Aalborg University Copenhagen

Semester: 10th Semester

Title: A New Look into Office Atmosphere

Project Period:
February - June

Semester Theme:

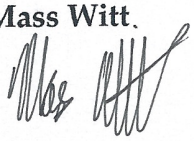
Master's Thesis

Supervisor(s):

Ellen Katrine Hansen

Project group no.:
Student ID: 20113435

Members:
Mass Witt.



Aalborg University Copenhagen

Frederikskaj 12,

DK-2450 Copenhagen SV

Semester Coordinator: Georgios Triantafyllidis
Secretary: Lisbeth Nykjær

Abstract:

This thesis investigates the research question "*Is it possible to prove a negative association to the atmosphere in an office space, and then change that atmosphere by simply changing the light through a lighting design for this type of space?*" . It does so by defining Atmosphere after literary review, and then proceeds to analysis what role light has in the atmosphere of a room or space. Here models by Lone Stidsen and Iben Winther Orton, are merged into a new model for analysis of atmosphere in an office space and a template for lighting design. An online survey showed an indication of negative association and an analysis of the IDA offices using the new model provided evidence of elements, which could create a negative association to the atmosphere. Finally, a new lighting design is presented, adding new elements to the office as well as a new version of others. Due to a small sample group for the survey and the lack of opportunity to test the new design, this thesis can only concluded that there is evidence to show an indication of negative association to office space, until opportunities for further testing presents itself.

A New Approach to Office Atmosphere

Investigation of a Negative Perception of Light in Office Spaces, and How to Change It.

Aalborg University

Mass Witt

June 2016

Abstract

This thesis investigates the research question *"Is it possible to prove a negative association to the atmosphere in an office space, and then change that atmosphere by simply changing the light through a lighting design for this type of space?"* . It does so by defining Atmosphere after literary review, and then proceeds to analysis what role light has in the atmosphere of a room or space. Here models by Lone Stidsen and Iben Winther Orton, are merged into a new model for analysis of atmosphere in an office space and a template for lighting design. An online survey showed an indication of negative association and an analysis of the IDA offices using the new model provided evidence of elements, which could create a negative association to the atmosphere. Finally, a new lighting design is presented, adding new elements to the office as well as a new version of others. Due to a small sample group for the survey and the lack of opportunity to test the new design, this thesis can only concluded that there is evidence to show an indication of negative association to office space, until opportunities for further testing presents itself.

Dedication

Friend, Family and Maibritt.

Acknowledgements

The author would like to thank: Iben Winther Orton for teaching me the three corner stones of lighting design.

Lightscapes, for the internship which inspired the idea behind the thesis, and for the lighting trinity.

Ellen K. Hansen for bringing me into the world of lighting design.

Thanks to Niels for reading this more than once.

The inventors of coffee, you keep the world awake.

Contents

List of Tables

List of Figures

Chapter 1

Motivation

In the autumn of 2015 I did an internship at Lightscapes, with Iben Winther Orton. There I mainly worked on two projects: an office building for the jewelry company Pandora and a new treatment building, for brain and back trauma, for Glostrup Hospital. Even though the functions of these two buildings are as far apart as can be, the projects had one thing in common. When we were hired, the architects did not want the hospital to feel like a hospital and the jewelry company did not want the office building, to feel like an office. In neither of the cases, there was no real description of what the client meant by "office building feeling" or "Hospital feeling" but there was an implicit consensus of what they meant.

I found it interesting, that there was an interest in changing the perception of the space, which is based on a shared association founded in a past experience. This thesis will investigate the existence of a consensus in the general public, that the lighting in certain office spaces is perceived as negative. The reason for focusing on offices is that it is a type space where a lot of people spend time every day and have no say in how it is like in there. Few placed do the employees have a say in what kind of tables, chairs or light that decorates the room, because of this and the fact that we spend untold hours there. I believe there is a need to turn our focus towards offices to make them as comfortable as possible and to make them a place you want to spend time, not a place you have to spend your time.

1.0.1 Imaginative Research Question and Aim

Based on experiences from the internship, I have formed the hypothesis that there is a association to being in an office, and additionally the feeling one has when experiencing the atmosphere is mainly negative, . These negative perceptions of the atmosphere then becomes a common reference to bad or uncomfortable atmosphere in general. More than once, I have heard others describe bad lighting as "It feels like I am in a dentist office" or something similar. Other spaces include office buildings, hospitals, schools and libraries and so on. I believe that it is possible to change these common perceptions, by giving a space a lighting design that is designed specifically to that space, and thereby changing the atmosphere. Based on this, the hypothesis presented for this thesis is:

This thesis will investigate the following Imaginative Research Question:

Is it possible to prove a negative association to the atmosphere in an office space, and then change that atmosphere by simply changing the light through a lighting design for this type of space?

This thesis will attempt to achieve this by:

1. First defining what Atmosphere is.
2. Explaining Lone Stidesens 'Model of Light Atmosphere.
3. Explaining the Lighting Trinity from Iben Winther Orton
4. Forming a new model which will be utilized to analyse the lighting atmosphere in a space or room.
5. The final terms to be defined will be Association and assosicationism.
6. A survey will investigate the general association of experiencing an office space.
7. A case of this type of space will be analyzed using the model.
8. A place specific lighting design will then be made.

The following chapter will investigate and define the term Atmosphere and why it is essential to this thesis, furthermore, the psychological study of Associationism will be investigated and finally the method with which the hypothesis will be tested and a final problem statement will be formed.

Chapter 2

Method

As mentioned in the Motivation, the research question is based on the feeling a user experiences in a office building. In order to define what this feeling is, this chapter will investigate and define, first the term Atmosphere, what is it and how we experience it. Then, more specifically it will investigate what role light plays in the experience of Atmosphere in a space and describe how this can be analysed, using the Model of Lighting Atmosphere, by Lone Stidsen, and The Lighting Trinity, by Iben Winther Orton. These will be utilized as a tool to give insight into why users might experience the atmosphere of a space in a negative manner. Furthermore, this chapter will investigate the theory of association, and why users relate the lighting in a space in a certain way.

2.1 Atmosphere

"*Is there anyone who has not, at least once, walked into a room and 'felt the atmosphere'?*"

- Teresa Brennan(Brennan 2004)

When one enters a room, we get a feeling about that room instantly. This feeling is what we might call 'the atmosphere of the room'. The challenge with the term 'atmosphere' is, that there is no clear definition on what creates an atmosphere or even what it is. Some architects and philosophers seem to agree that an atmosphere is the result of a combination of things: The shape of a room/space, the material in the given room/space, the social mood there and the observers 'basic mood' etc. The following section will define the term atmosphere for this thesis and how it will be utilized, meaning it will not be a definitive definition of the term.

According to Teresa Brennan, as the quote suggests, we feel the atmosphere in a room or space, and, as previously mentioned, many philosophers and architects agree. The German philosopher Gernot Böhme writes in his essay 'Urban Atmosphere: Charting New Directions for Architecture and Urban Planning'(Böhme et al. 2014), that the term atmosphere is such a undefinable term, it is hard to put into words, using European ontology. He uses the Japanese philosophical terms 'Ki' (or 'Qi', which describes aerial elements such as 'breath', 'air', or 'gas', and is also used when talking about spiritual components such as 'material energy', 'life force', or 'energy flow') (Lee, Pittler,

and Ernst 2008).) and 'Aidagara' (translates to betweenness or relationship(Shields 2009)) Böhme uses these terms to illustrate that the Atmosphere excites between, what he calls the object and the subject, or in the case of this thesis, the observer and the space. He writes that experiencing atmosphere is something quasi-objective, which can happen upon us regardless if we choose to or not: *"Atmospheres fill spaces; they emanate from things, constellations of things and persons. The individual as a recipient can happen upon them, be assailed by them; we experience them, in other words, as something quasi-objective, the existence of which we can also communicate with others."*(Böhme et al. 2014).

Christian Borch, Professor MSO, PhD in Management, Politics and Philosophy at CBS, gives an example of this in the essay 'Why Atmosphere'. Borch uses the Holocaust Tower at the Jewish memorial in Berlin and how it has a very intense oppressing atmosphere. Though to say our mood is dictated by the atmosphere or qualities of a room is not correct, Böhme says that the atmosphere is affecting our 'basic mood' rather than dictating it.(Böhme et al. 2014)

Borch also mentions Juhanni Pallasmaas text, "Space, Place, and Atmosphere: Peripheral Perception in Existential Experience" (Böhme et al. 2014), in his essay and brings up two main points about the experiencing of atmosphere and how/why it affects us. The first is "*Atmosphere is experienced emotionally, before they are understood intellectually.* (Böhme et al. 2014)", this means that a rooms atmosphere is effecting us on an unconscious level before we are aware of the effect, so we have a sort of intuitive gut feeling about a room before we have an intellectual opinion about it. This is followed by the second point "*Our pre-intellectual encounter with architecture is a multi-sensory experience. A space is seen, felt, heard etc. before it is consciously and intellectually reflected upon.*", (Böhme et al. 2014), meaning an Atmosphere is not a measured unit, but an emotional and multi-sensory one, so taking a quality of a room A into a space B might not give space B the same atmosphere as room A, as it is the combination of elements in room A that creates its atmosphere, not a single element. Space B might, however, have another atmosphere than before(Böhme et al. 2014). Pallasmaa himself calls this 'Experiential Atmosphere' and defines it himself as "*Atmosphere is the overarching perceptual, sensory, and emotive impression of a space, setting, social situation. It provides the unifying coherence and character of a room, space, place, and landscape, or a social encounter. It is the 'common denominator', 'the colouring', or 'the feel' of the experimental situation. Atmosphere is a mental thing, an experimental property of characteristic that is suspended between the subject and the object.*"(Böhme et al. 2014)

Lone Stidsen PhD, wrote in her dissertation 'Light Atmosphere in Hospital Wards', that there are certain cultural aspects of atmosphere and how preferred lighting might differ between cultures. She uses the example that in Denmark candle light is associated to the type of cosy atmosphere referred to as '*Hyggelig*'. However, in some cultures candles lights are associated with something completely different. Taking Italy as an example, due to the majority of the population being catholic, candle lights are associated with the passing of someone. So taking a living room and putting in several candle lights, would be considered 'hyggeligt' in Denmark, but might be connected with sadness, loss, and mourning in Italy. (Stidsen 2013) This is something to keep in

mind as this project is about changing an atmosphere from something perceived as a negative and changing it to something more positive. What ever a successful design might be, could differ from culture to culture. Therefore this project and the designs to come, will be with a Danish/Nordic lighting culture in mind. Then one could test these design for other cultures in a different project.

To summarize; Böhme, Borch, Pallasmaa and Stidsen all consider atmosphere to be an unquantifiable but purely emotional and multi-sensorial experience, created by different combinations of elements in a room or a space(Böhme et al. 2014). In her dissertation of lighting atmosphere, Stidsen creates a Model of lighting Atmosphere that is a tool, or template if you will, to quantitatively analyze the lighting in a room and to try and examine what the light does to the atmosphere in said room. The following sections will present the Model of Lighting Atmosphere and the different parameters that makes up the model and how it can be used to answer the problem statement,

Is it possible to prove a negative association to the atmosphere in an office space, and then change that atmosphere by simply changing the light through a lighting design for this type of space?

2.2 Atmosphere & Lighting.

Stidsen created the Model of Lighting based on a process which started with simple brainstorming then as the model evolved, she used literary review, visual experiments, exploitative studies and experimental studies to further develop the model(Stidsen 2013).

The model is based one Millets four parameters of luminous effect, which has four main categories: '*Material*', '*Light*', '*Space*' and '*User*'. Millet defines them as:

I. Material: '*The reflective surface that receives and modify light.*'
II. Light: '*The source and its intensity.*'
III. Space: '*The geometry or the relationship between the source and the receiving surface*'
IV. User: '*The person who views both the source and the illuminated surface.*'(Stidsen 2013)

The biggest change Stidsen made to Millets definition, was to put 'Material' under the category 'Space' as it is not necessary for 'Material' to have its own category. 'Time' is a category Stidsen added, since the time of year and even the time of day, plays a big role when it comes to the light in a room. In the interest of keeping this section as a short presentation of the model, each subsection will be summarized in as brief and precise a manner as possible, in terms of what they mean and how they work in relation to light.

2.2.1 The four parameters of the Model of Light Atmosphere

As seen on Stidsens model, there are four main categories I: USER, II: SPACE, III: LIGHT, and IV: TIME, see 2.1. Each with its own sub-categories(A. B. C. etc), which in turn have individual parameters(1. 2. 3. etc).

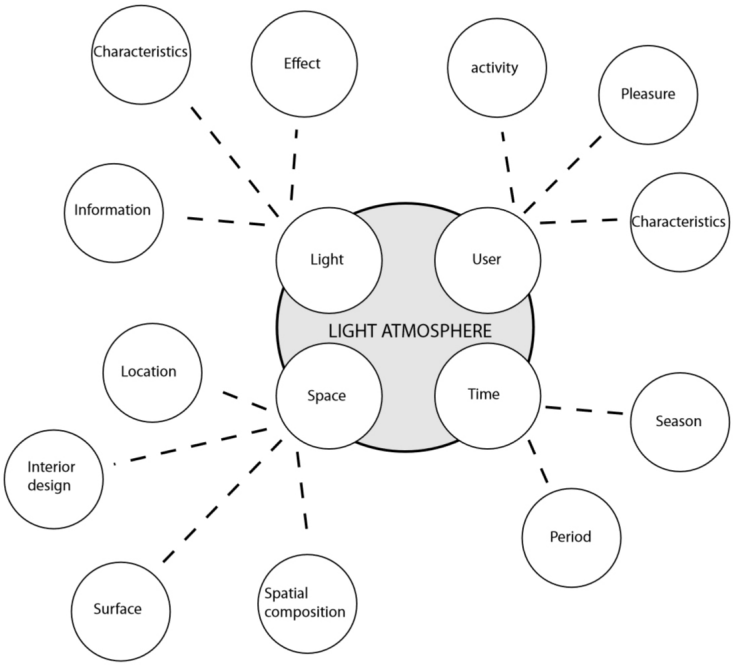


Figure 2.1: Stidsens 'Model of Light Atmosphere'

2.2.2 I: User.

This category describes the user of a given space, who the user is, if they are pleased with the space, and what their role in the space as.

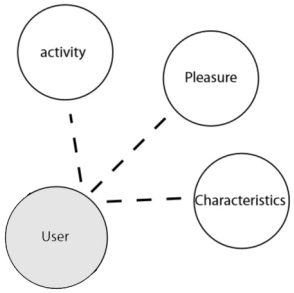


Figure 2.2: 'User' category and the three sub-categories

A: Activities. What is the user using the space for, this again is split in to several parameters.

1. Sleep or sleep related activities. Bed rooms or patient room

2. Everyday activities, this includes work related activities.

3. Dangerous or extremely difficult activities. This would include surgical theaters or any space that need to be able to do mass evacuation.(Stidsen 2013)

B: User Pleasure. Stidsen refers to Patrick Jordan's four terms of pleasure: Physio, Psycho, Ideo, and Socio Pleasure, (Stidsen 2013).

Physio Pleasure	Physio, meaning physical pleasure is "The kind of pleasure, experienced in connection with the physical capacity of a product. In which way can the product make you physically capable to manage or perform both biological and visual performance?" According to Boyce, visual pleasure is defined as the absence of visual discomfort. Which is defined as the gaps in luminance distribution, For this thesis I would like to add glare to this definition, both direct and reflective, (Stidsen 2013).
Psycho Pleasure	The psychological pleasure a space can provide, in the emotional and cognitive sense of the word. Stidens writes of Küller who introduces four elements he describes as important in order to enjoy an environment: Coherence, legibility, mystery and complexity meaning a individual should be an active interpreter of information. These are in turn part of an emotional process of four stages: arousal/aversion (evaluation), attention/orientation, and coping/control, these are called *The Basic Emotional Process*. The process is that every impression causes a reaction or arousal of a high or lower level, this results in a preparedness for a coming situation, as we establish control, the process is done, this process repeats itself as environments change. Stidsens concludes with "*For the experience of light atmosphere, it means that the 'Basic Emotional Process' regarding light is affected by the sense of coherence. Does the light "fit into" the situation.* (Stidsen 2013)"
Ideo Pleasure	Individual pleasure, meaning personal taste and preference. This pleasure term is near impossible to full fill in the literal understanding of the word, therefore we shall consider this as a cultural pleasure term. As mentioned in (Stidsen 2013) there is a danish preference to warm lighting as we know it from candles lights, (Stidsen 2013).
Socio Pleasure	Social pleasure. Gifford studies the effect lighting had on peoples communication and mood. Some of his results include: Brighter level of illuminance encourages more general communication. Home-like, somewhat intimate, lighting lead to more general and intimate communication, (Stidsen 2013).

Table 2.1: Table explain Jordans four terms of personal pleasure.

C: User Characteristic. Might also be called user group, who is the space designed for

and who uses it. Since her dissertation is about hospital wards, Stidsens users are patients, staff and visitors. For this thesis, there will be two groups of users, short term and long term users. Short term meaning people who use it one day or a few hours or less. Long term meaning staff or otherwise long term users such as hospital patients.

With these terms in mind it will be possible to set up a analysis of a space which shows if a room is considered pleasurable within these four terms.

2.2.3 II: Time.

As mentioned earlier the natural light changes over time, and depends on the time of the day and the season of the year.

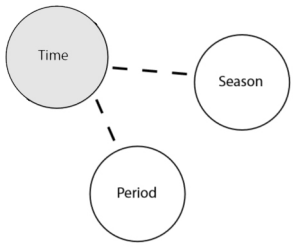


Figure 2.3: 'Time' category and the three sub-categories

A: Season. Just as light changes during the day, light changes over the seasons of the year. In Denmark we have long days during the summer, with the sun at a high zenith and in winter we have shorter days with the sun at a lower zenith, see figure 2.5. The variation in the zenith of the sun plays, dictates the length of the shadows cast.(Stidsen 2013)

B: Period. Previously, the transition between daylight and the light in the evening was described. This transition will effect a space in several ways, both in terms of shadows cast and their length and the color of the light. All of this changes during the period of the day the space is observed. Morning, noon afternoon and evening all have different attributes(Stidsen 2013).

2.2.4 III: Space.

Used to define the space in which one is working. Spanning from geometrical location to surfaces and interior design.

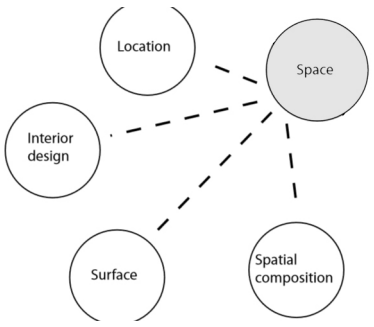


Figure 2.4: 'Space' category and the three sub-categories

A: Location. Overall there will be no change in this sub-category as it deals in geometrical location. Daylight changes depends on latitude relative to the equator. But as all spaces in this project will be located in Denmark, sub-category will not be subject to change. It is worth mentioning that since Denmark is located far North relative to the equator, we have a long transition period from day to evening, it is four to seven hours with major variation depending on time of year(Stidsen 2013).

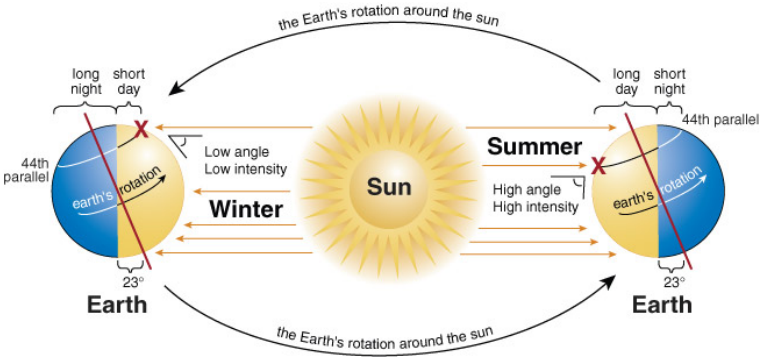


Figure 2.5: Illustration showing how high and low angles along the 44th parallel, roughly where denmark is located, affects the duration of the day. (*Why Solar? The how and why of FREE heat!*)

B: Interior design. Has to do with the interior of the space. Everything from size, shape to material to the perceived hardness or softness of a piece of furniture. How do all these elements effect the lighting in the space in terms of shadows, reflection,refraction etc(Stidsen 2013).

Figure 2.6: Illustrates how interior changes the impression of a room

C: Surfaces. While one might consider this part of the two aforementioned sub-categories, Stidsen grants it its own. this is due to the reflective effect a surface can have in a room, e.g. a wall with a certain hue and strong reflective character will 'bleed' into the rest of the room effecting the color of everything and thereby changing the perception of things. Surfaces deals with Hue, reflection, glossiness etc.(Stidsen 2013)

D: Spacial composition.

Stidsen defines this sub-category as *"The architectural organisation of the speciality, enclosure, arrangement of door, windows etc."*(Stidsen 2013). The arrangement of door and windows, effects where and how light is allowed into a space and how it can flow between rooms. Furniture and interior is excluded from Spacial Composition and has its own sub-category. So this is the naked room, its air quality, acoustics, building materials and so on.

2.2.5 IV: Light.

This category aims to describe the qualitative and quantitative measures of the light in a space, both daylight and artificial light sources.

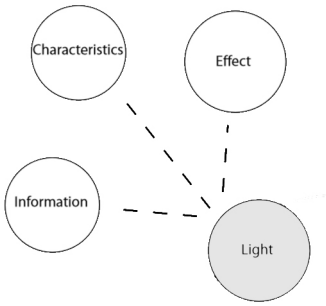


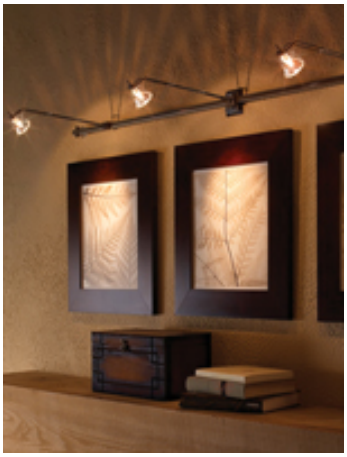
Figure 2.7: 'Light' category and the three sub-categories

A: Characteristic. this is described in two parts sunlight and artificial. Both descriptions include direct, indirect(reflected), and refracted light. While these are also in Interior design and spacial Composition, I will keep this separate in order to allow deeper investigation into the effects the different light sources might have on the space, (Stidsen 2013).

B: Effect. This sub-category describe the three typical layers or types of lighting: Functional(or ambient), task, and attention(or accent) lighting. Functional lighting is light which allows people to navigate a space safely. Task light allows users to perform a task, e.g. a desk lamp allows a person to read or write, while sitting at a table. Attention lighting adds to a space by calling attention to certain features or interior, like grazing light cast from the bottom up on a naked brick wall, enhancing the texture of the bricks giving it a shadow play of contrast. Or something as simple as a spotlight on a statue or a painting, (Stidsen 2013).

(a) Functional/Ambient

(b) Task



(c) Attention/Accent.

Figure 2.8: (a) Here the ceiling luminaries provide the ambient lighting, (b) The task light will help the user to use the kitchen table effectively, (c) The luminaries cast accent light on the paintings, calling the viewers attention to them.

C: Information. Stidsen defines Information as the cultural expectation of how light effects space, color and shapes. since our ancestor haw lived in the Nordics with our high zeniths and a 'hyhge' culture, "*There should be a sense of coherence in the experience of the connection between self-perception and the situation you actual experience*"(Stidsen 2013). She also write how light can add an elements of mystery and illumination can add attention to some areas and hide others, in that way control information.

2.2.6 The Lighting Trinity

Stidsens 'Model of light atmosphere' allows us to systematically analyze a room or space in a quantitative way and can make the foundation for an educated guess into how the light in a space affects the atmosphere a person would experience in that space.

Stidsens model lacks some more in depth analysis of what the light in the room does and the how and why. Some of the aspects of the model derives from the fact that it is created specifically to analyse the atmosphere in hospital wards. Furthermore, as few of the point in the model also stem from the fact that Stidsen has a background in product design she splits lighting into several categorizes that I would argue cannot be separated. The majority of the Lighting Atmosphere Model is about how the space is effected by the light, there is very little about how the light itself is. The only focus on artificial light is describing the three layer in a layered lighting design, ambient, task, and accent lighting. In order to dig more into these elements, models which has a larger focus on what light can do to the viewer as well as the space and how it does this, another model must investigated.

Another model that is a bit more in depth from a lighting design perceptive, is what we might call 'The Lighting Trinity'. This is a model based on the teaching philosophy at Bartlett School of Architecture in London, described to me in a conversation I had with Iben Winther Orton. She told me that at Bartlett they teach lighting design with philosophy that there are three parameters that needs to be taken into consideration. The thee parameters of this trinity is: The Engineering layer, The Humane Layer and The Architectural Layer.

The Engineering/Quantitative Layer

This layer describes everything that can be measured. This layer describe how much lumen a luminaire needs to output from a certain height in order to cast the required amount of lux on a given surface, as set up in the the requirement for that surface type, e.g EN 12454-1, which is the European Standard for lighting in Office spaces.

The Humane/Qualitative Layer

The Humane Layer is about the well-being of the user and how the light can play a major role in that. This layer considers parameters like glare, comfort, not disrupting the circadian rhythm into consideration.

The Architectural Layer

This layer could also be called a decorative layer, but not in terms of the appearance of the luminaries itself, but what the light does for the room. Lighting can be used to accent or hide certain aspects of a space, an example could be a spotlight on a statue or a spotlight shining on a tree from the ground to the crown.

Iben W. Orton also mentioned control as an aspect which plays a bigger role in lighting design now that it has previously. Due to the new emerging control systems like from the company DALI, which which allows for better control of the light via sensor system and pre-programming.

This Model illustrates the importance of what role the three layers of light, ambient, task, and accent, plays in a complete lighting design. While Stidsens Lighting Atmosphere Model offers a somewhat anthropological look into what we feel when we are in a room and offers various theories

as to why we feel that way, it lacks a more detailed look at what the light does. The Lighting Atmosphere model and the Lighting Trinity have some things in common. The Light Group from Stidsen's model is a less detailed version of the trinity and the Space and Time groups are again parameters that cannot be ignored in the Trinities Humane and Architectural layers. The places where Stidsens might strengthen the Trinity Model, is especially the user aspect and its pleasure theories and the overall anthropological approach of the experience of the room and the multi-sensual aspect of things. Therefore, in order to have the strengths from both models, new model named the Lighting Diamond will be formed for this thesis, having a more detailed version of the three layers from the Trinity adding the user aspects from Stidsens model and including a Control layer, with a focus on usability.

2.2.7 The Light Diamond Model

The new model combines the previous two described models, The Lighting Atmosphere Model (LAM) by Lone Stidsen, and The Trinity Model(TM) by Iben Winther Orton. The new model will combine certain aspects of the two models, eliminate some and add a new parameter, 'Control'.

Since the Light, Time and Space groups from the LAM concerns artificial and natural light, these will be folded into the Engineer, Humane, and Architectural layers of the TM with a more anthropological approach to describe the experience and why the light plays the role it has in this and how. It will be spilt into the three layers of the TM, in order to have all aspects covered.

The User group from LAM will now be covered with the Humane layer of the TM, with a special focus on the pleasure parameters as the User Characteristics and Activities fall into a general explanation of a space.

The new layer added to the Diamond Model that is not included in the other two, is Control. By Control I mean the on/off and dimming system if such is installed. Since there are several different kinds of control systems, there are several layers of intuition to the controls and to how to install a lighting program, if such is possible. This can play a role in atmosphere if the control system allows to adopt he lighting to different times of day and the year as the natural light changes. however, different control systems allow different degrees of control, and if a system is not intuitive this might lead to the system not being used to its full potential which might lead to a setting that does nothing for the room even though it is possible for it to do so.

Figure 2.9 illustrates the new model.

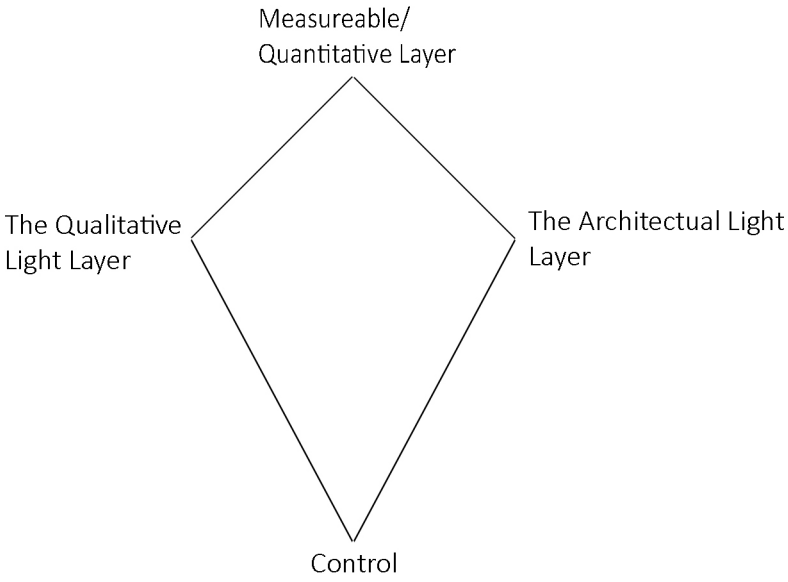


Figure 2.9: Illustrates The Lighting Diamond and its four layers

2.2.8 The Light Diamond symmetrization

The Following is a short description of what the different layers contains. Parameters such as season location and daylight are included but not mentioned as a separate entity.

The Measurable Layer

Includes all factors of light which can be measured, such as lux, lumen, CRI ect. And if these complies to the recommendations for the space, or at least make the space functional. If there is a energy efficient focus in the design, it is included in this layer.

The Qualitative Light Layer

This layer focuses on the well being of the user in the space. It analyses if the space is pleasurable, using the four terms of pleasure by Patrick Jordans where relevant. Also focuses on circadian rhythm, the absence of glare and the qualitative side of the choice of fixture in the luminaries.

The Architectural Layer

An analysis of the room/space, the shape, what materials are used, interior and where the strengths and weaknesses of the space is in relation to the intended function. How does the light improve of worsen these features and what can be done.

The Control Layer

This layer concerns itself in the type of control the artificial light has and if the space have automatic shades what kind and how they work. If the control system is dynamic, meaning allows for more control than a simple static on/off system, what kind is it and is the system intuitive. Too much control tends to lead to overcomplicated user interface, which in turn leads to people simply using the on/off function.

2.3 Association and Associantionism

This thesis is based on the idea that when people talk about an office space, the majority of them have the same image in their head. This section defines what an association is and how we form an association.

'Association' is defined as: *a feeling, memory, or thought that is connected to a person, place, or thing*(Merriam-Webster 2016). In psychology there is a school of Associantionism, which theorises that one associates things together based on past experiences, so if an individual would associate X with Y based on previous experience linking the two.(Mandelbaum and Zalta 2016) Associationism could be considered a subconscious form of learning.

(Mandelbaum and Zalta 2016) discribes Hume's theory of association, which states that " *The frequency with which an organism has come into contact with X and Y in one environment determines the frequency with which thoughts about X and Y will arise together in the organisms[red. individual] future*"(Mandelbaum and Zalta 2016)

So in theory if an individual has spent enough time in a certain atmosphere and thereby has felt a certain emotional and multi-sensoral impression, over an extended period of time, that individual properly will associate that atmosphere with that type of space.

2.4 Sub-Conclusion

To summarize, we can consider the term atmosphere to be a experience of an room or space. We experience this feeling as an emotional and multi-sensory experience, that gives us a bodily, unconscious feeling or opinion about the room. This opinion is based on a multitude of on many qualities in the room (social mood, material, lighting, time of day, time of year, weather etc.), but this thesis focuses on what role the light in the room plays and how we might change the atmosphere by changing the light. To put the light atmosphere into a systematic model, Stidsens 'Model of Light Atmosphere' was presented as a tool to analyse a given room/space. Stidsens model stems from her background in product design and have a more anthropological approach, so in order to have a bit more focus on the lighting design elements in a room or space, Iben Winthe Ortons Lighting Trinity was presented with its focus on the three bearing elements of lighting design. The two models were combined into one model, the Lighting Diamond, combining strengths of both models. Following the atmosphere investigation, the theory of association was

defined as an opinion based on previous experiences.

These conclusions will be utilized in a following chapter in order to analyse the Atmosphere and the role light plays in a actual office building in Copenhagen. First a survey will be conducted to investigate how laymen associates to the experience of an office building and to prove that there is a general consensus of the experience of being in a office space.

Chapter 3

Survey

This chapter seeks to find an answer to the first part of the following IRQ:

Is it possible to prove a negative association to the atmosphere in an office space, and then change that atmosphere by simply changing the light through a lighting design for this type of space?

In the previous chapter, Atmosphere was established as an unmeasurable, emotional multi-sensory experience/quality in a office space. If the hypothesis stands correct, and there is in fact a consensus association to offices, the people making the association must have been exposed or been present in an office enough times or over an extended period of time in order to have a valid opinion about the Atmosphere they experienced there.

In order to answer the question if there is a common consensus of a negative association to the feeling of being in an office, this chapter will describe the specifications which must be met before the surveyed can partake, how the survey was designed and what the results are.

3.1 Designing the Survey

The survey was designed to consist of three easily understandable steps. The first step of the survey aims to give an overview of the participants gender, occupation, and age. This will allow me to see that the survey embraces sample groups as diverse as possible.

The second step asked participants to whether or not they are employed in a office building or have been been a visitor (not employed) in a office building more than ten times in the past ten years.

The third and final part of the survey asks the participants to write a minimum of three adjectives which associate with an office space, and also ask them to rate the adjective on a scale from one to five, one being most negative and five being most positive. The idea is to get an understanding of what people think about office space, and the rating system is to make sure the adjective are not misunderstood by mistake during the analysis of the results.

3.2 Results

The survey was released on March the 9th 2016, and results were gathered on March the 14th with a total of 32 (females 21 and males 11) participants. 21 are students, 11 work full time, none have answered with the option 'Other'. Most (22) are between the ages of 24 and 29, eight of them are between 18 to 23 and two fall in the 30 to 50+ categories.

As for the parameters, the participants must have been a visitor in an office building at least ten times over the last ten years and also not have been employed in an office building, to which 30 people fit, or be employed at an office which three people were.

Table 3.1 show the distribution of the adjective ratings, which are primarily negative. Each participant had to write a mini mun of three adjective and and a maximum of seven. A total of 122 adjectives were given, 62 of them were rated below 3, which would be considered neutral on the scale from one to five. The total mean of all the rating was 2,58, which is to the negative side. See Appendix A.1 for all collected data.

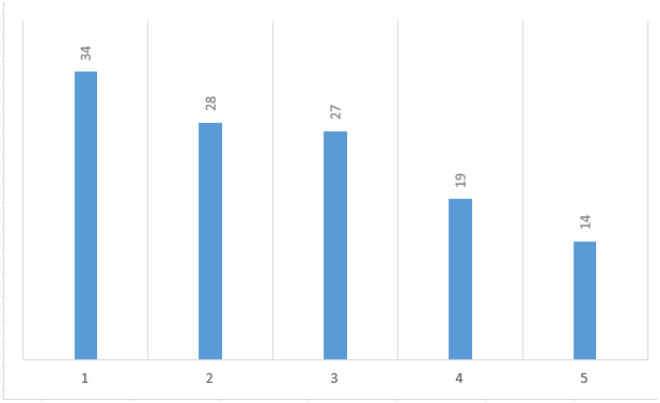


Figure 3.1: Graph of Ratings Distribtion for Office Building Adjectives

Tables 3.1 and 3.2 show the weighed adjectives and their ratings, the adjectives that were repeated are marked by * and the rating have been averaged,. To see the full list of adjective and ratings see Appedix A.1.

Adjective	Rating
Actively	4
Atmospheric	5
Bad Cleaning	1
Bad Mood	1
Bad Smell	1
Big	4
Blinking	1
Boring*	1.4
Bright	4
Busy*	2.5
Calm	5
Classic	4
Clean	2
Climatic Bad	1
Cloying	3

(a)

Adjective	Rating
Clinical*	1.75
Cold*	1.6
Color Full	4
Compact	2
Condensed	3
Coordinated	4
Cramped	3
Creative*	5
Dingy	2
Dirty	3
Dry	2
Dusty*	2
Effective*	3.5
Energy-draining Environment	1
Fine	3
Flexible	5
Formal	3
Green	5
Headache	1
Heavy Air*	1.5

(b)

Table 3.1: Adjective and Rating for the Office group, I of II

Adjective	Rating
Hipsterish	3
Homo gen	2
Hyggeligt*	4
Impersonal*	2.3
Kindness	5
Lack of Clean Air	1
Messy*	2.2
Minimalistic	3
Neutral	3
Noisy*	1
Normal	3
Old	3
Open	4
Organized	2
Pinched	1
Poor Ventilation	1
Practical	3
Professional*	4.3

(a)

Adjective	Rating
Proper	4
Relaxed	4
Secluded	2
Social*	4.5
Spacious	5
Sterile*	1.75
Stress Full	2
Talkative Equality	4
Technical	3
Tension	2
Trapped*	2.4
Ugly	1
Uniform	1
Uninspired	2
Warm	3.5
White	3
Work Space	3

(b)

Table 3.2: Adjective and Rating for the Office group, II of II

Based on figure 3.1 which show the distribution of ratings, there is a light lean towards the negative side of the scale, and as table 3.1 and 3.2 Boring, Sterile, and Trapped shows all rate negative(1.4, 1.75, and 2,4) and all appear more than once.

As the graph of the ratings for the Office adjectives and the list of adjectives show, the participants associate to the offices in a manner which is not comfortable or at least not very favorable. Looking at the list of adjective, the most repeated ones are: White(rating 3 on average), Stuffy(2.4), Boring(1.4), Clinical(1.75), Cold(1.6), Sterile(1.75), and Unpersonal(2.3).

As the survey was done online and is designed to form a view of the general association to offices, there is no way of knowing

3.2.1 Conclusion on All Results

While the results presented in this survey are clear they are also done in the blind, meaning there is no way of knowing the space of which they base their opinion. Nonetheless, half of the adjectives given by participants were to the negative side of the one to five scale. This gives an indication that there is indeed an unfavorable association to office spaces in the sample group of this survey.

Now that it has been established that there is an indication of a negative association to office

spaces in the general public the next step is to analyse a office space utilizing the Lighting Diamond model, and then see if the results might explain why the participants gave the adjectives that they did.

Chapter 4

Case Analysis Applying the New Model

In order to present a real life case, a typical office building will be analyzed using The Lighting Diamond (See section 2.2.7). Using the four layers Quantitative, Qualitative, Architectural and Control to describe what role the light plays in a case. The office building in question is the headquarters of IDA: The Danish Society of Engineers, called 'Ingeniørhuset'. It is located on Kavlebod Brygge in Copenhagen, build in 1997 and has to the best of my knowledge not had any major reconstruction since.

4.1 IDA - Ingeniørhuset

The analysis was carried out on the morning of 21st of April where the sky was cloudless so the sun was out in full effect.

The focus of the analysis was mainly on the third floor of the building, which can be separated into three wings: The Tower, East Wing and West Wing. All three areas have many large windows. In the Tower every window faces the Copenhagen Canal, in the East and West wings one wall face the canal and the wall with windows faces Kalvebod Brygge and a large office building on the other side of the street.

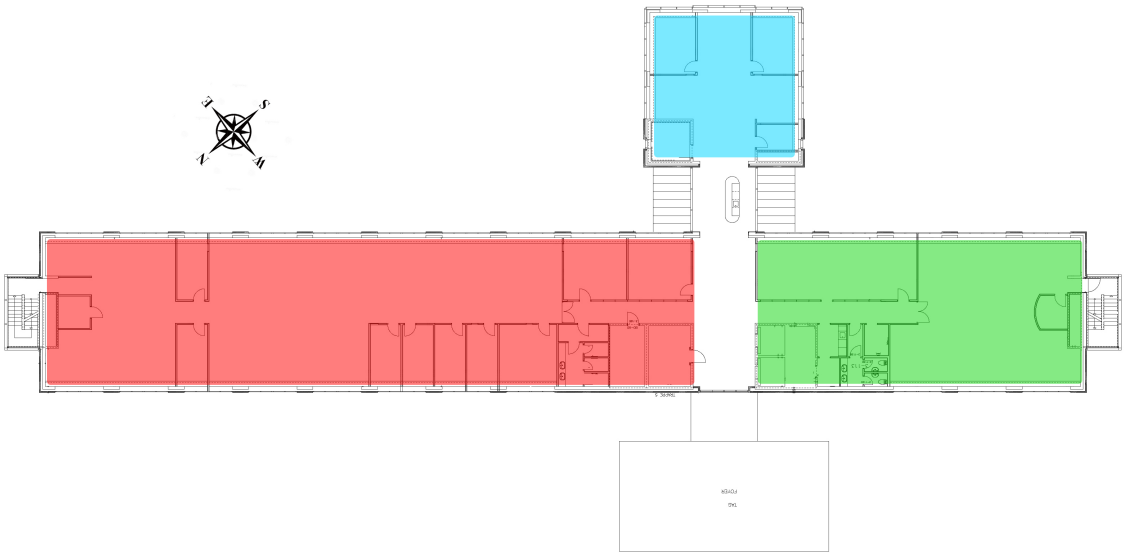


Figure 4.1: A floorplan of the third floor of the IDA office. The Red section is the East Wing, the Green is the West wing, the white space between the East and West wing is the Elevator area, and the Blue is the Tower.

4.1.1 Case: IDA - Quantitative Layer

According to IDA's property Inspector, the square luminaire in the East and West wing is a 40 W Indigo Ed2-R1 from Fagerhult. It has one fluorescent light tube providing the light, the Indigo luminarie has a very symmetric, round lighting profile, which provides a uniform light layout in the space when installed in a grid like at IDA. The East wing has a total of 32 Indigos installed. the Florence light tube provides a CRI of below 80, a color temperature of 3000 K and 3500 lumen.

Figure 4.2: A floorplan showing the placements of the luminareis. Red square is the Indogo, Green dots are the Discoveries and the Blue circles are Combos

The luminares in the hallway areas are a 14 W Discovery, also from Fagerhult, providing a

soft downlight in the corridors. The compact light tubes with the model provide 900 lumen with below 80 RA and a color temperature of 3000 kelvin. The Tower has six Combo Round 450 23W e2 LED from XAL. Each combo provides 2300 lumen at 4000 kelvin, with a high CRI, according to their website. See figure 4.2 for a floorplan showing the placements of each type of luminaries. See Appendix **??** to find photometric data on all the previously mentioned luminaries.

The sun was out on a cloudless sky, and shining unobstructed on the south-eastern face of the building. Since the south-eastern side of the building is also facing the Copenhagen canal, there are no neighbouring building to block the sun. These are not optimal conditions to perform a lux grid and daylight factor in. Therefore, the lux measurement will be calculated in the software 3D studio Max. As it is unknown how much daylight the shades keep out, lux measurements, daylight factor and any illustrations (in this section and design) will not include the shades over the windows. Figures 4.3 and 4.4 shows false color renderings of both the West Wing and the Tower, on a cloudy day in April at noon. Rendered in 3D Studio Max.

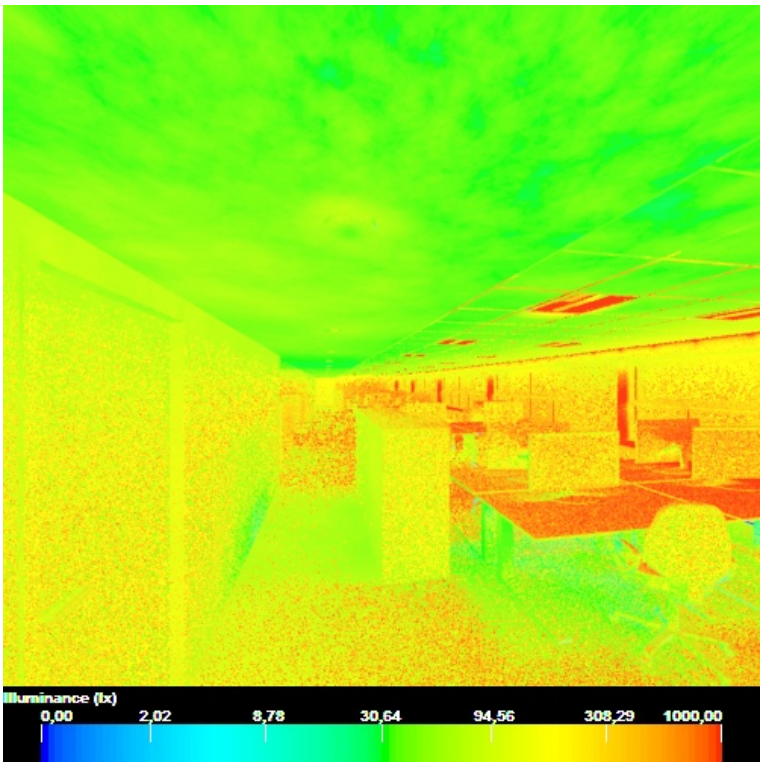


Figure 4.3: A False Color Rendering of the East Wing office, showing the illumination levels on a cloudy day in April at noon

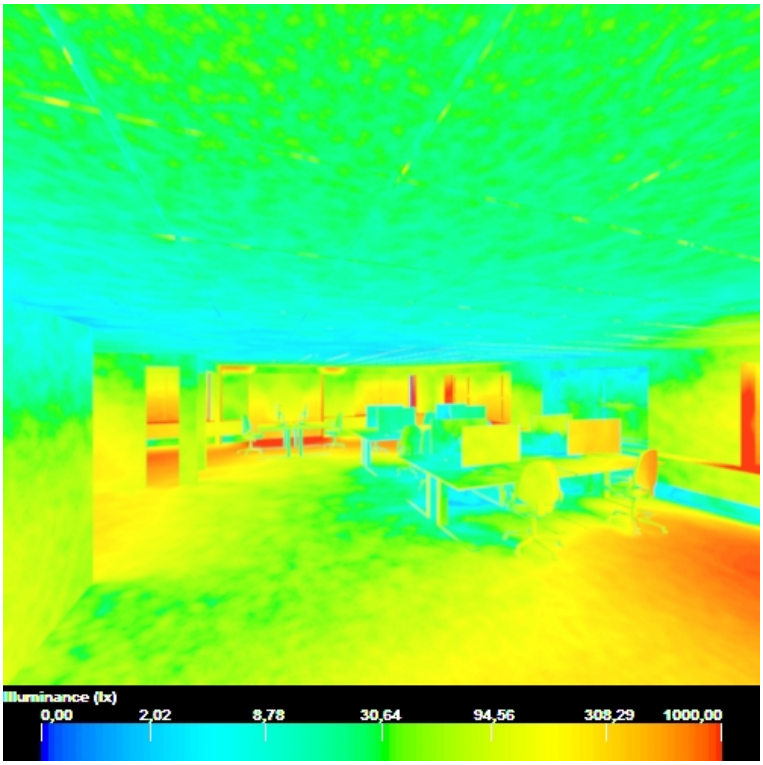


Figure 4.4: A False Color Rendering of the Tower office, showing the illumination levels on a cloudy day in April at noon

4.1.2 Case: IDA - Qualitative Layer

The offices are not uncomfortable to be in as far as the definition of "*comfort is the absent of discomfort*", see 2.1 goes, meaning I did not experience any glare of overly bright surfaces in any of the offices, but I would not call the spaces 'hyggelige'. The amount of daylight that the Tower and the two wings received on the day in question, was the most positive thing about the lighting. This is also due to the fact that the south-eastern side of the building is facing the Copenhagen canal. I could however, imagine the spaces feeling very stuffy in the parts of the year where the sun is not as prominent as during the summer, part because of the warm white color temperature from the luminaries. In my opinion, a uniform distribution of warm white in large room makes the room feel smaller and stuffy.

The atmosphere in the building is a space designed to house an office, and the light is installed with only one goal; providing enough ambient light so that people can be in the space comfortably. Everything about the offices seems generic, it is the same square recessed fluorescent luminaries that I have seen in other offices, all the furniture is bought in bulk and does in no way separate it from other office buildings hat I have visited in the past. The light serves no other purpose then safe navigation after dark, which is something I would consider typical for most office buildings, however in this building there is also a dark wooden floor installed. This floor makes to room feel smaller than it is due to the fact that the ceiling, 2.75 meter by my measurement, is not high enough to compensate for the floor swallowing the light in to room.

As for "*Basic Emotional Process*" of Coherence, legibility, mystery and complexity. There is coherence and legibility, the light makes the office makes sense in a orientation aspect. However, there is very little if not nothing in therms of complexity of mystery, walking around in the space there is no point where you would stop and think "What this, how is that happening?" there is nothing out of place. The arousal, orientation, and coping process Stidsens writes about is a very simple one here.

My judgement of the Socio Pleasure parameter, see table 2.1 in section 2.2.2, was made during my three hour stay on the floor, I observed mostly intimate communication between people who sat a few tables from each other, would stand up and walk over to each other instead of staying seated and talking over a distance.

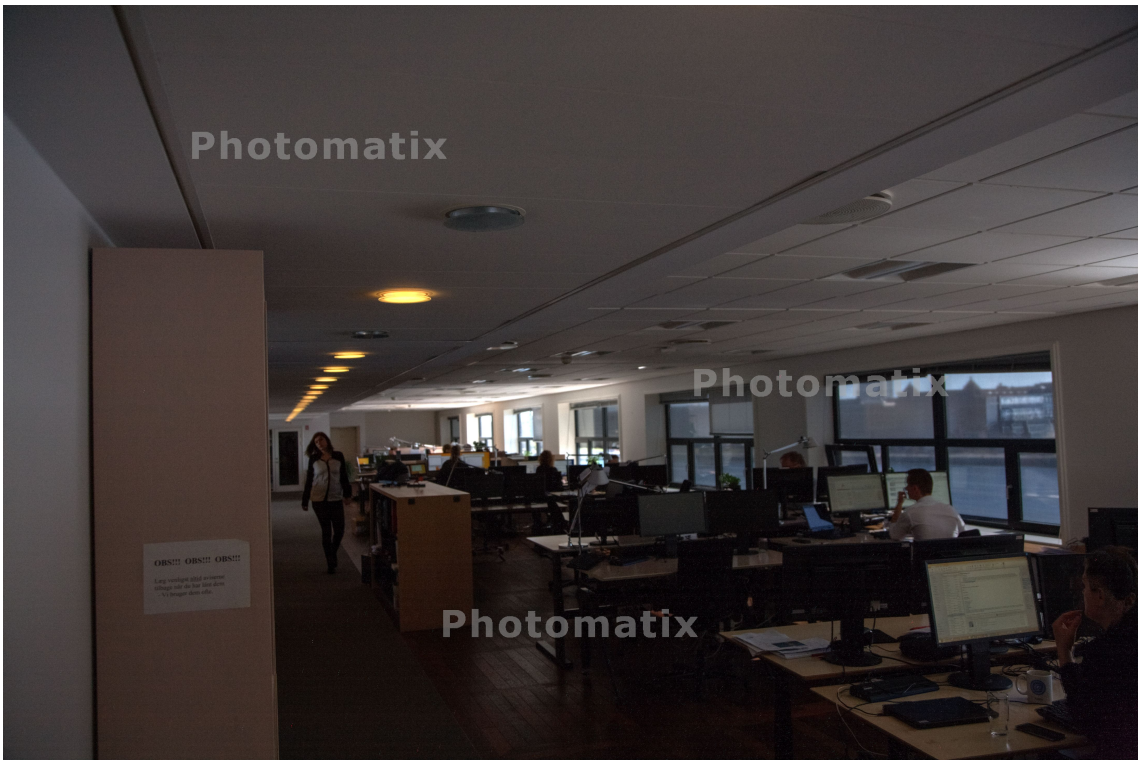


Figure 4.5: A photograph of the East Wing, Red part in figure 4.1

.

4.1.3 Case: IDA - Architectural Layer

Figure 4.6: A picture showing the area by the elevators, which even during the day and despite the four Combo luminaries still appears dark.

On the third floor, right when you exit the elevator, there is a big window on your left. This window is directly out to the roof of the foyer, which at the time of day I was there, at 10:00 AM, gives very little light, this might change during the day as the sun will shine from the other side of the building. Same situation is present in the rest of the building, the floor is dark and the ceiling is not very high, further more the circular luminaries recessed in the ceiling have a diffuser, which drop under the ceiling by a few centimeters. This diffuser also shines the very warm color of the fixture, which is around 2500-3000 Kelvin, it calls attention to the low ceiling and the not particularly interesting luminaries.

The rest of the floor can be divided into three parts: The Tower, East Wing and West Wing. All three houses one big office space each, with two small offices in the elevator area. The Tower is a square room with two meeting rooms, separated from the main room by glass panels, preserving the open feel of the room. The floor is the same dark wood as the elevator area, which has also been used for the window sill that runs all along the walls. The furniture is all black and dark grey, divided in two desk table 'islands', with four workstations each, and a smaller 'island' with two workstations. The Tower has big window panels on all three walls, with a magnificent view of the full extend of the Copenhagen canal. The big windows make the room feel open and the long view makes it feeling much bigger than it is, which works in the room favor.

The same basic format is used in both the East and West wings, both of these spaces also have

several desk islands, albeit in a lighter color. The East wing also have a small kitchen, two meeting rooms, and a small sofa area.

Figure 4.7: This pictures shows the Tower office and how it appears open and large due to the windows.

All three areas have several large windows, with automatic blinders, which according to my liaison does not work as intended and employees have to work them manually from inside the office. The windows in these areas also allows for an impressive view, but because it is not a panorama view, it is not as attention seeking as The Tower.

The artificial light installed in the ceiling in all three areas consists of only ambient lighting. Task lighting is present on the desks via desk lamps, in the kitchen and some meeting rooms. This creates a very static light space, with little or no diversion to provide a little life in the space.

Figure 4.8: The end on the East Wing, with the shades down and the lights off, the end cubical is very dark.

4.1.4 Case: IDA - Control Layer

The controls themselves are light switches with no indication of how they work. When asked, my guide Luarits H. Hoppe who is a Strategy Consultant and Environmental Manager from Office Management, had to try different things in order to adjust the light. This is due to the system not being intuitive, which could be a source of frustration 4.9. Unintuitive interfaces might cause some people not to bother with figuring it out and find a different solution, like only using there desk lamp as a light source, which is not optimal.

Figure 4.9: One of the controls for the lights in the offices.

4.1.5 Case: Ingeniørhuset - Atmosphere summarized

The atmosphere in the IDA offices should be very familiar to anyone who has spent time in a office environment. The lighting in all three areas, elevator, hallway, and office areas, is static and from a design point of view, uninteresting.

4.2 Sub-conclusion to Case Analysis

After analyizing the IDA offices the following have been found.

1. Static, both in terms of light spaces and in color temperature.
2. The grid pattern in which the luminaries are set is generic and uninteresting.
3. No personality in the light, seems to only meet the recommendation of EN 12464-1 and bring very little light into the light scape.
4. The light only highlights the blandness of the rooms, there is no attempt to add something extra.

The aforementioned finding point to the fact that there is room for improvement in the lighting design. Looking over the adjectives from the survey, there are several that fit the IDA offices as well: Stuffy, boring and impersonal to point out a few.

In order to meet these findings, the following chapter will propose a lighting design with design parameters based on the finding from this chapter and the chapter on the survey, chapter 3.

Chapter 5

Design

Based on the findings in the analysis of the IDA headquarters and the results from the survey, there are some elements of the lighting in an office space, which is in need of improvement. These elements are presented in the following section and will be implemented in a lighting design describe throughout this chapter, the Lighting Diamond Model will act as a template to describe the elements of the design.

5.0.1 Overall goals and criteria for designs.

Resulting from the analysis preformed in this thesis, see chapters 3 and 4, the following design criteria has been established:

1. Create a dynamic light space.
2. Create a more welcoming atmosphere in the elevator area.
3. Open up the room, mainly East and West Wing.
4. Priority to keep to the EN 12464-1 recommendations.

The main goal of the design is to break from the association to the generic office lighting design without going overboard with a unrealistic or unnecessary design (Function over beauty).

There is no mission to make the entire office have a 'hyggelig' feeling, the goal is more to give the space a comfortable and professional appearance, here comfortable should beyond the 'Comfort is the absence of discomfort' as we have seen it defined in Stidsens LAM.

The design will be using The Lighting Diamond Model to give a structured description of the goal of each design decision and reasoning behind these.

5.1 Project Design.

This section will be presented in the following order: First the Lighting Diamond parameters will be presented with a short description of what the design will aim for and should fulfill. Following

the Lighting Diamond rendering of the design will be presented with descriptions of what has been done and the reasons behind these.

5.1.1 Quantitative Layer

Wherever possible the quantitative Layer will follow the recommendations of EN 12464-1, which has the following recommendation for an office space

- Task/Work surface should have 500 lux.
- The area/surface surrounding the work/task surface should have 300 lux.
- hallway areas should have an average of 200 lux on the floor.
- Luminaries should have a CRI of minimum 80.
- The Unified Glare Rating (UGR) should be 19.

In terms of color temperature (K), this design will utilize two temperatures, a neutral white for ambient and hallway lighting and a warmer white in the 'Light Zones'.

5.1.2 Qualitative Layer.

The goal of this design is to disassociate from the known without reinventing sliced bread. The main thing to watch out for in an interior space where people spend a lot of time is comfort. Therefore parameters like glare and discomfort due to brightness are thing to look out for. While following the recommendation of EN 12464-1, which means having 500 lux on work areas and 300 lux in the surrounding area. I also want to incorporate subtle areas where the light will give the viewer a warm comforting feeling, these zones will be called 'Hygge Zones'.

5.1.3 Architectural Layer.

The biggest challenge with the IDA offices, is the floor. As mentioned in the something section, the dark floor makes the room fell small, therefore a challenge is to open up the rooms using light. In order to accommodate this, the two meeting room in the end of the East Wing, will be changed from the current drywall to having glass walls instead, such as in the Tower . All luminaries will be as small as possible or hidden entirely in an attempt to disconnect to the typical office with large visible ones. The same for the placement pattern of the luminaries where this design will experiment with a different pattern than the normal 'grid pattern',

5.1.4 Control Layer.

The design must have a DALI control system, which functions semi-automatically. This means the interior lighting, and the CCT, will be based on the amount of sunlight and act accordingly in a non-invasive way, while still allowing the user to override the program in order to fit their needs.

The main point about the DALI system is that the interaction design must be intuitive, making it as easy as possible to use for the employees of the office. The specific interaction design and its UI (User-Interface) design is not a part of this design section.

The reason for DALI is that is allowing for several types of control platforms, ranging form stationary such as computers and wall mounted control panels, to mobile systems such as various smart devices like, tablets and smart phones.

As this is not a user-interface project, these criteria will not be further investigated.

5.1.5 Proposed Solution

This section will show how the criteria, see 5.0.1, have evolved into a new lighting design, adding warmth, contrast, openness and a sense of drama to some areas in the space. For photometric data for luminaries used in the design and their placements, see Appendix A.2 and A.3

Figures 5.1, 5.2, 5.3, & 5.4 illustrates the proposed solution to this Project Design.

Figure 5.1: A rendering of the East Wing office.

Figure 5.1 is a long view of the office area in the East wing. In order to make the room feel larger, the two meeting rooms ind the end of the wing have had the wall replaced with glass walls. This make the room more transparent and thereby seeming larger. This is also to make the glass walls from the Tower a repeated feature in the rest of the office, these walls also allow more daylight in the entire office during the day. Ambient lighting is provided by Iguzzini Laserblade luminaries, this is a smaller luminaire than the Indigo currenlty installed at IDA. The small size of the Laserblade give a more undisturbed look to the ceiling.

Figure 5.2: A view of the end of the East wing office, showing the new glass walls and the covelight 'light zones'.

Figure 5.2 is a view from the end of the East wing office, while showing a better view of the glass walls, also shows two 'Hygge Zones' on the end walls, one wall in the office and the other in the larger meeting rooms. These 'Hygge zones' are cove lights cast on a dark slightly glossy wooden structure installed where the wall meets the ceiling. Beside providing a warm feeling in the offices, these cove lights and illuminated wood in general are also elements that will give the IDA offices a touch of personality. These are the elements meant to add those elements of complexity and mystery Stidsen mentions in the Psycho Pleasure, as an added plus they also give the end walls a sense of an end to the room thanks to the contrast between the white wall and the dark wooden panels with the covelights. The covelighting is from a Iguzzinin Underline 15 LED strip. 2.2.2.

Figure 5.3 is a render of the elevator area, now with illuminated wood next to the elevator door and the door to the stairway. These wooden panels adds a warmth by glazing them with a warm spot light at 2700 K of the type Laser from Iguzzini. The ambient lighting is now from spots recessed in the ceiling, the small Iguzzini Deep Laser luminaries are more hidden than the old Combo luminaries due to the fact that the visible part of the luminarie is only 17 mm in diameter. The grazing effect from a hidden light source is adding a sense of mystery and with the dynamic illuminations of the floor, more drama as well.

Finally figure 5.4 is a rendering of from the Tower towards the elevator area. Where used to be Combo luminaries in two lines all the way to the elevator area. This introduces the wooden panel

Figure 5.3: Illustrates the new more welcoming elevator area.

'light zones' in the area with two large windows between the Tower and elevator area, giving this area the same warmth as by the elevators.

Figure 5.4: A look from the Tower towards the elevator area.

Chapter 6

Discussion

This chapter will discuss the various points of the project, the methods used to define the terms atmosphere and the creation of the Lighting Diamond. Furthermore the methodology of the case analysis will come into focus and the Design desissions and the methodology that would be necessary in order to test the design and what the lack of a test means for this projects.

6.1 Discussion of Methods

The following section will go through points which are presented in the Method chapter REFERENCE, and discuss which points might be considered as a weak point in this thesis.

6.1.1 Discussion of the definition of Atmosphere

This project bases the definition of Atmosphere on several prominent architectural philosophers, who have written multiple books and articles on the subject of experiencing space and shape. These are, however, mainly theoretical opinions of great thinkers and while they are regarded as opinion leaders, there is no evidence presented which support their statements, see 2.1. This is due to the fact that collecting data on the subconscious opinions of people, is if not difficult then, next to impossible. so while there are few alternative to finding sources in order to come up with a definition of 'Atmosphere', the concluded definition of *"An emotional and multi-sensory experience, that gives us a bodily,unconscious feeling or opinion about the room or space"* is fine for this particular thesis, it is not a definitive definition as someone who might disagree could not be presented with fact to prove them wrong.

In order to further define what role lighting plays in the atmosphere in a room, this thesis presented two models of lighting atmosphere and design; Lone Stidens Lighting Atmosphere Model, see 2.2 and Iben Winther Ortons Lighting Trinity, see 2.2.6. Stidsen created her model for her dissertation on atmosphere in hospital wards, also using Böhme, Pallasmaa and others to define atmosphere for her project. Therefore, one could point out that the basis of the Lighting Atmosphere Model suffers from the same weak spot as this model. Furthermore, the model itself is also

for the most part of qualitative form. This means that some of the parameters, such as the pleasure parameters and in part the descriptive manner of what the interior design does for the space, are based on the subjective opinion of the person or persons using the model. Therefore, the same as the definition of Atmosphere, both in this thesis and in Stidsens desertion, this lacks facts in order to make an analysis of a space more definitive and less based on subjective opinion. This does not mean that the model is useless, as it utilizes what I consider valid and relevant parameters, all it means is that the model is a tool to explain why the analyser describes the atmosphere as they do, this is however subject to change from person to person.

All of the previous points from the definition of Atmosphere and both model which the Lighting Diamond Model is based on means that the point in The Lighting Diamond are subject to critique and to subjective opinion.

6.1.2 Discussing Association

While the section on Association and Associationism explained how an individual forms an association and what it is, see 2.3, there is a lack of how positive and negative associations are formed and how they affect us. A more elaborate look into how associations to rooms and spaces specifically are formed would have strengthed the section and base of the thesis. Moreover a methodological approach to investigate peoples associations would also have made a more solid point.

6.1.3 Discussing the Case Analysis

Besides the points presented in section 2.1, the case analysis was lacking on two points.

The first point would be the quantitative analysis as a lux grid and daylight factor was not possible due to weather conditions and the fact that I did not have a partner for performing the daylight analysis, see 4.1.1. Laurits Hoppe, my contact at IDA, might have been able to help, but that is not his job and he was reluctant to let me walk around the office alone. Performing a lux grid and daylight analysis might have given a different understanding of the space and have had an effect on the design for the proposed solution.

The second point the analysis was lacking is that the analysis was performed in a single day for a three hour duration. Further analysis over longer periods at different time of the year and performing interviews with the staff about there perception of the atmosphere might have impacted the results differently.

With these finding brought to light, the following chapter will conclude on the IRQ: "*Is it possible to prove a negative association to the atmosphere in office space, and then change that atmosphere by simply changing the light in a typical office setting, by creating a lighting design for this type of space?*

Chapter 7

Conclusion

This thesis set out ot answer the Imaginative Research Question "*Is it possible to prove a negative association to the atmosphere in office space, and then change that atmosphere by simply changing the light in a typical office setting, by creating a lighting design for this type of space?*". In order to this, first Atmosphere' was defined as "*An emotional and multi-sensory experience, that gives us a bodily,unconscious feeling or opinion about the room.*" using the theories form the leading philosophers on the subject, such as Gernot Böhme and Johanni Pallasmaa. Second a Lighting Atmosphere model called The Lighting Diamond, was formed by combining elements from Lone Stidens Lighting in Atmosphere Model and Iben W. Ortons Lighting Trinity. Then a survey and analysis was executed. The survey showed a tendency to negative association to the atmosphere in an office space, this was supported by the analysis of the IDA offices in Copenhagen. The analysis showed that the static and uniform light in the office was not adding anything extra to the space. this was in part due to the use of the luminaries and a focus on only following the EN 12464-1 recommendations to light in an office. The proposed design solution adds several elements which aims to corrects this by using a higher quality of luminaries, switching out the walls of two meeting room to glass walls in order to make the space seem bigger and allow more daylight into the rest of the office. Furthermore the design adds 'light zones' that aim to add an element of 'hygge' to the office spaces and creating a more welcoming atmosphere in the elevator area, while also being decorative. The conclusion to the thesis based on the survey, the analysis and the design is that there is an indication of a generally negative association to the atmosphere in an office and based on the findings in the discussion, the design would need to be implemented in the building and be subjected to long term analysis to see if it has an effect.

Appendix A

Appendix Title

A.1 Appendix I

Answers form the survey

Beskæftigelse	Hvis du er studerende eller i arbejde, hvilket felt er du inden for?	Alder.	Kolonne1	Køn.	Kont) 1. Tillægsord
Studerende	Lys Design	18-23	2	Mand	Kedeligt
Studerende	Handel	24-29	2	Mand	Trængt
Studerende		24-29	2	Kvinde	Koldt
Arbejde	Undervisning	24-29	2	Kvinde	Rummelig
Arbejde	fashion designer	24-29	2	Kvinde	koldt
Studerende	Kommunikation	24-29	2	Kvinde	stressende
Studerende	Historie	30-35	2	Kvinde	Larmende
arbejdende studerende	Software udvikling	24-29	2	Mand	Sterilt
Studerende	Teknologivudering	24-29	2	Kvinde	anspændthed
Studerende	Hospitalsteknisk assistent	24-29	1	Mand	Organiseret
Studerende	Samfundsvidenskaberne	24-29	1	Mand	Blege
Arbejde	Undervisning	24-29	2	Kvinde	Praktisk
Arbejde	Bibliotekar	24-29	2	Kvinde	rodet,
Arbejde	Forskning, naturvidenskab	24-29	2	Kvinde	Støvet
Studerende	Medicin	24-29	2	Kvinde	Arbejdsrum
Studerende	lighting design	24-29	3	Kvinde	kedelig
Studerende	Lysdesign	24-29	3	Kvinde	Kedeligt
Studerende	IT (Ingeniør-uddannelse)	18-23	3	Kvinde	hyggeligt
Studerende	Fysioterapi	18-23	3	Kvinde	Hvid
Studerende	Medieteknologi	18-23	3	Mand	roligt
Studerende	Lys	24-29	3	Mand	Professionelt
Arbejde	Resturant og service samt designer	24-29	3	Kvinde	Aflukket
Studerende	Arkitektur	18-23	3	Mand	Kompakt
Studerende	Medialogy Games	24-29	3	Mand	Hyggeligt
Arbejde	guide + underviser	24-29	3	Kvinde	sterile
Arbejde		47- over 50	3	Kvinde	Larmende
Arbejde	Servicebranchen	18-23	3	Mand	Klinisk
Studerende		18-23	3	Kvinde	Indelukket
Studerende	Økonomi/polit	18-23	3	Kvinde	Hvidt,
Studerende	Arkitektur	24-29	3	Mand	Klimatisk dårligt
Arbejde	marketing	24-29	3	Kvinde	Tørt
Arbejde	Bartender	24-29	3	Kvinde	Hyggeligt

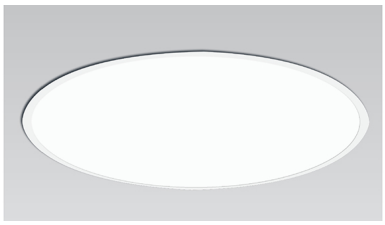
Skala	Kont) 2. Tillægsord	Skala2	Kont) 3. Tillægsord	Skala3	Kont) 4. Tillægsord	Skala4	Kont) 5. Tillægsord
	1 Normalt		3 Effektivt		4		
	3 Indelukket		3 Beskidt		3 Vammelt		3 Gammelt
	3 Klassisk		4 Fint		3		3
	5 Grøn		5 Varmt		3 Nusset		2 Rolig
	1 sterilt		1 kedeligt		1		
	1 indelukket		1 klemt		1		
	1 Dårligt lugtende		1 Tung luft		1 Energidrænende miljø		1
	2 Koldt		1 Hvidt		2 Hipsterish		3
	2 Lummert		2 Travlt		3		
	2 Farverigt		4 Stilrent		1		
	1 Sterile		2 Upersonlige		2		
	3 Minimalistisk		3 Koldt		1		
	2 Upersonligt		3 Grimt		1 Stressende		2 Tungt
	4 Varmt		4 Blinkende		1 Travlt		2
	3 Støvet		1 Neutralt		3		
	1 uniform		1 formel		3		
	2 Koldt		2 Effektivt		3		
	5 venlighed		5 snaksagelighed		4		
	4 Faglig		4 Homogen		2		
	5 rumligt		5 kreativt		5 fleksibelt		5
	4 Kreativt		5 Rodet		1 Afslappet		4
	2 Teknisk		3 Socialt		4 Uinspirerende		2
	2 Lyst		4 Klinisk		1 Ensartet		2
	4 Stor		4 Rodet		2		
	2 kliniske		1 indelukkede		5 atmosfæriske		5 rene
	1 Støvet		1 Dårlig rengøring		1 Dårlig udluftning		1 Mangel på ren luft
	2 Professionelt		5 Koordineret		4		
	2 Tætpakket		3 Socialt		5		
	3 klinisk		3 Ordentligt		4 ro		5 Upersonligt
	1 Støjende		1 Indelukket		1		
	2 Kedeligt		2 professionelt		4		
	3 Rent		4 Åben		4		

Skala5	Kont) 6. Tillægsord	Skala6	Kont) 7. Tillægsord	Skala7
	3 Rodet	3	Beskidt	3
	3			
	2 aktivt		4	
	2 rodede	3	hvide	
	1 Dårlig stemning	1	Hovedpine	1
	2			

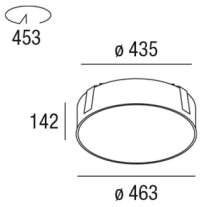
A.2 Appendix II

All data from all known luminaries currently installed at the IDA offices.

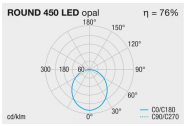
COMBO ROUND 450 23W e2 LED 2300lm

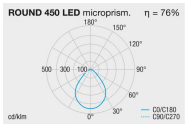


DRAWING



POLAR CURVES





PRODUCT INFORMATION

Round housing made of aluminium with trim. Surface in white powder coating, suitable for ceilings from 2-25mm. Housing for installation in plasterboard ceilings initially available (up to 450). Satined or microprismatic PMMA cover flush with the ceiling. Toolless removal of diffuser, easy maintenance. Energy efficient LEDs with high CRI. Version with LED emergency inset 1h or 3h, self-test function. 2 cable entry points and clamp for through-wiring

GENERAL

MOUNTING TYPE	: Ceiling recessed
COLOR FINISH	: Powder-coated
LAMPS DESCRIPTION	: 23W e2 LED 2300lm
COLOR TEMPERATURE	: 3000K, 4000K
NOTES	: System power - Luminous flux 3000K, opal
SCOPE	: Indoor

OPTICAL

AIMING	: Fixed
EMISSION	: Direct
DIFFUSER	: Opal satined, Microprismatic
OPTICAL SYSTEM	: PMMA cover

ELECTRICAL

VOLTAGE (V)	: 220-240

PHYSICAL

CONSTRUCTION MATERIAL	: Aluminium
CEILING THICKNESS (MM)	: 2-25
DIAMETER (MM)	: 463

CUTOUTS

Ceiling type	Trim type	Cutout diameter (mm)	Recessed depth (mm)
Plaster board	Trim	453	142

CERTIFICATIONS:

QUICKSHIP

HOUSINGS

CONCRETE INSTALLATION HOUSING 450
Order Code: 061-99008
COMBO ROUND 450 H(mm): 170

ORDER CODE

Order code	Color	Control	Diffuser	Emergency	Color temperature
063-3246517O	White	Non DIM	Opal satined	Without	3000K
063-3246537O	White	DIM DALI	Opal satined	Without	3000K
063-3246617O	White	Non DIM	Opal satined	Without	4000K
063-3246637O	White	DIM DALI	Opal satined	Without	4000K
063-3246617P	White	Non DIM	Microprismatic	Without	4000K
063-3246637P	White	DIM DALI	Microprismatic	Without	4000K
063-3246517P	White	Non DIM	Microprismatic	Without	3000K
063-3246537P	White	DIM DALI	Microprismatic	Without	3000K

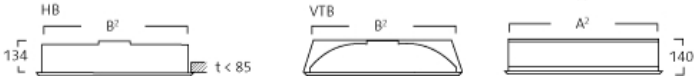
FAGERHULT

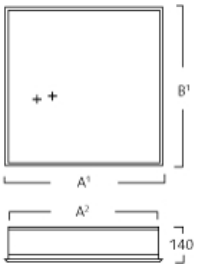
Indigo Ed2 R1 Perfo

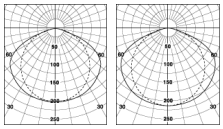
HF-std

W	Vægt	Art.No.
FSD		
Modul 600x600, skjult profil (HB)		
1x40	6.8	**24626**

W	A¹	A²	B¹	B²	A×B
VTB					
2×13/14/20/24	596	575	596	560	
1×40/55	596	575	596	560	
HB					
2×13/14/20/24	600	575	600	550	580×580
1×40/55	600	575	600	550	580×580







1-rør, FSD 2-rør, FDH

Installation
Armatur for indbygning i ventileret eller uventileret loft. To alternative udførelser.
VTB – for lofter med synlig bæreprofil 25 eller 15 mm.
HB – for lofter med skjult bæreprofil. Faste lofter, gips, lofter med C- eller D-kant samt for metallofter. Med HB-armaturer leveres 4 stk.ophængningsbeslag. Må dækkes af isolering, dog ikke armaturer bestykket med nødlys.

Tilslutning
Armaturet er forsynet med en hvidtilslutningsledning på 2,4 m med jordet stik. Ved tillægsnummer for lysregulering leveres armaturet med 5-leder, frie ledningsender, 5-polet indstiksklemrække 2,5 mm².

Udførelse
Armaturhus og reflektor i hvidlakeret stålplade (RAL 9016 strukturoverflade).

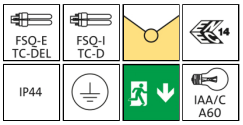
Afskærmning
Perfo – hvidlakeret stålplade (RAL 9016 struktur) med opalplastdiffusor på inderside. Monteres i armaturhuset via fjederclips i gavlene. Jordet.

Reflektor
Hvidlakeret stålplade lakeret som ovenstående.

Lysregulering
De fleste varianter kan også udstyres med andre lysreguleringsforkoblinger.

FAGERHULT

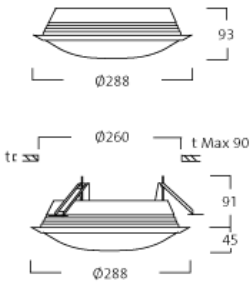
Discovery



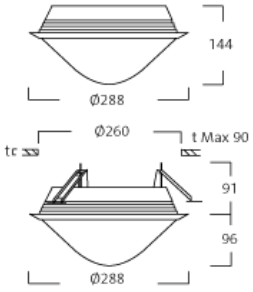
HF-std

W	Vægt	Kupp	Luminansklasse	**Art.No.**
FSQ-E				
1x13	1.3	Polycarbonate	B	**56536-85**

FSQ



IAA



Installation
På loft alt. væg eller indbygget. To fastgørelseshuller. Ved indbygning skal der bestilles indbygningsbøjler. Må ikke dækkes af isolering. For detaljeret info, se montageanvisningen på hjemmesiden.

Tilslutning
Indstiksklemrække 5x2,5 mm², mulighed for 3-fase sløjfning. Mulighed for udenpåliggende ledning, sløjfning 0° eller 180°. Tre indføringshul Ø16mm med membrannippel er placeret på armaturets overside.

Udførelse
Armaturhus i polykarbonat og skærm i slagfast akryl alt. polykarbonat. IP 20 med sensor.

Nødlys
Nødlysarmaturet har batteri (1 time drift) i separat boks og nødlysaggregat for indbygning alt. udenpåliggende montage. Indstiksklemrække 4x2,5 mm².

Lysregulering
e-Sense smartSWITCH – armatur med indbygget PIR-sensor for bevægelsesmelder on/off, IP 43 i loft, IP 20 på væg.
e-Sense Detect – mikrobølgesensor til tænd/sluk-funktion.

Tilbehør
Kantring, skærm og påbygningsring i hvid alt. grå (RAL 9006) aluminium. IP 55 pakning. Skærm passer ikke til armatur for IAA.

Design
Wilma Daemen.

A.3 Appendix III

Floorplan of the third floor of the IDA building. Modelled in 3D Studio Max, with the luminaries used i the new design.

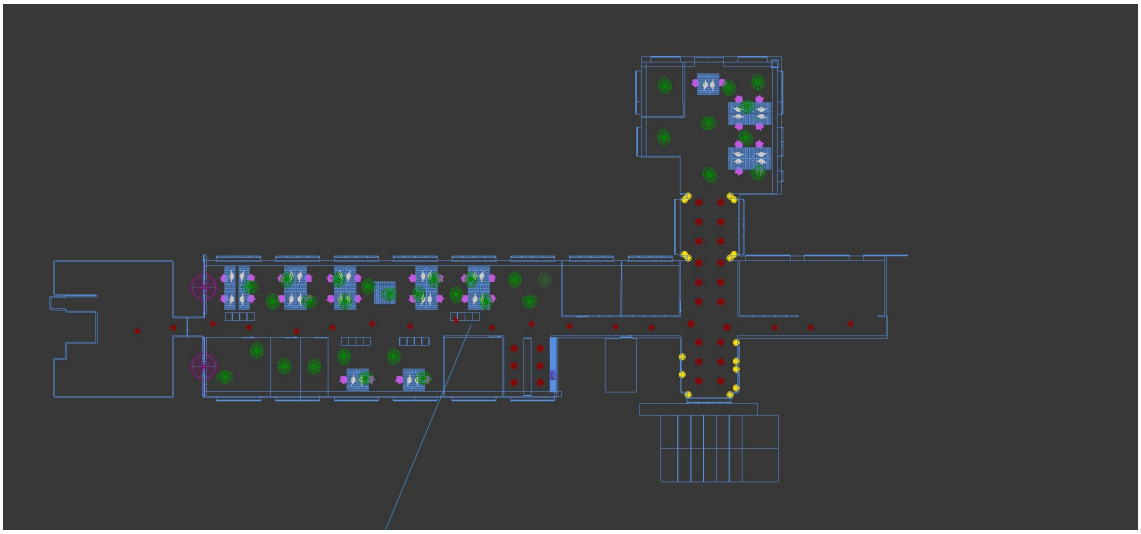


Figure A.1: A floorplan of the third floor of the IDA office. showing the placement of luminaries for the new lighting design.

- Red: Iguzzini M936 Laser spotlight
- Green: Iguzzini MQ61 Laserblade
- Yellow: Iguzzini P304 Laser Narrowspot
- Purple: LED strip, photometric data from Iguzzini Underscore 15, code M251, kelvin changed to 3000 K

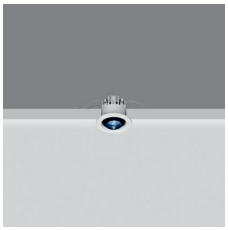
A.4 Appendix IV

All Data for the luminaries from the design, starts next page.

Deep Laser

Design iGuzzini **iGuzzini**

june 2016

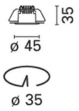


Deep Laser

code
M936

Technical description
Fixed round recessed luminaire designed to use a 1X1,5W LED lamp in warm white (3100°K) with medium optic. Recessed item with rim consisting of a single die-cast aluminium body. The upper part of the luminaire is fitted with a heat sink which helps to carry away the heat given off by the lamp. LED optics with a single lens made of thermoplastic material.

Installation
Recessed using springs which allow easy installation in false ceilings with thickness ranging from 1 mm to 30 mm.



Size (mm)
ø45x32

Colour
White (01)

Weight (kg)
0.04

Mounting
wall recessed | ceiling recessed

Wiring info
Electronic components to be ordered separately

Complies with EN60598-1 and pertinent regulations

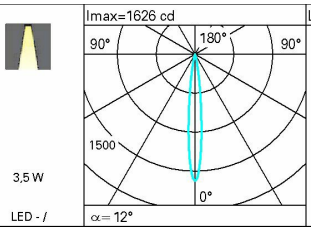
IP23

Product configuration: M936+LED
LED: LED warm white (nr.1)

Product characteristics
Total lighting output [Lm]: 90,3
Total power [W]: 3,5
Luminous efficacy (lm/W, real value): 25,8
Life Time: 50.000h - L80 - B20 (Ta 25°C)
Total luminous flux at or above an angle of 90° [Lm]: 0
Emergency luminous flux [Lm]: /
Voltage [V]: -
Number of optical assemblies: 1

Optical assembly Characteristics 1
Light Output Ratio (L.O.R.) [%]: 85
Lamp code: LED
ZVEI Code: LED
Nominal power [W]: 1,6
Nominal luminous [Lm]: 106
Lamp maximum intensity [cd]: /
Beam angle [°]: 12°
Number of lamps for optical assembly: 1
Socket: /
Ballast losses [W]: 1,9
Colour temperature [K]: 3000
CRI: 85
Wavelength [nm]: /
MacAdam Step: /

Polar

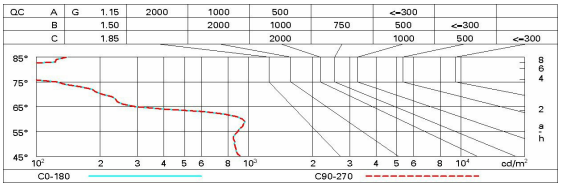


Lux			
h	d	Em	Emax
1	0.2	1241	1626
2	0.4	310	406
3	0.6	138	181
4	0.8	78	102

Utilisation factors

R	77	75	73	71	55	53	33	00	DRR
K0.8	77	73	70	68	72	69	69	66	78
1.0	80	76	74	72	76	73	73	70	82
1.5	84	81	79	77	80	78	78	75	88
2.0	87	85	83	82	84	82	81	79	93
2.5	88	87	86	85	86	84	84	81	95
3.0	89	88	87	87	87	86	85	83	97
4.0	90	90	89	89	88	88	87	84	99
5.0	91	91	90	90	89	89	87	85	100

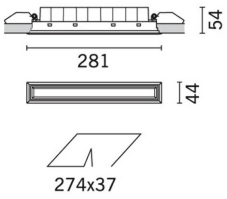
Luminance curve limit



Laser Blade

Design iGuzzini **iGuzzini**

june 2016



Laser Blade

code
MQ61

Technical description
Miniaturized recessed rectangular luminaire with LEDs. Main body with die-cast aluminium radiant surface, version with perimeter surface frame. Optical system designed for diffused lighting distribution. Flux enhancer - superpure aluminium reflector - microprism screen in transparent PMMA with optimised geometry texture; a special film in acrylic material, combined with the screen, allow for a comfortable level of lighting diffusion. Black polycarbonate internal perimeter frame. Supplied with DALI dimmable control gear connected to the luminaire. Neutral white LED.

Installation
recessed with steel springs for false ceilings from 1 to 25 mm; can be installed on cealings and walls (vertical + horizontal) - preparation slot 37 x 274

Size (mm)
281x44x54

Colour
White / Black (47) | Grey / Black (74)

Weight (kg)
0.65

Mounting
wall recessed | ceiling recessed

Wiring info
on power box: screw connections

Notes
dimming function with pushbutton (TOUCH DIM/PUSH): for this option consult the instructions included in the package

Complies with EN60598-1 and pertinent regulations

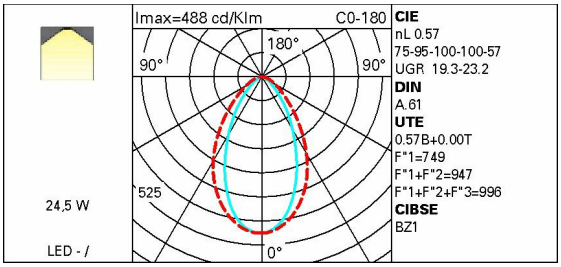
IP20 IP43 On the visible part of the product once installed

Product configuration: MQ61+LED
LED: n.10 led neutral

Product characteristics
Total lighting output [Lm]: 1049,2
Total power [W]: 24,5
Luminous efficacy (lm/W, real value): 42,8
Life Time: 50.000h - L90 - B10 (Ta 25°C)
Total luminous flux at or above an angle of 90° [Lm]: 0
Emergency luminous flux [Lm]: /
Voltage [V]: -
Number of optical assemblies: 1

Optical assembly Characteristics 1
Light Output Ratio (L.O.R.) [%]: 57
Lamp code: LED
ZVEI Code: LED
Nominal power [W]: 21
Nominal luminous [Lm]: 1840
Lamp maximum intensity [cd]: /
Beam angle [°]: /
Number of lamps for optical assembly: 1
Socket: /
Ballast losses [W]: 3,5
Colour temperature [K]: 4000
CRI: 95
Wavelength [nm]: /
MacAdam Step: <3

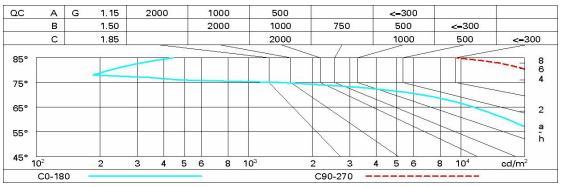
Polar



Utilisation factors

R	77	75	73	71	55	53	33	00	DRR
K0.8	45	41	38	35	40	37	37	34	60
1.0	48	44	41	39	43	41	41	38	66
1.5	53	50	47	45	49	47	46	44	76
2.0	55	53	51	49	52	50	50	47	83
2.5	57	55	53	52	54	52	52	50	87
3.0	58	56	55	54	55	54	53	51	90
4.0	59	58	57	56	57	56	55	53	93
5.0	59	58	58	57	57	57	56	54	94

Luminance curve limit



UGR diagram

Photometric curve code: MC570000.R49
Uncorrected UGR values (at 1000 lm bare lamp luminous flux)

Riflect.:											
ceil/cav		0.70	0.70	0.50	0.50	0.30	0.70	0.70	0.50	0.50	0.30
walls		0.50	0.30	0.50	0.30	0.30	0.50	0.30	0.50	0.30	0.30
work pl.		0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Room dim				viewed					viewed		
x	y			crosswise					endwise		
2H	2H	19.1	19.9	19.4	20.2	20.4	22.4	23.3	22.7	23.5	23.8
	3H	19.1	19.8	19.4	20.1	20.4	22.5	23.2	22.8	23.5	23.8
	4H	19.0	19.7	19.3	20.0	20.3	22.4	23.2	22.8	23.4	23.8
	6H	18.9	19.6	19.3	19.9	20.2	22.4	23.0	22.7	23.3	23.7
	8H	18.9	19.5	19.3	19.8	20.2	22.3	23.0	22.7	23.3	23.6
	12H	18.8	19.4	19.2	19.8	20.1	22.3	22.9	22.7	23.2	23.6
4H	2H	19.5	20.2	19.8	20.5	20.8	23.2	23.9	23.5	24.2	24.5
	3H	19.5	20.1	19.9	20.5	20.8	23.3	23.9	23.7	24.2	24.6
	4H	19.4	20.0	19.9	20.3	20.7	23.3	23.8	23.7	24.2	24.6
	6H	19.4	19.8	19.8	20.2	20.6	23.2	23.7	23.7	24.1	24.5
	8H	19.3	19.7	19.8	20.2	20.6	23.2	23.6	23.6	24.0	24.5
	12H	19.3	19.6	19.7	20.1	20.5	23.1	23.5	23.6	23.9	24.4
8H	4H	19.5	19.9	19.9	20.3	20.7	23.3	23.7	23.8	24.2	24.6
	6H	19.4	19.7	19.8	20.2	20.6	23.3	23.6	23.7	24.1	24.5
	8H	19.3	19.6	19.8	20.1	20.6	23.2	23.5	23.7	24.0	24.5
	12H	19.3	19.5	19.8	20.0	20.5	23.2	23.4	23.7	23.9	24.4
12H	4H	19.4	19.8	19.9	20.2	20.7	23.3	23.7	23.7	24.1	24.6
	6H	19.3	19.6	19.8	20.1	20.6	23.2	23.5	23.7	24.0	24.5
	8H	19.3	19.5	19.8	20.0	20.5	23.2	23.4	23.7	23.9	24.4

Variations with the observer position at spacing:

S =	1.0H	1.5 / -2.2	0.5 / -0.9
	1.5H	2.4 / -4.5	1.6 / -1.8
	2.0H	3.7 / -7.2	3.1 / -2.8

Laser

Design iGuzzini **iGuzzini**

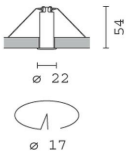
june 2016

Laser

code
P304

Technical description
Fixed round mini-recessed luminaire with contact frame. The LED is set back to minimize direct glare. The recessed body is made of machined aluminium and the inside of the ring of thermoplastic available in a range of painted and metallised finishes. PMMA - spot (16°) high resolution optic lens. High color rendering index 2700K LED. Tool free assembly. Power unit available with a separate code no.

Installation
Recessed in a false ceiling by means of a steel wire spring - minimum thickness of false ceiling: 1 mm - preparation hole Ø 17 mm.



Size (mm)
ø22x54

Colour
White (01) | White/Brass (41) | White / Black (47) | White/Chrome (E4) | white / chrome burnished (E7) | white / gold satin-finish (E9)

Weight (kg)
0.03

Mounting
wall recessed | ceiling recessed

Wiring info
Direct current ballasts are available with a separate code no.: ON-OFF / 1-10V dimmable / DALI dimmable / Trailing Edge dimmable

Complies with EN60598-1 and pertinent regulations

IP20 IP43 On the visible part of the product once installed

pending CE A++

Product configuration: P304.01+LED
LED: LED Warm CRI>90 - colour 01 - White

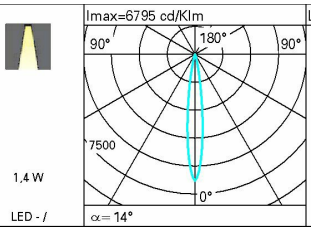
Product characteristics

Total lighting output [Lm]: 65,6	Total luminous flux at or above an angle of 90° [Lm]: 0
Total power [W]: 1,4	Emergency luminous flux [Lm]: /
Luminous efficacy (lm/W, real value): 46,8	Voltage [V]: -
Life Time: 50.000h - L80 - B10 (Ta 25°C)	Number of optical assemblies: 1

Optical assembly Characteristics 1

Light Output Ratio (L.O.R.) [%]: 57	Number of lamps for optical assembly: 1
Lamp code: LED	Socket: /
ZVEI Code: LED	Ballast losses [W]: 0
Nominal power [W]: 1,4	Colour temperature [K]: 2700
Nominal luminous [Lm]: 115	CRI: 90
Lamp maximum intensity [cd]: /	Wavelength [nm]: /
Beam angle [°]: 14°	MacAdam Step: <3

Polar



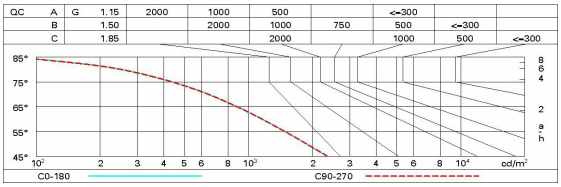
Lux/Klm

h	d	Em	Emax
2	0.5	1293	1699
4	1	323	425
6	1.5	144	189
8	2	81	106

Utilisation factors

R	77	75	73	71	55	53	33	00	DRR
K0.8	49	46	44	42	46	44	43	41	72
1.0	52	49	47	45	48	46	46	44	77
1.5	55	53	51	50	52	51	50	48	84
2.0	57	55	54	53	54	53	53	51	89
2.5	58	57	56	55	56	55	54	53	92
3.0	59	58	57	56	57	56	56	54	95
4.0	60	59	59	58	58	58	57	55	97
5.0	60	60	59	59	59	58	57	56	98

Luminance curve limit



Underscore15

Design iGuzzini **iGuzzini**

june 2016

Underscore15

code
M251

Technical description
Product for linear lighting - with white monochrome LEDs - made on a white flexible circuit coated with a layer of silicone; the silicone protection guarantees IP65 protection for the uncut strip. The ends of the circuits are fitted with connectors with IP20 protection, therefore we recommend that the strips be used indoors. Supplied in 5-metre long coils wound on suitable supports; the pack includes a connections kit for in line or power supply connections. The back of the circuit is coated with adhesive for rapid application; mounting accessories are available for less simple installations. The strip can be cut at a centre-to-centre distance of 50 mm (minimum 3 LEDs); if intermediate cuts are made, ensure that the cut ends are carefully sealed. LED features: white 4000K colour (the value is an indication only and may vary slightly) - 60 LEDs/m - flare angle 120° - 24W total - power supply 12V - a maximum of 3 coils can be connected in line.Ballasts to be ordered separately

Installation
rapid installation with adhesive; clips are available for added fixing guarantees (code MWG2: 10 pieces) and rigid aluminium supports (code MWG1: 5 pieces x 1m)

Size (mm)
5000x10x3

Colour
Indeterminate (00)

Weight (kg)
0.21

Mounting
wall arm

Wiring info
Constant voltage ballasts to be ordered separately; available for a single coil (code MWF7) or for a maximum of 3 coils in line (code MWF8). Ballast/coil connection with connectors (IP20) included in the pack with the strips

Notes
The connectors grant an IP20 protection, for this reason it is advised the use of strips in internal installations. in case of cuts to the strips it is necessary to restore the sealing with accuracy after having done the connection weldings.

Complies with EN60598-1 and pertinent regulations

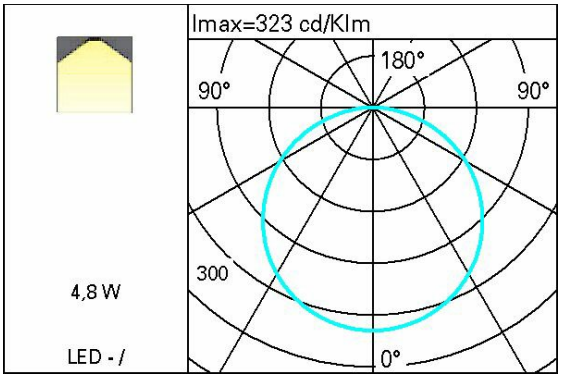
IP20 IP65 if the strip is uncut

Product configuration: M251+LENGTH1+LED
LENGTH1: Length 1 (m)
LED: LED 4000 K

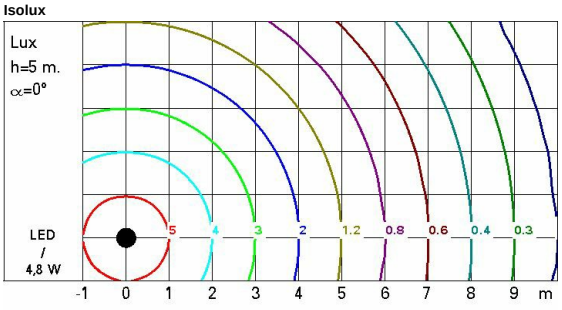
Product characteristics
Total lighting output [Lm]: 390
Total power [W]: 4,8
Luminous efficacy (lm/W, real value): 81,3
Life Time: 40.000h - L70 (Ta 25°C)
Total luminous flux at or above an angle of 90° [Lm]: 5,1
Emergency luminous flux [Lm]: /
Voltage [V]: 12
Number of optical assemblies: 1

Optical assembly Characteristics 1
Light Output Ratio (L.O.R.) [%]: 100
Lamp code: LED
ZVEI Code: LED
Nominal power [W]: 4,8
Nominal luminous [Lm]: 390
Lamp maximum intensity [cd]: /
Beam angle [°]: /
Number of lamps for optical assembly: 1
Socket: /
Ballast losses [W]: 0
Colour temperature [K]: 4000
CRI: 75
Wavelength [nm]: /
MacAdam Step: /

Polar



Isolux



Bibliography

Böhme, Gernot et al. (2014). *Architectural Atmospheres: On the Experience and Politics of Architecture.* Basel, Switzerland: Birkhauser, pp. 60–90.

Brennan, Teresa (2004). *The Transmission of Affect.* Ithaca and London: Cornell Univercity Press.

Lee, M. S., M. H. Pittler, and E. Ernst (2008). "Effects of Reiki in clinical practice: a systematic review of randomized clinical trials". In: *International Journal of Clinical Practice 62 (6)*, pp. 947–954.

Mandelbaum, Eric and Edward N. Zalta (2016). *The Stanford Encyclopedia of Philosophy: Associationist Theories of Thought.* URL: `http://plato.stanford.edu/archives/spr2016/entries/associationist-thought/`.

Merriam-Webster (2016). *www.merriam-webster.com.* URL: `http://www.merriam-webster.com/dictionary/association`.

Shields, James M. (2009). "he Art of Aidagara: Ethics, Aesthetics, and the Quest for an Ontology of Social Existence in Watsuji Tetsurõ's Rinrigaku". In: *Asian Philosophy, 19:3*, pp. 265–283.

Steinberg, Adam. *Why Solar? The how and why of FREE heat!* URL: `http://solar.steinbergs.us/solar.html`.

Stidsen, Lone (2013). "Light Atmosphere in Hospital Wards." PhD thesis. Aalborg Universitet.