NATURAL LIGHT

as the PRIMARY DESIGN TOOL:

promoting creativity, increasing productivity and enhancing wellness
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To my parents, John and Anna, without their love and support, this journey would have been much more difficult. And to all my friends who have been there for me and put up with me through the difficult times, especially Tiffany, Stephanie and Jake.
NATURAL LIGHT AS THE PRIMARY DESIGN TOOL: PROMOTING CREATIVITY, INCREASING PRODUCTIVITY AND ENHANCING WELLNESS

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The presence of natural light affects everyone in different ways. While the effect varies from person to person, the outcome is that the presence of natural light in buildings enhances the well-being of society. Spaces that most often do not utilize natural light as a method to boost wellness include work environments. This issue becomes critical because most of society is enclosed in these spaces during the time when sunlight is present. Therefore, if natural light is not present in the work environment, many people will only be exposed to a few hours, if any, of daylight per day. This absence of daylight can lead to psychological as well as physical problems. By designing work environments that allow natural light into the entire building, employees would be able to experience a better quality of life leading to increased productivity. Psychologists have found that productivity is greatly affected by employee's job satisfaction and pleasant working conditions, which can be enhanced through the presence of natural light.
INTRODUCTION
natural light as a guiding force

BACKGROUND
issues and questions revolving around light
consequences of lack of natural light
importance of light in the workplace
physical context
program summation
division of the advertising agency into departments

EXPLORATION
exploring light and glass
daylighting methods
shading techniques & types of glass
precedent research
advertising agencies throughout the U.S.
process
from early stages of design to resolution

RESOLUTION
design project overview
about Advertects
description of the headquarters
solutions applied to the headquarters
diagrams
explanation of wall system
tour of the headquarters
overall design of the headquarters

REFLECTION
generic guidelines for any project
final thoughts
Introduction

natural light as a guiding force
"A growing knowledge that light affects health may influence architecture and planning."
- Hyman
- The Light Book

Through years of research, it has been proven that the presence of natural light has many positive effects on the human body and is a key factor in determining how the body functions. The main reason sunlight is needed by the body is to stay healthy because it is very difficult to maintain a good quality of life if you are not healthy. Natural light is an important component of achieving a good quality of life. It is of such high importance because it has an impact on a variety of life's aspects from health to human involvement to work habits. Just as plants need sunlight to grow and survive, humans need sunlight to maintain their daily cycle.

People need the physical presence of sunlight to feel connected to the outside world when they are inside buildings. Enclosed spaces with no or very few windows make people feel disconnected from the changes taking place outside. People want to be aware of the changes taking place throughout the day and the seasons. Therefore, the ability to visualize this process is very important. In hospital rooms where sunlight is present, patients heal quicker than patients who are deprived of natural light. Sunlight stimulates positive thinking and keeps the brain active. Natural light has also been proven to be beneficial in classroom settings and work environments. The presence of natural light in classrooms keeps students awake and alert leading to higher levels of comprehension. Natural light is needed in work environments for the same reason. When employees are alert, they work faster and make fewer mistakes leading to increased rates of productivity. Sunlight not only triggers brain activity, it also is a natural energy and mood booster. People usually feel more energetic on sunny days and during the summer months. Sunny days also seem to lift people’s spirits especially during the winter months when there are long periods of overcast skies. The result is that natural light keeps people healthy, happy and energized which results in many positive outcomes.

The focus of this thesis was on the impact of natural light on work environments. People spend a majority of their time working and although there are exceptions, the typical career demands that a person work from 8:00 to 5:00, 5 days a week, in an office building. The hours worked are simultaneous to the time of day when the sun is present, especially during the winter months. During the summer months, there are usually a few hours of sunlight before and after the work day. The amount of exposure a person has to natural light depends on how well the
office building is designed to admit sunlight. Unfortunately, many work environments in the United States do not provide adequate amounts of daylight to all employees. In many office building designs, windows seem to be design elements that only affect the appearance of the exterior facades with little concern about the activities that take place beyond the windows on the interior. It seems that many office buildings are enclosed by either glass curtain walls or only provide small windows, which do not allow much natural light into the building, depriving many employees of the presence of natural light. Enclosing a building entirely by curtain walls may allow an abundance of light to enter, but that is not the answer to providing adequate amounts of daylight into a building. Allowing too much sunlight into spaces could pose problems of glare. The key to designing adequately day lit spaces is to start with daylighting as one of the major design issues that drive the design. Designing from the interior out is another key aspect of designing using daylighting. By designing from the interior out, each space can be analyzed to determine the amount of natural light needed to perform the tasks without distractions.

Although natural light has been proven to raise productivity, this concept does not seem to be apparent to some owners and architects. Most companies strive to have the highest rate of productivity and one would think that the design of the building should reflect this goal. But often, the issue of daylighting is jeopardized to meet the budget. Often, windows will be eliminated if the budget is not met. If the windows being removed greatly affect daylight needed to provide good working conditions, I believe the design should be analyzed to determine what other elements could be removed instead of the windows.

Shouldn't it be our role as an architect to design work environments that increase productivity and enhance the quality of life? As a response to this question, I designed an advertising headquarters as my thesis design project. The advertising agency is called Advertects. Light became the guiding force throughout the entire design of Advertect's Headquarters in Charlotte, North Carolina. The goals of the building from the owner's perspective are to increase productivity, promote creativity and enhance wellness, which are accomplished through daylighting.

From this exploration, the intent is to inform designers of the importance of providing adequately day lit spaces in all buildings. A basic knowledge of designing with daylight is provided in the hope that it will be applied to future projects during the early design phases. A set of generic criteria is established to aid in the creation of better environments using daylight.
Background

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physical context of Charlotte

program summation
division of the advertising agency into departments
Consequences of lack of natural light

"Architects could see themselves as healers, prescribing designs rather than drugs."
- Gallagher

The absence of light for long periods of time can have serious implications on a person's health, which can eventually lead to serious psychological disorders such as severe nonseasonal depression, sleep disorders, bulimia nervosa and Seasonal Affective Disorder (S.A.D.). S.A.D. struck my attention because it is a relatively new disorder, which many people throughout the world suffer from, and the treatment for the disorder is as simple as exposing oneself to more daylight. S.A.D. is a type of depression caused by the absence of light, and while the disorder is more common in the northern region of the U.S. including New York and Seattle where there are not as many daylight hours in the winter, it also affects some people living in the southern region of the U.S. including Florida. Although S.A.D. is known as a seasonal disorder, which typically occurs during the winter months, prolonged periods of overcast skies during the summer months can also instigate these symptoms.

Do you feel down or depressed during the winter when there are long periods without sunlight?

The reason that sunlight is the key factor of S.A.D. is because light triggers the circadian rhythm, which keeps our bodies in sync with the progression from day to day. The circadian rhythm of the body keeps us within a 24-hour cycle signaling us when to sleep and wake up corresponding to the earth’s revolution on its axis. The circadian rhythm is controlled by the pineal gland in the brain, which produces melatonin. Melatonin is a hormone, which makes us drowsy. Light causes the gland to stop producing melatonin. Therefore, when light is not present, the gland produces melatonin, causing drowsiness. If the gland continues to produce melatonin non-stop for several days during periods of overcast, it can lead to a person feeling depressed which is referred to as S.A.D. For instance, in Alaska, where there may only be a few hours of daylight each day during the winter, their cycle could be as long as 35 hours because light is not present to signal the beginning and end of their daily cycle. Therefore, their circadian rhythm does not correspond to the sun's rotation, which is what leads to psychological disorders.
If not treated, the symptoms of S.A.D., which range from psychological to sociological to physical could continually build up causing a person to feel shut off from the rest of the world resulting in isolation and sometimes even suicide. While the treatment of S.A.D. is as simple as bright light therapy, which involves sitting beneath a bright light fixture to mimic the sun’s intensity for a specific amount of time, it is only a quick fix added to a building or house. Bright light therapy is a substitution for sunlight when it is not present. Natural light is the best cure for S.A.D. When sunlight is present, buildings should allow light to enter, which means that bright light boxes would not need to be used. However, this is not always the case in all buildings. If the interrelated issues of light and health are addressed in the initial design, the treatment for S.A.D. could be built into a building instead of adding fixtures later by introducing more natural light into buildings, orienting the building to receive proper amounts of sunlight throughout the day and positioning artificial light to substitute as natural light on overcast days. This design criteria will not only create a better environment for people who suffer from S.A.D., but it will benefit society as a whole because even people who do not suffer from S.A.D. are affected psychologically by changes in the sun’s intensity.

Can architecture enhance the quality of life through the use of daylighting?

During this investigation, I talked with a person who suffers from Seasonal Affective Disorder to better understand the disorder. Here is her story: Several years prior to this woman’s diagnosis of S.A.D., she often felt depressed. She just thought she was suffering from depression until she starting paying attention to when she felt depressed. She noticed that every summer she lead a normal life, but every September she would start feeling depressed and this depression would last throughout winter. Sometimes the depression became so out of control that she would stay in bed for days and not eat. Eventually, she was diagnosed as suffering from S.A.D. As a treatment, she uses a bright light box an average of a half hour per day or more when she feels worse. The winter months are when she uses the light box the most. She may start feeling down on overcast days during the summer, but within a few days it is sunny again and she feels fine, so she does not use it during the summer. This therapy has been very beneficial in helping her cope with S.A.D., but she stated that natural light is still the best treatment.

"The interior worlds we create have climates that affect our well-being as surely as the climate outside."
- Gallagher

- The Power of Place
Importance of light in the workplace

Have you ever worked in an environment with an abundance of natural light?

Despite what some people think, research has been conducted proving that the presence of natural light in workspaces affects the rate of productivity. Studies prove that workers who are exposed to natural light have a higher rate of productivity than those workers who are not exposed to natural light. This is because the presence of natural light has been proven to raise alertness leading to increased productivity.

Have you ever worked in an environment where there was an absence of natural light?

The presence of natural light generally makes spaces more enjoyable and lifts people's spirits, therefore, enhancing human well-being, which in turn, improves their working abilities. If daylit workspaces are not possible throughout the entire building, at least a visual connection to the outdoors should be provided. This still allows the people to feel connected to the changing world around them. Daylight does not always have to enter from side lighting. Top lighting is also an acceptable method of allowing sunlight to penetrate the workspace. The brightness of the light and the patterns created by the light still communicate the changes that are taking place outdoors. For example, in some factories where side lighting is not an option, skylights are placed over circulation paths to provide a connection to the outside. The skylights have proven to be a beneficial addition to the factories.

In each of these environments what was your mood like, how productive were you, how would you describe the overall atmosphere of each place and the attitudes of co-workers?
Because daylight is not static, the question arises: If a space is designed to take advantage of daylighting, what happens on overcast days and at night? Artificial light must be provided. The artificial light fixtures may be positioned to provide a general, diffused light throughout the space or to mimic natural light. Artificial light may be provided through a typical overhead lighting system, individually focused task lighting or a combination of these. If task lighting is available at each individual work station, it may not only provide the light needed to perform the task, but it may also be able to function as the bright light therapy needed by those people suffering from S.A.D. In this case, people suffering from S.A.D. could simply turn on the task light anytime when they need an extra dose of light.

"Except for prestigious lobbies and a few special rooms, the interior luminous environment of offices seem to be almost an afterthought."
- Lam  
  Perception and Lighting As Formgivers For Architecture

Daylighting design is not something that can be pushed off until the final stages of design if it is to be achieved correctly. For instance, some designers may think that providing many windows will cure the daylighting problem, but that is not true. Adding more light or developing new technology is not the answer. Applying the current technology is sufficient to properly daylighting buildings. But in order to do this, we must first understand how we see, what we look at and what we perceive and why. In a good luminous environment, light should be an asset not a distraction and should emphasize those things that we want to see while hiding or down playing those things, which are of no particular interest. To achieve a good luminous environment, quality of light not quantity is essential. If workstations with computers are located behind large areas of windows, glare could become a major problem if not dealt with properly, which is why quality of light becomes the important factor not quantity.

To efficiently use daylighting in design, the following should be considered:
- analyze the space beyond the windows to determine the actions and functions that occur there
- determine if glare could be a problem
- should specific elements be emphasized or highlighted
- does the space need darkness to function correctly?

If sunlight has been proven to raise the rate of productivity, why is it not a key factor in every work environment?

Since it is proven that natural light increases productivity, why is it not a major design issue in office buildings in the United States? Often, lighting issues are not dealt with until the final stages of the design and then artificial lighting is usually used to meet the requirements. If lighting had been a major issue in the beginning, the need for artificial light could probably have been minimized by introducing distributed natural light into the spaces. In European countries, there are laws that require workplaces to admit daylight. For example, in Denmark, social laws rule that all workplaces shall have access to daylight. And in Germany, an ordinance was passed in 1975 that requires direct communication from each workplace with the outside world. So why is it that the United States does not have any laws regulating daylight requirements in workspaces? Unfortunately, the environment where we spend a majority of our time could be one of the worst designed spaces in regard to enhancing the quality of life through daylighting.
The site chosen for the advertising headquarters is in Charlotte, North Carolina. Weather is one of Charlotte's strongest assets. The climate is moderate, pleasant and sunny with 214 days of sunshine yearly and an average low temperature in December of 39°F and an average high temperature in July of 79°F which entices people to get outside throughout the entire year.

While Charlotte is internationally known as having the #1 Pro-Business Attitude, it is also described as a hub of cultural diversity with more than 50 cultural organizations.

The site for the advertising headquarters is located just a few blocks outside of the heart of downtown Charlotte. The site is on the corner of 4th Street and Cedar Street. 4th Street is a major 4 lane street that connects the downtown and I-77. Cedar Street is a secondary 2 lane street that provides access to the residential area. The blocks are not oriented north/south. They are skewed 45 degrees. There are no tall buildings adjacent to the site, which would interfere with sunlight reaching the advertising headquarters. Adjacent to the west side of the site are fairly new townhouses and the remainder of the site has only flat land adjacencies. Visually adjacent to the site is the Ericsson Stadium, home of the Charlotte Panthers. The east side of the site has a boundary of trees and beyond the trees are a rail line and the skyline of Charlotte.

After the project was close to being halfway completed, it was discovered that the site is zoned for residential. But since the site is surrounded on 3 sides by mixed use zoning, it is more than likely possible to file a variance to have the site changed to mixed use zoning.
The site is very large compared to the size of the advertising headquarters. The site is 200,000 square feet while the advertising headquarters occupies only 60,000 square feet. Therefore, a decision had to be made about what to do with such a large site. Three options about how to develop the site were explored. Option 1 was to buy the whole site and divide it into lots using only 1 lot for the headquarters. Option 2 was to use the whole site and design a large building to fit the site, which would be made up of the headquarters and spec office space. Option 3 was to use the whole site for the headquarters leaving about half of the site undeveloped. But thinking into the future, eventually this land would be built up. So, option 1 was the option that was chosen in order to focus solely on the design of the headquarters. The advertising agency would buy the entire site and divide it into 2 lots. The corner lot will be occupied by the advertising headquarters and the other lot will be leased for another building to be built. But the advertising agency owns the land so they set zoning regulations for the building that will be built on the adjacent lot. The zoning regulations are to ensure that the building will not interfere with the concept of the advertising headquarters.
The advertising headquarters is designed to accommodate 100 employees. Flexibility and openness were key factors in designing the layout of spaces. Advertising agencies have a tendency to want to alter their appearance every 5-10 years so flexibility is very important. The environment should also express the creativity that takes place both on the interior and exterior.

Advertising executives sometimes work long or odd hours, which means that the typical office setup does not accommodate their needs. They do not prefer the typical office setup where each person is isolated in their own cubicle because often they work in teams. Therefore, their workstations should allow work to be completed individually as well as in groups.

The headquarters was designed from the inside out locating each space in accordance with its relationship to the sun and the amount of natural light needed. Once the organization of spaces was established, a metaphor was created that compared the qualities of light to the design process. The metaphor determined those spaces, which would receive even, distributed natural light and those spaces which would use natural light to create visual interest and contrast. As a person moves through the headquarters, they will pass through several spaces with different qualities of light.

**COLOR CHART**

- blue: accounting dept.
- green: account management dept.
- purple: media dept.
- pink: production dept.
- orange: creative dept.
- yellow: atrium/major circulation path/light well
- gray: support space
- brown: open to below
Advertising agencies are comprised of several different departments, which work together to produce the final outcome. These departments include accounting, account management, media, creative and production. From the research conducted, it is typical to keep each department grouped together. While the departments may seem to be separate entities, it is important to create physical or visual connections between the departments to emphasize the interaction and collaboration that occurs. Most of the workspaces are situated within an open plan system. However, like most office environments, managers usually require more privacy because they deal with more confidential issues. Therefore, the department managers have more enclosed workspaces. In an effort to avoid isolation or feelings of superiority, the offices are enclosed partially by transparent materials. And only the managers who require a high level of privacy will have doors on their office. Offices without doors are another detail that conveys the sense of interaction and equality. Other than managers, there are 2 other departments that require enclosed offices with doors due to acoustics. They are the media department and the writers in the creative department. The media department needs enclosed offices because they spend a majority of their time on the telephone and if there were no partitions between the employees, concentration may be affected because of all the other conversations taking place. The writers also require acoustical privacy for concentration.

Other important spaces within the headquarters are conference rooms and huddle areas. There are 2 formal conference rooms, which include many high-tech features. Each department has their own basic conference room for informal meetings. Each department also has a huddle area, which is an informal meeting space where only a few people would gather. Huddle spaces may include a table with chairs or couches and oversized, comfortable chairs. Advertising executives desire a variety of spaces in which to work including comfortable, relaxing spaces which, explains the need for couches and oversized chairs. A few other spaces that cater to the desire to have spaces for escape and relaxation include the lounge, the outdoor plaza and the exercise room. The lounge has a television and couches, as well as, a pool table and foos ball table. The outdoor plaza serves as a place to take a break or a place to work outdoors on nice days. The exercise room was included to promote wellness so that when people are working long hours they can take a break to exercise.
exploring light and glass
  daylighting methods
  shading techniques & types of glass
precedent research
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  from early stages of design to resolution
Daylighting methods

One of the major areas of exploration during this thesis was different methods of admitting daylight into buildings which can be divided into 3 sub-categories: side lighted buildings, top lighted buildings and top lit shared central space buildings.

Characteristics of side lighted buildings:

- Best used on narrow buildings with windows on each side of the building
- Works well on buildings with long north / south facing facades
- Higher ceilings allow light to penetrate farther into the building
- Redirect sunlight to primary room surfaces such as walls and ceilings, which in turn, illuminate secondary horizontal work surfaces

Location of windows:

Low windows

- Advantages:
  - Most uniform illumination achieved by reflecting light deep into the room
  - Area of room affected by glare and overheating from direct sun is minimized
  - Direct sunlight penetration is kept close to window and below eye level along the perimeter of the wall
- Disadvantages:
  - Low partitions may block light from being reflected deep into the room
  - Contrast between bright opening and unlit upper wall and ceiling produce a gloomy effect
  - Reflecting surfaces are placed below or near eye level, which results in glare

Middle windows

- Advantages:
  - Allows view to the exterior
  - Glare from sunlit sills can be minimized by sloping the sill to below eye level, yet allowing them to be "seen" by the ceiling
- Disadvantages:
  - Not optimal for distributing ground-reflected light
  - Not optimal for distributing overcast sky light

High windows

- Advantages:
  - Deepest penetration from direct, diffuse light sources to horizontal work planes / has an advantage on overcast days
  - Brightest reflecting surfaces are above eye level
  - High location of zone of maximum brightness reduces the potential for glare
  - Low partitions do not block reflected light
  - Provide light with a degree of privacy
- Disadvantage:
  - Less favorable light distribution to ceiling from ground-reflected light
Characteristics of top lighted buildings:

- Provides uniform light distribution using minimum glazing area
- Very efficient for low-rise buildings
- Direct sunlight on interior walls can give occupants in windowless spaces a “view” that provides information on exterior weather conditions and the time of day
- Incoming sunlight must be baffled and redirected to avoid glare
- Sloping the ceiling up to meet the aperture minimizes the contrast between the aperture and the space below
- Glazing in skylight can be horizontal or vertical

Types of top lighting using vertical glazing:

- Clerestory
  - Favors low angle light
  - Orientation is critical
- Sun scoop
  - Clerestory monitors oriented toward the sun
  - Receive twice as much light in winter as in summer
  - Receive direct sunlight, sky light and roof-reflected light
- Light scoop
  - Clerestory monitors oriented away from sun
  - Receive sky light and roof-reflected light
  - Provides lowest and steadiest light level with minimum heat gain
  - Reduces illumination on overcast days

Types of top lit shared central space buildings:

- Atrium - central space of building open to sky, usually multi-story
  - Reduce light and solar gain through orientation and reducing the glazed area
  - The taller the atrium, the more glass should be used
  - Use light reflecting surfaces to bounce light
  - Some direct light should be allowed to hit architectural elements to create sharp shadow lines and patterns
- Littrium - an atrium that optimizes sun lighting in adjacent spaces
  - Adjacent spaces may be physically open or thermally and acoustically separated
  - Much more light is desired than in the atrium
  - Direction, quality and quantity of light must be carefully controlled
- Lightwell - vertical opening through 1 or more floors of a building
  - Provide natural light to adjacent spaces and top light to spaces below
  - Can be integrated with vertical circulation
  - Usually it is uninhabited
Shading techniques & types of glass

While studying ways of admitting light into a building, the exploration of shading techniques and glazing became equally important to prevent problems related to glare and over-heating. There are several types of glazing which transmit different amounts of sunlight into a building including low transmission glass, mirror glass and tinted glass. Although glazing can be used to determine how much sunlight is transmitted into the building, there should be minimum reliance on glazing for sun control. Instead, shading devices should be used for sun control. Several types of shading devices explored during this thesis include louvers, lightshelves, overhangs and suncatchers. If properly designed, these shading devices can control the amount of sunlight admitted to prevent glare and over-heating in spaces.

**General shading concepts:**

- On the north / south facades, fixed shading is effective to control glare and HVAC loads.
- On the east / west facades, glare is difficult to control at dawn and dusk and should be supplemented with movable devices.
- Horizontal devices are simpler than vertical devices and can redirect sunlight to the ceiling as desired.
- Horizontal devices respond to the sun's orbit and provide shade at noon when the sun is highest.
- Vertical devices respond to the sun's bearing angle as it moves around the horizon.
- Vertical devices act as a supplement to horizontal devices.
- Eggcrate devices combine horizontal and vertical devices for maximum sun control.
- The spacing of louvers is important because if they are too far apart, they may not be effective in shading.
- If possible, locate the building with the long facades facing north / south.

**Shading concepts:**

**Overhangs**
- Provides shading without redirection of sunlight.
- Sufficient foreground must be available to utilize ground-reflected light.

**Lightshelves**
- Provides shading and excellent distribution of sunlight with minimum glare.
- Increase illumination deeper into the space.
- Optimize the use of reflected light.
- Add human scale to the interior and character to the exterior.
- Must be designed accurately in order to work properly.
- Careful considerations of designing the lightshelf include height, depth, shading requirements, location of glazing and finishes used.
Suncatchers
Lifts low angle sunlight above eye level
Blocks sunlight to prevent glare while allowing ground-reflected sunlight to enter
Most useful on western exposure

Types of glazing:
Clear glass is the best way to admit light with minimum heat loss. It also maximizes views and allows a sense of contact with the outside world. When bright sunlight is not desired in a building, different types of glazing can be used which transmit different amounts of light to the interior. As mentioned earlier, glazing should not be the sole method for sun control. The types of glazing which lower transmittance values include tinted glass, mirror glass and low transmission glass. Tinted glass absorbs a portion of the light passing through. Tinted glass is available in a variety of colors including green, bronze, silver-grey and silver-blue. Each color transmits a different amount of light. The chart below lists types of glazing and their transmittance values. Dark tinted glass transmits little light and is useful only for viewing. When using mirror glass, consideration should be given to the environment surrounding the building. Mirror glass may reflect unwanted amounts of light into adjacent spaces. On the interior of the building, mirror glass produces a fishbowl effect at night. A person sees their reflection instead of what is outside. Just as mirror glass may absorb some of the heat from the sun, low transmission glass also absorbs some of the heat but both need supplementary shading to prevent over-heating. Low transmittance glass is useful when the amount of light is not as important as the view. It produces an effect of gloom and ambiguity in a space regardless of the weather and the time of day.

<table>
<thead>
<tr>
<th>Glazing</th>
<th>Transmittances</th>
<th>&quot;R&quot; factor for winter night</th>
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<tr>
<td></td>
<td>Solar %</td>
<td>Visible %</td>
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<tr>
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<tr>
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<td>68</td>
</tr>
<tr>
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</tr>
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<tr>
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<tr>
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Precedents

Precedent studies greatly influenced my decisions and design process of the advertising headquarters. Precedent study was achieved through several sources including magazine articles, information from the internet and personal interviews. Although each agency was different than the others, they all had 1 thing in common: grouping each department together not intermingling the departments throughout the building.

To better understand the breakdown of an advertising agency and the environment in which they work, I visited 2 advertising agencies in Indianapolis, Indiana. They were Young and Laramore, who is an Indianapolis based firm, and Bates USA, who have offices nationwide. The 2 offices had very different feelings.

Young and Laramore's workspaces were open and more group focused and possessed a collaborative feeling. Communication and ideas seemed to flow well. The atmosphere throughout this office is creative and energetic which is achieved through the many design details. Just a few of these details include a custom designed wood and glass revolving door to a conference room, openings in walls that promote communication throughout the office and the spiral stair that leads to a glass enclosed meeting space at the top of the building.

Bates USA's office was comprised of enclosed offices. Everyone had their own office which gave the feeling of being individually focused. Communication and collaboration did not seem as evident due to the enclosure. Creativity was not expressed throughout the entire building. The only space that seemed to express creativity was the lobby and a staircase that connects the first and second floors.
The following precedents came from magazine articles and the internet:

**Chiatt / Day - Los Angeles, CA**
They are one of the largest and best known advertising agencies in the United States. The concept of this warehouse renovation was to create a village-like setting that expressed creativity throughout the spaces. One important issue was providing privacy to advertising executives without being removed from everyone else. They were also the first to incorporate the idea of hoteling, which means that people constantly move around and do not have permanent workspaces. This concept has not been very successful for many firms who have tried this because people like to have the feeling of having a permanent spot. It also became difficult to find people if they are always moving around.

**Ackerman McQueen - Dallas, TX**
The concept of this office is that a great space can be an ideal marketing tool by bringing clients into an environment where they have never been before and where the staff can bring creative ideas to their product. The idea is to surprise the clients with the drama and excitement associated with the concept of new ideas.

**Zimmerman Laurent & Richardson - Des Moines, IA**
The office is located in a renovated warehouse where illumination became the guiding force of the design. The use of translucent fiberglass panels on conference rooms and offices allowed daylight to filter through spaces yet provide a certain degree of privacy.
Process

During this thesis, several issues that greatly influenced the design were expressing creativity on both the interior and exterior, providing connections between the various departments and using natural light diffusely for workspaces and directly to create visual interest in support spaces.

In the early stages of design, the organization of spaces became the most dominant issue. The main entry was placed at the corner of 4th Street and Cedar Street. The atrium, which serves as vertical circulation and gallery space, was located adjacent to the entry. The various departments were adjacent to the atrium on 2 sides, which meant that not all the departments were visually or physically connected. Only the departments on each side of the atrium are connected. After organizing the interior spaces, the exterior form of the headquarters was explored through massing models using a variety of shapes to convey the creative expression. Creative methods of displaying work on the exterior were also beginning to be explored. One idea was that if the headquarters was clad with metal panels, the panels could have images printed onto them to act as billboards. The panels could be easily interchanged to allow displays to be changed often. The exploration of window types also began during this phase. Models were built using a variety of window placements and sizes; then tested in sunlight to determine how light reacts on the interior.

fabric sail acts as a diffuser to direct sunlight

transparent elevator walls allow a view to the exterior
During the intermediate phase of design, the entry was moved away from the busy intersection. The entry is now located adjacent to the parking lot and the atrium was moved towards the center of the site. The various departments were shuffled and now surround the atrium. This allowed for all the departments to have a visual or physical connection to the other departments, which conveys the feeling of unity instead of separation. Additional lighting studies were conducted with the focus on creative methods of lighting spaces. Using natural light to highlight specific elements and create patterns of visual interest was the focus during this phase. The exterior form of the headquarters was resolved while the placement and types of exterior displays became the major issue. More high-tech types of displays were explored which include interactive screens that are motion activated, translucent screens that have images projected onto them and shutter billboards, which have several faces that revolve to display different images.

At the late phase of design, the emphasis was on ways of admitting light into the headquarters. It was decided that the headquarters would be enclosed by a curtain wall made of transparent glass with a secondary skin outside of that which provides shading and control of sunlight. The exterior billboards and screens are also incorporated into the secondary skin. The high-tech screens were further developed and now display live web feeds from branch offices around the United States. Materials were also greatly emphasized during this phase with the design of the exterior wall system. Steel, glass and concrete were the main materials used throughout the building with the exception of the billboards and screens.
Resolution

design project overview
  about Advertects
description of the headquarters
solutions applied to the headquarters
diagrams
  explanation of wall system
tour of the headquarters
overall design of the headquarters
Design project overview

Advertects is a fictional advertising agency that was developed from the precedent studies. Ideas were borrowed from existing advertising agencies and combined to establish the philosophy and mission statement of advertects.

Advertects was designed to act as a large, well known advertising agency with offices nationwide. The building designed during this thesis is Advertect's headquarters office, which implies that it should be top quality with the most up-to-date, high-tech equipment.

**philosophy:**  
"Everything is a matter of perception."

- perception: how an individual views something and their reaction  
- how a person relates to an advertisement  
- making connections

**mission:**  
Our mission is to build your brand. As brand architects, we customize a plan - a blueprint if you will - outlining all the details of the brand. We wake up thinking about ways to strengthen it, differentiate it, and make it stand out from the competition.

**image:**  
High-tech, innovative advertising agency  
Unique and creative designs that attract attention  
Stand out from the competition  
Awareness of human well-being and emotions

**building mission:**  
It's simple. Create an atmosphere for great people to do great work. The building itself should express creativity and enhance the experience of life.
As stated throughout this report, Advertect's headquarters should express creativity on both the interior and exterior, provide connections between departments, and take advantage of natural light throughout the building. Natural light is used diffusely in workspaces to provide an even, distributed light in which to work by. In support spaces, natural light is used both directly and indirectly to create visual interest. Many light studies were conducted to study how light reacts in spaces and photographs of this study are provided throughout the book in the bottom band of pictures on various pages.

Other issues that were critical to the design include flexibility and a high-tech appearance. Flexibility is important because advertising agencies like to change their appearance and work setting about every 5 to 10 years to keep up with the latest fads and technology. The headquarters is designed to allow changes to occur to prevent the advertising agency from needing to relocate to a new building. The interior is open plan with the concrete columns as the only permanent elements. The second and third floor are supported by steel trusses, which span between the columns. Although there are offices located throughout the building, they are not permanent structures. The offices are constructed of light weight, flexible materials such as translucent fiber glass panels and corrugated plastics and metal. The concept of a flexible work environment was portrayed on the exterior as well. The building is enclosed by a double facade, in which the outer layer allows a great amount of flexibility and change to occur easily. The outer layer allows glass panels, metal panels, billboards and screens to be moved around as often as Advertects desires. The outer layer allows change to occur on the interior as well as the exterior. This allows displays to be changed often affecting the exterior appearance, while the placement of the panels affects the interior as well by determining the amount of light that is transmitted into a space. For instance, depending on the project and the work, which is to be completed, a specific department may require darkness. The darkness can be achieved by arranging the panels on the exterior to prevent light from entering at that specific location. The location of the panels also affects views out and into the building.
Diagrams

Site
Entire site is divided into 2 lots showing the headquarters, the adjacent building and parking
The atrium is located in the center of the headquarters
The outdoor plaza is shaded by the creative department which projects out on the third floor

Circulation
Main circulation runs at a 45 degree angle and is emphasized by direct sunlight from the atrium and lightscoop
Secondary circulation runs horizontally acting as a connector and is dramatically lit by reflected daylight to create visual interest

Structure
Concrete columns are the vertical structural elements which support the building
A glass curtain wall encloses the entire building providing thermal and moisture protection
The atrium is enclosed by a glass curtain wall system that is independent of the remainder of the building
The headquarters is composed of a double facade
A steel grid is the outermost layer of the facade which supports metal panels, glass panels, billboards and screens
The detailed wall axonometric provides a better understanding of the double facade. The interchangeable panels are attached to the steel grid by steel pins. The pins can easily be removed with the proper tools to allow the panels to be changed often.
Tour: exterior

view coming from I-77

detail of the facade

study of the layering of materials on the facade
The steel grid of the exterior facade is designed in 30 foot bays, which corresponds with the spacing of the columns on the interior. The placement of glass panels, metal panels, screens and billboards differs in each bay. The placement of these panels on each facade is determined by the direction the facade faces. The panels, as well as the vertical and horizontal steel members, act as shading devices, which is why their placement is important.
Tour: atrium, circulation, account management

The atrium allows a great amount of natural light in through the south facing curtain wall. Light filters from the atrium into adjacent spaces. Light passes through openings creating patterns of visual interest in the secondary circulation connecting the atrium and account management.

Daylight as a Metaphor for the Design Process
The phases of the design process are characterized by qualities of light. Daylight is used to emphasize contrasts between various spaces throughout the advertising headquarters. Workspaces receive even, distributed, controllable natural light while support spaces become the spaces where light is intriguing and creates visual interest. Spaces which receive bright light are areas where ideas come to life and where projects are developed and finalized. Spaces that do not receive large amounts of bright light are paths through the design process to the final outcome. Examples of these types of spaces and their light qualities are as follows:

**Bright spaces:**
- main horizontal circulation
- gallery
- conference room
- inspiring, energetic light
- dynamic light
- energetic light

**Not so bright spaces:**
- secondary circulation
- lounge spaces
- dramatic feeling
- relaxing light
- dramatic effects by artificial light
The enlarged section demonstrates how light enters the circulation space. The atrium is lit by artificial light at night, which filters into this space mimicking the effect of natural light.
Below is a diagrammatic perspective of the account management department showing the visual and physical connections between each department.
Tour: main circulation

A light scoop is placed above the main circulation. Throughout the day, the main circulation may be emphasized by direct daylight or by a glowing, natural light hovering near the ceiling. The enlarged section on the opposite page shows the placement of a billboard used to reflect direct sunlight into the space. The billboard is lit by artificial light at night, which mimics the effects of sunlight during the day.
Tour: circulation, sky deck

The enlarged section displays how light is playfully admitted into another secondary circulation space leading from the accounting department to the atrium. The space is lit by daylight filtering from the atrium. The pattern the light creates changes as the day progresses. This circulation space also takes advantage of the artificially lit atrium at night to mimic the effects created by natural light.
The above perspective is the sky deck conference room located above the atrium. The floor of this room sits 5 feet higher than the roof of the headquarters making this the highest space within the headquarters. It is enclosed by glass, which allows 360 degree views.
The red lines in the section drawings represent the visual connections throughout the headquarters. The wall section on the opposite page displays the treatment of the facade facing southeast. The panels act as louvers, which also act as a revolving billboard, that are electronically controlled by the employees in the interior spaces located behind this facade. Daylight can be admitted or blocked depending on the activities occurring and on the time of day.
Reflection

generic guidelines for any project

final thoughts
Generic guidelines for any project

The following is a list of generic guidelines that can be applied to most designs to take advantage of natural lighting:

Daylight should be a major design factor in the early stages, not something that is pushed off until the final design

Orient the building and spaces within to take full advantage of daylight by admitting large amounts of light on the north and south facades

Promote occupant well-being through natural light

Location of window openings is critical, not more openings

Daylight must be controlled in terms of intensity to be effective

Higher ceilings provide more light into the center of a building

Use horizontal and vertical shading devices instead of blinds or drapes

Horizontal openings are better than vertical because vertical openings create patterns of light and dark contrast

Avoid creating gloom

Choose finishes that distribute daylight

Factors that are specific to office building design:

Use daylight as a means to increase productivity

Maximize the diffuse natural light at workspaces

Minimize glare from direct sunlight

Higher windows provide daylight and minimize the possibility of glare
Final thoughts

During this thesis, I learned a lot about myself. In the past, daylighting and views have always been one of the major design forces in almost every project I have completed. When asked why this is a reoccurring concept throughout many projects, I simply stated, "because I like spaces that are lit by sunlight." Sunlit spaces cheer me up and have a positive affect on my mood. It wasn't until researching daylighting that I realized the significance of daylit spaces.

One of the areas of research I found especially beneficial to myself was Seasonal Affective Disorder (S.A.D.). After researching S.A.D., I believe that I may suffer from a mild form of this disorder. My mood can do a total 180 degree flip within an hour if there are major changes in the weather. I have always been a sun-lover and love visiting climates where the sun is present for longer periods of the day. I always thought I just liked those places because they had warm temperatures. Now that I analyze myself, I wonder if it is not the presence of the sun that I love more than the warmth given off. For instance, the presence of sunlight on winter days cheers me up even when it is cold outside.

From the knowledge I have gained from this thesis, I believe that I will look at spaces differently. For example, this topic has played a role in my job search. When I tour the work environment of a firm I am interested in working for, some questions come to mind: No matter where I sit in the office, will I have exposure to natural light? How will the amount of daylight present affect my work ethic? If I may not have exposure to natural light at my workstation, are there other spaces where I could spend time throughout the day to have exposure to natural light?

My hope is that designers will realize the importance of natural light to the health of human beings and design spaces with that concept in mind. And remember, windows should not be elements that are arbitrarily poked through walls to break up the facade. Windows should be used to their maximum potential to enhance the quality of life for the building's occupants. When studying daylighting in buildings, it is important to conduct light studies to determine how light actually will act in a space. Often, we may think that light will act in a certain way, but in reality, it does something completely different. The numerous light studies conducted during this thesis were beneficial to understanding how light will really act in spaces.
Bibliography


