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*Chief Editors:*

Claus Bech-Danielsen, cbd@sbi.aau.dk

Danish Building Research Institute, Aalborg University, Denmark.

Madeleine Granvik, Madeleine.Granvik@slu.se

Swedish University of Agricultural Sciences, Department of Urban and Rural Development, Unit of Landscape architecture, Sweden.

Anni Vartola, anni.vartola@aalto.fi

Aalto University, School of Arts, Design and Architecture, Department of Architecture, Finland.

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## MAPPING DANISH LIGHTING TRENDS

SOCIOCULTURAL ASPECTS OF LIGHT ANALYSED IN  
*BO BEDRE*

LONE STIDSEN, NIELS THUESEN AND POUL HENNING  
KIRKEGAARD

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### Abstract

The goal of this paper is to provide information on Danish lighting trends. The agenda is to present a method for documenting sensory qualities of light, which are often described as subjective preferences and not documentable.

The impacts of light on the atmosphere are discussed against socio-cultural aspects of light. By analysing 3,483 images in the Danish trend magazine *BO BEDRE* in the period 1961–2010, the study investigates the identifying marks of arranging artificial light in a horizontal tripartition of a space: *High Lighting Zone* (HIGH), *Centre Lighting Zone* (CENTRE) and *Low Lighting Zone* (LOW). The results show that a horizontal tripartition can be used to describe the various uses of light in Danish homes and, thereby, the sociocultural trends in residential lighting. In the living room, dining room, multifunctional rooms and rooms for sitting activities, lighting placement dominates in the CENTRE. The HIGH and CENTRE are normally used in rooms for standing activities. In rooms such as corridors and the bathroom, most light is arranged in the HIGH, and finally the LOW characterizes bedroom lighting.

Finally, the paper discusses results, advantages and disadvantages of the analysis and the method for collecting data.

Keywords:  
lighting design, atmosphere,  
cultural understanding, domestic  
light, light application, lighting  
trends, methodology.

## 1. Introduction

The experience of light is a core aspect in experiencing architecture (Rasmussen, 1957). The objective of this paper is to describe how architectural atmosphere can be influenced by light. With that in mind, six definitions of atmosphere is selected to illuminate and discuss different views on this phenomenon. Let me start with words from a practitioner, Peter Zumthor:

*The roots of architectural understanding lie in our architectural experience: our room, our house, our street, our village, our town, our landscape – we experience them all early on, unconsciously, and we subsequently compare them with the countryside, towns, and houses that we experience later on. The roots of our understanding of architecture lie in our childhood, in our youth; they lie in our biography. Students have to learn to work consciously with their personal biographical experiences of architecture. Their allotted tasks are devised to set this process in motion (Zumthor, 2006, p. 65).*

Peter Zumthor discusses the complex phenomenon of atmosphere in his work and points out the importance of a designer's consciousness of biographic aspects in the process of understanding the quality of architectural design. To create a pleasing atmosphere, the designer must understand what beauty is in the eye of the beholder, understand the impact of his own biography on the architectural understanding, and handle this complex in a design process.

The philosopher Gernot Böhme introduces atmosphere as a complex phenomenon and points out diverse conceptions of the term (Böhme, 2012). Atmosphere is used as a stamp of approval for beautiful architecture or exceptional experience of an environment. It is also used to describe the tone between people or in a space (Friis, 1986). Thus, the term is used for various purposes, but atmosphere is more than beautiful architecture or the tone between people. Atmosphere is everywhere and present at all times (Albertsen, 2009).

To understand atmosphere from a phenomenological point of view, Niels Albertsen introduced atmosphere in an urban context. Albertsen stated that «*Atmosphere cannot be seen – It must be experienced through other senses and an atmosphere rarely occurs through one sense alone, but in an interaction between several senses. Atmosphere affects people emotionally*» (Albertsen, 1999). Light, materials, and shapes of objects affect the way we experience a space and the way we experience the world through our vision and with our skin (Rasmussen, 1957, Pallasma, 2005). Atmosphere is therefore a sensuous experience in which we feel the simultaneous presence of what is sensed and ourselves sensing it (Albertsen, 2012; Böhme, 1993). This points to the fact that, in order to experience an atmosphere, there must be bodily presence in the space

while the experience of an atmosphere is a combined experience of sight, sound, smell, touch and taste. Anthropologist Mikkel Bille argues that things are ecstatic, in the sense that they step out of themselves to display their presence to their surroundings (Bille, 2009). The ecstatic nature of things and the fact that they step out of themselves entail that the connection of different objects to the total experience of an atmosphere can be discussed and made visible in that discussion. In this way, awareness of the objects can contribute to understanding a part of the sensory experience of a space – the atmosphere of the space. The work of Albertsen and Bille is related to, and based on, the philosopher Ger- not Böhme's concept of atmosphere and his philosophy of aesthetics (Böhme, 1993; 2007). Böhme presents atmosphere as: «*Atmospheres are indeterminate above all as regards their ontological status. We are not sure whether we should attribute them to the objects or environments from which they proceed or to the subjects who experience them. We are also unsure where they are. They seem to fill the space with a certain tone of feeling like a haze*» (Böhme, 1993, p. 114). Böhme specifically emphasizes bodily presence as essential for the experience of atmosphere. In this way atmosphere is something between *subject* and *space*.

The aim of this paper is to characterize how atmosphere can be shaped by light. The first step is to discuss sociocultural aspects of light and atmosphere in a Danish context. The second step is to propose a method defining important aspects of lighting design shaping the total experience of atmosphere. The third step is to display an analysis of lighting arrangement for eight specific spaces in Danish homes and to discuss the lighting trends in the period 1961–2010. Finally, the outcome of the analysis and the validity of the proposed method are discussed and concluded.

## 2. Light and atmosphere

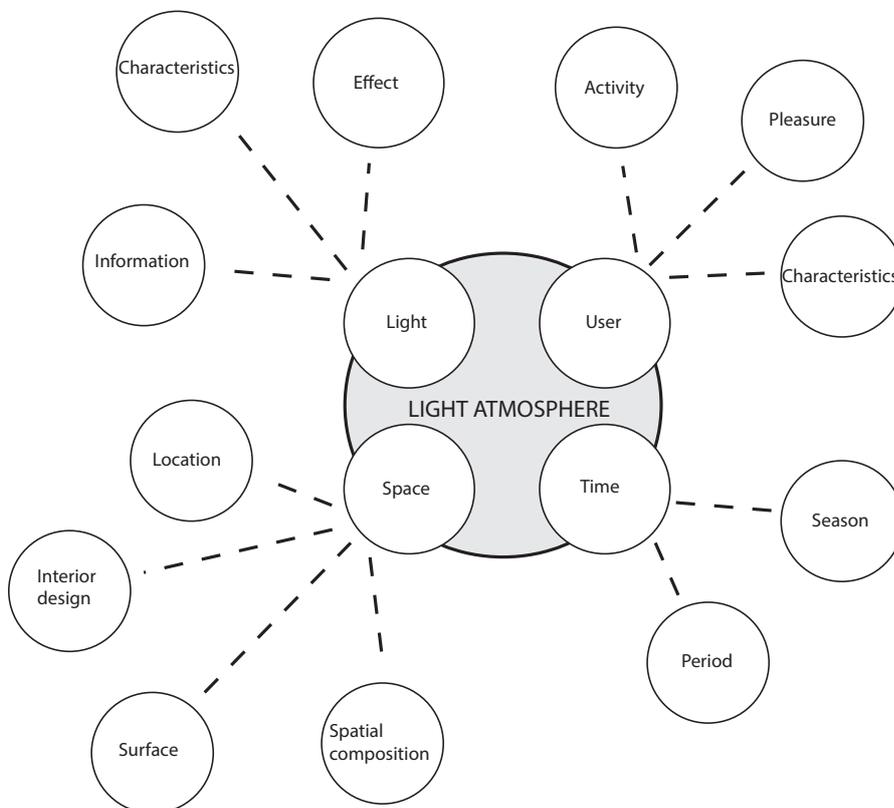
Can the concept of atmosphere be expressed in words or be represented in a physical design, and is it possible to describe or handle the concept without devaluing the contents of the concept? Albertsen (2012) states that it is possible to describe an atmosphere, depending on a common understanding. People can be trained to discuss an atmosphere and, thereby, communicate a common understanding of the sensuous experience and how they are affected by it. However, the discussion needs to be based on a common sociocultural understanding of the group and on a homogeneous audience. A description of atmosphere can be explained to absent people in such ways that «presencing» an atmosphere somehow resembles the atmosphere of original departure (Albertsen, 2012). Architects and designers in Denmark are considered as a socioculturally homogeneous audience, and they are experts in communicating an intended sensuous experience of spaces. They are expected to have a common understanding of aspects, which are important when creating sen-

sory experiences. The question is whether the communication of these aspects is precise enough to be understood by the man on the street?

Designers must include a sociocultural aspect in their designs in order to create an appropriate atmosphere to be experienced by the users. When it comes to lighting design, light has proven to have an effect on the psychological mood (Küller, et al., 2006), and the experience of light quality depends on a cultural understanding of quality (Park, Pae and Meneely, 2010; Stidsen and Kirkegaard, 2013).

From a study of mood and cognitive performance, the gender and age of subjects and the colour of the light have proven important for the evaluation of light (Knez and Enmarker, 1998). Light also assists patients' healing processes (Adeniji, 2006), it affects comfort in communication (Gifford, 1988) and it instils an experience of mystery (Carr and Dabbs, 1974). Light provides an opportunity to see the surroundings as well as impart a certain sense of place, and it is more than an individual preference (Bille, 2014). Light has an emotional effect as well as a visual and biological effect, and the effects need to be balanced in order to create an appropriate atmosphere (Laike and Goven, 2011). The previous work «Model of Light Atmosphere» (figure 1) introduces important aspects to be addressed in the process of designing a certain atmosphere shaped by light.

Figure 1  
Model of Light Atmosphere (Stidsen, 2012).



The model points out important aspects of atmosphere shaped by light, but does not answer in which way the different aspects can be qualified. The impact of light on atmosphere still needs to be investigated, and the role of light in sensing an atmosphere needs to be explored before it can be used proactively in the design process, and before the sensory aspects of light can go from being intuition to conscious, documented facts.

Traditionally, Denmark is well-known for focusing on lighting design, both in designing with daylight and with artificial light. The self-image of Danes is that they are skilled in lighting design, possess knowledge of the special kind of «Nordic daylight» (Volf, 2010) and that they use light in a certain way as a part of creating a cosy atmosphere in their private homes (Bille, 2014). This also applies in the case of institutional buildings: For instance the *Skolen ved Sundet* school (finished in 1938) was built on the basis of the idea that daylight has an important impact on the well-being of pupils (Coninck-Smith, 1989). The renowned Danish architect and designer Poul Henningsen (1894–1967) raised awareness of hygienic light and showed how light can be designed to provide beautiful surroundings. In Henningsen’s luminaire design, the core speciality is to reflect light and create a beautiful soft zone of light (Hansen, Jørgensen and Jørstian, 1994a; 1994b).

Throughout time, Danes have been brought up to pay attention to light and they have been told that light is connected to well-being and that light is an important aspect in life. This might be part of the reason why Danes seem to have a common understanding of what «good lighting» is, that they illuminate homes similarly and that many have problems understanding other cultures’ ways of illuminating their homes. Foreigners also notice the Danish traditions of lighting design, and a recent study on hotel guest rooms (Park, Pae and Meneely, 2010, p. 33) confirms that preferences on light are not universal.

An earlier explorative study on preferences for light atmosphere in Danish homes (Stidsen, 2013) illustrated that light is located in different horizontal zones – HIGH, CENTRE or LOW – according to the activity in the space. The study also showed that the people in the age group of 60–85 years old preferred flexibility when using light to create different atmospheres according to activity. Spaces with activities performed while standing up, like walking, working in the kitchen, standing in the bathroom and so on use the HIGH. In spaces where there is more sitting activities, e.g. living room and dining areas, lights were distributed in defined light zones around the space in the CENTRE or LOW. The study clearly showed similarities in the lighting technique used to support different atmospheres in Danish homes.

The present paper therefore proposes a method for evaluating aspects

of light that is important for the total experience of atmosphere, and creates knowledge on the distribution of light in a HIGH, CENTRE and LOW position in Danish homes. This knowledge is useful for lighting designers. The investigations of light preferences and specific information on arrangement of light can be used in argumentations about the effect on the total experience of atmosphere. Lighting designers often fall short when arguing for including perceptual qualities of light in a lighting design that is not measurable on the same level as direct measurable qualities such as light level, colour temperature or colour rendering. In recommendations and regulations, sensory qualities of light are often neglected due to lack of knowledge about the field.

### 3. Theoretical approach and method

Sensuous aspects of light and focus on how atmosphere can be influenced by light are relatively new research areas. According to researcher and lighting designer Christopher Cuttle, there is a problem with how lighting quality is evaluated today. He believes that the quality of light is more than just uniformly distributed light measured on the horizontal plane; what Cuttle defines as the first stage. He also defines a second stage which includes human aspects in lighting design, but he claims that this stage still fails to achieve its objective because it lacks human reality: the surroundings where the light is situated etc. Consequently, he has introduced a third stage, which is based on a reality where, besides applying illumination according to the standards, illumination also has to be evaluated to include the impact of the surroundings on the light experience. The essential difference moving from stage one to three is a shift from assessing light incident on planes to assessing light arriving at the eye (Cuttle, 2010). Still, there might be a need for a fourth stage in which lighting design is evaluated on the basis of a cultural understanding of lighting quality and a space appearing adequately lit.

In an optimal situation, the analysis of the role that light plays in a total experience of atmosphere should be evaluated *in situ*. However, evaluation of light and colour in images has been found comparable to the real experience (Newsham, et al., 2005). As representation for the real experience of atmosphere in Danish homes over the past fifty years, the trend magazine *BO BEDRE* was found relevant for this study, because the magazine is a frontrunner in its field in several ways. Palle Fogtdal launched the magazine in March 1961 as one of the first Danish specialty magazines for a broad non-professional reader group (Benjamin Media, 2012). At first there were no competitors to the magazine. Now, Danish magazines such as *RUM*, *Boligmagasinet*, and *Bolig+* are competitors to *BO BEDRE*, but the magazine is still the best known and most respected magazine in its field. When it comes to interior design of Danish homes, the magazine is a trendsetter and serves as both inspiration and a practical directory in the jungle of interior design options. Every month, the

magazine offers its readers reports from large, alluring dream homes as well as practical tips for everyday life. As a monthly magazine, *BO BEDRE* reflects on seasonal changes and future trends in interior design. The magazine seeks to inspire the reader, sort information, disseminate useful knowledge and have a high entertainment value. Since the first issue in 1961, *BO BEDRE* has presented pictures of the spirit of the time and collated volumes of the magazine make up a piece of Danish cultural history. *BO BEDRE* is the only media in Denmark which has officially been recognized as a super brand. Therefore, the magazine represents a wide range of high profile brands in areas such as housing, food, clothing, cars, jewellery, watches and personal care. The target group of the magazine is women (60 %) and men (40 %) aged 30 to 64 years old. Core readers have a higher household income than average, their lifestyle is reflected in the home, and they make very high demands on quality and design. *BO BEDRE* presents Scandinavian and international trends on housing, lifestyle and interior. The circulation is 80,000 copies, with 436,000 readers from July–December 2011; this makes it Denmark's most widely read monthly magazine (Benjamin Media, 2012). *BO BEDRE* is therefore used as a valid source of information and representative for lighting trends in Denmark in the period 1961–2010.

Currently, it seems that no validated method exists that could be used for evaluating an atmosphere shaped by light. In order to evaluate the role of light in the experience of atmosphere, it is important to collect information on both light and other aspects of sensory stimuli in a space. Therefore, an analysis chart was created specifically to evaluate both light and sensory stimuli as the impression of the space, use of spatial composition, interior design, colours and materials. All the information is represented in images of private homes published in *BO BEDRE*.

The light is analysed on the basis of knowledge gained through studying educational books, guides and research in the field. Educational books contributed knowledge defining well-known understandings of terms and language (Simons and Bean, 2001; Cuttle, 2008; Liljenfors, 1999; Leslie and Conway, 1996; Innes, 2012). Guides for lighting provided an insight into which important aspects to include (Philips Lighting, n.d.; Hansen, Jørgensen and Jørstian, 1994b; Zumtobel, 2004; Karcher, 2009). Lastly, research literature on the subject was studied to qualify the aspects included (Boyce, 2003; Boyce, 2004; Cuttle, 2013; Innes, 2013; Veitch, 2001; Stidsen, Kirkegaard and Fisker, 2010b; Stidsen and Kirkegaard, 2013; Stidsen, Kirkegaard and Fisker, 2010a; Küller, et al., 2006).

Seven basic terms developed by Liljenfors (1999) were used to describe the visual experience of light: «Level of lightness», «Spatial distribution of brightness», «Shadows», «Reflections», «Glare», «Colour of light» and finally «Colours of the interior». Researchers like Peter Boyce point to «Overall evaluation», «Perceptual clarity», «Spatial complexity», «Spa-

ciousness» and «Formality» as five essential aspects of light (Boyce, 2003). Boyce introduces an overall evaluation, which represents an assessment of sociocultural understanding of what is a friendly environment. However, there is a lack of information about preferences for pleasantness and familiarity with light. Boyce also finds it important to evaluate the experience of illumination on a bipolar scale (2003, p. 212). Boyce and Liljenfors agree on many of the central aspects of light evaluation, and together with the findings from earlier studies using «Model of Light atmosphere» (Figure 2), four aspects that have an impact on the experience are identified: «Light», «Users», «Time» and «Space».

Lighting techniques were defined using the definitions from Elsparefonden and El-Selskaberne i DK (2004) because they explain how light is distributed from the luminaire into the space. The information gained during the study of practice, information on lighting techniques in Danish homes and educational books contributed to the development of an analysis chart using bipolar scaling or a specific technique or space.

The analysis chart is displayed in Figure 2 and contains the topics: «General information», «Light appearance», «Space appearance», «Lighting technique», «Room definition», «Horizontal Light Zone» and «Vertical Light Zone» and lastly information on the «Photography» and the «Type of article».

Main Category	Sub Category	Evaluated as:
General	Year	1961-2010
	Magazine number	1-12
	Page	Ex. 63
Light appearance	Light level	1-5 scaling
	Light distribution	1-5 scaling
Space appearance	Visual temperature	1-5 scaling
	Spatial composition	1-5 scaling
Luminaire effect	Shadow effect	1-5 scaling
	Design focus	1-5 scaling
Lighting technique	Downlight	One of the subcategories marked (1)
	Mainly downlight	
	Uniform light	
	Up- and downlight	
	Mainly uplight	
	Uplight	
Room definition	Living room	One of the subcategories marked (1)
	Dining room	
	Standing activities	
	Bath	
	Multifunctional	
	Corridor	

Main Category	Sub Category	Evaluated as:
	Sitting activities Bedroom	
Horizontal light zones	High Light Zone Centre Light Zone Low Light Zone	Number of light sources in subcategory
Vertical light zones	Near walls Centre of the space	Number of light sources in subcategory
Horizontal light zones (numbers)	High Light Zone Centre Light Zone Low Light Zone	Number of light sources in subcategory
Vertical light zones (numbers)	Near walls Centre of the space	Number of light sources in subcategory
Photo	Night Day	One of the subcategories marked (1)
Article focus	Report	Yes or no
	DIY (Do-It-Yourself)	Yes or no

As interior design in Danish homes does not change significantly through seasons, there is no discrimination between time or season. Time is only seen as a historical timeline for the period 1961–2010. To ensure a homogeneous understanding of Danish lighting design, topics and scaling, two Danes trained in architectural design performed the analysis of the trend magazine for two months. In order to minimize misunderstanding of terms and their content as well as the scaling process, the two persons reviewed five issues of *BO BEDRE*, discussed and refined the understanding of terms, and tested definitions and scaling tables. The table was revised to a common understanding of terms. The adjustment included changing rating scale from a 7-scale to 5-scale, while the intervals between the numbers were found insignificant. The scaling in light level was also changed from 1) dark to 1) dim light, because a dark room will never be presented in a magazine and as such is not relevant. After the streamlining of the table, five volumes of *BO BEDRE* were simultaneously analysed by the two persons sitting next to each other. Finally, the photographs were indexed and numbered consecutively by year and magazine number.

The analysis was based on a representative number of magazines from the period (figure 3). The review process was carried out in summer and autumn 2011 and 3,483 photographs were analysed. The registration distribution spans across indexations of five-year intervals: 1961–1965, 1966–1970, 1971–1975, 1976–1980, 1981–1985, 1986–1990, 1991–1995, 1996–2000, 2001–2005 and 2006–2010. The number of registrations per interval varies from 46 in 1961–1965 to 135 registrations in 1981–1985.

**Figure 2**  
Analysis chart evaluating the main categories «Light appearance», «Space appearance», «Luminaire effect», «Lighting technique», «Room definition», «Horizontal light zones», «Vertical light zones», «Numbers of luminaires in horizontal zones», «Numbers of luminaires in vertical zones», «Photo» and «Article focus».

Period	Number of magazines
1960–1965	46
1966–1970	79
1970–1975	78
1976–1980	122
1980–1985	135
1986–1990	111
1990–1995	65
1996–2000	76
2000–2005	112
2006–2010	114

**Figure 3**  
Number of magazines obtained for the specific indexation of years in five-year intervals.

The images included in this study total 3,483, representing «Living room» (n=937), «Dining room» (n=704), «Standing activities» (n=555), «Bathroom» (n=287), «Multifunctional room» (n=202), «Corridor» (n=221), «Sitting activities» (n=221) and «Bedroom» (n=360).

Photographs displaying summerhouses or pictures from houses abroad, or interior set-ups were excluded as well as detail pictures. There was a distinction between images presenting a real-world environment, «do it yourself», educational interior design rooms, commercials or sketches of rooms. Only photographs of real-world environments were included, meaning that the images were always from interviews or reports from real homes.

#### 4. Results and discussion

The study of lighting preferences substantiated a horizontal tripartition of a space describing the Danish culture of using light for different purposes in a home.

The horizontal tripartition is central for analysis of the enormous amount of data. The aim is to evaluate whether the trend changes from 1961–2010 for the categories living room, dining room, standing activities, bathroom, multifunctional room, corridor, sitting activities and bedroom.

##### Atmosphere shaped by light

The degree to which atmosphere is shaped by light, and the importance of knowledge about sociocultural aspects of lighting design is open to discussion. This paper presents only one aspect of the total experience of atmosphere shaped by light. In order to define the role of light in an atmosphere, more studies need to be implemented.

The study challenges the idea of universal design and existing research

on lighting. Lighting research is often based on a common understanding or an undocumented expectation that everyone prefers a uniform lighting design with ceiling-mounted, even light distribution. This study questions this common understanding and points out specific aspects that are important for the qualification of light in a Danish context.

The number of images analysed is not evenly distributed over the years covered by the study, and this may bias the study. Even though a statistical analysis was not conducted, the lighting trends seem to be trustworthy except for the problematic results outlined below.

The results are displayed in figure 4 and discussed for every room category.

**Figure 4**  
Dataset representing the number of registrations of analysed images in BO BEDRE, displaying the number of light sources placed in HIGH, CENTRE and LOW in the period 1961–2010 ( $n_r$  = numbers of images analysed).

Living room				
Year	$n_r$	High	Centre	Low
60–65	49	0.06	0.82	0.12
66–70	88	0.05	0.86	0.09
70–75	96	0.03	0.77	0.20
76–80	143	0.09	0.72	0.19
80–85	167	0.20	0.62	0.19
86–90	136	0.28	0.60	0.13
90–95	85	0.36	0.47	0.16
95–00	99	0.34	0.58	0.08
00–05	140	0.26	0.63	0.11
05–10	143	0.27	0.59	0.14

Dining room				
Year	$n_r$	High	Centre	Low
60–65	27	0.07	0.89	0.04
66–70	48	0.02	0.98	0.00
70–75	66	0.03	0.94	0.03
76–80	81	0.06	0.93	0.01
80–85	107	0.12	0.88	0.00
86–90	98	0.19	0.80	0.01
90–95	75	0.39	0.60	0.01
95–00	55	0.22	0.78	0.00
00–05	96	0.14	0.84	0.02
05–10	96	0.16	0.83	0.01

Standing activities				
Year	$n_r$	High	Centre	Low
60–65	13	0.23	0.46	0.31
66–70	30	0.10	0.87	0.03
70–75	27	0.26	0.74	0.00
76–80	68	0.29	0.71	0.00
80–85	76	0.18	0.82	0.00
86–90	109	0.36	0.64	0.00
90–95	66	0.43	0.57	0.00
95–00	70	0.31	0.69	0.00
00–05	115	0.44	0.54	0.02
05–10	114	0.42	0.58	0.00

Bathroom				
Year	$n_r$	High	Centre	Low
60–65	10	0.10	0.90	0.00
66–70	8	0.63	0.38	0.00
70–75	10	0.60	0.40	0.00
76–80	18	0.89	0.11	0.00
80–85	37	0.73	0.24	0.03
86–90	52	0.77	0.21	0.02
90–95	71	0.63	0.37	0.00
95–00	33	0.64	0.30	0.06
00–05	51	0.59	0.35	0.06
05–10	49	0.69	0.22	0.08

Multifunctional room				
Year	$n_r$	High	Centre	Low
60-65	44	0.14	0.80	0.07
66-70	41	0.05	0.80	0.15
70-75	31	0.19	0.71	0.10
76-80	34	0.15	0.68	0.18
80-85	39	0.26	0.62	0.13
86-90	60	0.23	0.60	0.17
90-95	14	0.36	0.57	0.07
95-00	2	0.50	0.00	0.50
00-05	14	0.43	0.43	0.14
05-10	16	0.56	0.31	0.13

Corridor				
Year	$n_r$	High	Centre	Low
60-65	5	0.40	0.00	0.60
66-70	1	0.00	1.00	0.00
70-75	9	0.60	0.40	0.00
76-80	34	0.15	0.68	0.18
80-85	40	0.65	0.23	0.13
86-90	40	0.70	0.28	0.03
90-95	29	0.76	0.17	0.07
95-00	13	0.62	0.38	0.00
00-05	30	0.83	0.13	0.03
05-10	44	0.77	0.09	0.14

Sitting activities				
Year	$n_r$	High	Centre	Low
60-65	9	0.11	0.89	0.00
66-70	16	0.00	1.00	0.00
70-75	20	0.05	0.90	0.05
76-80	29	0.59	0.28	0.14
80-85	37	0.00	1.00	0.00
86-90	17	0.18	0.82	0.00
90-95	16	0.25	0.75	0.00
95-00	21	0.19	0.81	0.00
00-05	29	0.21	0.79	0.00
05-10	35	0.20	0.77	0.03

Bedroom				
Year	$n_r$	High	Centre	Low
60-65	11	0.00	0.91	0.09
66-70	18	0.00	0.72	0.28
70-75	39	0.10	0.51	0.38
76-80	29	0.59	0.28	0.14
80-85	58	0.17	0.36	0.47
86-90	49	0.10	0.31	0.59
90-95	44	0.32	0.25	0.43
95-00	43	0.23	0.35	0.42
00-05	56	0.21	0.39	0.39
05-10	81	0.20	0.47	0.33

In order to visualize the dataset in figure 4, the distribution of light sources between HIGH, CENTRE and LOW is displayed graphically in the diagram below (figure 5). The x-axis displays the five-year period and y-axis the percentage of light in the HIGH (grey), CENTRE (light grey) and LOW (dark grey) lighting zones.

Figure 4, cont.

Private homes are illuminated more or less consciously, but despite preferences for luminaire design and levels of considerations for illumination, the study showed a similarity in use of lighting techniques in the eight room categories. The lighting trend is most likely influenced by the technological development of more efficient light sources such as halogen light, which was introduced in the 1990s and is used as uplight and indirect light distribution. Later on, the Light Emitting Diode (LED) was developed and is used as recessed downlight. This influence is especially seen in the living room, dining room, for standing activities and in the multifunctional room, but there is also indication of this influence for sitting activities and in bedroom lighting.

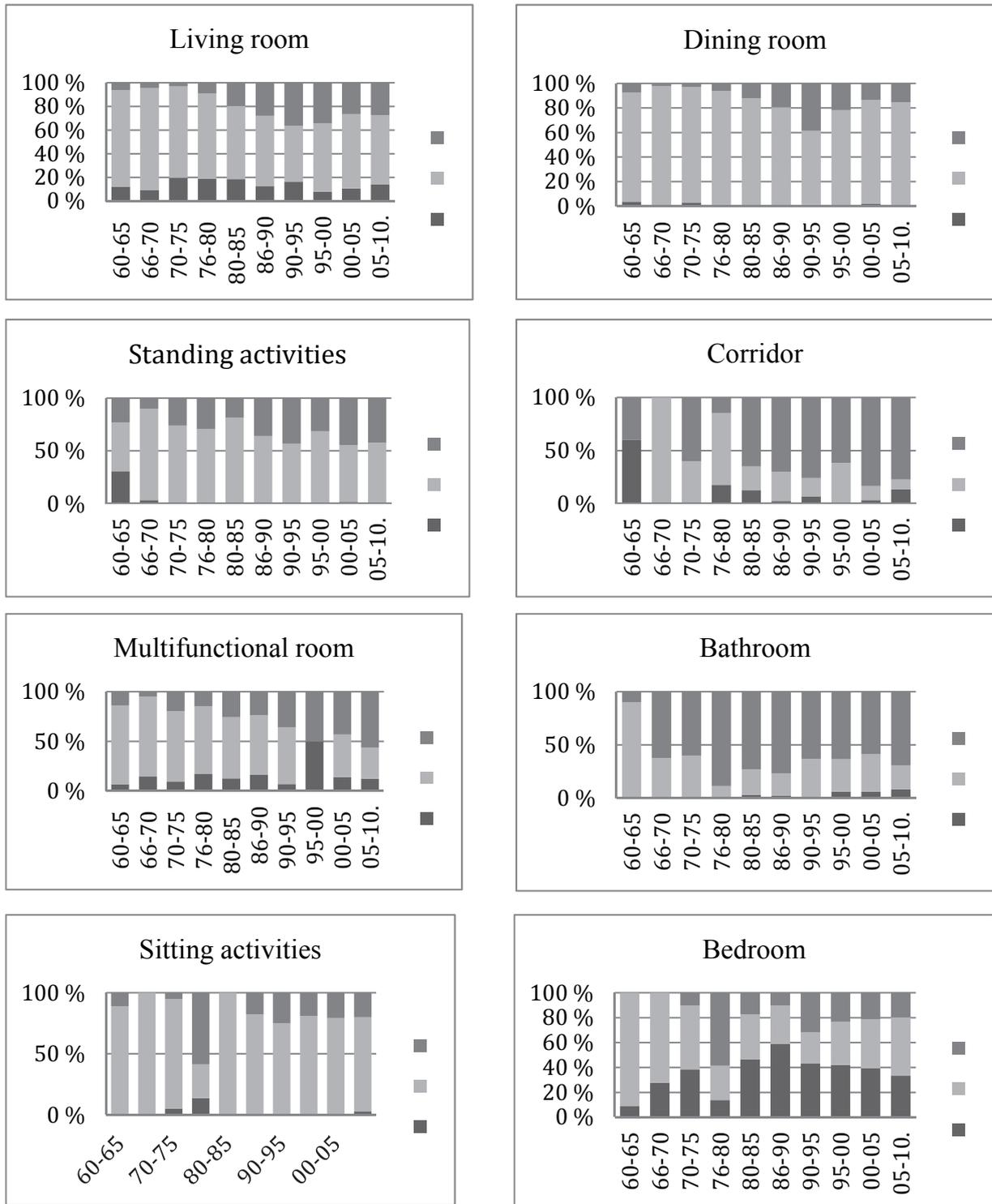


Figure 5  
The dataset as a percentage representation of light sources placed at HIGH (Grey), CENTRE (Light Grey) and LOW (Dark Grey) in the period 1961–2010.

There seems to be a development in the type of articles in the magazine over time. At the start of the period, most reports were from Danish homes, but later articles show more international interior trends. In the same period, the images start from showing the room and interior design as a whole, and later they show details and focus on objects in the room. Interior design was also represented in drawings instead of photographs for a period. Therefore, images were excluded which could have had an impact on the results.

The study can also have been affected by the economic situation in Danish society, as there are significant variations in the number of images available for registration, in the number of pages, and in the amount of advertising in each edition. This could also be seen in the trend with «do it yourself» articles instead of articles showing interior trends. There was also a change in the «celebrities» chosen to present their homes. In the beginning, architects presented their homes, later musicians, then athletes and recently celebrity chefs. This may reflect a common tendency in society.

### Living room

The light for living rooms is generally arranged in the centre of the space. LOW is used between 8–20 % throughout the period. CENTRE is used less than 47 % in 1990–95 and most represented with 86 % in 1960–70. HIGH is most represented in 1990–95 with 36 %. Thus, the lighting trend changes in the late 1980s, the 1990s and in the early 21<sup>st</sup> century, moving from CENTRE to using HIGH more frequently.

### Dining room

In the dining room, there is a slight variation over time and most light is arranged in CENTRE. LOW is almost not used as a lighting technique for dining rooms. HIGH increases in the early 1990s but decreases again in the late 1990s.

The most frequently used lighting zone for standing activities is surprisingly CENTRE, even though HIGH is also used often. HIGH increases in the late 1980s and so the most common lighting zone is evenly distributed between these two zones in this period.

### Bathroom

The light arrangement in the bathroom is mostly HIGH, but there are unexplained variations in the 1960s and early 1970s, which could be caused by too few samples. From the late 1990s and onwards, there are few LOWs represented, possibly because there was a general trend to perceive the bathroom as a wellness room where you can relax.

### Multifunctional room

The multifunctional room has evolved from most light in CENTRE to most light in HIGH; the change occurs in the 1990s. Only two registrations in 1995–2000 were made and, therefore, the result is not representative of the period and this is the reason for the increased representation of light in LOW.

The result is expected because the activities in the space are often playing, reading and relaxing combined with going to sleep. Therefore, the result reflects a combination of the results from standing and sitting activities as well as from the bedroom.

### Corridor

The result of corridor illumination is only built on few data from the 1960s and the early 1970s, which is reflected in the variations of the results. But in the late 1970s, CENTRE is mostly represented and from the 1980s and onwards HIGH is frequently used, and LOW reflects a trend for having a table lamp on a chest of drawers or table in the corridor.

### Sitting activities

For sitting activities, the most common lighting zone is CENTRE. There is only a variation in the late 1990s when the HIGH was most common. The reason for this change in lighting trend could again be changes in lighting technology, with halogen light and the introduction of spots mounted on shelves, or the trend of uplight. However, HIGH is only represented as the most common in the late 1990s, which is not similar to the living room etc. Therefore, this result is surprising, although the table lamp on the desk for task lighting remains the most common lighting technique for sitting activities.

### Bedroom

The bedroom has a remarkably high representation of LOW, even though this varies between 9 % in the beginning of the 1960s to 59 % in the late 1980s. Lighting by the bed is the reason for the high representation of LOW. HIGH or CENTRE lighting provides the general illumination of the space. HIGH increases in late 1970s. The reason for this variation is not demonstrable.

### *BO BEDRE* as a resource for data collection

It was not an option for us to personally be in homes representing a period of 50 years, even though this would be the first choice. Therefore, the magazine was seen as a way to get the information on lighting trends. Newsham, et al. (2005) concluded that images can be a reasonable surrogate for the real space, particularly on ratings related to aesthetics. Newsham noted that you can look for general trends, but you cannot find the optimal scene. Therefore the method seems appropriate for a study identifying general trends, even though it is preferable to be present in

the atmosphere being evaluated. So, it seems appropriate to use images as representative material, at least when it is not possible to recreate real-world studies of the environment.

It can also be discussed whether the method of using photographs from an interior design magazine during a period is representative for the actual trend in the period or rather a question of representing fashion in photography and ways of illustrating interior design. Photographers are able to manipulate light in pictures and a set-up can be supported by light not visible in the image. The expression in the images can also vary as the technology has gone from analogue to digital processing, which can have an impact on the images. This can of course be a problem, but since the magazine hires the photographers, they must follow the guidelines of the magazine and the visual identity of the magazine. So, the way of representing an interior design is seen as an approach from the magazine and not as a photographic style or approach. Still, it is important to be aware of the dilemma throughout the study and take note if remarkable changes happen. Therefore, focus is on the location, shapes, size and numbers of luminaires in the images and not on the light represented in the image. Bright or dark pictures and luminaires without light were included in the study. In this way, the imagination of the light situation is a part of the study, while the analysis requires knowledge on how luminaires distribute light in a space. So, it is possible to see whether the photographer has added extra light in the set-up or not. For example, the light level is defined by the way the luminaires distribute light and not by the reflected light from surfaces in the space.

However, as the images are analysed with knowledge on how light is distributed, it should be possible to evaluate the light level in the pictures and not if the picture is more or less bright. The appearance of materials and space requires the same kind of knowledge, since the analysis is based on knowledge of how materials and space reflect or absorb light, and the characteristics of materials. While the data included in this paper are the horizontal arrangement of light in eight categories, the data collected on other aspects will not be discussed here, even though these data are particularly relevant for identifying light's impact on the total experience of atmosphere.

## 5. Conclusion

The paper presented the hypothesis that the lighting trends in Danish homes are characterised by HIGH, CENTRE or LOW, depending on the activity in the space. Eight room categories in 3,485 images from the Danish trend magazine *BO BEDRE* in the period 1961–2010 were analysed for the arrangement of light into a horizontal tripartition.

Firstly, the purpose of the paper was to discuss how atmosphere can be

shaped by light and to define core elements to include in a method relevant for evaluating light's impact on the total experience of atmosphere. Secondly, the paper aimed to describe the development of the method on the basis of knowledge obtained from educational books, research and practice. Thirdly, results were presented, displaying light distributed in HIGH, CENTRE and LOW for eight central categories in Danish homes: living room, dining room, standing activities, sitting activity, bathroom, multifunctional room, corridor and bedroom. Finally, the goal was to conclude on the study.

The paper presented a method evaluating the impact of light on the total experience of space. The goal was to take the complex phenomenon of atmosphere and describe one aspect important for the total experience. The paper only evaluated the horizontal arrangement of light and only provided one single aspect of light. Therefore the study did not define light's impact on the total experience of atmosphere, but provided an understanding of the aspect of arranging light in a horizontal tripartition depending on the space. The information was collected from the trend magazine *BO BEDRE*. The images represent the spaces where Danes establish their architectural understanding. Following this it was concluded that more studies are needed to provide a full image of aspects of light before the impact on atmosphere is mapped. Other aspects important but not presented in this study could be a) vertical placement of light in the eight categories, b) the correlation between horizontal and vertical placement of light and the space temperature defined as objects, materials, and colours represented in the space, and c) the use of daylight distribution in the space.

The results showed that HIGH was used for corridors and bathrooms. CENTRE was used for living rooms, dining rooms and sitting activities. Lastly, the study showed that the LOW was used in bedrooms, and the light for standing activities was mostly characterised by a combination of CENTRE and HIGH.

The study strived to elaborate on the previous research results on preferences for light in Danish homes. The study succeeded in verifying the hypothesis of characterisation of light into the three lightning zones.

The knowledge on lighting trends in Danish homes is relevant for lighting designers when they create applications for public domains. The characteristic public light application is mostly to use HIGH supported by light arranged in CENTRE for workspaces. Our familiarity with lighting from our homes and, thereby, our architectural understanding of the use of light can be the reason why Danes have a hard time understanding other cultures' choices of light applications. Many Danes recognise the unfamiliarity of light situations when they travel to the southern part of Europe or in public domains; e.g. being a patient in a hospital ward

and trying to relax in a space where the light application is known from rooms for standing activities, in corridors or bathrooms.

The study can thus be used as the argumentation for upgrading lighting applications to more than uniform light distribution, and as argumentation for why light should support and respect the user's sociocultural architectural understanding to achieve a pleasurable atmosphere in a space.

The introduction of sociocultural aspects of light could call for larger budgets on light application, but it opens up for more studies on the benefits of reducing energy consumption. One example is again from the hospital ward and the situation of using light for watching TV. Here, Danes are familiar with demarked light zones in CENTRE and unfamiliar with uniform light distribution. In this context it may be relevant to go from maybe eight fluorescent T5 light tubes to 2–3 compact fluorescent light bulbs: one close to the patients, one by the TV and one somewhere else to get the feeling of the space.

The characterisation of light into horizontal tripartition of the space can also benefit from being studied in other cultures or for research results dealing with light preferences for different activities. More research is needed in this particular research field. However, this study contributes with relevant information on trends and traditions for lighting in Denmark.

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### Biographical information

Lone Mandrup Stidsen  
Designer, Folkeskolelærer, Ph.d.  
Aalborg University, Department of Civil  
Engineering  
Address: Aalborg Universitet, Institut for  
Byggeri og Anlæg, Sohngaardsholmvej 57,  
9000 Aalborg, Denmark  
E-mail: ls@civil.aau.dk

Lone Mandrup Stidsen educated as Textile Designer from Kolding School of Design, Primary School Teacher from Silkeborg Seminarium and holds PhD in Lighting Design from Aalborg University, Department of Civil Engineering. Lone is currently Postdoc working on Light and mental healthcare and has a focus on qualifying sensory aspects of light in her



### Biographical information

Niels Thuesen

M. Sc. in Architecture, Research Assistant  
Aalborg University, Department of Civil  
Engineering

Address: Wilkinson Eyre Architects  
33 Bowling Green Lane, EC1R 0BJ,  
London, England

E-mail: [thuesen.ark@gmail.com](mailto:thuesen.ark@gmail.com)

Niels Thuesen is M. Sc. in Architecture from Aalborg University. Today he is an architect for Wilkinson Eyre Architects in London, where he works on cultural and high-end residential developments with a focus on integrated design. Incorporating sustainable lighting solutions, which complement their settings to provide healthy environments for those who use them.



### Biographical information

Poul Henning Kirkegaard

M. Sc. in Civil and Structural Engineering,  
Ph.D.

Aarhus University, Department of Engi-  
neering – Tectonics

Address: Aarhus Universitet, Institut for  
Ingeniørvidenskab,  
Inge Lehmanns Gade 10, 8000 Aarhus C,  
Denmark

E-mail: phk@eng.au.dk

Poul Henning Kirkegaard is M.Sc. in Civil and Structural Engineering from Aalborg University and PhD from Aalborg University. Today he is Full Professor in Engineering & Architectural Design at Aarhus University. His vision for the research and teaching focuses on bridging the engineering topics to architectural design and vice versa.

