# Daylight in Architecture

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Workbook aug - nov 2012
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Stockholm, Sweden

*“Horas non numero nisi serenas”*

- Inscription often found on old sundials, meaning approximately
“I only count the happy / sunny hours”

# Register





Daylight in Architecture

My last workbook of the ALD course... That feels kind of weird... Over the past 16 months, I have developed some sort of hate - love relationship to those, as they are a great reference, and it is really fun to look back on thoughts and ideas I had earlier, but getting them finished... Well, let us not get into details here...

I now only have one lighting installation and my thesis project left before I will graduate as a lighting designer, so I kind of feel I should make some sort of summary of what I have learnt here.

Of course though, there is no obvious one. When I started studying light last august, I had this naive idea, that after two years, I would know everything about lighting. It only took me a few months to realize I would never know everything, but that is what makes it so much more intriguing, there is always something new to explore.

My main fascination with lighting at the moment is how powerful it is at drawing attention and creating curiosity. I saw the edited photograph on the right at Fotografiska earlier this year, and it is a very good example of what I mean. Would you not just want to jump into it to have a look at what lingers inside the wall?

Muros de luz 002 by Aitor Ortiz [p10]





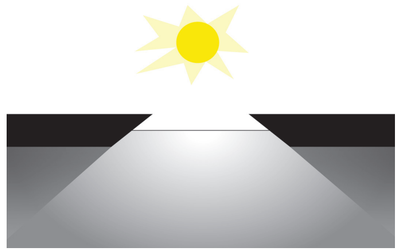
# Ljuslaboratoriet

- Lecture notes from the past few months

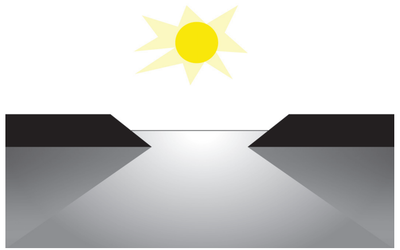
# Jan Ejhed - Daylight

Jan talked about a visit to the Tevastehus castle in Finland, where he had noticed that the unusual window shapes enhanced a positive evaluation of the room. While thick walls are commonly built at an angle around windows to allow more light to enter, at Tavestehus the edges are tilted in the other direction. While this does not raise the light level as much, it created an interesting play of light and shadow in the space. Following the idea of this example, Jans stated that it is sometimes good to try the opposite of what seems to be the right way, as this can inspire interesting results.

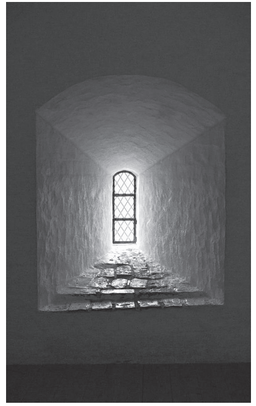
Further, Jan talked about that outside, the brightest point is always above us, and that we often try to imitate this inside by making floors dark and ceilings white. However, the brightest point inside is always on the floor, as this is where the sun- and sky light fall through windows. He thus questioned whether making ceilings white and floors darker is necessary the right approach. White floor would for example spread most daylight throughout the space, while the ceiling is only reached by daylight that has already bounced off the floor, and thus has less of an impact.



Plan, Common, traditional, castle window [p1]



Plan, Castle window at Tavestehus Castle [p1]



Window at Tavestehus Castle [p3]

Tavestehus Castle in Finland [p2]





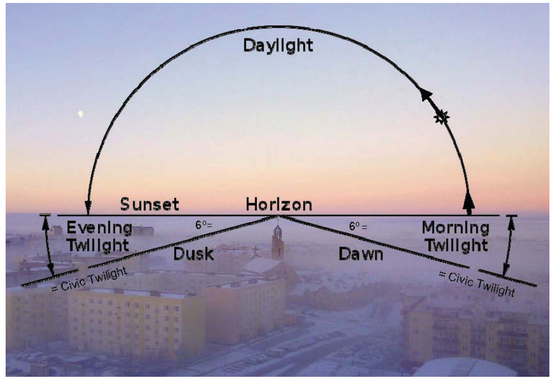
# Bengt Sundborg - Urban planning by Daylight

Bengt started with talking about what makes the Nordic light so special. We are all aware of that we have short days in winter and long summer nights, but two important characteristics that fewer people notice consciously are the low sun angles we experience during winter, and the long sunsets we get in summer. Long sunset also mean long Twilight, the time when the sun is between 0˚ and 6˚ below the horizon. Twilight provides a very special kind of light, that has been long loved by photographers and associated with mystery.

Next, Bengt mentioned some important things to consider in city planning. When we draw up streets on a plan, we need to not only consider how well they get us from one place to another, but also what views we will experience while walking them. Broken sight lines give new views as we change direction, providing variation, but making orientation harder. What is more, they block sunlight, especially at low angles. Breaking sight lines should therefore only be done with careful consideration, as they might provide an amazing walk with interesting things to notice, but seeing the same facade from slightly different angles often does not add anything positive to the experience. Contrary to common belief, streets that change angle are not very effective at reducing wind, while they often block sunlight completely compared to straight ones. However, one should be careful when building identical houses opposite each other, as this often makes people stare straight into each others windows.

A rule of thumb to get well lit streets in the middle of Sweden, is building no higher than 3 stories at the sides of 10m wide streets. A way to get additional sunlight on streets, is chamfering the corners of surrounding buildings.

Reflections of the sun, glass as mirrors, and water as mirror, are three phenomena that are seldom considered in city planning, but are very often noticed by people, and should thus be given more attention.




Twilight diagram [p4]

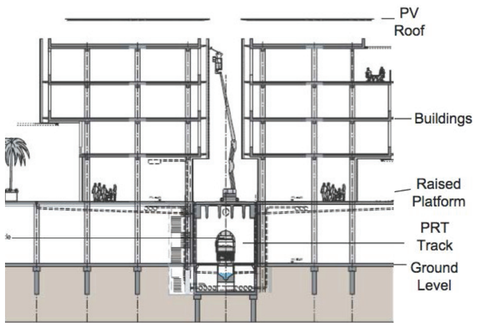

Outside Pantheon, Rome [p4]

# Karim Najar - Energy in the city

Karim talked about that we are today living more comfortable lives, at the cost of using more natural resources, than ever before, and that not many people today believe that humans will be able to continue doing this for much longer. He then continued with talking about the LEED energy preservation criteria, and concluded the lecture with discussing an example of a large-scale sustainable development, the city of Masdar.

The LEED criteria is a rating system for buildings, divided into several categories of evaluation. Within every category, there are a few prerequisites that have to be met in order to receive a LEED certification. There are also optional credits in every category, that award certain amounts of point to the design. In contrary to the prerequisites, some credits can be skipped all together, but a minimum point total has to be achieved in order to certify the building. Higher point values allow for silver, gold, and platinum certifications.

Masdar is a city under development in the Unite Arab Eremites, that will be the first city in the world to operate completely without fossil fueled cars and trucks. The transport system in Masdar will consist of walking, cycling, rail traffic, and a kind of underground monorail called “rapid personal transport system”.  The city is aiming at  an overall sustainable approach, and will be powered exclusively by renewable energy, house energy efficient buildings, enforce a zero waste objective, and work with on-site wastewater treatment. 60% of the citys water needs will be covered by recycled water.




Underground monorail in Mazdar city [p5]


Transportation grid of Mazdar city [p5]


Public Transportation [p5]





# Diana Joeles - Lighting Planning Basics

Diana talked about that it is important to work for people in a local oriented way. The spatial experience and the social context is important for the understanding of a lighting design project, while a project might look quite simple and boring in a lighting magazine it might still have an amazing effect on the area it inhibits. With light, it is possible accent a point that will make a person experience an environment in a specific way.

It is noticeable that we have quite little daylight in Sweden during winter, as people run out and sunbathe fully clothed in the beginning of spring while there is still snow, as soon as the sun comes out. It is also much more common to not have curtains in Sweden than in countries further to the south, so I guess I am not as special as some visitors think, with not having had any other curtains than blinds to close at night for the last 10 years.

Diana stated that it is important to work in teams on urban projects, to cover as many possible considerations that should be made in urban planning, as possible. She described that good historical architecture is about light in space, openings, textures, and the interactions of those with each other.

Diana also mentioned Jamie Lerners term “Urban acupuncture,” to consider a projects effect not only on its immediate area, but also on the surroundings, and how its effects will spread into other contexts.  When designing the lighting for a square, we are not only designing it for the person in the square, but also for the one watching it from a distance.

While the light itself is generally more important than the appearance of the fixtures used, we should be aware of that how fixtures are placed also influences how the space is experienced during the day. How we direct fixtures determines how much light is cast up into the sky, which should be avoided in order not to create unnecessary light pollution. While regulations only concern direct light, the reflected light from the ground and facades also has a big impact on the amount of light cast to the sky.

Further, the misconception that we can chase away crime by simply putting up lights, was discussed. Drug dealers, and other criminals might move to a nearby dark areas, but might also very well continue on with their business, when a street is lit. By lighting up dark streets, we increase peoples feeling of safety, but research has often not found any improvement to how secure they actually are. Therefore, it might be better to light the safer streets to lead people on their way safely, then trick them into feeling safe where they are not. Diana also mentioned that, like with light, we have different views on crime in different countries, in Mexico you would not call drunks fighting a crime, you would call it their problem.

A final important note was that while we use our focal vision to notice details, moods and emotions are mainly interpreted through our surround vision. This is important to consider in order to design environments where we not only see, but also feel comfortable.

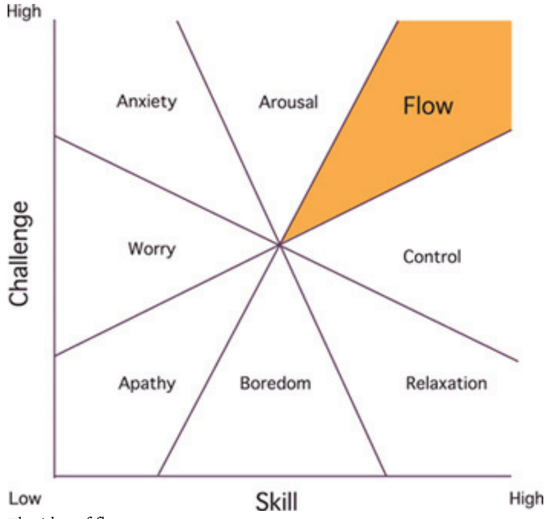
# Karim Najar - Wellbeing

This lecture was about how our environment can as well enhance our health and wellbeing, as deteriorate is, and revolved around four theories of psychological and physiological processes.

One is Mihaly Csikszentmihalyi work, Flow: The Psychology of Optimal Experience. His theory states that people are most happy when they are in a state of flow, a state of concentration or complete absorption with the activity and situation at hand. It is a state of mind in which one is so involved in an activity that nothing else seems to matter (Csikszentmihalyi, 1990), and occurs when an individual is challenged an appropriate amount relative to hers or his skills.

Aaron Antonovsky concluded in his research, that in the western world today, chronic rather than infections diseases are the main cause of suffering. It is thus important to move away from a view of defeating illness only by fighting pathogens, but also focus on modern causes of ill health, like stress and other lifestyle factors.

The physiosocially supportive design approached is described by Alan Dilani, and details that the basic function of design is to start a mental process. By attracting a persons attention in the right way, a mental process can be started, that can reduce or eliminate anxiety. To bring positive changes, psychosocially supportive design should challenge our mind in order to create pleasure, stimulation, creativity, satisfaction, and enjoyment.



The idea of flow [p6]

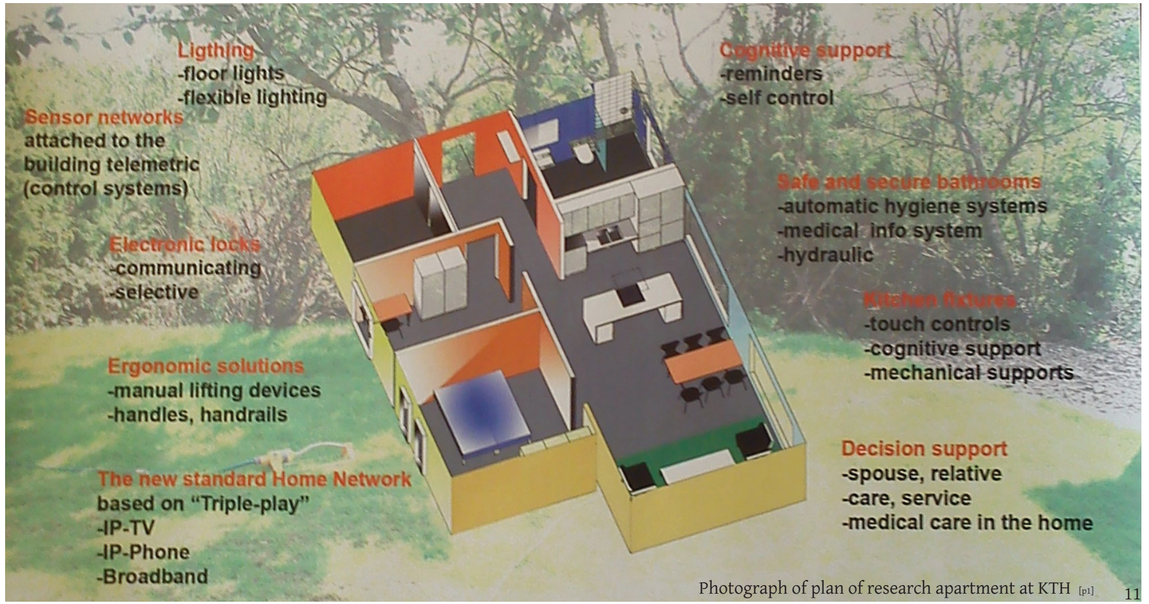
Rachel and Stepen Kaplan developed the Kaplan restorative theory, which says that when Humans are forced to pay sustained attention to their surroundings, they inevitably experience attentional fatigue. ART is based on research that separates our attention into two components: involuntary attention, where attention is captured by inherently intriguing or important stimuli, and directed attention, where attention is directed by cognitive processes. To restore the mind to a healthy state, one should periodically be exposed to a restorative environment, like nature, where only involuntary attention is experienced.





# Study visit at Micasa

Jenny Hjalmarson showed us around 3 display apartments at Södermalm, and two research apartments at KTH, Haninge, all of which are designed to suit the needs of older adults. Jenny talked about that we can aid orientation with light and colors, giving two walls opposite each other in a room a slightly different color than the other two helps describe the space, and contrast are generally important for vision as people get older. The apartment below is designed for a couple with a shared bedroom, it also has an extra bedroom close to the entrance where one person can sleep if getting ill, so that service personal can access the person without disturbing hers or his partner.



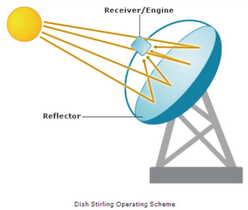
Photograph of plan of research apartment at KTH [p1]

# Karim Najar - Solar Technologies

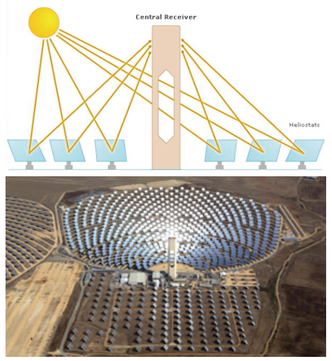
Solar power is a renewable power source and, once we learn to harvest it well, a very powerful one. The amount of energy from the sun, that reaches the earth every day, equals 40 times the amount that the world uses annually. Development of sun harvesting techniques is currently going in two directions, looking into small, adjustable systems that can be used of the grid, as well as large scale, effective, developments from where energy can be transmitted in a conventional way.

As for systems that are locally placed, they are basically improvements of the sun panels available today, with higher efficiency, and often angles that adjust towards the sun throughout the day. For large scale systems, there are however several different approaches, ranging from simply very big sun panels, to panels placed up in space where they are not disturbed by the atmosphere. Below, I will describe 3 ways to harvest sun power, that lie somewhere in between those when it comes to innovation.

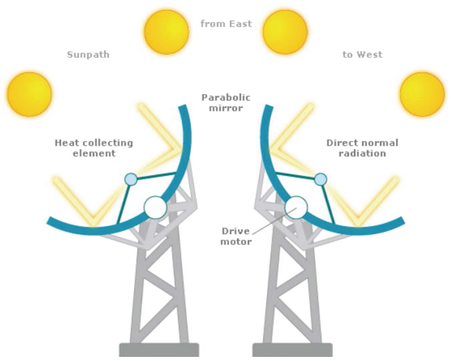
Dish stirling technology uses a parabolic disc to focus sunlight towards a transmitter, in this way the actual sun panel can be made small, while the disc consists simply of reflective material. Solar tower developments work in much the same way, but are of a larger scale with reflectors placed in a parabolic shape dug into the ground.  Light is directed towards a tower in the middle of the hole, which works a transmitter. Trough technology, like stirling technology, also uses a parabolic disc to concentrate sunlight, and has the added benefit of rotating with the sun angle.




Dish stirling technology [p5]




Solar tower [p5]




Trough technology [p5]





# Lone Stidsen - Atmospheres

Lone talked about that atmospheres can affects peoples emotions both positively and negatively, and stated that beautiful things makes us stop and notice. Further, she described Peter Boyces 3 categories of light effects on human beings, and talked about an installation by Daniel Rybakken, that experiments with how a place changes in what we experience to be daylight, verses artificial light.

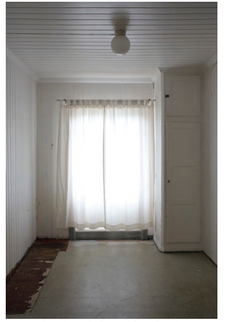
Peter Boyce talks about 3 different ways, in which light affects our health. The first is that of light as radiation, exposure to visible, ultra-violet, and infrared radiation. All of those can potentially damage both our eyes and skin, through thermal and photochemical mechanisms. Although the danger of such damage occurring is rare in indoor lighting installations today, it might need to be considered in some situations. [1]

The second way light affects us is through the visual system, lighting enables us to see but we need to take care to avoid conditions that cause visual discomfort, as those can lead to eyestrain. Many of the lighting conditions that cause visual discomfort are well known and can be avoided, this should be a priority as people who frequently experiences eyestrain will not be at their best health. [1]

The third way in which light operates is through the circadian system. We still know very little about the impact light has on our circadian rhythm, but enough to realize that it is an important topic that needs to be researched further. We have already seen that light influences sleep patterns and some research has shown that it is linked to the development of breast cancer among night shift workers. [1]

“Subconscious effects of Daylight” is an installation by Daniel Rybakken, that shows a simple room lit with lights behind a curtain simulating daylight, and with a conventional luminaire. The picture on the top right shows the daylight simulation, on his website Daniel writes that “When you have daylight in a room you get information of something outside. This creates a feeling of an expanded perceived space. A sensation of freedom” [2]. Once daylight is no longer shining into the room, it will feel enclosed and smaller [2], as on the picture on the right.

While we today are able to create pretty good lighting installations that at a first sight look like daylight coming through a window, they do not actually provide any information of what is going on outside, and can thus be confusing. Many people also feel tricked once pulling away a curtain to look out the window and realizing that they are staring into a wall with mounted lights. I therefore believe that this kind of installations need to be carefully considered, not for being able to look like daylight, but for the effects that they can have on our visual and circadian systems.



Room lit by fake “daylight” [p7]

Room lit with a luminaire [p7]

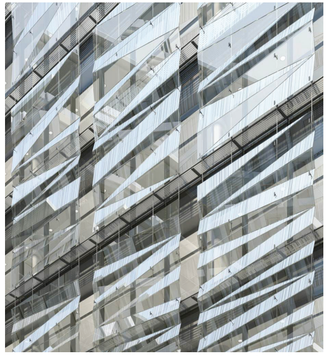
# Luke Lowings - Daylight / Night Light

Luke described two different projects in London where he has worked with reflecting views of the sky into a space, the courtyard of Wilkinson building and the Salvation army chapel. He also showed some picture of the lighting design of a private staircase in Hong Kong, that is meant to reflect light in such a way that it creates the feeling of a soft bamboo grid.

Further, he said that not every building needs to be lit, that light at night should be used sparsely, that “it is nice to just have your path guided, in the dark”. He also mentioned the negative effects of excessive light on our circadian system, “The day and night cycle is something we have developed with, we should accept it”.

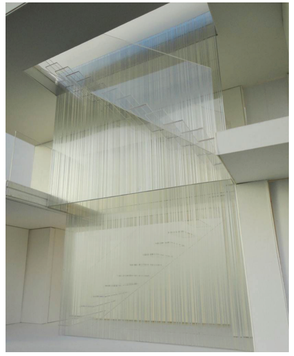
In the Wilkinson building project, the task from the client was to create an interesting facade. As the affected side of the building was facing a small courtyard, the design was made with tilted glass panels in order to make reflections of the sky visible from the ground, thus increasing the amount of sky seen.

As the Salvation army chapel is located only one floor up, facing a busy street between St. Pauls cathedral and Tate modern art museum, a straight view to the outside was not seen as the most appropriate for the space. Instead, a view of the sky is reflected to the inside of glass panels covering the window area.



Wilkinson building facade [p8]

Salvation army chapel [p8]



Staircase in Hong Kong [p8]





# Lighting Exercises

- Focusing on different aspects of light

# Software exercise

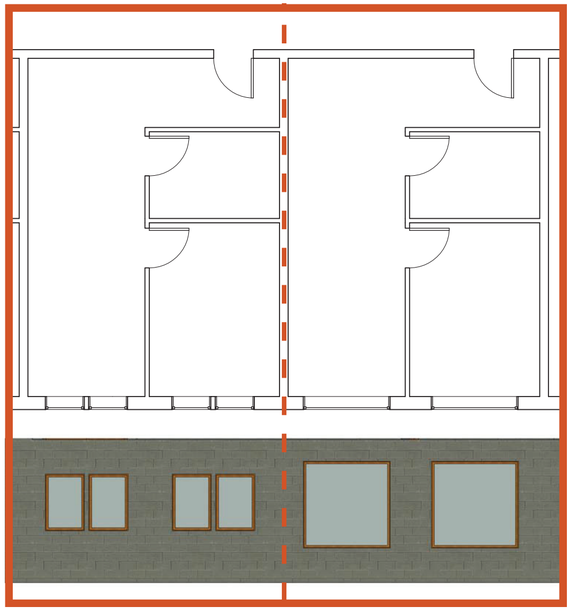
This exercise was about evaluating and improving the lighting of an apartment in the building we designed for our Daylight project with Ecotect, and evaluate the improved design according to the LEED scheme. The calculations can be seen on the next spread.

I chose to focus on the worst-case scenario apartment in our building, with windows only on the short side, and originally drew it with standard windows of 900x1300mm at a sill height of 900mm. As expected there were sufficient light close to the windows, but it did not reach very far into the apartment.

To get a better spread of light, I decided to make the windows bigger, and let them reach all the way up to 100mm below the ceiling. I also made the top of the bedroom, and bathroom, walls glazed above cupboard level to get a bit of light into the bathroom and hallway.

The difference is not huge when looking at 12 o´clock lux levels or the daylight factor, but the daylight autonomy calculation shows that the percentage of time when a daylight level of 300 lux is reached, rises drastically.

The LEED scorecard is shown on the next page, as it is suited for a whole development, and not a single apartment, I have rated the design of our entire building [*pg. 25*]. As we only go as far as a concept design in this project, it is not possible to show that all criteria are actually met at this point, so I have awarded points according to what criteria I would have the ambition of fulfilling, if developing the project further. The criteria directly related to lighting are “solar orientation” and “light pollution reduction”, whereof the first was considered throughout the design of the building. And although not all apartments can be directed to the south, we made sure to create communal areas both outside and inside, that will have access to sunlight. As for light pollution, the main concern would be the lighting in the courtyard, which will be well shielded off to not cast much light up into the sky.



Original apartment (left) and Improved apartment (right) - scale 1:100 [p1]





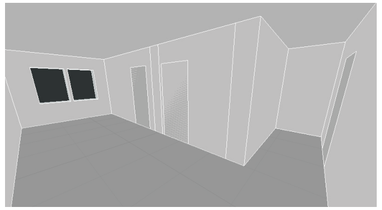
**LEED 2009 for Neighborhood Development**
**Project Scorecard**

Project Name: Norra Djurgårdsstaden
Date: 08 / 11 - 2012

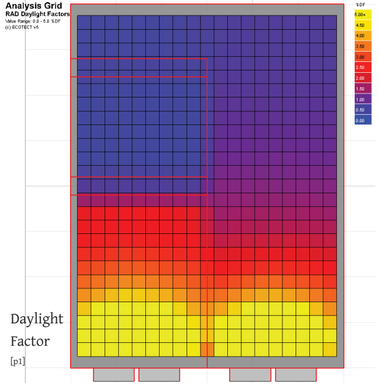
| Yes | ? | No | | | |
|---|---|---|---|---|---|
| 25 | 0 | 0 | **Smart Location and Linkage** | | 27 Points Possible |
| Y | | | Prereq 1 | **Smart Location** | Required |
| Y | | | Prereq 2 | **Imperiled Species and Ecological Communities** | Required |
| Y | | | Prereq 3 | **Wetland and Water Body Conservation** | Required |
| Y | | | Prereq 4 | **Agricultural Land Conservation** | Required |
| Y | | | Prereq 5 | **Floodplain Avoidance** | Required |
| 10 | 0 | 0 | Credit 1 | **Preferred Locations** | 10 |
| 1 | | 0 | Credit 2 | **Brownfield Redevelopment** | 2 |
| 6 | | | Credit 3 | **Locations with Reduced Automobile Dependence** | 7 |
| 1 | | | Credit 4 | **Bicycle Network and Storage** | 1 |
| 3 | | | Credit 5 | **Housing and Jobs Proximity** | 3 |
| 1 | | | Credit 6 | **Steep Slope Protection** | 1 |
| 1 | | | Credit 7 | **Site Design for Habitat or Wetland and Water Body Conservation** | 1 |
| 1 | | | Credit 8 | **Restoration of Habitat or Wetlands and Water Bodies** | 1 |
| 1 | | | Credit 9 | **Long-Term Conservation Management of Habitat or Wetlands and Water Bodies** | 1 |
| Yes | ? | No | | | |
| 39 | 0 | 0 | **Neighborhood Pattern and Design** | | 44 Points Possible |
| Y | | | Prereq 1 | **Walkable Streets** | Required |
| Y | | | Prereq 2 | **Compact Development** | Required |
| Y | | | Prereq 3 | **Connected and Open Community** | Required |
| 12 | | | Credit 1 | **Walkable Streets** | 12 |
| 6 | | | Credit 2 | **Compact Development** | 6 |
| 3 | | | Credit 3 | **Mixed-Use Neighborhood Centers** | 4 |
| 4 | | | Credit 4 | **Mixed-Income Diverse Communities** | 7 |
| 1 | | | Credit 5 | **Reduced Parking Footprint** | 1 |
| 2 | | | Credit 6 | **Street Network** | 2 |
| 1 | | | Credit 7 | **Transit Facilities** | 1 |
| 2 | | | Credit 8 | **Transportation Demand Management** | 2 |
| 1 | | | Credit 9 | **Access to Civic and Public Spaces** | 1 |
| 1 | | | Credit 10 | **Access to Recreation Facilities** | 1 |
| 1 | | | Credit 11 | **Visitability and Universal Design** | 1 |
| 2 | | | Credit 12 | **Community Outreach and Involvement** | 2 |
| 1 | | | Credit 13 | **Local Food Production** | 1 |
| 1 | | | Credit 14 | **Tree-Lined and Shaded Streets** | 2 |
| 1 | | | Credit 15 | **Neighborhood Schools** | 1 |
| Yes | ? | No | | | |
| 22 | 0 | 0 | **Green Infrastructure and Buildings** | | 29 Points Possible |
| Y | | | Prereq 1 | **Certified Green Building** | Required |
| Y | | | Prereq 2 | **Minimum Building Energy Efficiency** | Required |
| Y | | | Prereq 3 | **Minimum Building Water Efficiency** | Required |
| Y | | | Prereq 4 | **Construction Activity Pollution Prevention** | Required |

| Yes | ? | No | | | |
|---|---|---|---|---|---|
| | | | **Green Infrastructure and Buildings, Continued** | | |
| 4 | | | Credit 1 | **Certified Green Buildings** | 5 |
| 2 | | | Credit 2 | **Building Energy Efficiency** | 2 |
| 1 | | | Credit 3 | **Building Water Efficiency** | 1 |
| 1 | | | Credit 4 | **Water-Efficient Landscaping** | 1 |
| 1 | | | Credit 5 | **Existing Building Use** | 1 |
| 1 | | | Credit 6 | **Historic Resource Preservation and Adaptive Reuse** | 1 |
| 1 | | | Credit 7 | **Minimized Site Disturbance in Design and Construction** | 1 |
| 2 | | | Credit 8 | **Stormwater Management** | 4 |
| 1 | | | Credit 9 | **Heat Island Reduction** | 1 |
| 1 | | | Credit 10 | **Solar Orientation** | 1 |
| 0 | | | Credit 11 | **On-Site Renewable Energy Sources** | 3 |
| 1 | | | Credit 12 | **District Heating and Cooling** | 2 |
| 1 | | | Credit 13 | **Infrastructure Energy Efficiency** | 1 |
| 2 | | | Credit 14 | **Wastewater Management** | 2 |
| 1 | | | Credit 15 | **Recycled Content in Infrastructure** | 1 |
| 1 | | | Credit 16 | **Solid Waste Management Infrastructure** | 1 |
| 1 | | | Credit 17 | **Light Pollution Reduction** | 1 |
| 2 | 0 | 0 | **Innovation and Design Process** | | 6 Points |
| 1 | | | Credit 1.1 | **Innovation and Exemplary Performance:** Best Design | 1 |
| 1 | | | Credit 1.2 | Innovation and Exemplary Performance: Best Daylight design conditions | 1 |
| | | | Credit 1.3 | **Innovation and Exemplary Performance:** Provide Specific Title | 1 |
| | | | Credit 1.4 | **Innovation and Exemplary Performance:** Provide Specific Title | 1 |
| | | | Credit 1.5 | **Innovation and Exemplary Performance:** Provide Specific Title | 1 |
| | | | Credit 2 | **LEED® Accredited Professional** | 1 |
| Yes | ? | No | | | |
| 0 | 0 | 0 | **Regional Priority Credit** | | 4 Points |
| | | | Credit 1.1 | **Regional Priority Credit:** Region Defined | 1 |
| | | | Credit 1.2 | **Regional Priority Credit:** Region Defined | 1 |
| | | | Credit 1.3 | **Regional Priority Credit:** Region Defined | 1 |
| | | | Credit 1.4 | **Regional Priority Credit:** Region Defined | 1 |
| Yes | ? | No | | | |
| 88 | 0 | 0 | **Project Totals (Certification estimates)** | | 110 Points |

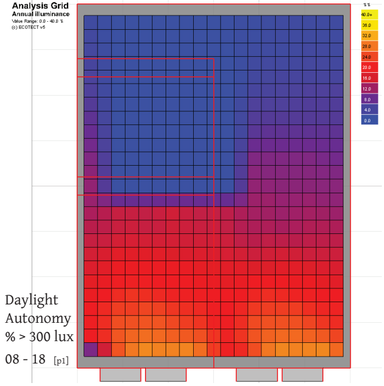
**Certified:** 40-49 points, **Silver:** 50-59 points, **Gold:** 60-79 points, **Platinum:** 80+ points



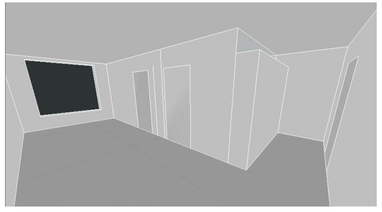
Original Apartment [p1]



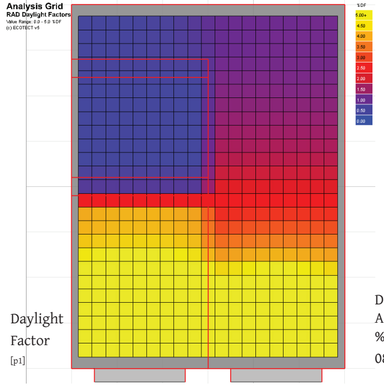

Daylight Factor [p1]



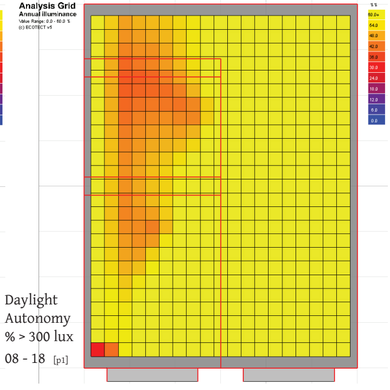

Daylight Autonomy % > 300 lux 08 - 18 [p1]



Improved Apartment [p1]



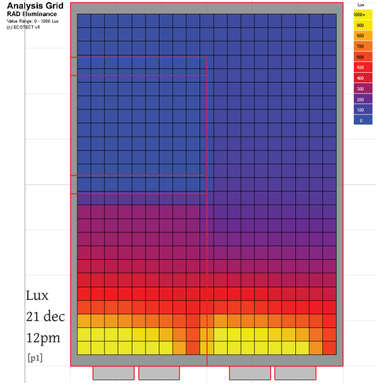

Daylight Factor [p1]



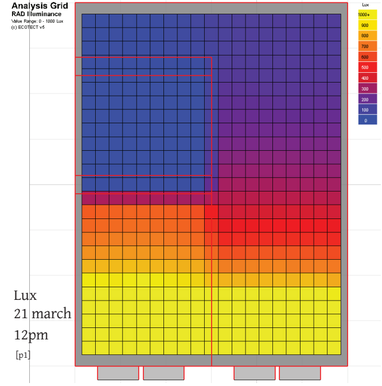

Daylight Autonomy % > 300 lux 08 - 18 [p1]



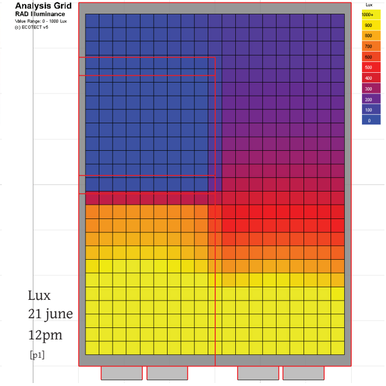




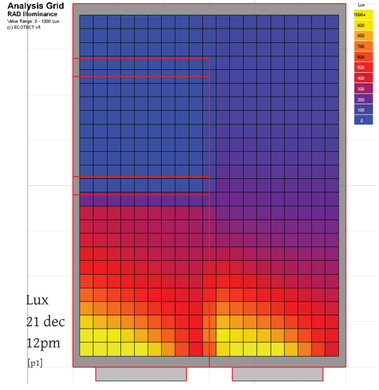

Lux 21 dec 12pm [p1]



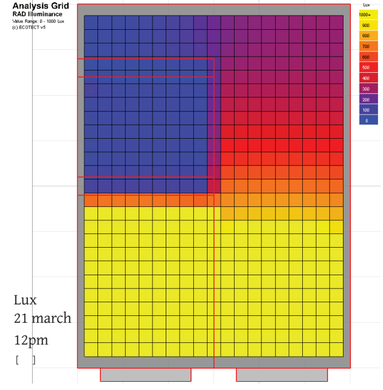

Lux 21 march 12pm [p1]



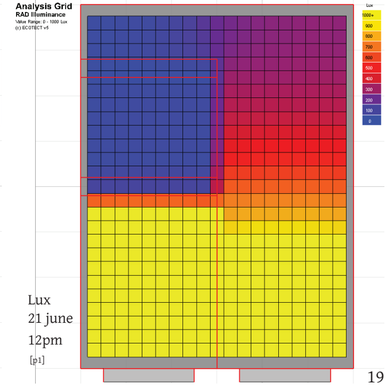

Lux 21 june 12pm [p1]




Lux 21 dec 12pm [p1]




Lux 21 march 12pm [ ]




Lux 21 june 12pm [p1]

# Vernacular architecture
## - traditional building in a new twist

The Queenslander, is a type of building that is defined primarily by architectural characteristics of climate consideration. It can be found in Queensland, and the northern parts of New South Wales, Australia. The building type developed for a humid, sub-tropical climate, with average temperatures of 23-36 °C. The area has two distinct seasons, the "Dry period" in April through October with many sun hours and often a risk of bush fires, and the "wet cyclone season" between November and March, when heavy rains, strong winds, and occasional cyclones and floods have to be expected. The location also creates a concern of termites.

A Queenslander type building is often constructed out of timber, due to local availability, and gets built in one or possibly two stories in order to minimize wind exposure. The building is elevated off the ground on pillars, for protection from heavy rains, termites, and to provide a possibility to create natural ventilation. There is always at least one veranda space, and often some living areas of the building are only partly enclosed, as the tropical climate allows many activities to be performed outdoors. A typical Queenslander is built on a platform floor, that together with the pillar foundation make it relatively easy to raise, lower, or relocate the building.

I saw the house on 13 Braemer Crescent while exploring a new development area in Townsville, Queensland, Australia, back in 2011. The area is at beautiful hillside location, facing the ocean. There are many modern and interesting buildings around, but this is the most eye-catching one, seen clearly all the way from the beach below. What makes the building furthermore interesting is however that despite its unusual design, it really meets the considerations and criteria of a traditional Queenslander building. Examples of that are shown below.

Map [p15]

Platform on stilts [p14]

Big verandas [p14]

Openable areas [p14]



Traditional Queenslander [p11]

Traditional Queenslander [p12]

13 Braemer Crescent, Townsville, Australia [p1]



# Fairs and Exhibitions
## - Looking at light

# Nationalmuseum - Light and Darkness

I was expecting the  exhibition to focus more on light and show different ways of painting it, which was not really the case as the paintings were placed quite randomly. I did however find a few paintings that show light in a really interesting way, my favourite ones are seen below.

Storm på havet by Marcus Larson [p1]

Hornsgatan nattetid by Eugène Jansson [p1]

Månskenslandskap med fors by Carl Gustav Plagemann [p1]

Klipplandskap med vattenfall by Marcus Larson [p1]

Frukostdags by Hanna Pauli [p1]

Rivning av gamla barnhuset by Anshelm Schultsberg [p1]





# Gallery Agardh & Tornvall - Shadows

Well, I went to the exhibition because the invite I got by email had a picture of a painting which was a self portrait of the artist in it. In this specific painting, he resembled my boyfriend, who he also happened to share first names with, spookingly much. So the idea was to get Joachim to pose next to the painting, although the artist showed out to not look anything like him for real.

However, once at the exhibition, I was quite fascinated with how light was treated in many of the paintings. The sharpness of shadows and reflections often looks exaggerated, creating eye catching point, like at the picture on the right. I also really liked the Light Box painting, as it makes one curious of what is inside the light, in the same way as Aitor Ortiz photographs do.

[p9]

Joachim Klahr standing next to a self portrait by Joakim Joansson [p1]

Light Box by Joakim Joansson [p9]

# Elmässan, lecture by Thorbjörn Laike

The electricity fair in Stockholm hosted some lighting manufacturers, although most exhibitors were dealing with control systems and different equipment for installations. Most lectures concerning light were also pretty basic, Thorbjörn Laike however, held a really interesting one. Thorbjörn is a docent at Lunds university, and has been studying how light affects our circadian rhythm, he is also a director of ceebel.se , the centre for energy efficient lighting.

Thorbjörn said that in order to create environments where people feel well, we need to provide not only task lighting, but also ambient light, and variate the light level throughout the day. Varying color temperature can also be beneficial.

He mentioned that although the third receptor was not found until 2002, we started to understand lights relation to our wakefullness already back in the 1950ies. One early study looked at schoolchildren in classrooms with and without daylight, it was found that children that did not have access to daylight were home due to illness more often, but also that they were better at focusing during individual tasks. Children that studied in rooms with daylight, were on the other hand better at cooperating and performed better at exams.  A clear difference was also seen in curves of chronobiological markers cortisol and melatonin.

Cortisol is a stress hormone that normally rises during the day when we are awake and active. Melatonin is in a way the opposite, a hormone that makes us tired and sleepy. The prevalence of the hormones is regulated as well by our inherent circadian rhythm, as by light exposure. 30 to 40 lux can be enough to completely block the production of melatonin, telling the adrenal glands to start producing cortisol.

It is however not all light that triggers the third receptors, which are the most important receptors concerning our circadian system, contrary to common belief it is not even all blue light. The receptors are extremely sensitive, but only to a very specific blue radiation of 460 to 480 nm.

This made me think of a new type of diode that Osram showed at their event in 2011 [*Light and Humans workbook pg. 11*]. It was developed to enhance the color rendering of red, and created white light by a mixture of red and mint green diodes. I do of course know that strong enough, light of any color will keep us from going into sleep mode, but one still has to wonder how placing light without any 460 to 480 nm radiation would affect the workers at a retail store. On the other hand, it might be a very good idea for a home, where we mostly spend our evenings.

Thorbjörn also quickly mentioned a subject that has interested me for a while [*Outdoor Lighting workbook, pg. 60*], why the effects of colour of objects, and colored light, on humans, are described to be so different. Blue walls are supposed to make us calm, while blue light is activating, but how does that fit with the fact that blue walls should reasonably increase the amount of radiation within wavelengths that we perceive as blue, within the room? He brought it up to highlight how little we actually know about light today, and like Kevan Shaw [*Outdoor Lighting workbook, pg. 60*], concluded that we do not actually know the reasons behind this yet, at this point we can only guess and do our best to design environments well suited for humans.

# Project Vision and Site analysis

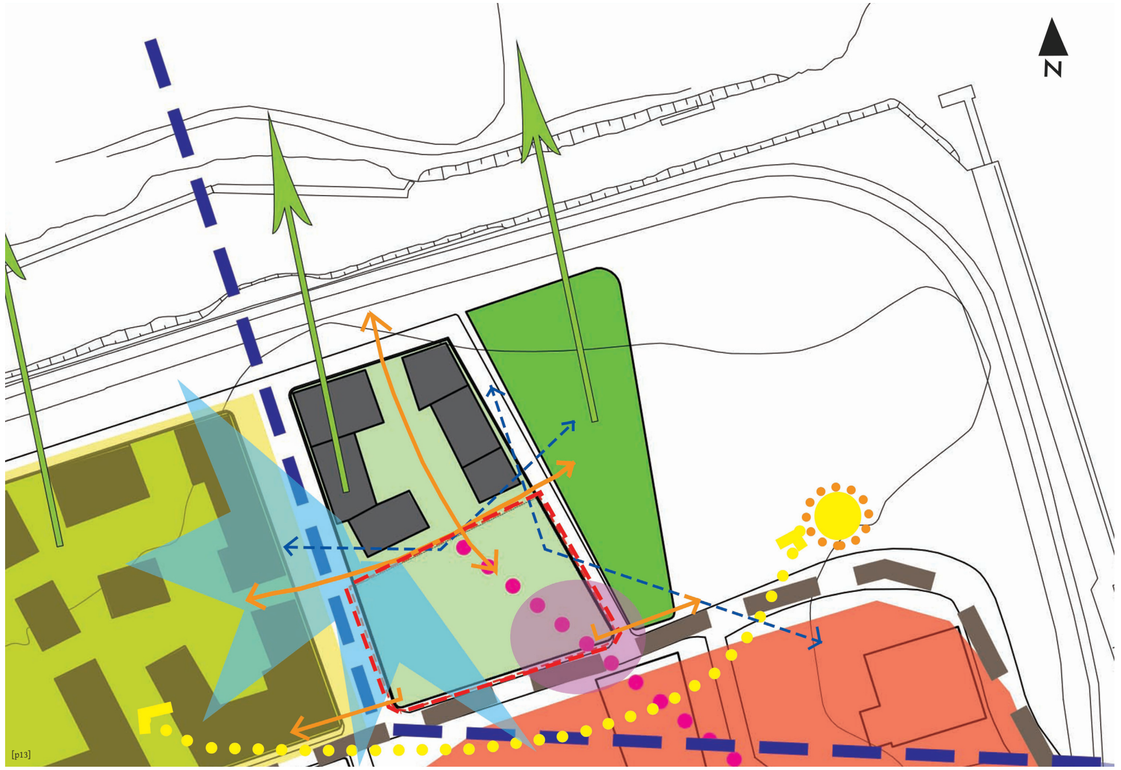
At some point in our lives age will become a factor that we need to consider, and in this project we focused on creating positive environments that are suitable as well when people get older. It is well known that surroundings and the environment can have both positive and negative effects on humans' mental and physical wellbeing, and our goal was to create a user focused environment which is safe and pleasant, using natural light to provide positive atmospheres and health factors.

Our site is located in Norra Djurgårdsstaden, close to Ropsten subway station, and the site analysis can be seen to the right on the next page. The building will be located on the second row from the water (site limits dotted red), and since the buildings in front have an open courtyard, it is possible to get views out in this direction. A park (dark green) will be located just east of our building, ensuring that sunlight will not be blocked by a new development in this direction. Wind (turquoise) blows mainly from west and southwest at the site, which needs to be considered in order to create pleasant outdoor environments. The main access to the site is the southeast corner (pink), where one arrives both if walking from Ropsten station (dotted pink) and if driving by car over Lidingöbron. The southern part of the site faces the main street of the area, which provides the opportunity of connecting the courtyard with a flow of people, visually or physically.


[p13]



Daylight Project - Daylight in Architecture




[p13]

# Urban scale

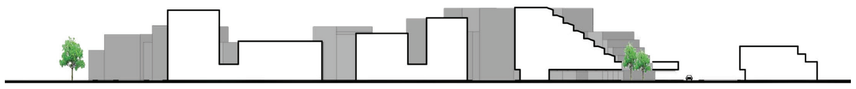
As the site is mainly accessed through the southeastern corner, following the road from Ropsten subway station, we wanted to emphasize this part of the building as an entrance to the development. The corner is therefore built low, and has a garden passage underneath, creating both a visual connection and opening up a pathway to the courtyard.

The western block on the building will be its highest part, to shield the interior of the site from wind. To make use on the sun-hours we do get in Sweden, we have created an elevated communal terrace for the residents on top of the southeast corner. The space is located on the third floor, and gets a lot of sun, while it is shielded from wind by the western block. All the apartments have also been equipped with balconies.

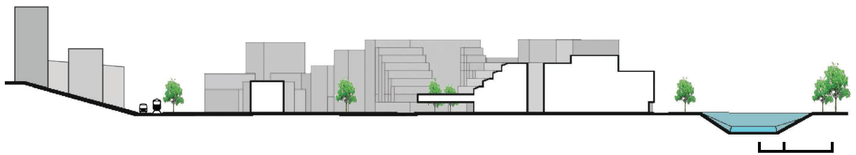
We have integrated the ground level with the existing urban grid, to preserve several different ways of walking, and designed the courtyard as a public space, to enhance interaction between different people from the area.

The bottom floor of the building will consist of entrances and retail stores, and will be mostly glazed to provide further visual connectivity between the street and the courtyard.

Courtyard Sketch [p13]



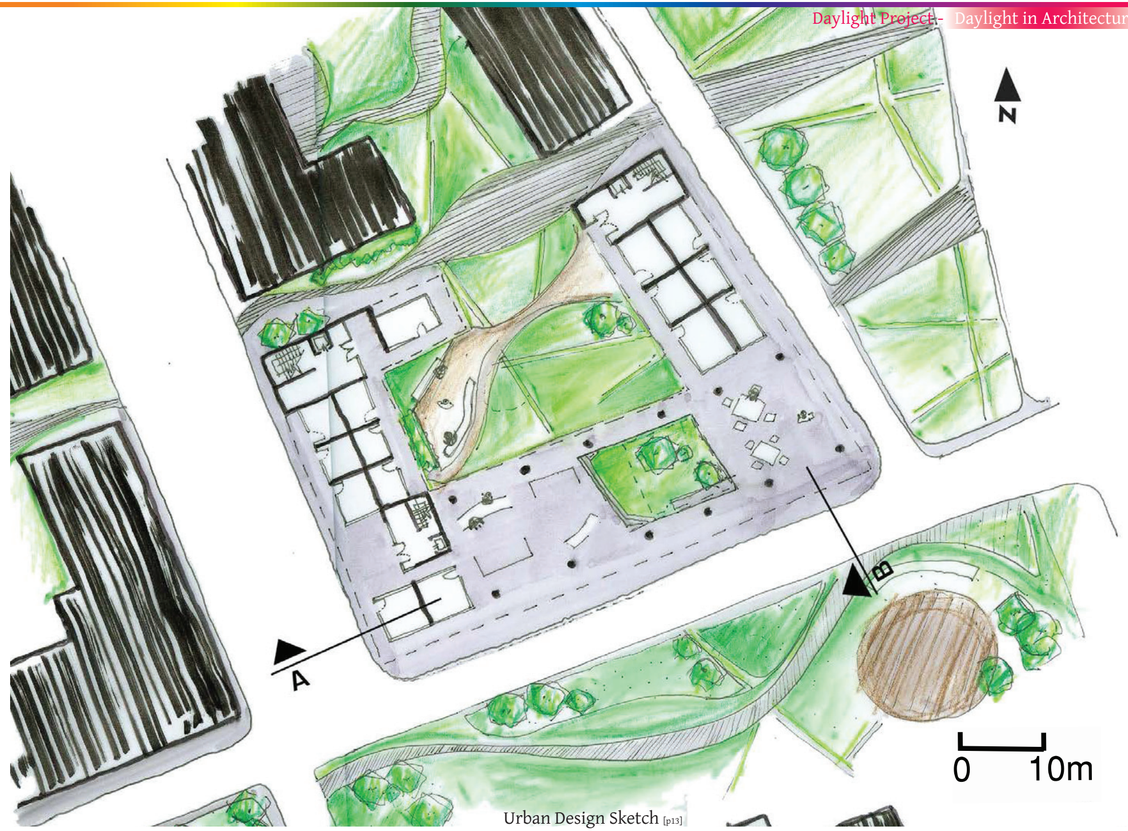

Urban Section A [p13]




Urban Section B [p13]





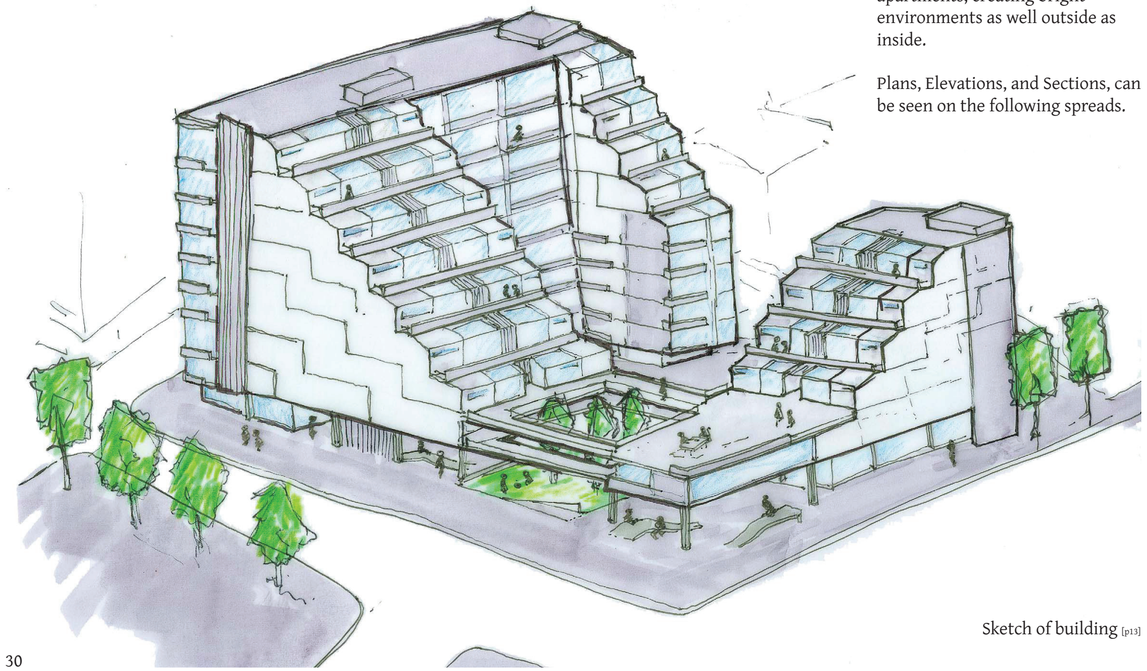



Urban Design Sketch [p13]

# Building Scale

The stepped shape of the building provides as well sunny terraces, as sloping skylights for many apartments, creating bright environments as well outside as inside.

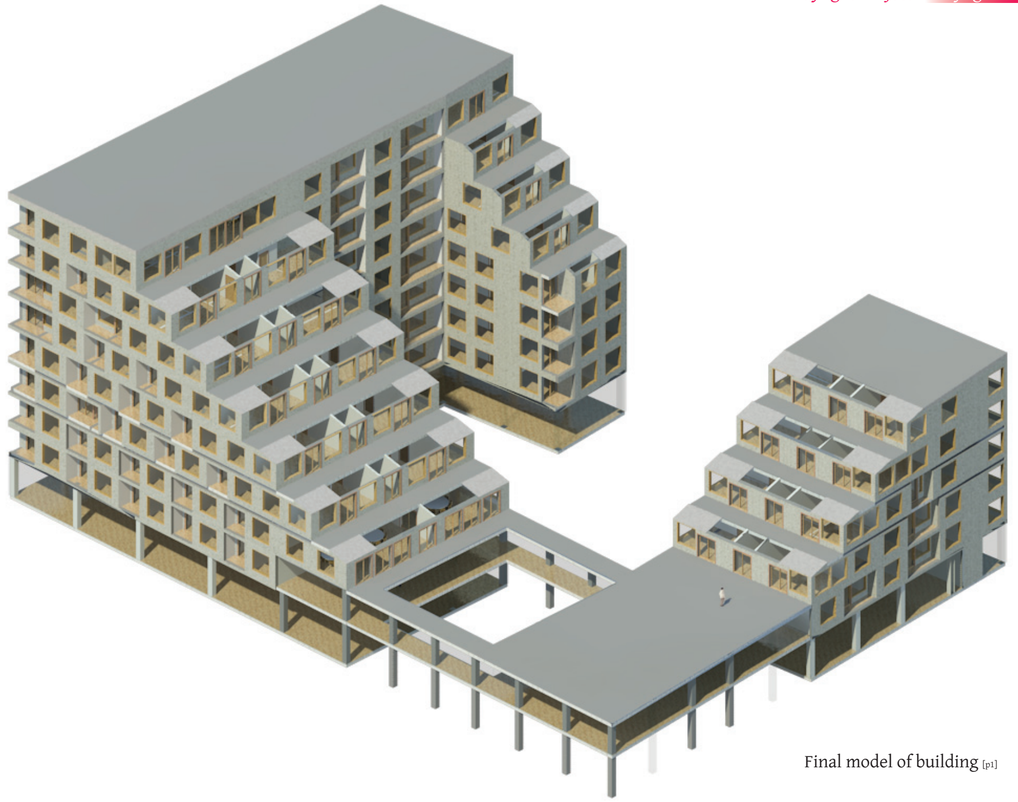
Plans, Elevations, and Sections, can be seen on the following spreads.



Sketch of building [p13]



Daylight Project - Daylight in Architecture



Final model of building [p1]

# Floor plans

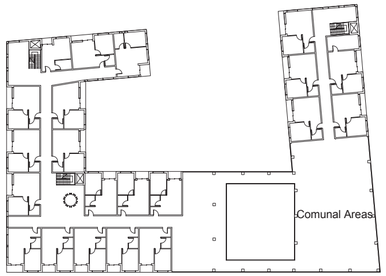
The bottom floor of the building contains three entrances, a reception for the residents by the southern entrance, and public stores.

The first apartments are located on the second floor, where most communal areas are also found. Smaller meeting areas are also located on the third floor next to the communal terrace, and by the southern staircase on every floor.

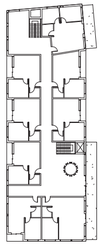
There are 128 apartments in the building, most of them measure between 40 and 45 sqm amd consist of a bedroom, a bathroom, a combined living room and kitchen, and a balcony. They are well suited for a couple or a single person. There are also a few studio apartments of 25 - 35 sqm, and some 2 bedroom apartments at the size of 50 - 80 sqm.

All apartments are situated in such a way that all spaces, except for bathrooms, get access to daylight. To maximize daylight within the building, we have used my window layout from the software exercise [*pg. 16*], although the layout of some apartments has been slightly changed since then in order to provide all apartments with balconies or french windows.


Level 1 - scale 1:800 [p1]




Level 2 - scale 1:800 [p1]

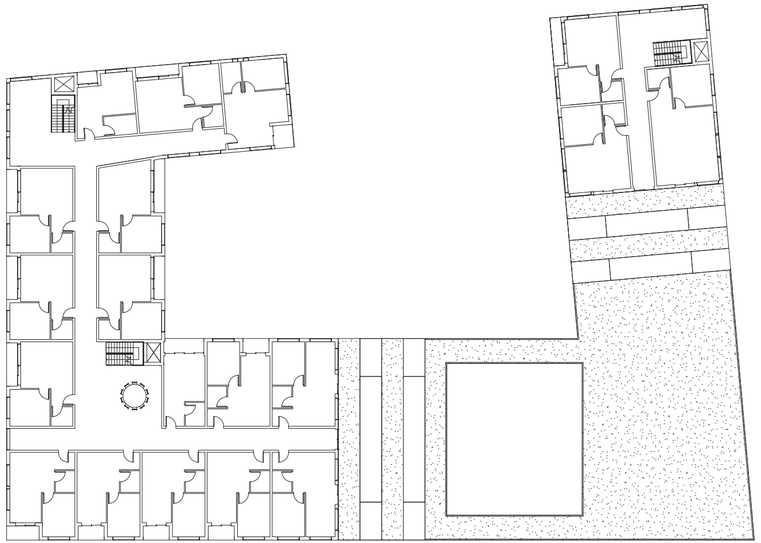


Level 9 - scale 1:800 [p1]

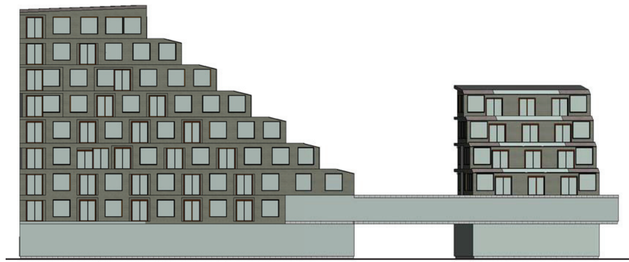




# Floor plan - lvl 5 - scale 1:400 [p1]

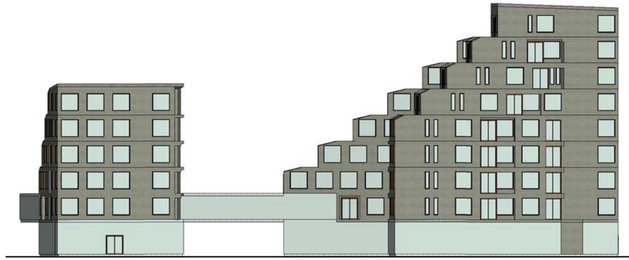


# Facades - scale 1:500

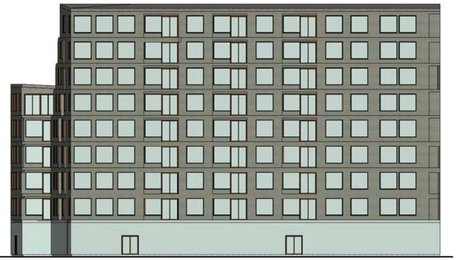


Facade from South [p1]

Facade from East [p1]



Facade from North [p1]

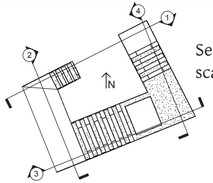


Facade from West [p1]

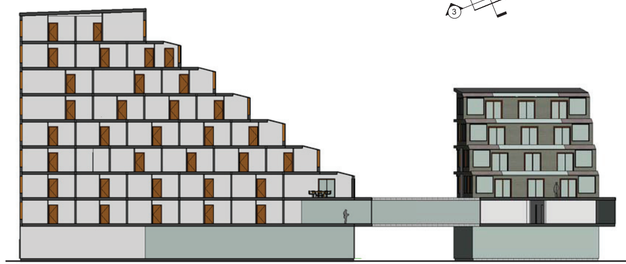




# Sections - Scale 1:500

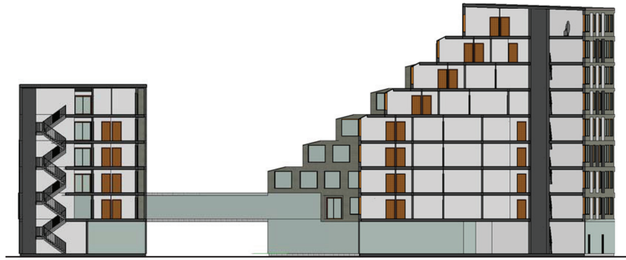



Section plan
scale 1:2000 [p1]



Section 3 [p1]

Section 4 [p1]



Section 1 [p1]

Section 2 [p1]

# Room Scale

The first drawing on the right shows two typical apartments in our building, our model apartment with long terraces and skylights, and the worst-case scenario apartment when it comes to daylight access, which I worked on improving during the software exercise [*pg. 16*]. They both measure a few square meters over 40.

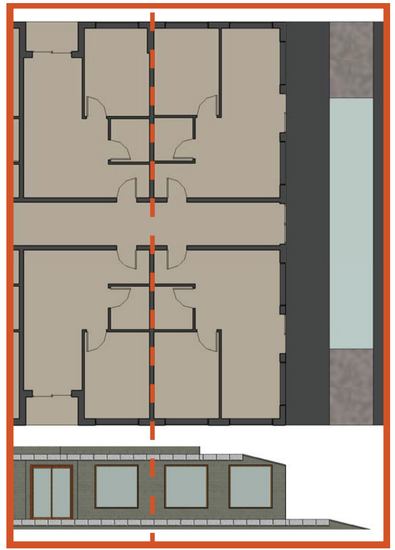
In the model apartment, there is access to light from two directions, and additionally from a sloped skylight. The living room and kitchen are located in the sunniest part of the apartment, under the skylight and next to the terrace. The bedroom has two big windows, making also it a light space. The entrance has been placed so that there is enough space by it to place a chair in order to make it easy to get dressed to go out.

The worst-case scenario apartment has better daylight conditions than my label might indicate. The bedroom has a big window, just like in the model apartment, and sliding glass doors bring light into the living room. The kitchen is to be located in the corner opposite the bedroom, and will only get daylight through the glazing in the living room. Although this does create lower light levels, one will constantly have a visual connection to the outside while being in the kitchen.

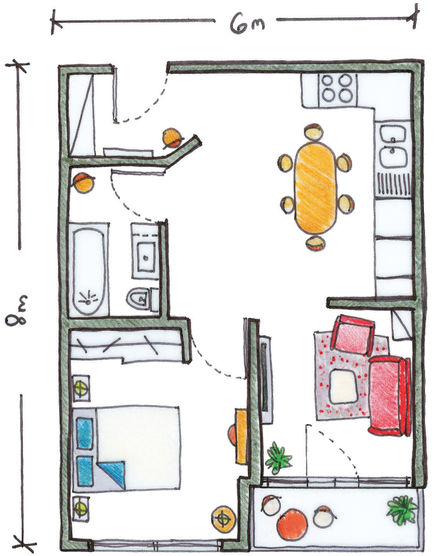
The sketch on the far right is an early example of how one an apartment with this layout could be furnished. It was made before we decided to have sliding doors to the balconies, and the bathroom is supposed to have a shower instead of a bathtub, and will thus not at all be as tight on space as in the sketch.



Daylight Project - Daylight in Architecture



Darkest apartment (left) and Model apartment (right) - scale 1:200 [p1]




Example of possible furnishing

# Thoughts on improvements

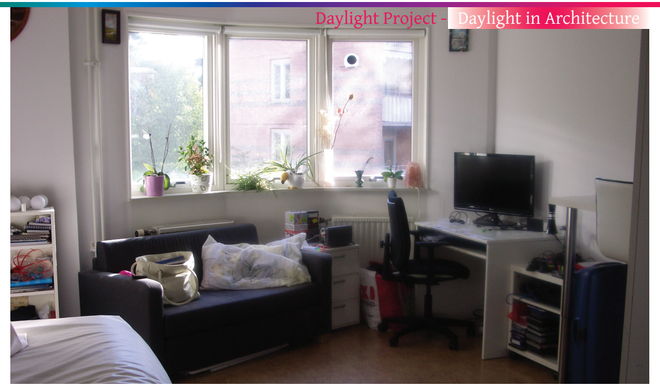
This was a very short project, so I thought I would mention some improvements I would want to make if working on it further. During our presentation, someone asked whether we had considered making bay window on the building, and in all honesty, I did, but we just never got there before the project was over. I have a bay window in my own apartment, which I absolutely adore, but even for a small apartment, I would have really liked a balcony as well.

Therefore, I would not want to substitute the french windows in our design with bay windows as was suggested, but instead had a look at integrating both. I also thought back on the window layout I had after the software task, that brought in quite a bit light all the way into the kitchen. When deciding to place balconies in all apartments, the thought was that they should be accessed from the living rooms, but I later realized that it would make the space behind the balcony darker.

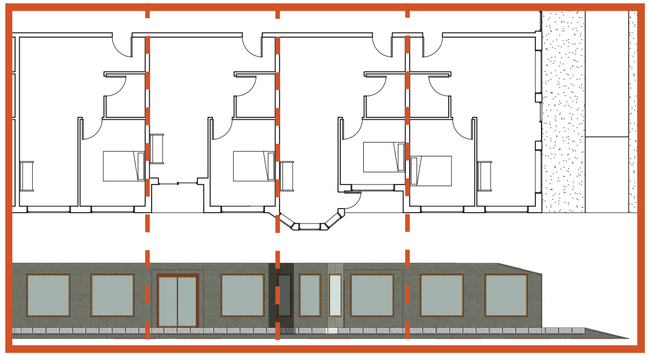
My improved apartment suggestion can be seen on the right, together with the older layouts. The french window is here moved in front of the bedroom, that does not stretch as deep into the building, and thus can accept somewhat lower daylight levels. The entrance to the balcony is still from the living room, where a bay window has now been extruded, providing a bright place to sit in as well when it is too cold out on the balcony.

The terrace apartment is left unchanged from the final plan, as I am quite happy with that one. I guess it is no secret that it is the apartment we got furthest on developing, but I now believe that I have a very nice daylight solution for the adjacent apartments as well.





Bay window at my apartment in Sollentuna [p1]



Apartment from daylight analysis | Final apartment | Improved apartment | Final terrace apartment | 1:200 [p1]



# Further Thoughts

- Experiences and things to consider in the future

# Manipulating light experiences

We are currently finding out more and more about the subconscious effects light has on us, as well physiologically, as psychologically. However, we need to keep in mind that light also affects us strongly in a conscious way.  Most people will feel instantly happy when opening up their curtains on a sunny day, and rainbows re always a fascination. The one below appeared when I was walking how from the train, when getting back from a two weeks trip abroad. It was actually a double rainbow, although to weak for the camera I had on me to pick up, and on the right side, a faint beginning of a outer third one could also be seen. An experience like this will always make, at least me, feel happy and welcome home. I think that at least part of the answer to why some colors are shown to be activating in some research and calming in other [*pg. 24*], lies in a discrepancy between how we experience light and color consciously, and the unconscious effects they have on us.

If we can pin down the differences between the different effects, it will allow for some very interesting possibilities. For example, if we have a wall that looks green from a distance, it could actually be green, or consist of a pattern of blue and yellow, fine enough to visually be experienced as green. Provided that the colors are fine tuned to look like the same green, our visual, and thus conscious experience, should be the same. Unconscious effects on the other hand will arise from the wavelengths of radiation actually reaching our eyes, and could be very different for blue + yellow verses green.

More specifically with light, we could add a high portion of 460 - 480 nm (blue) radiation, or remove it completely [*pg. 24*]. Lighting systems with varying color temperature have already been installed in several places, but if looking specifically at this small portion of wavelengths, it should be possible to create light that visually looks the same whether the specified wavelengths are present or not. I am not sure this would be desirable for luminaires, where also the visual color shift helps us feel variations over the day, it would however be very interesting for computer and tv screens. They are often the biggest problem in exposing us to much light just before going to bed, so what if we could make them activating during the day, but less so in the evening, while preserving visual quality?

Rainbow in Sollentuna, July 2012 [p1]





# The End

- After references and a final thought

# Sources of information

Most of the content in this book is based on lectures and seminars at the Lighting Laboratory, KTH, during September through November 2012, lecture notes from those, and my own experiences. Additional sources of informations are stated below in no particular order.

Where it does draw from specific conversations and occurrences, this has been stated within the text, the rest are thoughts and understandings that have become clear to me during a longer period of time.

[1] csheb.org/PDF/2nd/Peter%20R%20Boyce.pdf

[2] danielrybakken.com/subconscious_effect_of_daylight.html





# Picture credits

[p1] Photograph / Image / Diagram by author

[p2] nordiskaarkivdagar2012.fi/index.php?page=mer-om-tavastehus

[p3] fineartamerica.com

[p4] From pdf of Bengt Sundborgs lecture

[p5] From pdfs of Karim Najars lectures

[p6] phdblog.net/the-elusiveness-of-flow

[p7] danielrybakken.com/subconscious_effect_of_daylight.html

[p8] From power point of Luke Lowings lecture

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[p11] flickrhivemind.net/Tags/house,queenslander/Interesting

[p12] artistwd.com/joyzine/australia/queensland/houses6.php

[p13] Images from project work by Katja Tsychkova, Anders Lind, Anastasia Iliadou, and Christina Martinez

[p14] realestate.com.au/property-house-qld-townsville-106854738

[p15] maps.google.com

I have sometimes been told than I am to curious. Well, if that had actually been possible, I am sure it would be true [p1]