TWEETLIGHT

(HOME) OFFICE LUMINAIRE

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(Home) Office luminaire TWEETLIGHT
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Degree Project for Master of Fine Arts in Design,
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ABSTRACT

Desk lamps were originally designed for reading and craftsmanship. However, with the increasing prevalence of computer-based work and the rise of remote and hybrid work arrangements due to the COVID-19 pandemic, our needs for lighting have evolved.

This project aimed to create a versatile desk lamp suitable for both traditional tasks like reading and writing, as well as modern computer work. Additionally, it considered the specific requirements of individuals working remotely, including the demand for effective lighting during video conferences.

To achieve this goal, a survey was conducted to understand the challenges and preferences of remote workers. The outcome of this research is a desk lamp inspired by nature, offering adjustable brightness, light color, and the capability for self-illumination. Its playful design distinguishes it from conventional office lamps, making it a suitable addition to home interiors.

In summary, this project introduces an innovative desk lamp designed to meet the evolving demands of today's work styles and home environments.

CONTENT

BACKGROUND AND MOTIVATION

As an industrial designer, I always analyze my surroundings, focusing not just on the objects around me, but specifically on their design aspects. I often catch myself spending most of the time by analyzing lamps, which led me to create a lamp as my bachelor's project (Picture 1). Following the completion of my undergraduate degree, I co-founded a NUNOKO brand that specializes in creating mycelium lampshades (Picture 2).

During my Master's studies at Lund University, I couldn't resist to design another lamp for my master thesis. My goal was to create a design that is not only visually appealing and functional but also considers the end user's needs and preferences. This project allowed me to integrate my passion for lighting design with the knowledge and skills I have developed throughout my academic journey.

In the pursuit of designing an exceptional lamp, I am motivated by the potential impact this project could have on people's daily lives. A well-designed desk lamp can contribute to an individual's productivity, comfort, and overall well-being. By focusing on the intersection of aesthetics, functionality, and user experience, I hoped to develop a product that genuinely enhances the lives of those who use it.

Picture 1 - me with my Bachelor's project

Picture 2 - me with a co-founder of NUNOKO Jurgis Judzentis

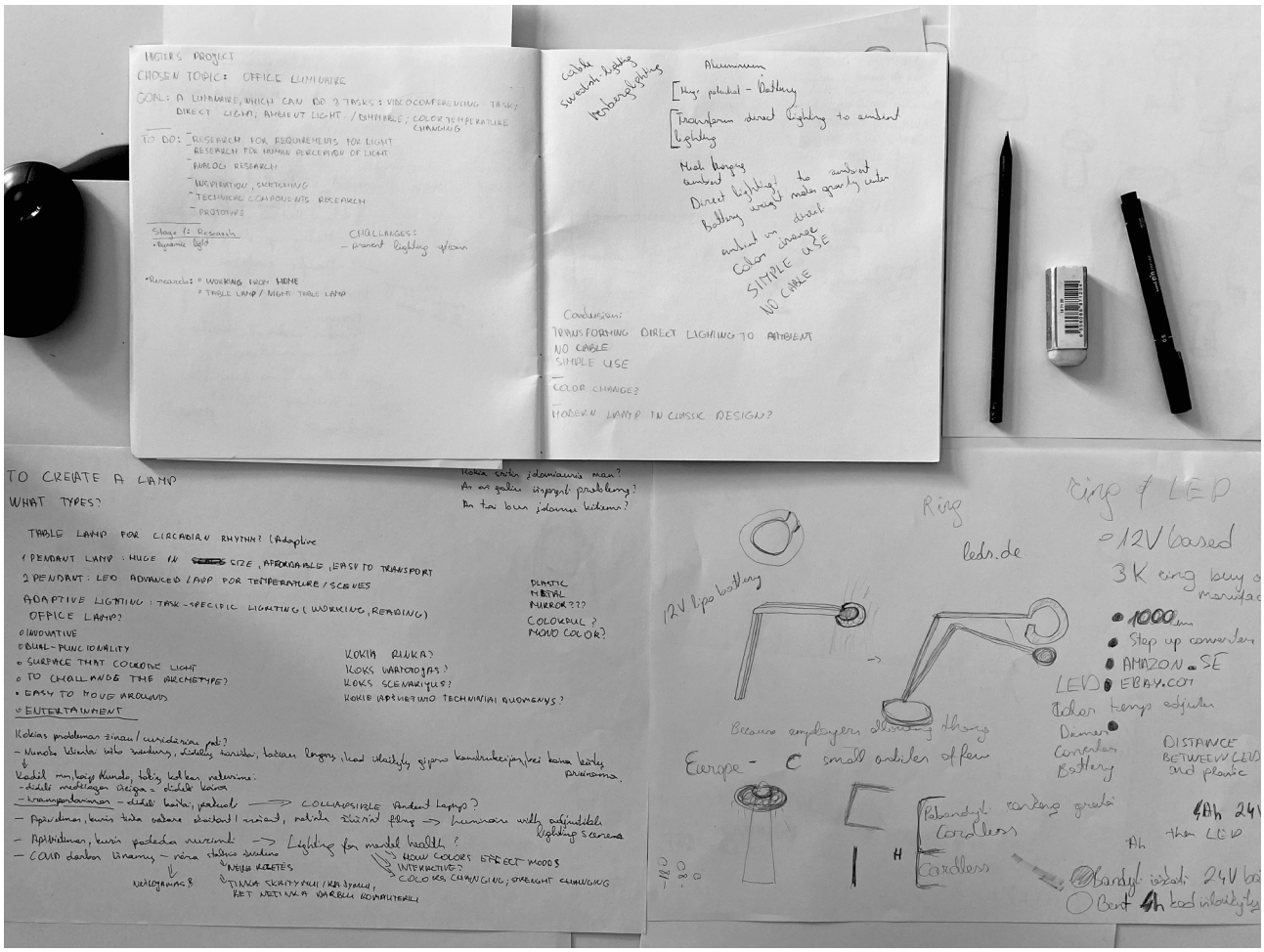
IDEA VOL. 1

At the very beginning, I knew that my Master's project will be dedicated for designing a lamp. The question that remained, however, was: what type of lamp should it be (Picture 3)? To answer this, I began reflecting on the problematic situations we have nowadays and that I had personally experienced. I also considered the challenges faced by modern individuals and current trends in society. One phenomenon that has significantly impacted our lives is the COVID-19 pandemic. Although the situation has stabilized for the time being, it has left a lasting mark on our lifestyles, one of which is the adoption of remote work.

Many people and companies were forced in a way to practice remote work for the first time, adapting to new practices and routines. It is important to note that people spend a considerable portion of their lives studying and working, and the quality of light plays a crucial role in these activities. Consequently, I decided to investigate the specific needs and scenarios associated with desk lamps for working individuals. This exploration led me to the decision to design a desk lamp that meets the needs of those who study and work from home.

Furthermore, I read an expression by Poul Henningsen that I cannot forget:

"Lighting is like driving a car. The conditions must be right."



Picture 3 - thoughts put on paper of what lamp should I make

RESEARCH PHASE

Introduction and research question

Throughout history, desk lamps have been essential tools for individuals studying and working in various settings. Task lighting has played a crucial role in ensuring task performance, mood, motivation and overall well-being (Boyce, 2003). With the establishment of computers, the requirements for task lighting have transformed, necessitating the development of desk lamps customised for a screen usage, reduce glare, and enhance the user experience (Karwowski, 2006).

Lighting, particularly in work environments, has been extensively studied for its impact on performance, health, and well-being (Veitch & Newsham, 2000). Offices typically follow to specific guidelines and standards to ensure optimal lighting conditions for their employees (CIBSE, 2015). However, the COVID-19 pandemic has triggered a broad change towards remote work and study, resulting in an elevated requirement for desk lamps that accommodate the unique needs of individuals working from home

Considering the changing demands for task lighting in remote work and study, how can a desk lamp be designed to meet the specific lighting needs of computer users and enhance their experience? This design should incorporate ergonomic principles and advanced lighting technology.

RESEARCH PHASE 1: ERGONOMIC LIGHTING REQUIREMENTS FOR READING AND COMPUTER WORK IN EUROPE

Introduction

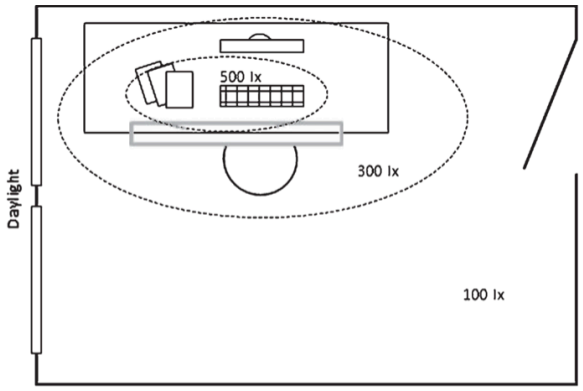
Understanding the specific lighting requirements for reading and computer work is crucial to ensure the proper design of a desk lamp. In Europe, various guidelines and standards have been established to address the ergonomic lighting requirements in different work environments. The rise of computer use in the workplace and at home during the latter half of the 20th century further demanded the establishment of lighting requirements specific to computer work, given that the characteristics of this work and its effects on visual comfort and productivity differ from traditional paper work tasks (IESNA, 2000).

This chapter will focus on the ergonomic lighting requirements for reading and computer work in Europe. It will discuss the illuminance levels, glare control, individual preferences, and the importance of adjustable lighting solutions in the context of reading and computer work.

European standards and guidelines for lighting

The European Standard for Lighting, EN 12464-1 (2011), sets the recommended illuminance levels for various tasks and activities. For reading and writing tasks, the standard recommends a minimum illuminance level of 500 lux. For computer work, the recommended level is 300 to 500 lux, depending on the task's complexity and visual requirements (Picture 4). The conditions for computer work are more similar to ambient lighting than task lighting. The standard also provides guidance on the consistency of lighting, color rendering, and glare control to ensure a comfortable and visually appealing environment.

Reading tasks and computer work differ in several key aspects, which can affect the appropriate lighting requirements for each activity. These differences include the visual demands, potential for glare, and ergonomic factors.



Picture 4 - Illuminance recommendation for computer work

Task lighting and ambient lighting

Since paper work requires task lighting and computer work requires more like ambient lighting, this subchapter will review specifics of both scenarios.

Task lighting

Task lighting is designed to provide illumination for specific activities that require higher levels of light than ambient lighting can provide. There are various types of task lighting, each with its own characteristics and benefits. The most common types of task lighting include localized average lighting, freely adjustable task lighting, and asymmetric task lighting.

Localized average lighting involves the use of both ambient and task lighting lamps. This type of task lighting is effective for illuminating a specific area, such as a work desk or reading area, while still providing general lighting to the surrounding space.

Freely adjustable task lighting, on the other hand, allows flexibility in positioning and directing the light to the specific task area. This type of task lighting includes lamps with gooseneck, balanced-arm, or swing-arm designs that can be easily adjusted to provide light precisely where it is needed.

Asymmetric task lighting involves placing the lamp at the side of the work area to minimize glare and enhance visual comfort. This type of task lighting is commonly used in computer workstations, where it is essential to reduce glare and reflections on the screen.

Other types of task lighting include under-shelf luminaires, which are used in retail or storage environments to provide focused light on products or items, and examination and operation lights used in medical and surgical settings. Task lamps are also commonly used in home environments for activities such as reading, sewing, writing, and other tasks that require precise and focused illumination.

Ambient lighting

Ambient lighting is the overall illumination in a space that provides general lighting and establishes the mood and atmosphere of the environment. It is a critical aspect of lighting design, particularly in work and study environments where it can affect visual comfort, performance, and well-being. Proper ambient lighting can reduce eyestrain, headaches, and fatigue, making it easier to concentrate and work effectively.

Ambient lighting can be provided through a variety of sources, such as ceiling-mounted fixtures, wall sconces, or recessed lighting. The use of indirect lighting, such as uplighting or wall-washing, can also create a soft and diffused ambient light that reduces glare and creates a more relaxing atmosphere (Boyce et al., 2003).

Important to mention that ambient lighting is also crucial while using task lighting, to avoid contrasts and eye strain.

Human centric lighting

Human-centric lighting (HCL) is a rapidly growing area within the field of lighting design that focuses on developing lighting solutions tailored to the user's well-being. This approach takes into account the physical, emotional, and biological effects of light on humans and seeks to optimize lighting for health, productivity, and overall well-being (DiLaura et al., 2011). HCL addresses several factors, such as color temperature, dynamic lighting, dimming, glare, and flicker, to create a lighting environment that serves users' needs.

Visual demands

Paper work requires horizontal view and increasing amount of light makes the surface more visible. In contrast, for the computer work the information is viewed vertically and increasing amount of light makes information in the self-luminous screen less visible (Boyce, 2003). Consequently, lower illuminance levels are typically recommended for computer work to minimize eye strain and improve visual comfort.

Color temperature and dynamic lighting

Color temperature, measured in Kelvin (K), refers to the warmth or coolness of light. In the context of lighting for paper and computer work, a color temperature between 3,000K and 5,000K is generally recommended (DiLaura et al., 2011). Cooler light (4,000K-5,000K) can help enhance concentration and visual clarity, while warmer light (3,000K-3,500K) creates a more relaxed atmosphere suitable for reading or creative tasks.

Dynamic lighting, also known as circadian lighting, mimics the natural changes in light throughout the day. By adjusting the color temperature and intensity of light, dynamic lighting can help regulate users' sleep-wake cycles, enhance alertness, and support cognitive performance during the day. For paper and computer work, incorporating dynamic lighting can help maintain a user's focus and productivity by creating an environment that supports their natural circadian rhythm (DiLaura et al., 2011).

Dimming

Dimming allows users to adjust the light intensity according to their needs and preferences, which is particularly important for both paper and computer work. Proper dimming helps reduce glare and eyestrain, creating a comfortable working environment. For computer work, an illuminance of 300 to 500 lux is recommended, depending on the task's complexity and visual requirements, while for reading and writing tasks, a minimum illuminance level of 500 lux is suggested. Providing adjustable lighting solutions that accommodate individual preferences for both types of tasks is crucial in creating a comfortable and efficient workspace.

Glare

Glare is a significant concern in both reading tasks and computer work. However, the sources of glare and the strategies for reducing glare differ between these activities. For reading tasks, glare may result from bright light sources or reflections from glossy paper surfaces. To minimize glare in reading tasks, it is essential to control the direction and intensity of the light source (Innes, 2012). For computer work, glare may appear from reflections on the computer screen or excessive brightness from the screen itself. To reduce glare in computer work, it is crucial to position screens away from direct light sources, adjust screen brightness, and make use of glare-reducing screen filters when necessary (Hedge, 2013). Proper screen positioning and brightness adjustments can greatly improve visual comfort and reduce eye strain, leading to increased productivity and reduced discomfort during extended periods of computer use.

Flicker

Flicker refers to rapid variations in light intensity that can cause headaches, eyestrain, and fatigue. In the context of lighting for paper and computer work, it is important to choose lighting solutions that are free of flicker and provide stable and consistent illumination. LED lighting with high-quality drivers can help minimize flicker and ensure a comfortable working environment (DiLaura et al., 2011).

Color rendering index

Color rendering index (CRI) is another important factor for a lighting quality. CRI measures a light source's ability to accurately reproduce colors compared to natural sunlight, which has a CRI of 100. A higher CRI rating indicates a better color rendering performance, which is important in tasks that require accurate color perception, such as graphic design or painting. The standard EN12464-1 specifies minimum colour rendering requirements for practically all kinds of tasks by CRI (Ra). CRI levels are recommended with minimum CRI 80 for nearly all types of rooms and applications (including reading, writing and data processing) except CRI 90 for health care examination and treatment.

Ergonomic factors

Ergonomic factors play a significant role in various objects, and the same applies to desk lamps. Reading tasks may require adjustable lighting solutions, as individuals may change their posture, reading angle, or reading distance throughout the activity (Innes, 2012). In contrast, computer work often involves a more fixed posture and screen position, necessitating a more consistent and uniform lighting environment (Boyce, 2003).

Importance of adjustability

A study by Veitch (2008) suggests that individual preferences for lighting conditions should be considered when designing lighting solutions. The study found that participants preferred different illuminance levels, ranging from 300 to 600 lux, depending on the task and personal preferences. These findings highlight the importance of adjustable lighting solutions that can serve to individual needs and preferences. Also, as mentioned before, color temperature adjustment is also a must for a desk lamp that meets the requirements of HCL.

Conclusions

To design a desk lamp that meets ergonomic lighting requirements for both reading and computer work, various factors should be considered. The European standard for lighting, EN 12464-1 (2011), provides recommended illuminance levels for different tasks, including reading and writing tasks, which require a minimum of 500 lux, and computer work, which requires 200-300 lux depending on the task complexity (CIBSE, 2019).

Incorporating human-centric lighting (HCL) into the design of a desk lamp can create an optimal lighting environment that promotes circadian rhythms, enhances alertness and cognitive performance during the day, and promotes relaxation. This can be achieved by incorporating features such as dimming and color temperature adjustability. Furthermore, personal perception of comfort with lighting makes the ability for adjustment even more important.

Color rendering index (CRI) is an important factor to consider. For paper work and computer work minimum 80 CRI is recommended.

Adjustability for position is also an essential factor to consider. The ability to adjust the lamp's position enables users to direct the light where it is needed, reducing glare, shadows, and improving visual comfort.

By incorporating these factors into the design process, a desk lamp can provide an optimal lighting environment that supports users' visual comfort, productivity, and overall well-being.

RESEARCH PHASE 2. REMOTE WORKING AND ITS IMPLICATIONS FOR DESK LAMP DESIGN

This second part of the research focuses on analyzing the growth of remote work and its future prospects. Additionally, the increasing use of video conferencing has created new lighting needs.

The aim of this phase is to gather reliable data on the current rise of remote work and projections for the future.

The rise of remote working and studying

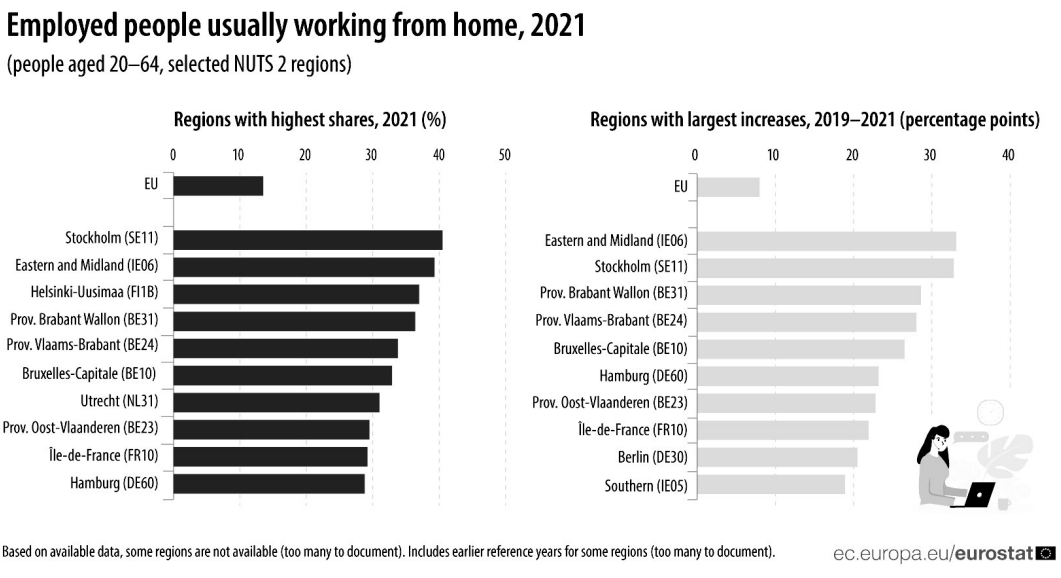
Remote work and study have become increasingly popular in recent years due to advancements in technology and the desire for a better work-life balance. The arrival of high-speed internet, cloud-based applications, and collaboration tools has made it easier than ever for employees and students to work and learn from anywhere.

This shift has been further sped up by the COVID-19 pandemic, which has forced businesses and educational institutions to start practice remote working and learning if they haven't before. As a result, remote working and studying have become an integral part of the new normal and are expected to continue shaping the future of work and education.

According to Eurostat, the percentage of employed persons in the European Union (EU) who usually worked from home increased from 5.5% in 2019 to 13.5% in 2021. This sudden transition has highlighted the need for comfortable and ergonomic home workspaces that serve to the diverse needs of remote workers and students.

In Stockholm – the capital region of Sweden – two out of every five employed people (or 40.5%) were usually working from home in 2022. Eastern and Midland in Ireland and Helsinki-Uusimaa in Finland followed closely with 39.3% and 37.0%, respectively (Eurostat, 2022).

Between 2019 and 2021, the share of employed people in the EU usually working from home increased by 8%. Capital and urban regions experienced particularly rapid growth in remote work during this period. Eastern and Midland in Ireland and Stockholm in Sweden saw increases of 33.1% and 32.8% respectively. These two capital regions had an increase in remote work that was more than four times the EU average when comparing the pre-pandemic situation in 2019 (Picture 5).

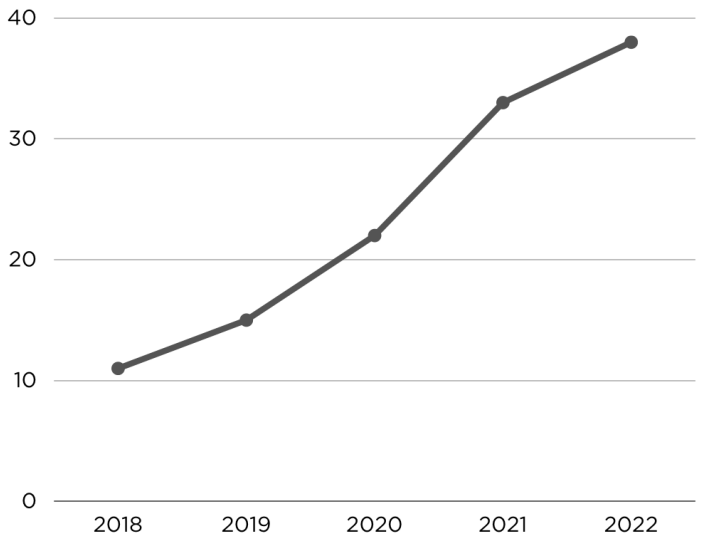


Picture 5 - Statistics of employed people usually working from home in 2021

The prevalence of remote work and its future prospects

Remote work is expected to remain common even after the COVID-19 pandemic subsides. Many organizations have recognized the benefits of remote work, such as reduced overhead costs, increased employee satisfaction, and access to a wider talent pool (PwC, 2021). Furthermore, employees have experienced the advantages such as greater flexibility, reduced travel time to work, and improved work-life balance. However, for students, the shift to remote learning has brought both advantages and challenges (UNESCO, 2021). As a result, it is likely that remote work will continue to be a significant aspect of the future of work, with more organizations offering flexible work arrangements, while schools will primarily practice remote education only under special circumstances.

For accuracy, I gathered information from my home country Lithuania, which is part of my target region, Europe, since the data was easier to access for me. I reached out to one of the main job search portals, www.cvonline.lt. According to their data, the job ads for remote work accounted for 5% to 7% in 2018 and 2019, and in 2022, it increased to approximately to 20%. Furthermore, the owning company also maintains a website for salary data statistics worldwide, and they shared the data on remote or hybrid work accessibility in all of Lithuania, not just on their website (Picture 6).



Picture 6 - Availability for people to work remotely or hybrid in Lithuania

Challenges and opportunities associated with remote working and studying

One of the key challenges of remote work is the need to create a comfortable and productive workspace within the constraints of a home environment. This can be particularly difficult in small apartments and homes, which are common in urban areas. Inadequawte lighting, glare, and visual discomfort can all contribute to physical and mental fatigue, eye strain, and headaches. As a result, it is important to design lighting solutions that are both comfortable and functional for remote workers and students.

The rise of video conferencing and the importance of lighting

While gathering information on lighting requirements and the impact of remote work due to Covid-19, it is essential to note the increased use of video conferencing. The pandemic was a significant trigger, and since remote working is here to stay, so is video conferencing. Zoom is the leading video conferencing platform (Tudor, 2022), with revenue increasing by 1,227.49% from 2019 to 2023, and the trend is expected to continue (MacroTrends, 2023), despite the lifting of lockdowns in Europe since June 2021 (BBC, 2021).

Facial expressions are crucial in virtual meetings, and poor lighting during video conferencing can reduce the quality of conversations by making it difficult to see facial expressions. This can lead to misinterpretations of signals and a decrease in engagement (Wolff & Burrows, 2021). Natural light is the best source of lighting for video conferencing, but remote workers may not have access to it due to constraints such as house structure, weather, or time of day. In such cases, artificial lighting is essential. Quality of lighting and adjustability of position are crucial parameters to direct lighting towards the faces and avoid glare and eye strain. Visual content creators, such as talk show and podcast producers, use LED rings with well-led glass to disperse light and avoid glare and eye strain.

Picture 7 - LED ring light

Conclusion

In this chapter, I discussed the rise of remote work and study, their impact on work and study patterns, and their future prospects. As video conferencing becomes more common, it's crucial to consider proper facial lighting for effective communication in virtual meetings.

As remote work continues to expand, conducting a survey to understand people's preferences for desk lamps while working from home is essential.

RESEARCH PHASE 3. SURVEY

To gain a better understanding of the needs of people working remotely, I conducted a survey targeting individuals in Europe who are currently working or have previously worked remotely, as well as those who are studying or have studied remotely. A total of 47 responses were collected.

The survey aimed to evaluate the participants' home working conditions, their lighting preferences and challenges, and their desired features in a desk lamp. By analyzing their responses, valuable insights were gained which helped to set the goals for the desk lamp of this Master's thesis.

Key findings

In order to understand the working conditions of participants, I asked about the layout of their homes. The majority of the participants (29, or 60.4%) have a desk in common areas such as the living room or bedroom. 9 people (18.8%) have a dedicated home office, while surprisingly, 8 people (16.7%) work at a kitchen table.

Regarding their lighting conditions, it appears that ambient lighting is the most common, with 36 people (75%) using it. Task lighting is used by 18 people (37.5%), and specialized lighting for video conferencing is used by three people (6.3%). As multiple options could be selected, nine participants use both ambient and task lighting; 2 participants use ambient lighting and lighting for video conferencing; and 1 participant uses ambient, task, and lighting for video conferencing.

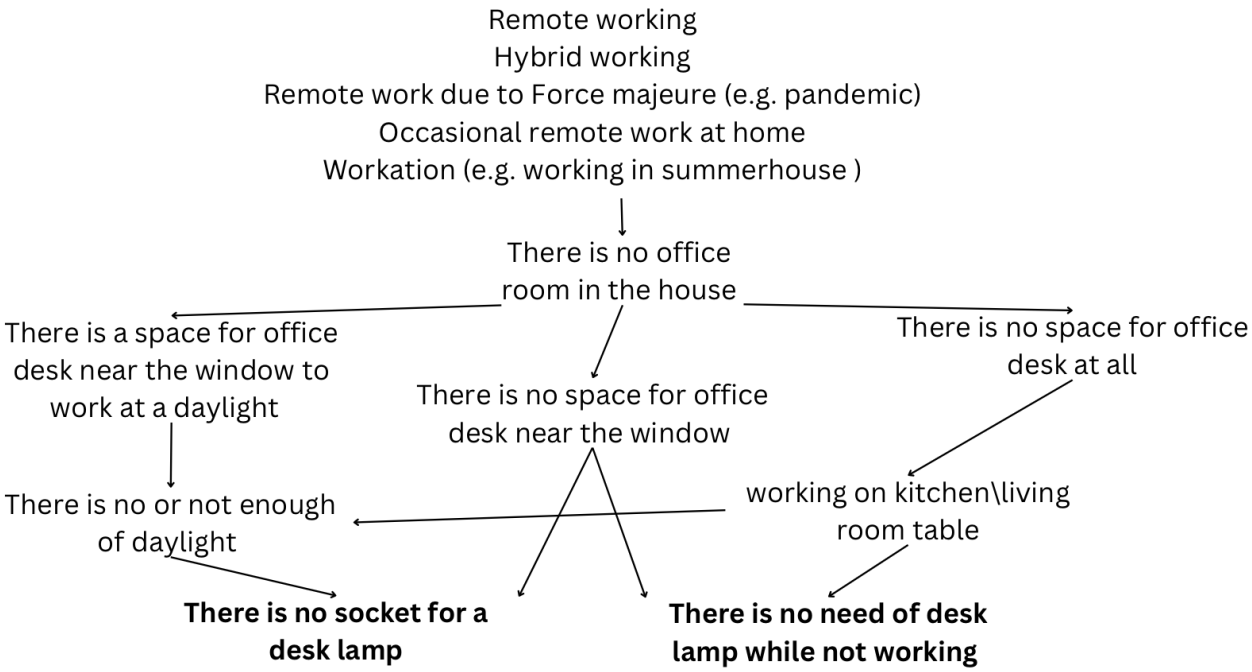
When asked about the challenges they face, 18 people (37.5%) claimed not to face any. However, 12 people (25%) faced challenges such as insufficient or no daylight. Notably, 10 people (20.8%) struggle with poor lighting for video conferencing, and eight people (16.7%) struggle with the distance to a socket for plugging in their desk lamp. Additionally, 11 people (22.9%) experience glare.

Among those who use a desk lamp, most of them (22 people, or 45.8%) use a lamp with an adjustable arm, while 6 people (12.5%) use the function of temperature adjustment.

To understand market preferences, I asked participants which properties are most important to them. For 21 people (44.7%), functionality (the ability to adjust) was the most important aspect. 4 people (8.5%) claimed that playfulness and not reminding a traditional desk lamp were the most important features. However, 22 people (46.8%) said that both properties are very important to them.

Conclusions

Overall, the survey results provide a valuable overview of the working and studying conditions of remote workers and students in Europe. The data shows the common lighting conditions and challenges experienced by respondents, along with their preferences for desk lamp features. This survey also helped me visualize the scenarios of remote working individuals, who does not have a home office room (Picture 8).



Picture 8 - the scenarios of people who work remotely and does not have a home office room

RESEARCH PHASE 4. MARKET REVIEW

In this chapter, I will analyse existing desk lamps available in the current market. The products will be reviewed based on the requirements that have been gathered throughout the research process, and their suitability for various scenarios will be examined. This comprehensive evaluation will provide valuable insights into the strengths and weaknesses of existing solutions, helping to develope my desk lamp.

The products are chosen by various websites recommendations and people review in blogs and forums. Products will be analysed according to 4 categories. First one - technical lighting requirements. For paper work: Minimum illuminance of 500 lx, Color temperature from 3000 to 3500 K, CRI minimum 80. For computer work minimum illuminance 300 lx, CRI 80. The second category is adjustment, categorised to dimming, color temperature adjustment and light direction adjustment. Third category is for scenarios, like video conferencing and absence of socket around (need of portability). The last category is to describe design if it is functional, playful or both (Picture 9).

						
		Tolomeo by Michele De Lucchi for Artemide	**Forsa by IKEA**	**Dyson Solarcycle Morph**	**Nova by Humanscale**	**Mini lamp by On Fire**
Lighting requirements	Illuminance	Too low	Depends on bulb	Yes	Yes	Not described
	Color temperature	Yes	Depends on bulb	Yes	Yes	Not described
	CRI	Yes	Depends on bulb	Yes	Yes	Not described
Adjustment	Dimming	Yes	No	Yes	Yes	Yes
	Color temperature adjustment	No	No	Yes	No	No
	Light direction adjustment	Yes	Yes	Yes	Yes	Limited
Scenarios	Video conferencing	No	No	No	Yes	Yes
	Portable	No	No	No	No	Yes
Design	Funcional	Yes	Yes	Yes	Yes	
	Playful					Yes

Insights

Since light direction adjustability is crucial, only this type of lamps were chosen. While looking for products to analyse I found that there is almost no lamps in the market that are adjustable in lighting direction and portable.

Tolomeo by Michele De Lucchi for Artemide had adjustable light direction and dimming capabilities, but didn't provide sufficient brightness and color temperature adjustment. Forsa by IKEA was functional with adjustable light direction, but relied on the bulb for meeting lighting requirements and lacked dimming and color temperature adjustment.

Dyson Solarcycle Morph performed well in meeting lighting needs with dimming and color temperature adjustment options. However, it didn't address video conferencing or portability requirements. Nova by Humanscale also met lighting needs and offered dimming, but lacked color temperature adjustment and is not portable.

The Mini Lamp by On Fire stood out for its playful design, dimming capabilities, and portability. However, it had limited light direction adjustment options and did not provide information about its performance in meeting lighting requirements. There is a risk of a low LED quality while the information is not accessible, also the price significantly low (16$).

In conclusion, the market review showed that there is a place in the market for a portable, adjustable in position and temperature, dimmable, and high quality illuminance lamp.

Lighting source choice

For my desk lamp as a lighting source I chose LED due to several reasons. LEDs are energy-efficient, resulting in lower electricity bills. They have a longer lifespan, reducing the frequency of replacements. LEDs generate less heat, enhancing safety. Additionally, LEDs offer customizable lighting options, such as adjustable brightness and color. They provide clear and vibrant lighting, reducing eye strain. In summary, choosing LEDs in a lamp guarantees energy savings, durability, safety, and improved lighting performance.

Bulb can be replaced in the lamp, but can LED?

While bulbs are generally easier for users to replace themselves, LED plates are also becoming more standardized and readily available in the market. This means that repair shops can easily find and replace LED plates, not just relying on the original luminaire manufacturers' list. However, it is important for the luminaire manufacturer to ensure easy access to the LED without damaging the body of the luminaire.

Battery improvements for portability

Nowadays, it is easier to create a portable luminaire that can operate for longer periods because of improvements in battery efficiency and size reduction. The progress in battery technology has resulted in the creation of compact and high-capacity batteries that are well-suited for powering portable lighting devices. Moreover, the growing demand for portable electronics has made batteries more accessible in the market, making it easier to find suitable options for compact portable luminaires.

Materials used in desk lamps

Desk lamps and portable lamps are made using different materials to make them strong, functional, and attractive. Metal alloys like steel, aluminum, and brass are often used for their durability, these are mostly used for non-portable lamps. Plastic is lightweight and flexible, making it suitable for shaping lamp shades or reducing weight for portability. Glass is used for lamp shades to let light pass through and add decoration, however plastic diffusers are also widely used for diffusing light and securing from glare.

GENERAL CONCLUSIONS

Based on the research conducted in this thesis, it is clear that good lighting is essential for a productive and comfortable workspace, particularly for remote workers and students. Lighting requirements for desk lamps vary with a minimum illuminance of 500 lx needed for paper work and 300 lx for computer work. Color temperature should be between 3000 to 5000 K, and CRI should be at least 80.

The rise of remote working and the shift to virtual meetings has increased the need for adequate lighting for video conferencing. Desk lamps with adjustable light direction, dimming capabilities, and color temperature adjustment are crucial for creating visual comfort and productivity during virtual meetings.

The survey conducted in this research provided valuable insights into the working and studying conditions of remote workers and students in Europe. Respondents highlighted the need for portable desk lamps with adjustable light direction, along with lighting for video conferencing.

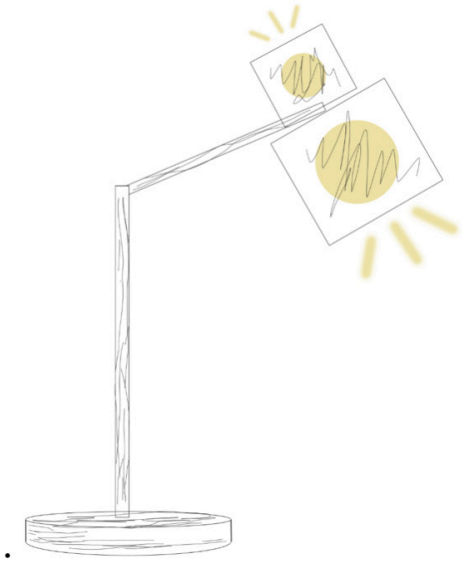
The market analysis showed that there is limited availability of portable desk lamps with adjustable light direction that meet all lighting requirements. While some products offer dimming and color temperature adjustment, they may not meet all lighting requirements or be suitable for video conferencing.

In conclusion, this research highlights the need for a portable desk lamp that meets mentioned requirements for remote workers and students. Such a desk lamp would be a valuable addition to the market, providing a functional and comfortable workspace for individuals working and studying from home. And finally, the goal is to move away from the typical desk lamp design and create a sense of playfulness in the design.

DESIGN PHASE

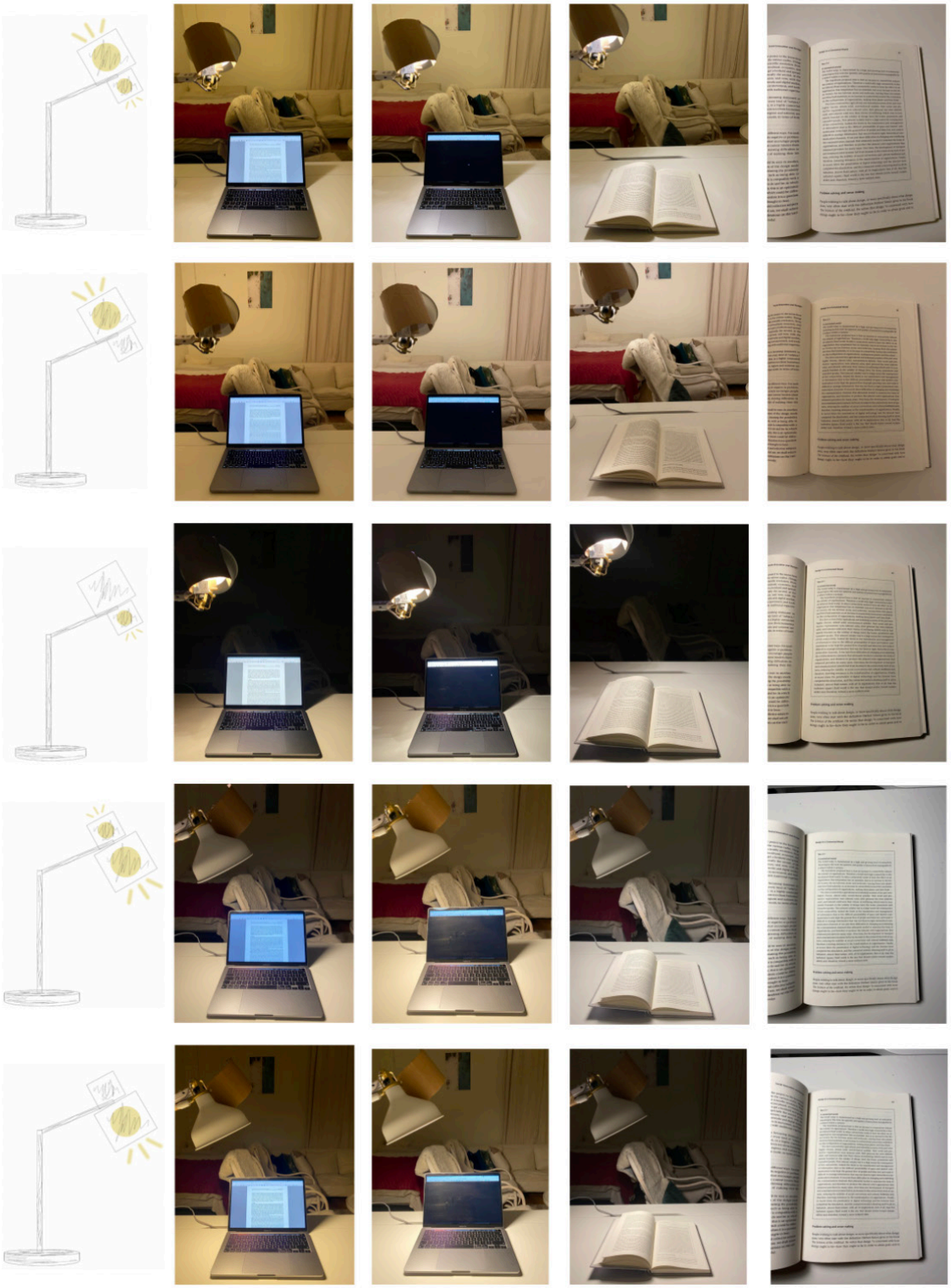
IDEA VOL. 2

After conducting research and gathering requirements and user needs, I updated my Idea Vol. 1 (creating a desk lamp) with a feature to have two lighting sources in one luminaire. One for paper work (task lighting), and another for computer work (ambient lighting). Both lighting sources would also work as ambient lighting around while using task lighting (Picture 10).



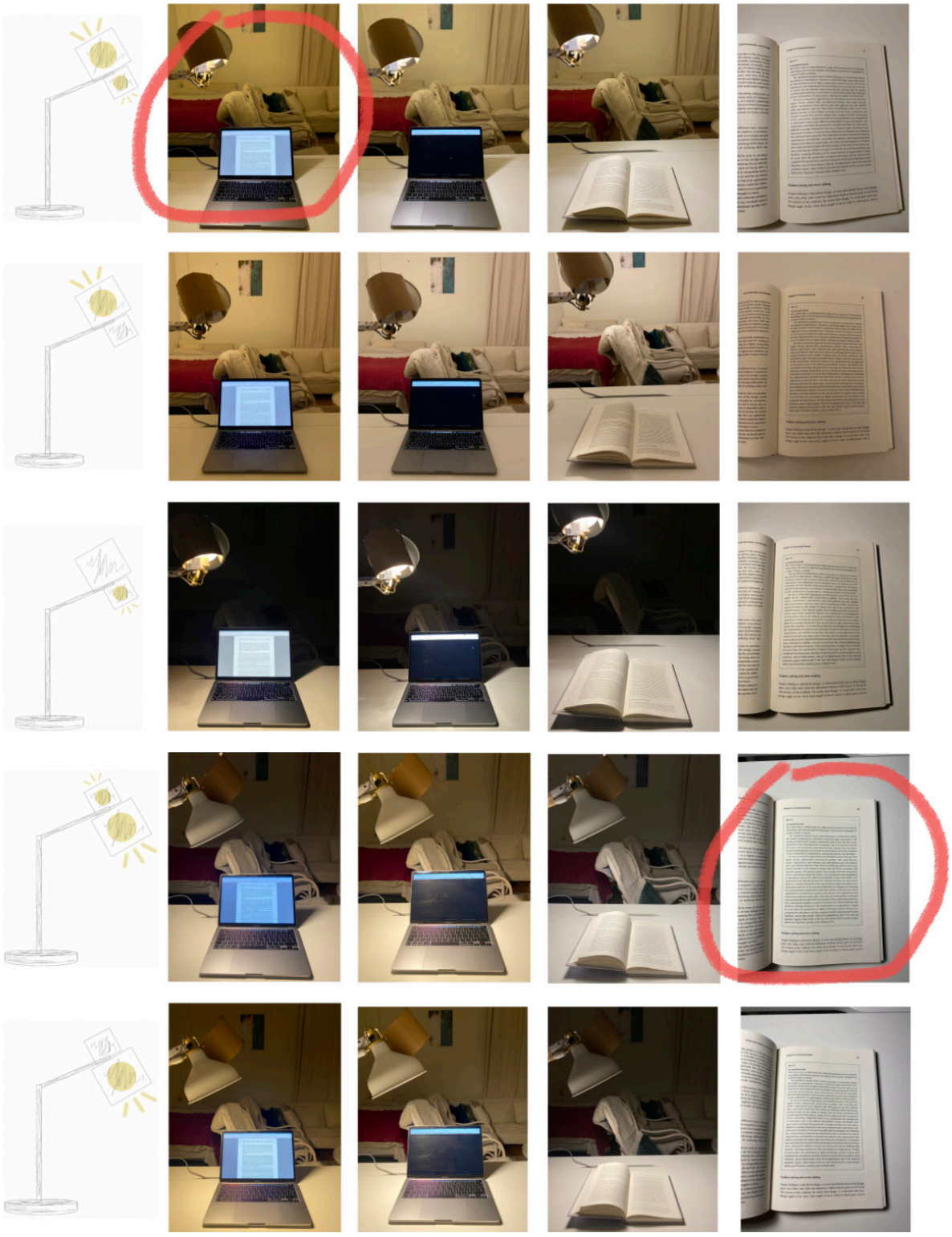
Picture 10 - Idea vol 2. Two light sources

I began by taking my current desk lamp and attaching a lower illuminance light source, and then testing various scenarios. This included using higher illuminance for computer and paper work, then using lower illuminance for both, as well as using only one light source and both light sources together (Picture 11).



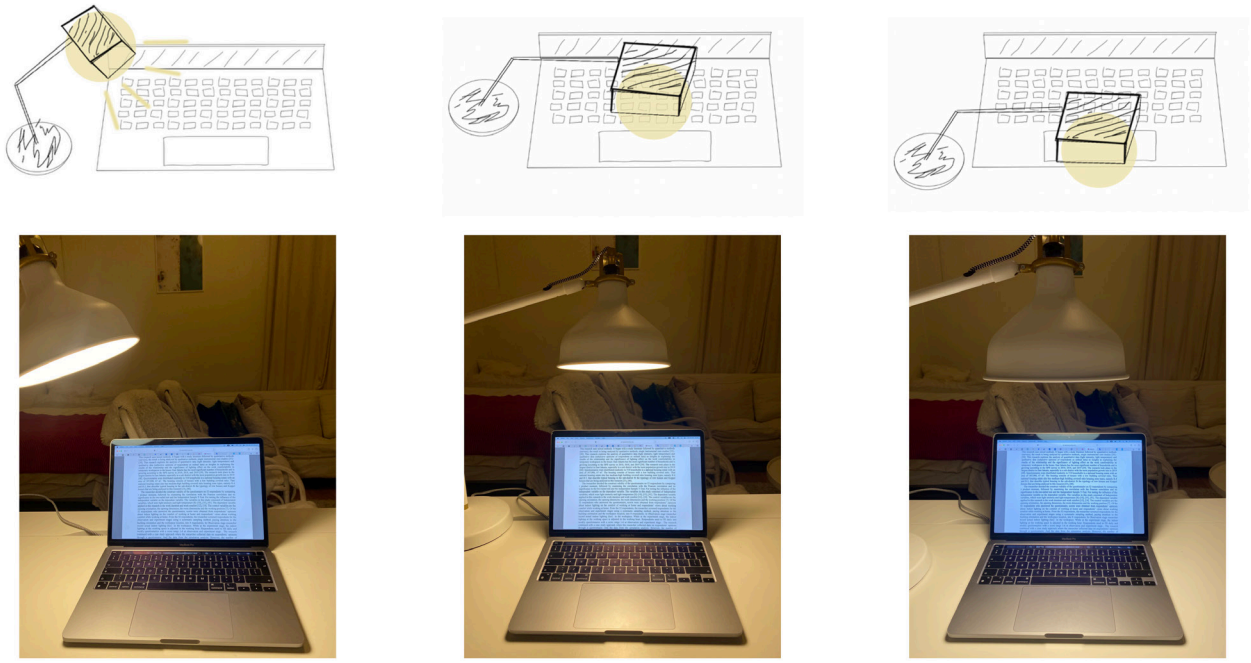
Picture 11 - testing personal lighting preferences for different tasks

Testing my personal preferences on lighting only confirmed previous requirements and recommendations. For example, lower illuminance felt better for computer work, while higher illuminance felt better for paper work. It was also more comfortable to have two lighting sources (Picture 12).

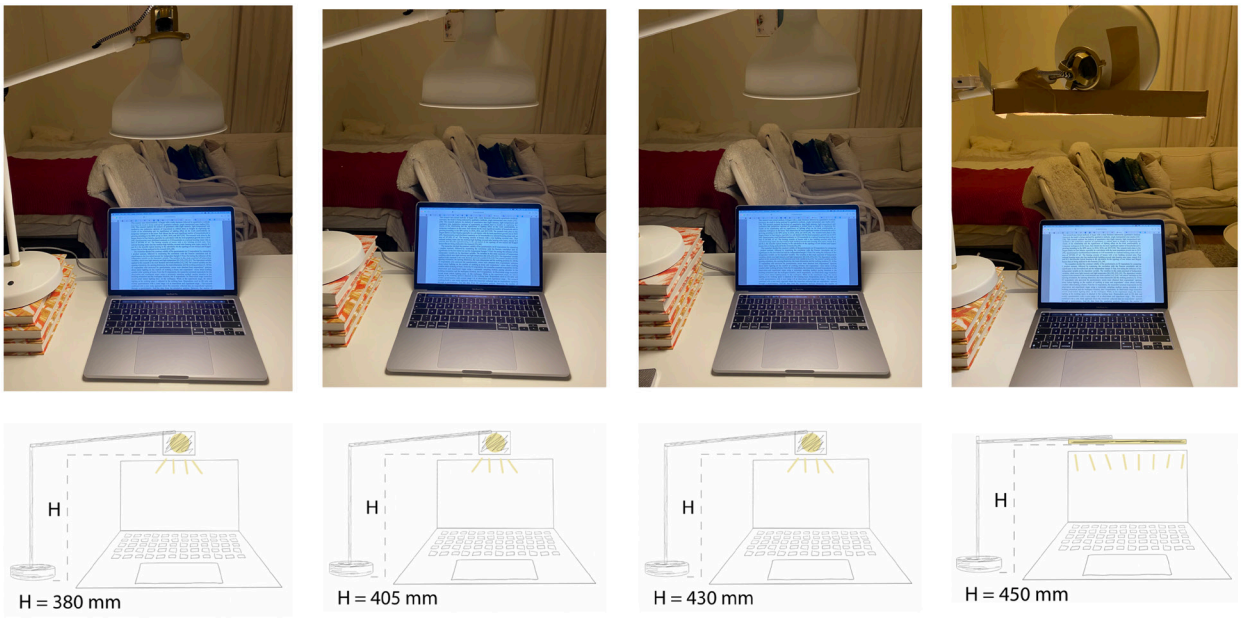


Picture 12 - personal preferences for paper and computer work

In addition, I played around with the position of the lighting source, adjusting it according to the width and length of the table (XY position) (Picture 13), and trying to find the most convenient height for the lighting source (Z position) (Picture 14).



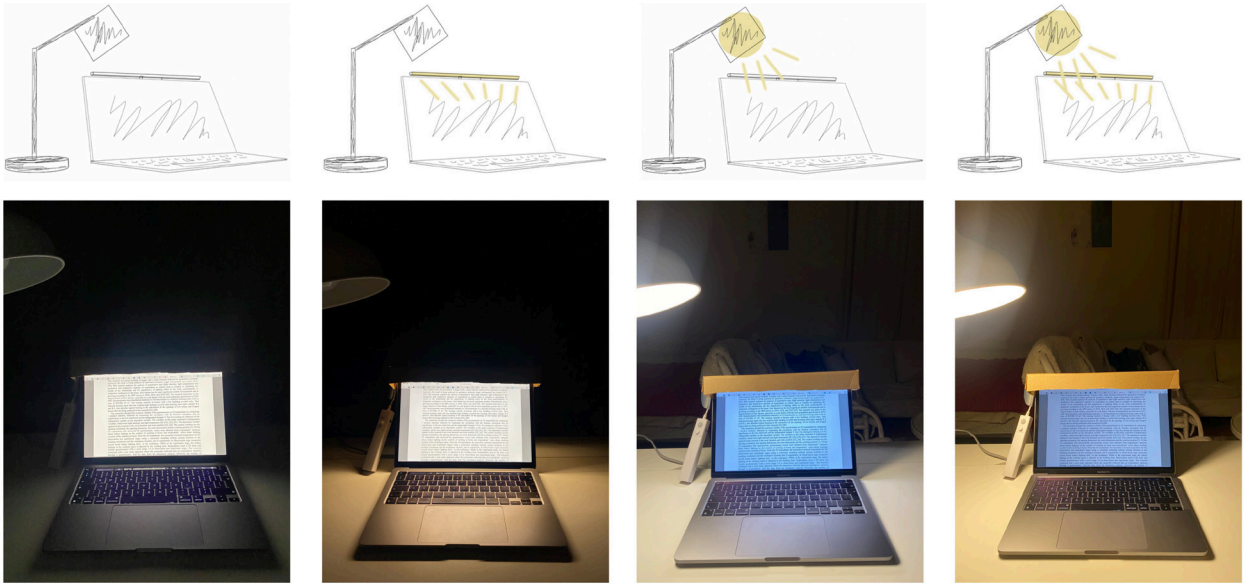
Picture 13 - testing XY position of illumination



Picture 14 - testing Y position of illumination

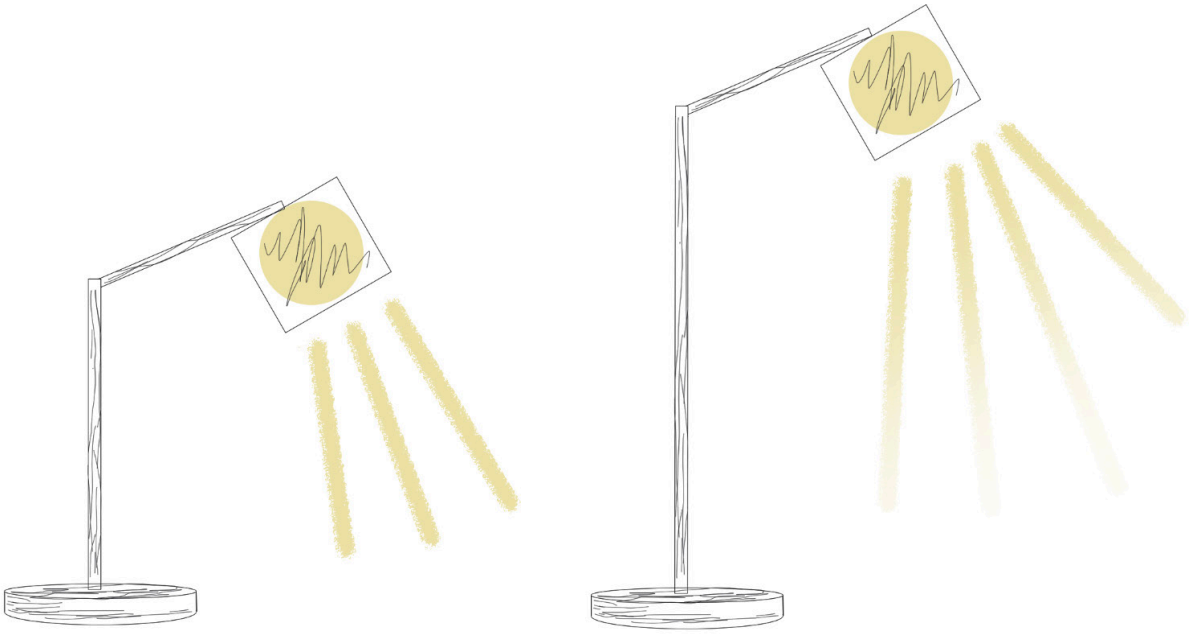
I also explored using a monitor bar (Picture 15) for computer work, and since I had a flexible LED strip, I tested this scenario as well (Picture 16) . This involved using only the monitor bar and then combining it with the desk lamp. I also experimented with combining the monitor bar with lighting directed outwards from the screen.

Picture 15 - monitor bar



Picture 16 - testing task lighting and monitor bar

After testing various illuminance levels, positions, and scenarios to understand what feels best personally and to discern the differences between ambient and task lighting, I realised that the higher I placed the task lighting, the more ambient it became (Picture 17). As a result, I abandoned the idea of having two separate lighting sources and instead pursued the concept of a single lighting source that could be positioned higher to provide ambient lighting.



Picture 17 - realisation... Is task lighting also an ambient lighting, when placed in higher position?...

IDEA VOL. 3

Integrating the information gathered from my research, particularly the survey, I established several essential requirements for my lamp:

- TASK (AMBIENT) LIGHTING which is achieved by one lighting source and adjusted by the adjustable arm and dimming and temperature adjustment;

-ADJUSTABLE (HIGH ENOUGH) is a must in order to shift from task lighting to ambient lighting;

-COMPACT

-CORDLESS

Since the market analysis revealed a lack of portable and adjustable desk lamps, I primarily focused on making the lamp compact. Additionally, I wanted this lamp to be useful for video conferencing, so I chose a ring-shaped LED to provide better light dispersion, which is inspired by LED ring lights that influencers use. I mainly considered the scenario where people do not have a dedicated desk and therefore do not need a desk lamp when they are not working. Also, my goal was to create a functional desk lamp that also serves as an aesthetically pleasing and playful decorative piece.

Picture 18 - primar sketching

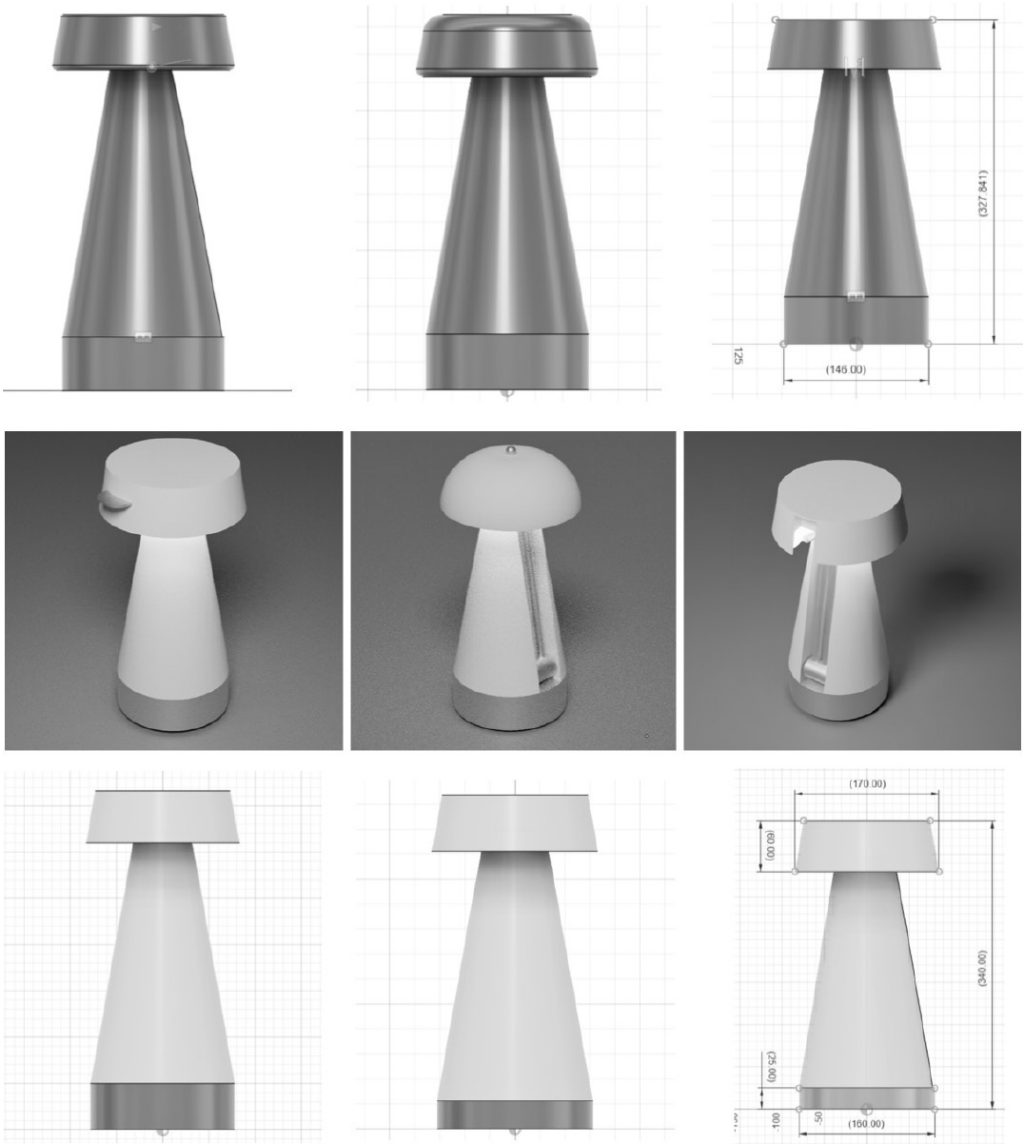
Searching for shape and materials

Due to the requirements I established for myself, the lamp's function dictated its shape, resulting in certain constraints.

First and the most important, I needed to design a compact lamp that could be easily stored when not in use as task lighting. This required having a foldable or extendable arm that could seamlessly integrate with the lamp's main body. Additionally, since the lamp's arm would need to be adjustable, stability was a major concern. Furthermore, the body of the lamp had to accommodate the battery. As a result, I initially chosen a cone shape as a suitable solution. I also chose metal as the material for the lamp's surface to provide additional weight and improve stability (Picture 19).

Picture 19 - renders In metallic surface

While working on the 3D modelling, I noticed something when I picked up my laptop. Its metallic surface felt unpleasant to hold, as it was much colder than the surrounding room temperature. This insight led me to consider that users might have a similar experience with my lamp. As a result, I decided to replace the material of the cone and head with plastic, while leaving the metallic base to maintain weight at the bottom for better stability, also as a place for the battery (Picture 20).



Picture 20 - 3D modelling when a body of the lamp is made of plastic

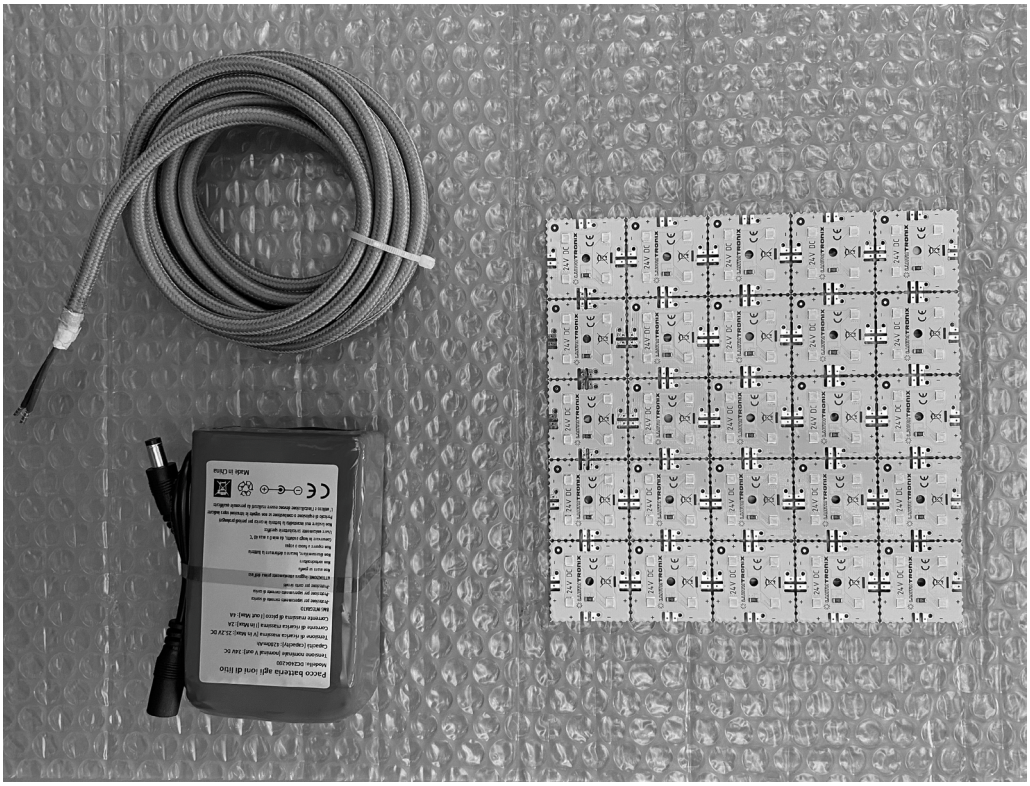
Components

LEDs were chosen as the lighting source for their energy-efficiency, longevity, and provision of consistent illumination was. The intention is to have a custom-made LED ring plate for the final product. However, for the prototype, a MiniMatrix 24V 4000K 85 CRI 1100 lm will be used.

A lithium battery was selected for its high energy density, long life, and lightweight properties. For the final product, a battery with at least 9000mAh capacity is needed to ensure approximately 8 hours of unplugged working. However, for the prototype, a 24V 4200mAh battery will be used.

To prevent glare, a specialized plexiglass designed for use with LEDs will be used, featuring a 72% light transmission rate.

In the final product, there should be both a dimmer and a temperature adjuster. However, in the prototype, only the dimmer will be a functioning button, as the used LED does not support temperature adjustment (Picture 21).



Picture 21 - components that are used for prototyping

A STORY OF A BIRD

Even though I had considered the ergonomics of the lamp, including the space for components and stability, I felt confident about its purpose but was still not entirely pleased with its appearance.

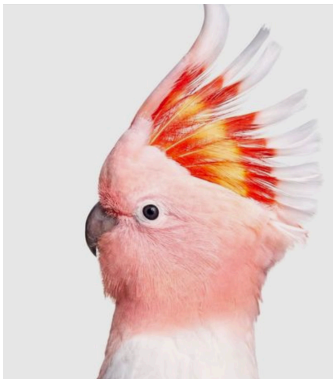
Whenever I feel overwhelmed, I often take a walk, and I did so this time as well. By chance, an advertisement for an open bird-themed exhibition (Picture 22) in Lund caught my eye. Intrigued, I decided to visit. While being at the exhibition, I realized that there are some connections between birds and my lamp.

Picture 22 - Photos taken in the exhibition that I visited

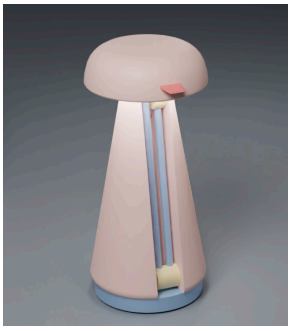
Birds are free to fly in any direction, just as my lamp is portable. Additionally, the extension of the lamp's arm is reminded me a flamingo extending its neck (Pictures 23-26). However, the main difference is that birds are alive, while my lamp lacks that sense of vitality.

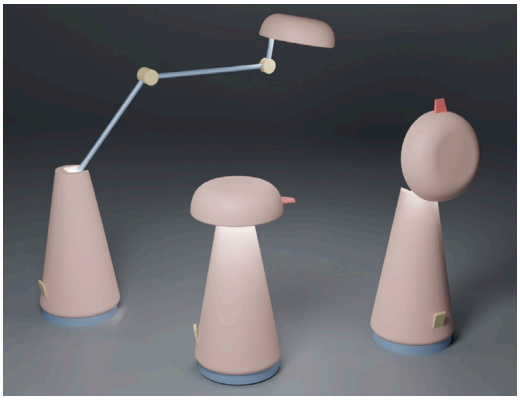
Picture 23 and 25 - Flamingos; Picture 24 and 26 - my desk lamp

After the exhibition, I started to look for pictures of various bird species and their color palettes (Picture 27). As a result, I added two bird-inspired details that also served functional purposes: a beak-like handle for extending and adjusting the lamp's head, and a tail that closes the charging port (Picture 28).



Picture 27 - Inspiration of the following lamp designs





Picture 28 - design updates

FINAL DESIGN

In the final design, I changed the shape of the round cone to a tapered rectangle cone, because the battery's shape is usually rectangular, making the space on the sides inefficient. As a result, the lamp became even more compact. The color choices were inspired by various bird species. Furthermore, I decided to remove a "tail" since the port closing feature might not work aesthetically while plugged in and also complicates the manufacturing and assembling (Picture 29). Furthermore, I named the luminaire TWEETLIGHT, which represents inspiration of the bird.

Picture 29 - further design updates

Picture 30 - final design (prototype) with extended arm

Final design has two buttons (Picture 32) - one for turning on and dimming the lamp, other for adjusting the color temperature. The beak (Picture 31) and the buttons are the same color since these parts are used for adjusting the lighting. The metal base and the head with LED are in different colors to highlight different functions they do.

Blurred diffuser is used for securing from eye strain during self-illuminance while video conferencing (Picture 34). Charging port is open in the back of the lamp (Picture 33).

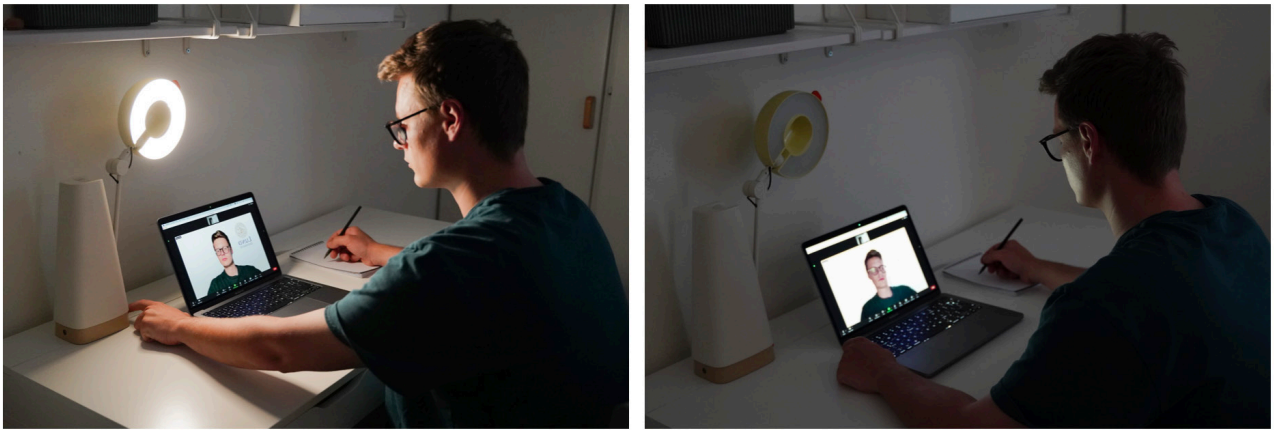
Picture 31 - beak

Picture 32 - buttons

Picture 33 - charging port

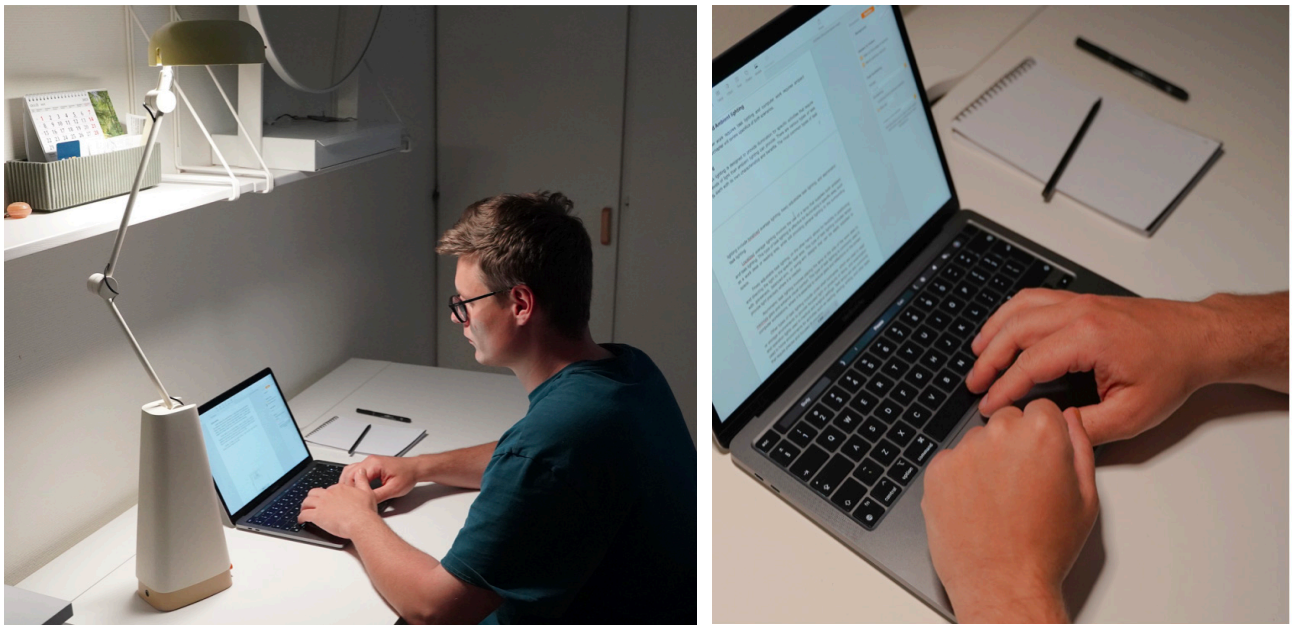
Picture 34 - diffuser

After creation of the prototype, I have tested the lamp for video conferencing and it didin't cause eye strain. Also, significantly improved visual quality of the video call (Picture 35).



Picture 35 - lamp testing for video conferencing

Furthermore, I have tested the luminaire for computer work and the results were positive be not causing the glare (Picture 36).



Picture 36 - lamp testing for computer work

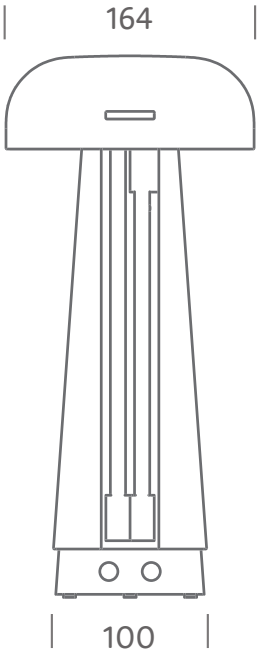
While not being in use as a task lighting, the TWEETLIGHT can be used as a decorative lighting (Pictures 37.1 and 37.2).

Picture 37.1 - TWEETLIGHT used as a decorative lighting

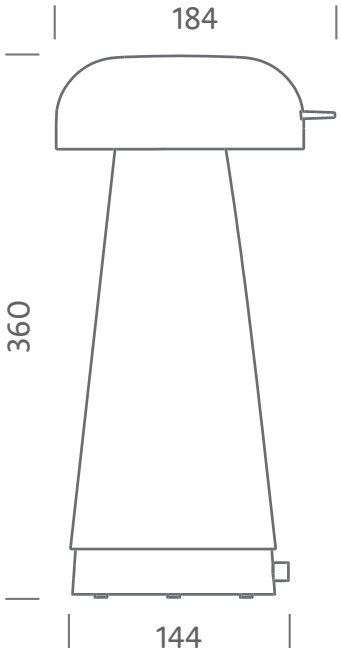
Picture 37.2 - TWEETLIGHT used as a decorative lighting

Picture 37.3 – TWEETLIGHT used as a decorative lighting

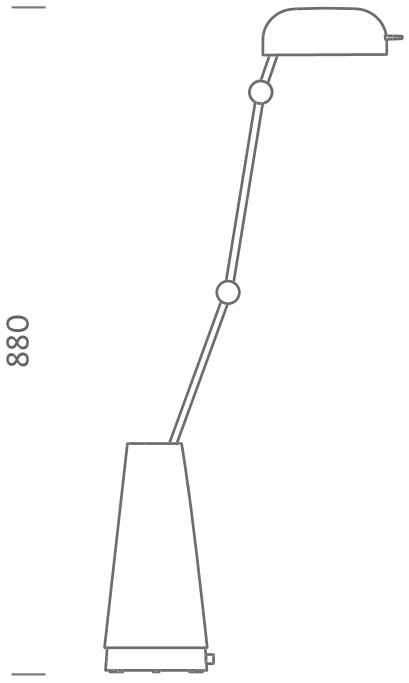
Picture 37.4 – TWEETLIGHT used as a decorative lighting



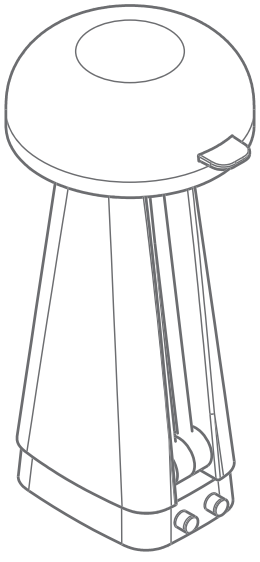
M 1 : 5



M 1 : 5



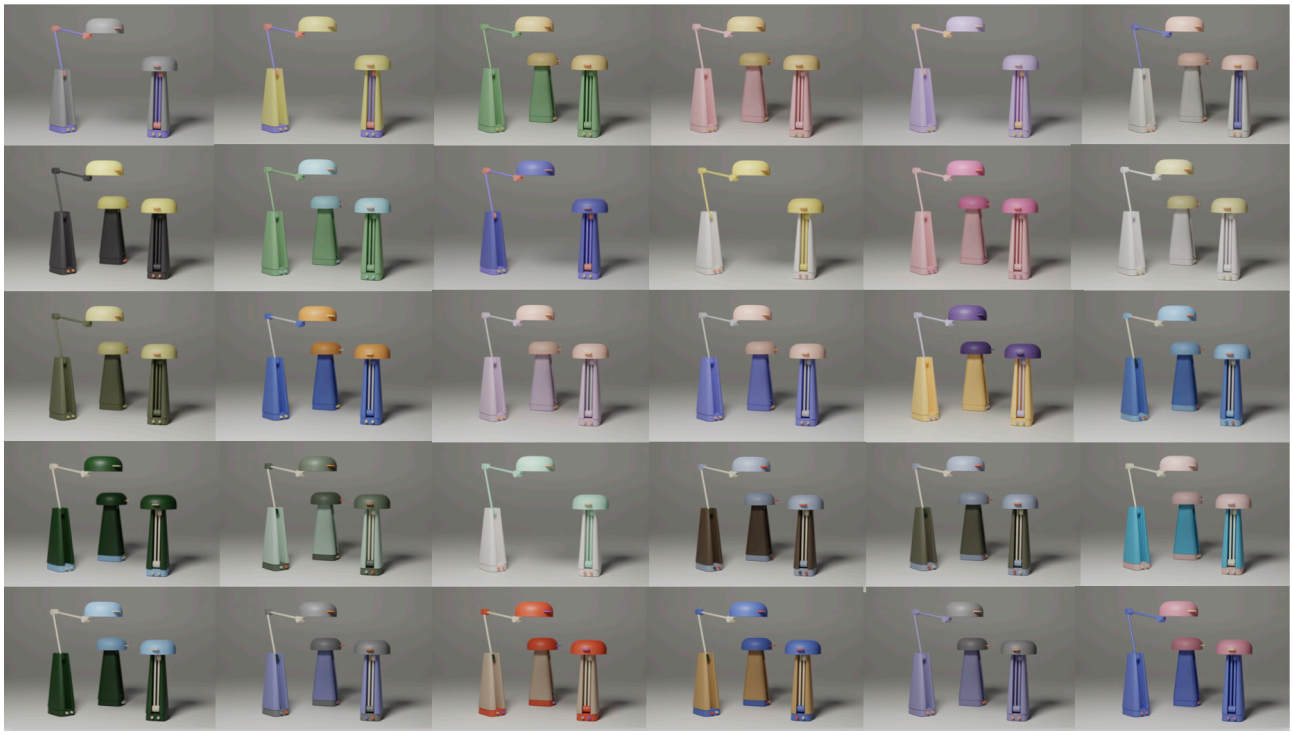
M 1 : 10



Picture 37.5 - final design (prototype)

Color choice

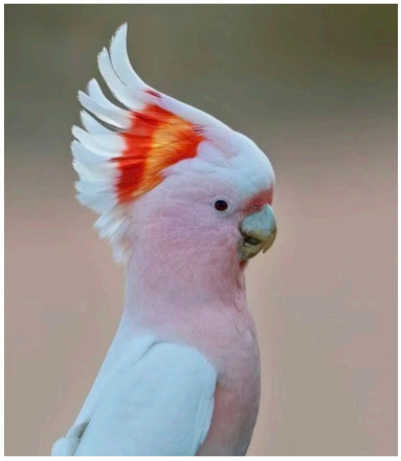
Colorways were explored by looking into various birds (Picture 38).



Picture 38 - considered colorways inspired by birds

Final color palette was set by having 3 playful options and 3 safe options (having black, white and grey colors). Every colorway was created with inspiration by specific bird (Pictures 39 - 51).

Picture 39 - lamp inspired by Yellow Cockatiel; Picture 40 - Yellow Cockatiel



Picture 41 - lamp inspired by Major Mitchell's Cockatoo; Picture 42 - Major Mitchell's Cockatoo

Picture 44 - lamp inspired by New Zealand Bellbird; Picture 45 - New Zealand Bellbird

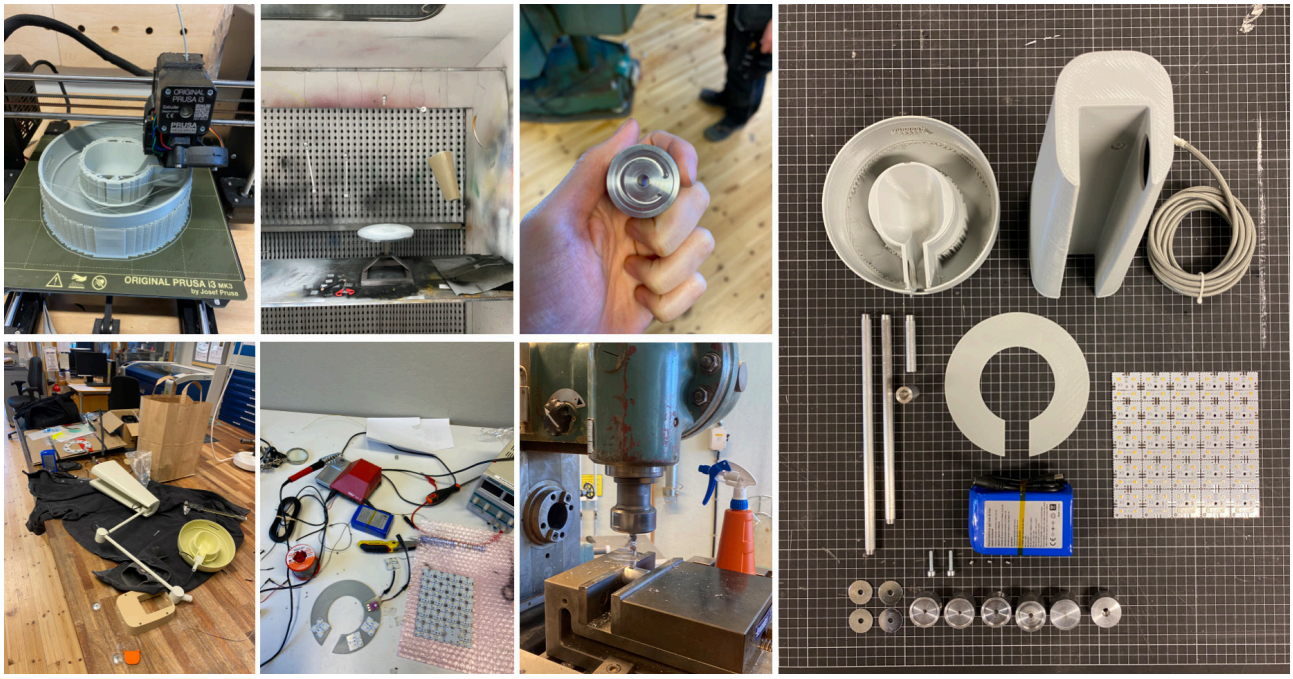
Picture 46 - lamp inspired by Magpie; Picture 47 - Magpie

Picture 48 - lamp inspired by White Cocka-too; Picture 49 - White Cockatoo

Picture 50 - lamp inspired by Snow Bunitng; Picture 51 - Snow Bunitng

PROTOTYPING

The lamp was made in the IKDC building with a tremendous help of the workshop guys (Picture 53). Aluminium base was CNC milled; plastic body, head, beak and buttons were 3D printed. Arm was made of aluminium tubes. Joints were made of solid aluminium stripe and milled with the machines. Washers and threads were used. LED plates were soldered and connected to the dimmer and battery by myself. Plexiglass was laser cut. Visible parts were spray painted by me (Picture 52).



Picture 52 - prototyping process

Picture 53 - me with the workshop guys

USAGE POSSIBILITIES

The luminaire was designed for people of all ages who work or study at home. The playful and monochromatic colors were chosen to appeal to different age groups and personal color preferences. In addition to being used for video conferencing, the luminaire can also be used for activities like applying makeup. The luminaire's portability allows it to be used for activities like board games or puzzles, which are often enjoyed in spaces such as the living room, kitchen, or even on the floor

SELF REFLECTION

The first challenge I encountered from the very beginning was the ideation and identification of the problem. Despite having previous experience in creating luminaires and a deep understanding of the market, it was still a difficult process to develop another luminaire when there were already so many existing options available. However, our daily habits and needs are constantly evolving, which means designers like myself need to continually review and update design solutions to improve the quality of everyday life. As a result, I decided to modify a traditional desk lamp and create a foldable and movable luminaire with additional features, such as lighting specifically designed for video conferencing, which has become a new requirement in today's computer working culture.

Another challenging aspect of the project was the engineering involved in achieving foldability. The need for adjustability with a foldable arm and portability with a battery posed constraints on the lamp's shape, resulting in a design that prioritized functionality. However, finding effective solutions for the joints of the movable parts and ensuring efficient assembly of all components, including the lighting elements, while maintaining a compact form was a tough task. Fortunately, with the assistance of the workshop team, I believe I was able to achieve a satisfactory result.

Ultimately, this project was deeply meaningful to me as a creator, as it reinforced the profound connection between humans and nature. Creating a desk lamp may not seem directly connected to nature, but the creative process has a way of teaching us unexpected lessons in unexpected ways. I never anticipated that a bird-inspired design would make the luminaire more visually appealing and relatable to humans, while also incorporating necessary ergonomic details. The transition from a rigid industrial design to the lively and playful TWEETLIGHT was a creative and most rewarding journey.

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PICTURE REFERENCES

Picutre 4 - Osterhaus, W., Hemphala, H., & Nylen, P. (2015) Illuminance recommendation for computer work https://content.iospress.com/articles/work/wor2163

Picture 5 - Eurostat, 2022 https://ec.europa.eu/eurostat/en/web/products-eurostat-news/-/ddn-20221108-1

Picture 7 - LED ring light https://www.pocket-lint.com/sv-se/prylar/deals/prime-day/161859-uppgradera-din-streamingkvalitet-med-dessa-fantastiska-elgato-erbjudanden/

Picture 15 - Monitor bar https://www.joom.com/sv/products/63ad35494185750172e433b6?variant_id=63ad35494185753372e45152

Picture 23 - Flamingo https://cozyflorida.com/2021/05/31/announcement/

Picture 25 - Flamingo https://www.pinterest.com/pin/539446861587383304/

Picture 27 - Inspiration bird https://www.pinterest.com/pin/833799318495106303/

Picture 40 - Yellow Cockatiel https://www.thesprucepets.com/cockatiels-as-pets-1236728

Picture 42 - Picture 42 - Major Mitchell's Cockatoo https://www.pinterest.com/pin/314055774019180469/

Picture 45 - New Zealand Bellbird https://www.flickr.com/photos/greaburn/7953296970

Picture 47 - Magpie https://www.pinterest.com/pin/479633429078680847/

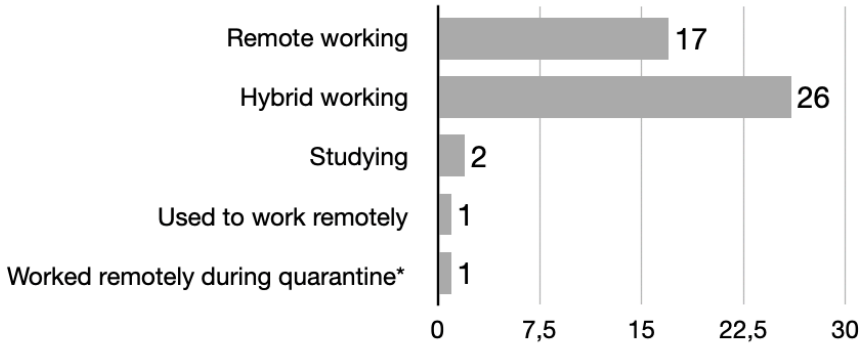
Picture 49 - White Cockatoo https://www.pinterest.com/pin/147915168990781498/

Picture 51 - Snow Bunitng https://www.pinterest.com/pin/470274386080507830/

APPENDIX

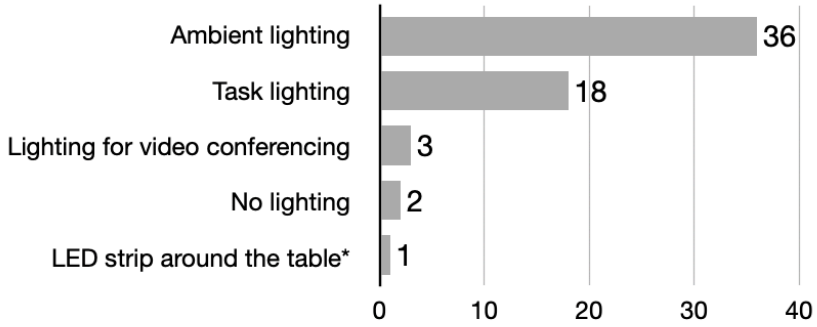
Anonymous survey. 47 participants. Answers marked with symbol * are the answers filled in by participants.

1. You are:

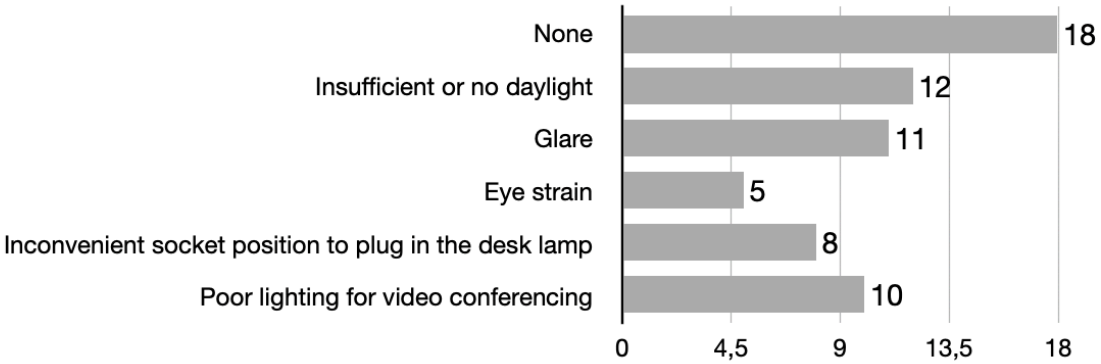


2. Your working place at home is:

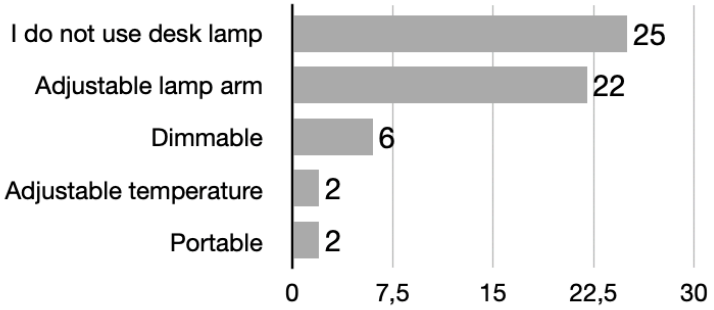
3. Lighting in your working place at home is: (few options possible)



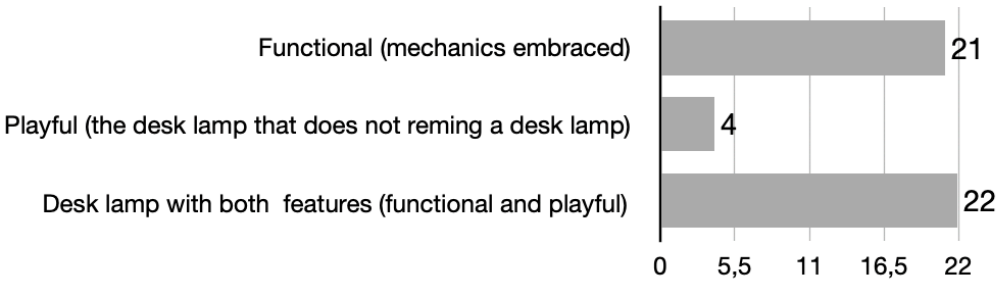
4. What are the challenges that you face in terms of lighting? (Few options possible)



5. If you are using desk lamp, what are the features?



6. What kind of design do you prefer for your desk lamp?



THANK YOU