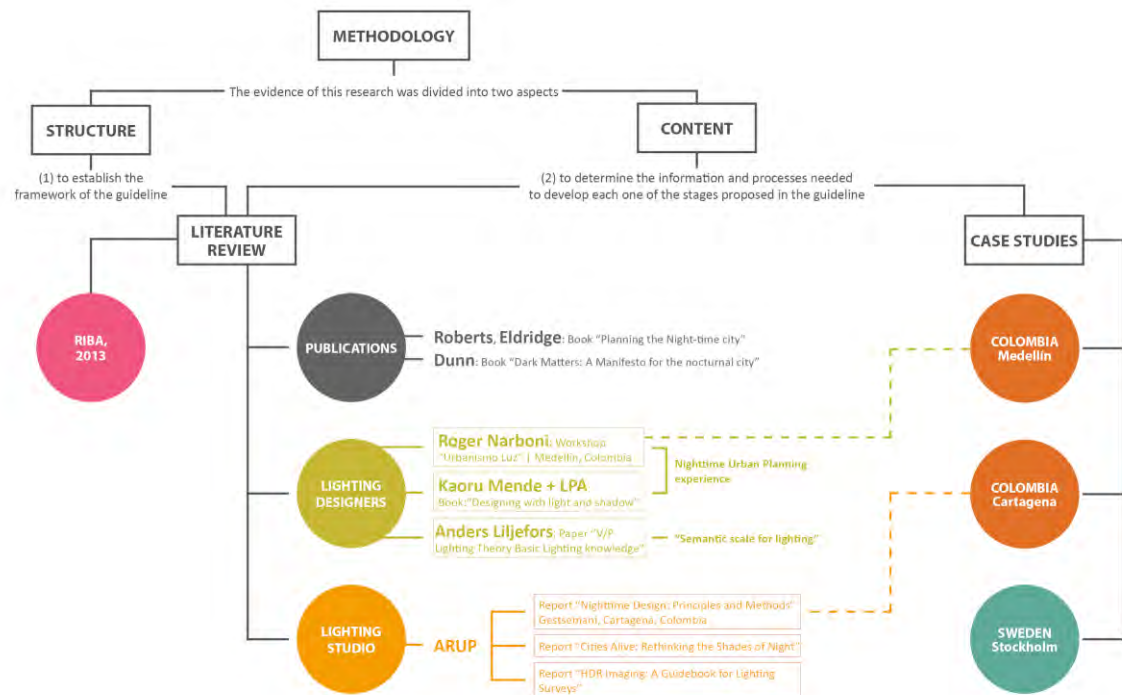


Figure 1.2 Overview of the methodology used in the research | Scheme: Author

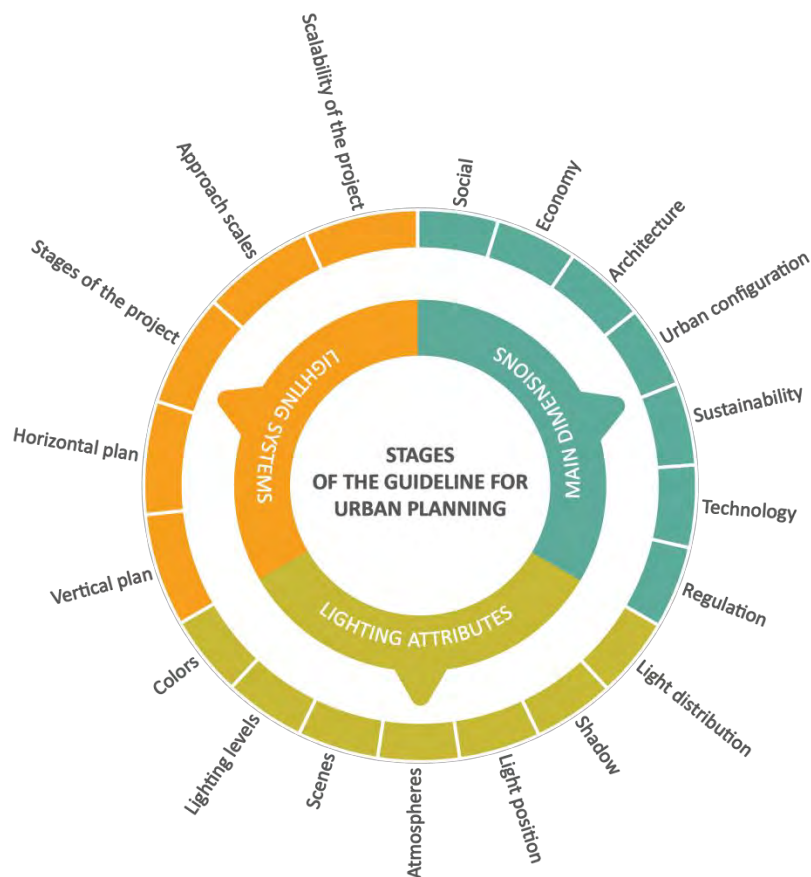


Figure 1.3 Overview of the stages of the guideline proposed for urban planning | Scheme: Author

The main outcomes of this research were two. Firstly, although pedestrians responded in diverse ways to lighting conditions and have different requirements according to their context; a method can be proposed both, to inquire about general parameters to study pedestrians in diverse contexts, and also to assess urban lighting projects from a socially-oriented approach. And secondly, after the study of the qualitative observation and quantitative measurements taken by the author, the results showed that the current regulation takes into account a partial users' perception of the urban environment, focused on the horizontal plane, but does not include the vertical plane, which provides reference points for orientation, according to the diverse visual field' levels of the pedestrians. Information that is relevant for pedestrians' interaction with urban environments at night.

Keywords: Human perception, citizens engagement, nighttime lighting, nighttime urban life, social interaction, nighttime urban planning, 24/7 cities.