DESIGN GUIDELINES THAT IMPROVE THE ONLINE RETAIL EXPERIENCE OF SMART LIGHTING PRODUCTS

Master Thesis
M.S. Design for Interaction
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Preface

With this project, two challenging yet exciting years at TU Delft come to an end. Looking back at the past two years, I have been working on the goal of creating meaningful designs for users. I gradually started to think about the rational logic of the design process from a result-focused designer.

To my excellent research team, thank you Maarten and Christina for your trust and guidance throughout this entire project. You are using your rich knowledge in the field of Design Research Methods and User Experience Perception to help me plan, analyze and summarize the user tests. Thank you for your feedback and critical questions, your kind words when I struggled, your dedication to making this my own project, and for helping me become a true designer.

To my company coach, Marisol, thank you for providing me with the opportunity to work on the project, always giving me guidance and positive encouragement. You impressed me with your personality and professionalism.

To the volunteers who participated in my studies, thank you for the time and energy that you gifted to this project. Your input truly guided this project and it would not exist without you.

To my mom, friends and friends' cats, thank you for your unconditional love and support.

Executive Summary

The Internet has significantly transformed the commercial world, becoming an essential platform where people gather information and make purchases. With the growing popularity of smart lighting products, it is crucial for online retailers to provide a seamless and user-friendly experience that promotes customer engagement and drives sales.

This report outlines the key challenges faced by customers when purchasing smart lighting products through different online presentations. With the user-centered approach and the report serves as an initial step in exploring the design aspects of online retailing pages for light products. By focusing on the user and light experience, this report aims to provide valuable insights into enhancing the design of these pages to better meet the needs and expectations of customers.

This project is guided by the following research questions: (1) Which aspects and how affect the use online experience? (2) How do they influence? (3) How to better present smart light products online?

In a quest to answer the above questions, this project conducted different user tests and studies and ended with a guidance. Based on the difference between the online and offline lighting scene presentation, the researcher invited 10 participants and started the first user test in which the following questions were studied:

1. How does the experience with the hue online representation differ from the real-world experience (regarding lighting and overall user experience)?
2. Which aspects affect the user's perception of online and offline experience? Images' style, quality, interaction way or other aspects?

From the first user test, the researcher learned that the difference between offline and offline experience is that offline can show more light levels and provide users with a sense of more control. According to the results of the questionnaire and interviews, users also put forward their requirements in terms of content, interaction and light experience.

Based on the first user test, the researcher developed four hypotheses to explore how different factors affect the experience and how design can be used to enhance the online product exhibit experience, and the second user test examined these hypotheses:

Hypothesis 1: The level of interaction will affect the online user experience. More interaction, better user experience.
Hypothesis 2: The level of interaction will affect the user's judgment of the light. With more interaction, users rate the light experience higher.
Hypothesis 3: The factors of the image content(furniture style, character in the photo, etc.) will affect the online user experience.
Hypothesis 4: The factors" of image content(furniture style, character in the photo, etc.) will affect the user's judgment of the light.

After receiving 20 valid results, in a second user study it was found that (a)higher interactivity of the prototype, better user and light experience, (b) abstraction stimulate the user's imagination of the product use scenario.

Based on user testing and analysis, the researcher summarized guidance that help designers have design direction when they start designing, or review existing designs. The guidance focuses on these three directions:

Better visual content
Interactive product display
Immersive light vibe

Through literature insights, user tests and a design guidance, this project hopes to contribute to designing a better online retailing light and user experience of smart lighting products.

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CHAPTER 1

Introduction

In this first chapter, I give an introduction into the project of designing an intervention that improve the online retail experience of smart lighting products. I cover its relevance, the challenges that are faced and the current research status. I will also present the aim and scope of the project, as well as introduce the main research questions.

1 Introduction

1.1 ONLINE RETAILING

The Internet plays a vital role in revolutionizing the commercial world, people get used to gathering information and making purchases on the Internet. European online business consumer sales have experienced significant growth in recent years, driven by the increasing popularity and accessibility of e-commerce platforms. According to a report published by the European Commission in 2022, online sales in the European Union reached €717 billion in 2021, representing a 25% increase compared to the previous year. Meanwhile, a lot of in-depth research has been working on the nature and effectiveness of online retailing. Vast work exists focuses on customer intention to purchase behavior, such as Stimulus–Organism–Response (S–O–R) framework (Eroglu et al., 2001) which explains the process through which external stimuli influence an individual's internal processes and subsequently lead to observable responses. From the Purchase intention model(Hakim et al.), the perceived quality of product effect on customer value, it indicates that the perceived quality of a good product will increase customer value.

1.2 COMPANY PROJECT

This project collaborates with the Smart lighting brand Philips Hue. The emergence of light emitting diodes (LEDs) has introduced many new possibilities to vary the light in a space (Stokkermans et al., 2017). After the First Wave of solid-state lighting, where combinations of blue LED chips and phosphors generate acceptable white light efficiently, but leave the full electronic potential of LEDs largely untapped (Karlicek, 2012). This phase began around the early 2000s when LEDs started gaining traction as a viable alternative to traditional lighting sources like incandescent and fluorescent bulbs. However, the initial LEDs had limited luminous efficacy, were relatively expensive, and offered limited options in terms of color temperature and light output.

The smart lighting system is created with the new control and communications methods in Second Wave. The Second Wave of solid-state lighting represents the stage in which LED technology has significantly progressed and become more widely adopted for various lighting applications. This wave is characterized by significant advancements in LED efficiency, output, color quality, and cost-effectiveness.

Philips Hue is a consumer LED lighting system that can be controlled from a smart device. The Hue system was released in October 2012 as an Apple Store exclusive. And The product Hue Bridge is the central device for controlling home devices. The latest system allows to control a home's lighting via a mobile app on a smartphone or tablet computer, but can also be controlled by a voice control function and it’s often for ambiance, security, and entertainment use at home.

The Philips Hue system consists of a range of LED bulbs, light strips, fixtures, and accessories. These lights are designed to be compatible with the Hue ecosystem and offer different features such as white light, various shades of color, dimming capabilities, and different form factors to suit different lighting needs. Colorful and brilliant light colors and intelligent control system is the main selling point of Philips hue.

1.3 ONLINE TOUCH POINT

The Hue website and Amazon store are the main entrance for Philips Hue online purchasers . Images and videos are widely used on online websites to give users a more elaborate experience. The difference between design in a Hue website and an Amazon page can be observed in various aspects. Philips hue keeps a consistent brand image across platforms, thus, the most significant difference will be the layout of those two websites. Hue website often have more flexibility in terms of layout and structure. It can showcase unique design elements, custom navigation menus, and distinct sections tailored to the brand's identity and content. In Hue website, users can interact with the components and switch the light scene(combination of the lights). While Amazon pages follow a standardized layout and structure across the platform to ensure familiarity for users and they are not allowed to have as much freedom in interaction aspect. Therefore, users often find that there is often a more engaging user experience on the Hue website, while on the Amazon page, it prioritizes seamless and efficient product discovery, comparison, and purchase processes. This report will examine the common features of these two platforms and conclude with design guidelines for the e-commerce experience of smart light products.

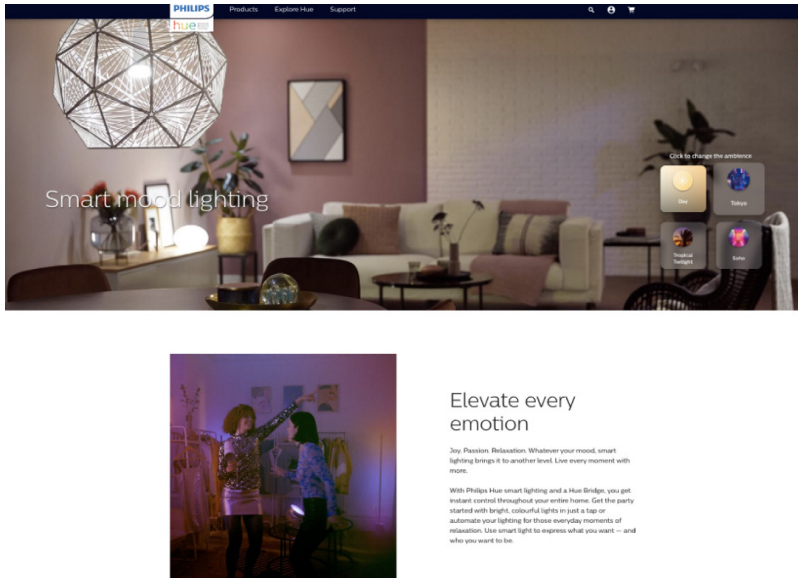


Fig.1 Hue website

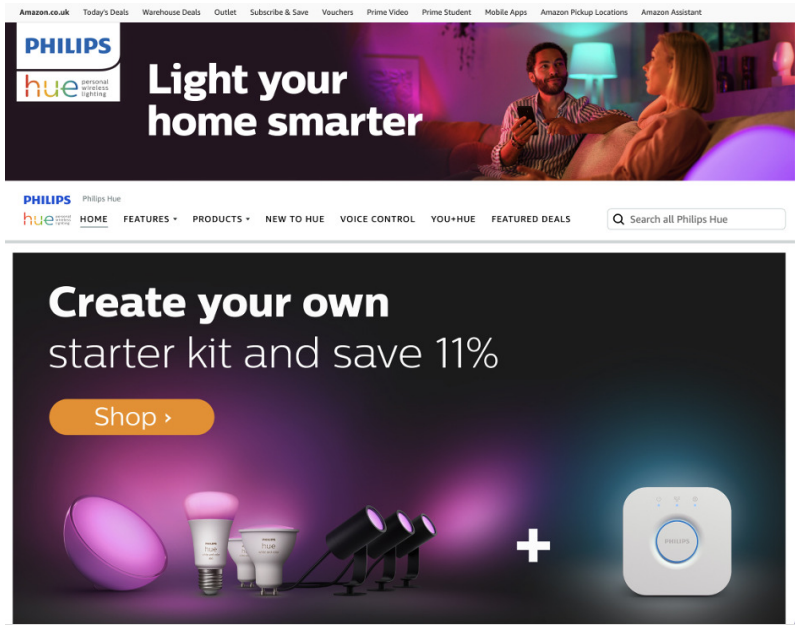


Fig.2 Amazon website

1.4 DIFFERENCE BETWEEN ONLINE AND OFFLINE

As mentioned before, multimedia presentations are effective marketing tools that can empower any E-commerce site whether it is selling products or services (Manvi&Venkataram, 2005). However, there is a difference between the way the human eye perceives light in reality and the way it perceives pictures with a light atmosphere on the Internet. In reality, human eyes can adapt to different lighting conditions, allowing us to perceive details in both bright and dark areas of a scene. However, pictures on the internet, especially those displayed on screens, may have limitations in reproducing the full dynamic range of the original scene. As a result, some details in very bright or very dark areas of the image may be lost or appear differently compared to how they would be perceived in reality. Besides, the color accuracy of pictures on the internet can be influenced by various factors, including the color reproduction capabilities of the display device, image resolutions, and rendering techniques. Also, since it is a two-dimensional space, the user loses the perception of space. Elements like distance, parallax, and depth can be altered in pictures, potentially impacting the overall perception of the light. Overall, it's difficult to communicate the light through the online presentation, "Real" usage scenarios are difficult to present on the web

1.5 PROJECT APPROACH

The report applied the user-centered design method and followed the design development process(Elizabeth & Pieter Jan Stappers, 2016) to understand the needs, behaviors, and preferences of users. The first part of the report is about conducting user research and testing to gain insights in the fuzzy front end(see Fig.3). This involves techniques such as interviews, questionnaires, user observations, and usability testing. Based on the preferences, motivations, and pain points related to online shopping, guidelines will be suggested and used for designing the demo in the later traditional design development process.

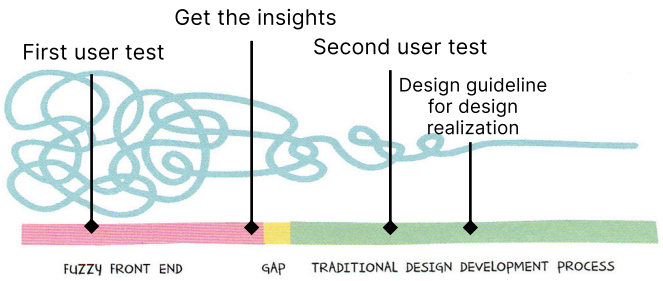


Fig.3 Design process

1.6 CONTRIBUTION OF THE REPORT

Just as the physical environment in a traditional retail store impacts the various psychological and behavioral shopping outcomes (Donovan and Rossiter, 1982, Bitner, 1992, Sherman et al., 1997), certain atmospheric qualities of the online shopping context are likely to affect the use (intentions and actual) and results (e.g., satisfaction, repatronage, amount purchased, and time spent online in the virtual store) of online shopping.(Eroglu et al., 2001). There is a lot of research on how the physical retailing environment impacts consumers' emotional states, however, there is a blank area focus on online design elements and their effects on shopper responses. Especially for light products, the online representation is essential but difficult to express. This report follows user-centered approach and take a first step in examining the design aspects of online light product retailing pages. First, major characteristics of online light product retailing are discussed to explicate the current status. Next, user tests are conducted based on the findings and assumptions. Finally, key insights from the tests are discussed.

CHAPTER 2

Background Research

This chapter aims to conclude and classify the perceived qualities from the research on the existing online retailing pages on the market and literature.

2 Background Research

2.1 ONLINE RETAILING PAGES IN THE MARKETS

The focus of the report is the perceived quality of smart lighting products. Current smart lighting companies in the market present products online in various ways. Different companies present the images in different interactions and styles. IKEA(see Fig.4) has created an interactive scenario where users can click on icons to enter product details and adjust the color temperature and brightness of the bulbs. While in the wyze brand website(see Fig.5) , users can slide the button to switch the effect of the bulb. For the brand nanoleaf(see Fig.6) , a combination of images and animations is used to convey product information.

The Interaction of the website may be associated with efficiency, precision, ease of use, and the ability to access vast amounts of information or perform complex tasks with relative ease. Companies in the market are more likely to try to use real pictures to express product qualities, those realistic images aim to depict objects, scenes, or people as they appear in the real world. They often convey a sense of authenticity, familiarity, and credibility.

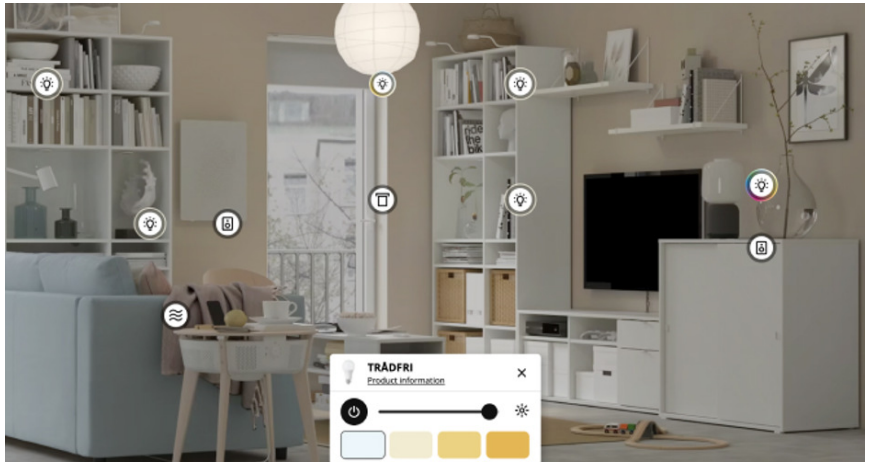


Fig.4 IKEA website

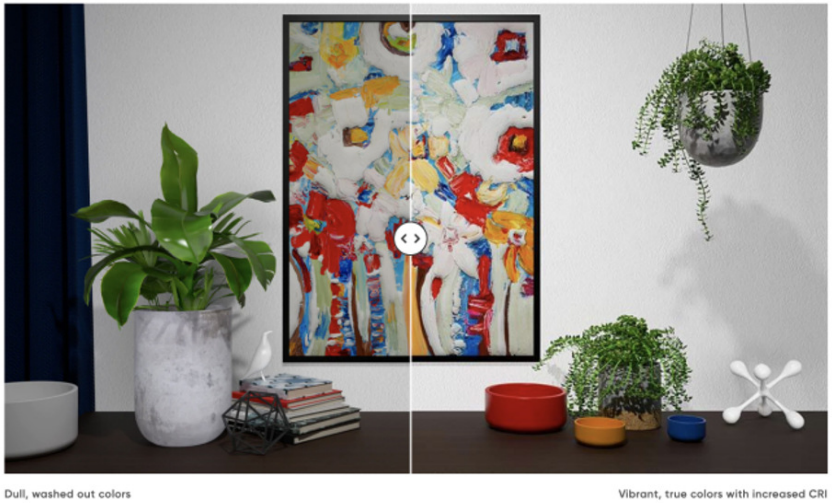


Fig.5 wyze website

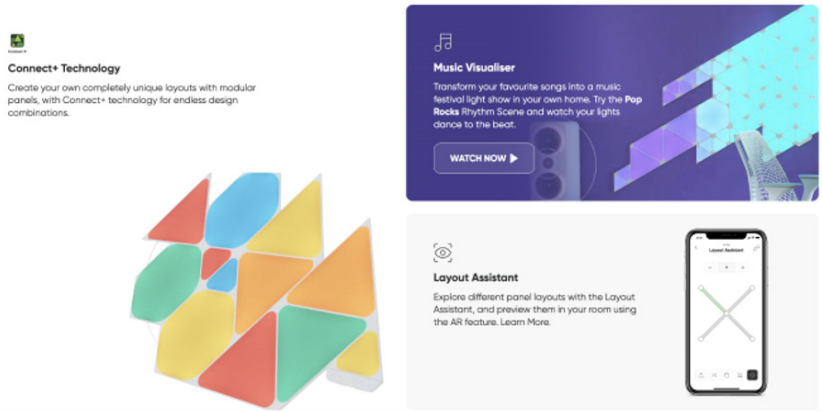
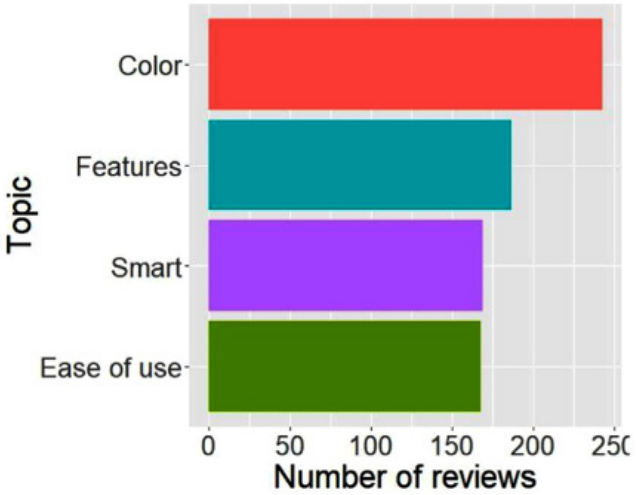


Fig.6 nanoleaf website

2.2 ONLINE REVIEW IN THE RETAILING PAGES

To understand the perceived quality of the smart light product in online shopping context, Online review analyses from Zarindast (2021) is used to know what kind of perceived quality users pay attention to. 750 reviews published in www.amazon.com related to two major smart lighting products 1- Philips Hue White and Color Ambiance A19 60W Equivalent LED Smart Bulb Starter Kit product is analyzed(Zarindast, Atousa, et al, 2021). As shown in Fig. 6, color, controllable system, and ease of use are among the most frequently referenced topics in both products.[MW18] Color was the most common aspect in online reviews for the Philips Hue lighting product. Color here not only is defined as the color of the light but also the predefined color ambiance (also called “scenes” in the Philips hue app) . In the context of Philips Hue, "scenes" refer to pre-defined lighting configurations or presets that can be created and saved within the Philips Hue system. Scenes allow users to easily recall and apply specific lighting settings to create desired moods, ambiance, or lighting effects in their environment. Features and Smart are also frequently mentioned topics in online reviews. What’s more, ease of use is another important aspect for users to quickly and easily set up the system.

This user research concern how the product is actually experienced and revealed three crucial factors affecting people’s experience: color presentation of the product, smart features and ease of use. Those factors can be separated and classified into two perceived qualities of the smart lighting product: the light side and the user experience side. In the later chapter, those two qualities will be an important dimension to measure the users’ perception of online and offline experiences.



(a) Philips Hue White and Color Ambiance A19 60W Equivalent LED Smart Bulb Starter Kit

Fig.6 Online reviews bar chart

CHAPTER 3 & 4

First User Test

In this section, a user test is conducted to assess and gain deeper insights into the differences between online and offline experiences. The user test gives the first impression on the variations in user perceptions, behaviors, and preferences between these two contexts. After the analysis, hypotheses are proposed for the next phase.

3 First User Test

3.1 RESEARCH QUESTIONS

Based on previous research, a general understanding of the perceived quality of users was illustrated. In the fuzzy front end (Elizabeth & Pieter Jan Stappers, 2016), there is no clear path on how to proceed and there may be many paths to explore. A user test was conducted to measure the difference and get deeper insights from online and offline experiences since the user test was at the beginning of the project.

The two main research questions for the present study were the following:

1. How does the experience with the hue online representation differ from the real-world experience (regarding lighting and overall user experience)?
2. Which aspects affect the user's perception of online and offline experience? Images' style, quality, interaction way or other aspects?

3.2 RESEARCH OBJECTS

As mentioned in the previous chapter, the official website and Amazon store are the main entrance for Philips Hue online purchasers.

Two design elements(Fig.7&8) from these two websites were chosen for the study, and they communicate the same message with different lighting and interactions: users can switch the lighting atmosphere on their own.

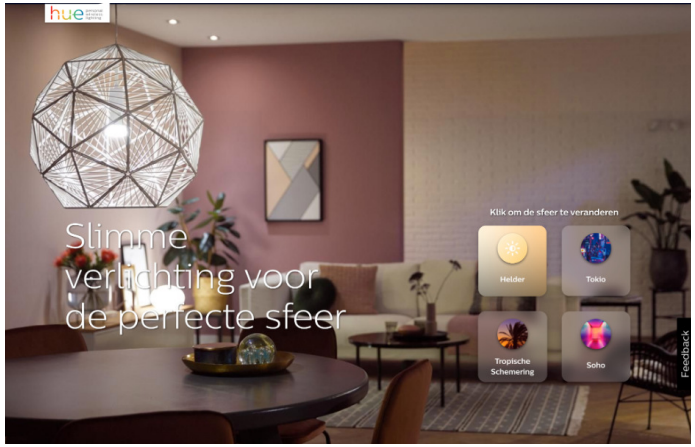


Fig.7 Design element from Hue website

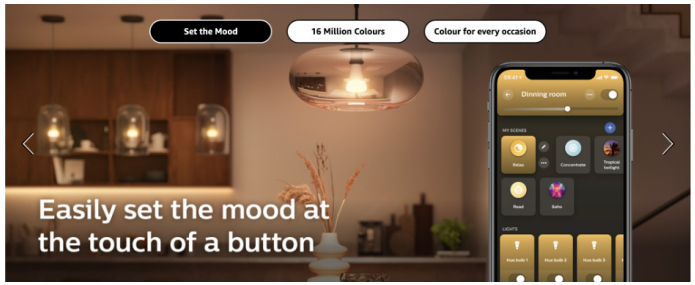


Fig.8 Design element from Amazon website

3.3 TOOLS

As mentioned in the previous chapter, the user test focuses on two aspects: The user experience aspect and the Light aspect. And each aspect are measured in the test by using different tools.

Tool 1:
Open questions and statements questionnaires

From Berni and Borgianni's research (2021), the dimensions of UX were assigned in the following circumstances (Figure 9):

Ergonomic: there is a clear focus on the interaction between the human and the system (usability, performance, affordances, effectiveness, users' behaviour).
Cognitive: the focus is on how humans perceive, understand, and know a product/system (perception, aesthetic, appearance).
Emotions: the paper concentrates on how the users feel, their inner state and engagement in terms of feelings, empathy, pleasure, aspirations, hedonistic values, social values, affection, appreciation.

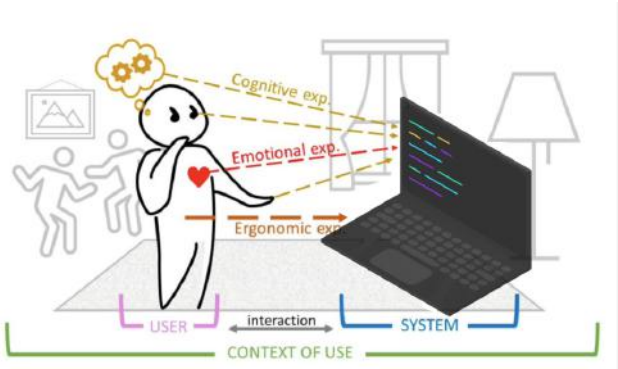


Fig.9 Dimensions of UX

And statements questionnaires and open questions were used to test those dimensions in the user test. The statements questionnaires are focused on the Ergonomic and Cognitive dimensions. Users first answered those statements:

1. The website allowed me to explore the interaction possibilities of the product
2. The visual representations of the products were aesthetically pleasing
3. I can imagine how the product will look in my own apartment
4. The visual images represented a broad set of situations

To avoid the neutral option(van der Merwe & Bekker, 2003), only 4 options are provided in the questionnaire from not agree(0,1) to fully agree(2,3), here is an example to show what the statement looks like(Figure 10)

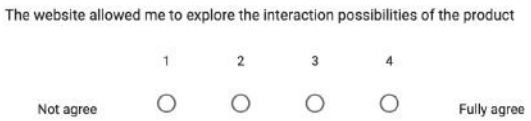


Fig.10 Statement example

Tool 2:
Flynn scale questionnaire

Another important aspect of the product is: light. Although users cannot experience the actual light in real life when visiting the website, they form subjective impressions of light through online visual presentations, such as videos and photos. Thus, a rating scale form that measures the subjective impression of an illuminated room is chosen to use in the test. Three main factors were used to differentiate the impression of illuminated spaces: perceptual clarity, spaciousness, and pleasantness (Flynn, 1973). And The full questionnaire can be found in Appendix 2

3.4 THE COGNITIVE WALKTHROUGH

In order to evaluate the current pages, the researcher conducted a usability evaluation of the app using the cognitive walk through method. A cognitive walkthrough is a task-based usability-inspection method that involves a crossfunctional team of reviewers walking through each step of a task flow and answering a set of prescribed questions, with the goal of identifying those aspects of the interface that could be challenging to new users.(Salazar, 2022). By completing two tasks: switching light color effects and learning information about product features on those two pages(Fig.11&12), the researcher obtained initial guesses about the web page.

From the survey from chapter 1.3 and the cognitive walkthrough, here is the expected difference:
- People can't imagine how the light will look in reality / in their own home
- Lighting is perceived differently because the home setup influences the light (e.g., room size, furniture, daylight, etc.)
- The online representation doesn't allow the full range of interaction possibilities

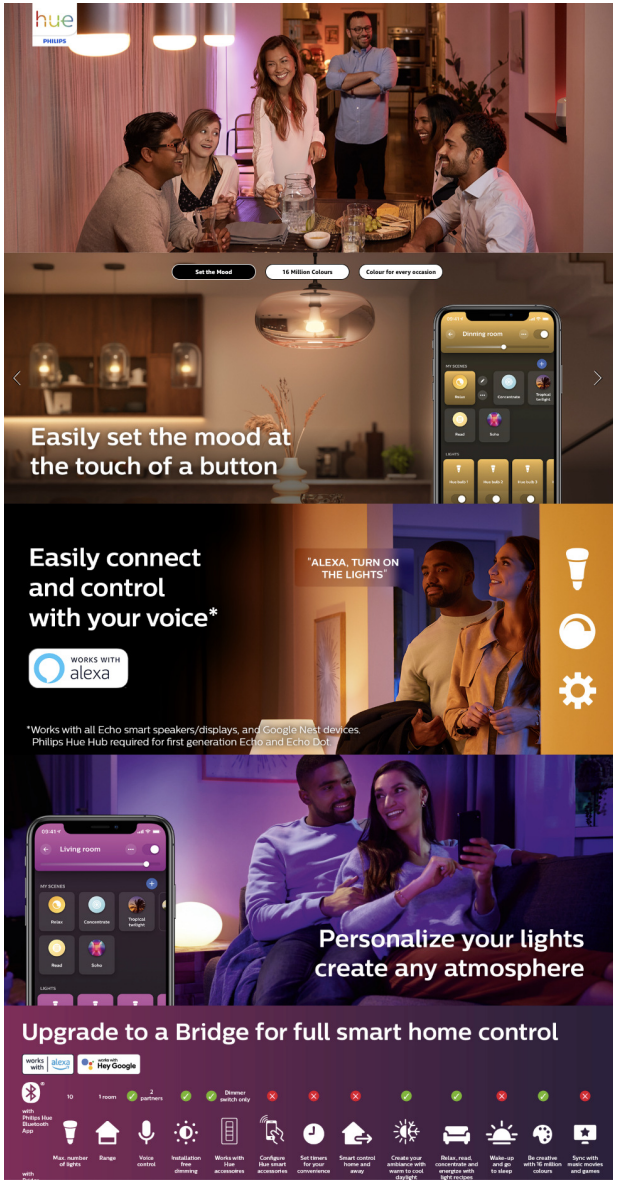


Fig.11 Amazon design element page

Fig.12 Hue design element page

3.5 TEST SETUP

10 participants were invited to do the user tests. Test was conducted in a 12 m² room and two Philips Hue bulbs were equipped in the room. The test took between 30-40 minutes per person. And the whole test process was divided into 3 parts, and the overview of the test process is shown in figure 13. After giving consent to participate, demographic data, photos and videos are collected.

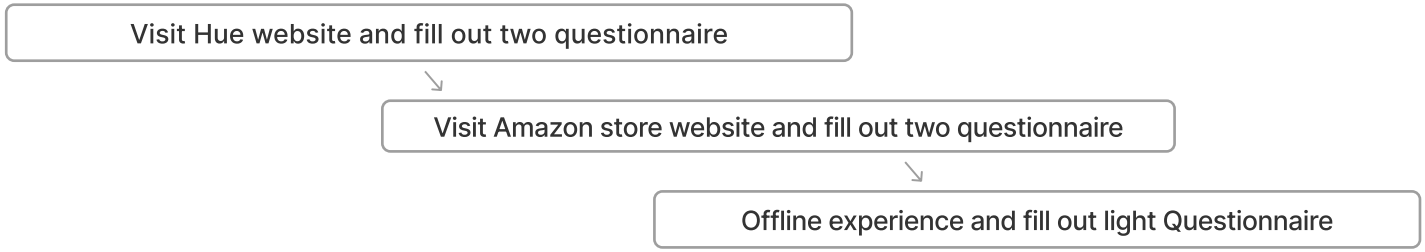


Fig.13 Test process

Part 1: Online design element test
In this section, users used two materials to test on the computer, and after each test, users filled out the Flynn scale and were asked qualitative questions. Users visited the e-commercial design elements from Philips Hue websites (material 1) and Philips Hue Amazon store (material 2) and express their feelings and thoughts by using the think-aloud method. Those two materials used different visual presentations(images) and interaction ways to express the same feature of the product: changing scenes. The tasks to be performed in part 1 by the user are shown below and those tasks are made to a task card (Figure).
1. Visit the online product page independently
2. Try to figure out how the product works, what functionalities it offers and what you are most interested in
3. Select a picture or visual representation of lighting from the website or store that you think you can replicate later in part 2
4. Rate the visual representation with Flynn's scale, answer the quantifying statements and the open questions

Part2: offline experience test
In this section, the user used the app to switch between different scenes and explored what the app can do. Then, they replicated the light of the visual representation they selected in Part 1. Tasks in this section are:
1. Use the app to switch between different scenes and explore what the app
2. Try to replicate the light of the visual representation they selected in Part 1
3. Rate the light with Flynn's scale

Part 3: open questions
In the end, Open-ended questions were asked about the differences between online and offline (see Appendix).

4 Analysis Of First User Test

4.1 WEBSITE 1 HUE WEBSITE

Website 1 received positive feedback for its **attractive interactive components and intuitive control of lights**. However, there were some areas of improvement highlighted in the negative feedback. **Users expressed uncertainty about the number of lights depicted in the images**, and they found the information and context regarding the usage of smart lights to be **insufficient**. Additionally, the website's depiction of empty rooms **failed to create a homely atmosphere**, and users struggled to relate their own homes to the presented pictures. These insights emphasize the importance of addressing these issues to enhance the user experience, such as providing clearer information, context, and creating a more relatable and cozy ambiance within the visual presentations.

4.2 WEBSITE 2 AMAZON WEBSITE

Website 2 received positive feedback for providing **useful information that helps users imagine the usage scenarios**. Users appreciated the presence of people in the pictures as it created **a sense of intimacy**. However, there were areas that received negative feedback. Users found the **information to be overlapped**, making it difficult to comprehend. The website was also perceived as **lacking interactivity**, which affected the overall user experience. **The combination of interaction and information was confusing for users**, leading to a sense of uncertainty. Furthermore, **the pictures were criticized for the furniture style and appearing unreal, resembling photoshopped images rather than authentic representations**. These insights highlight the need for improving information clarity, enhancing website interactivity, and ensuring that the presented visuals maintain a realistic and genuine quality.

4.3 COMPARISON - USER EXPERIENCE

The results of two online website are shown in Fig.14&15. Overall, **the official website provides a better user experience compared to the Amazon store**. 7 out of 10 participants (strongly) disagree the website allows them to explore the interaction possibilities of the product(statement 1), this indicate both platforms, the Hue website and the Amazon website, are perceived as having limited interactivity. However, more people show “strong agree” with statement when when visit the Amazon page. Thus, **the Amazon store is considered to have the least interactive elements among the two**. From the distribution of the bar chart, more people (strongly) disagree those four statements, which shows **users find the Amazon website to offer a less engaging user experience**.

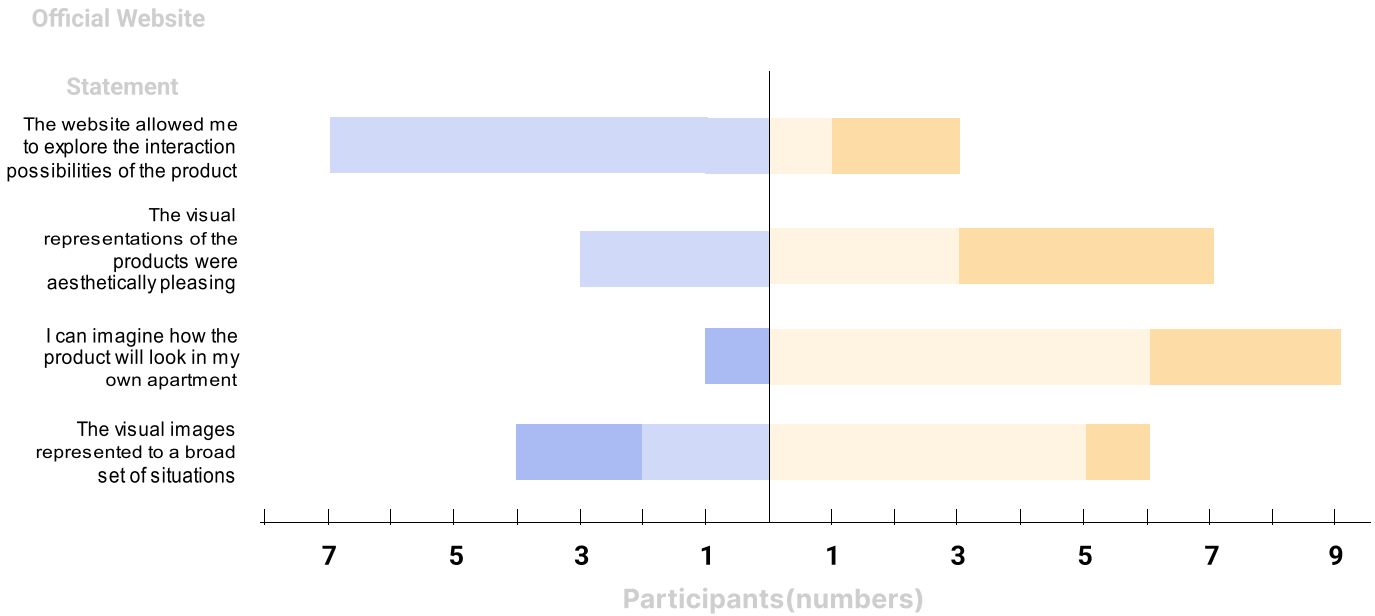


Fig.14 Hue store result

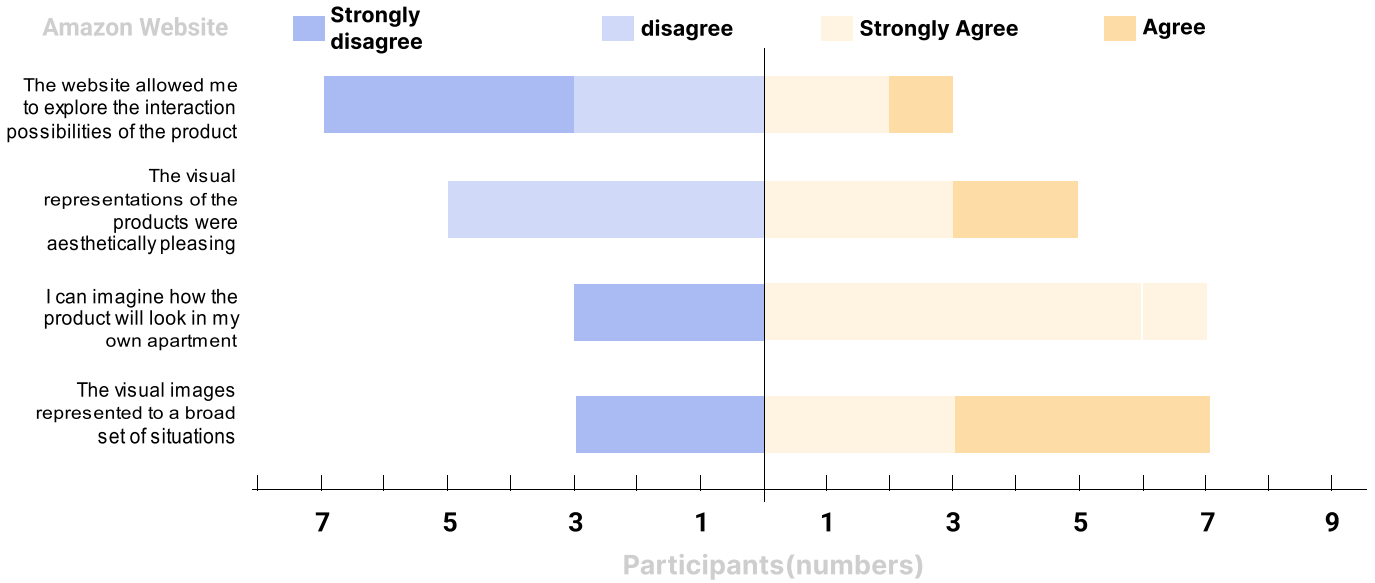


Fig.15 Amazon store result

4.4 COMPARE ONLINE-OFFLINE - LIGHT EFFECT

Flynn's questionnaires are applied to measure the light effect and the result is shown in figure 16. In the evaluation of light, the average values for the Amazon store were found to be higher compared to the other platforms. **This might suggest that users experienced a relatively poorer light experience when using the Amazon store pages.** On the other hand, in terms of perceptual clarity related to light, the average values for the official website were higher than the other platforms. This might indicate that users perceived the light with less clarity when using the official website pages.

4.5 COMPARE ONLINE-OFFLINE - USER EXPERIENCE

In the interview, there is a very obvious difference between offline and online raised by users, in terms of user experience, the way they use offline app to control the lights can get a significantly stronger **sense of control** than online, and can give users a strong sense of satisfaction. In addition, in terms of light experience, users believe that offline light provides with **more colorful layers**, but basically in line with the expectations of their online perception.

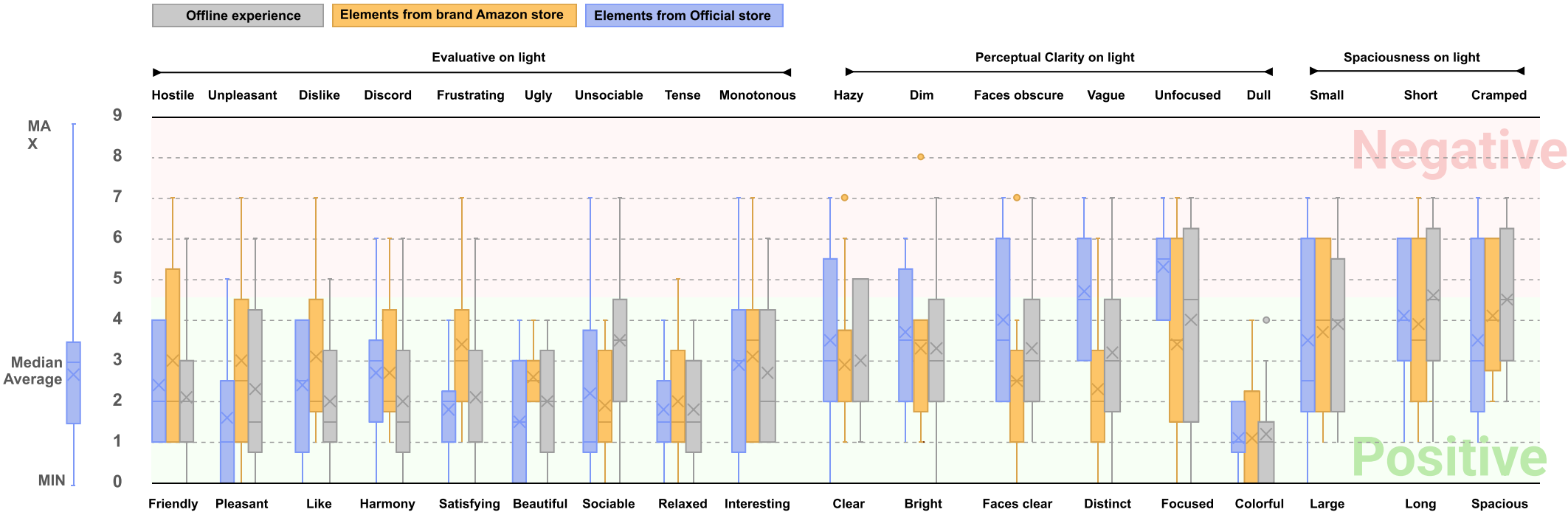


Fig.16 Light experience result

4.6 TAKEAWAYS FROM FIRST USER TEST

Based on research analysis, it has been found that users desire website content that evokes a sense of familiarity and comfort, establishing a **"Home-feeling"** atmosphere. Additionally, **trustworthiness and effective** storytelling are crucial factors that contribute to user engagement. Users tend to **highlight** images of products and product features, hoping to present a concise and effective visual effect.

In terms of website interaction, users prefer **intuitive** interfaces that facilitate effortless navigation and efficient access to desired information. They value the **freedom** to explore and interact with the website without encountering barriers or limitations.

Regarding light effects, users seek a visually appealing experience that showcases **layers of lighting**, creating a sense of **depth and ambiance**. They appreciate lighting designs that showcase the full potential of the environment and offer a glimpse into personal taste and various usage scenarios.

4.7 ANSWER THE RESEARCH QUESTIONS

- How does the experience with the hue online representation differ from the real-world experience (regarding lighting and overall user experience)

Offline light experiences are perceived by users to offer more vibrant and layered colors. Users learn more information of the usage senario(light location, numbers of lights and etc.)and they feel more sense of control when they experience app.

- Which aspects affect the user's perception of online and offline experience? Images' style, quality, interaction way or other aspects?

For the content of image side, offering Home-feeling, trustable, storytelling and efficient visual presentations are important.

For the interaction side, user prefer the intuitive, efficient, free interaction way.

For the light side, participants appreciate that they can see more layers, environment and location of light. Besides, they also want the light follow their personal taste.

4.8 LIMITATIONS OF THE USER TEST

Since the two websites online and offline do not present the same scene, a direct comparison of the effects of the lighting scenes does not lead to a very definite conclusion.

Regarding the assessment of spaciousness in relation to light, the distribution of answers provided by users was similar and wide, and the average values did not vary significantly. It is important to note that questions pertaining to spaciousness and light can be challenging for users to answer, potentially leading to a less conclusive evaluation.

4.9 HYPOTHESIS

From the analysis, the insights can be classified into Content, Interaction, and Light. People are looking for reliable visual presentations that provide a sense of home and are presented in a storytelling way. From the Interaction side, people want to have an intuitive user workflow and efficient learning process. From the light perspective, people look forward to seeing more layers of light and personalizing the environment, light location, and decoration style. Based on the findings there are some hypotheses proposed:

Hypothesis 1

These observations from “chapter: comparison - user experience” reveal the least interactive pages are also considered to have the worst user experience.

Thus, the Hypothesis 1 is proposed:
The level of interaction will affect the online user experience. More interaction, better user experience.

Hypothesis 2

The chapter “Compare online-offline - light effect” shows users experienced a relatively poorer light experience when using the Amazon store pages. Besides, from the interview, participants felt that a more interactive web page would enable them to get better light experience.

Thus, the Hypothesis 2 is proposed:
The level of interaction will affect the user's judgment of the light. With more interaction, users rate the light experience higher.

Hypothesis 3

The insight is shown from the Chapter “website 2 amazon website”: the visual presentations were criticized for the furniture style and appearing unreal, resembling photoshopped images rather than authentic representations.”

Thus, the Hypothesis 3 is proposed:
The factors of the image content(furniture style, character in the photo, etc.) will affect the online user experience.

Hypothesis 4

The insight is found in the Chapter “Compare online-offline - user experience: offline environment can provide more color layers. Because online presentations will be disturbed by the content of the images, it’s valuable to analyse how factors in the image affect the light experience.

Thus, Hypothesis 4 is proposed:
The factors” of image content(furniture style, character in the photo, etc.) will affect the user's judgment of the light.

In the later phases, those hypotheses are studied and tested in the second user test.

CHAPTER 5

Second User Test

The second user test focused on the impact of the abstraction of the image and the level of interaction of the prototype on the lighting and user experience. After the test, the hypotheses proposed in the previous test were verified.

5 Second User Test

5.1 ITERATE THE LIGHT QUESTIONNAIRE

The second user test also made an upgrade in the process. Since the first user test found that the **Spaciousness on light section of the light test scale was difficult for users to answer** and the results were not informative, this section was removed in the second user test. At the same time, since the test was mainly conducted by online questionnaire groups, some questionnaire groups were merged to avoid users from making mistakes when clicking.

5.2 HYPOTHESIS FROM FIRST USER TEST

From first user test, the researcher concluded four hypotheses:

Hypothesis 1: The level of interaction will affect the online user experience. More interaction, better user experience.

Hypothesis 2: The level of interaction will affect the user's judgment of the light. With more interaction, users rate the light experience higher.

Hypothesis 3: The factors of the image content(furniture style, character in the photo, etc.) will affect the online user experience.

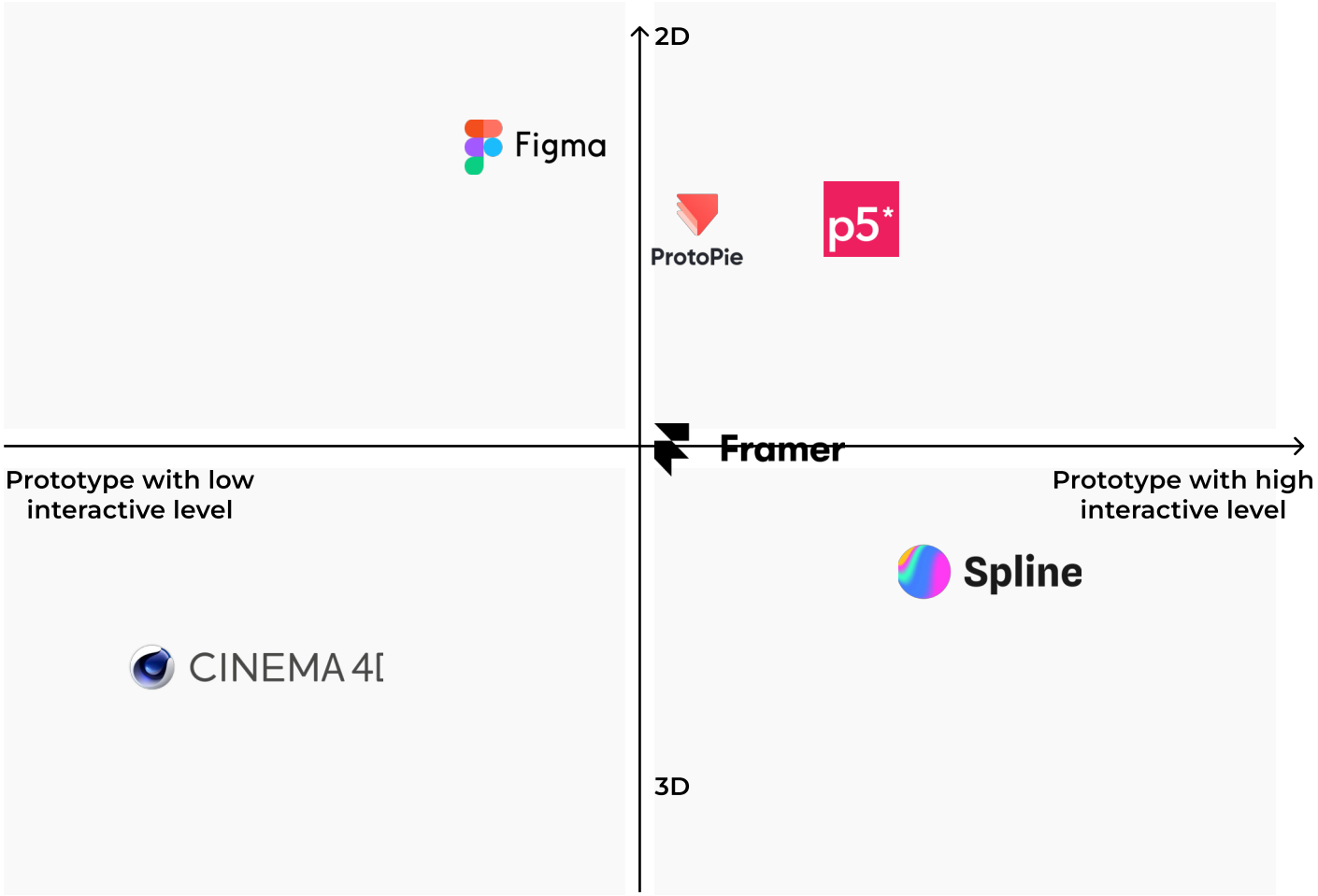
Hypothesis 4: The factors of image content(furniture style, character in the photo, etc.) will affect the user's judgment of the light.

In the later phase, experiments are made to test those hypotheses

5.3 CHOOSE THE RIGHT TOOLS

In order to find the right tools to create prototypes that can be experimented with, the researcher analyzed the more common design tools on the market.

Since the interactivity of the prototypes and the content of the images are studied in hypotheses, the researcher also analyzed these tools from these two perspectives. Looking at the vertical axis (interactivity of the prototypes generated by the tools), spline was able to produce the most interactive prototypes, while p5.js had a higher degree of freedom due to the ability to program using code. Therefore, these two apps were chosen as the tools to create the experimental prototypes



Spline

Spline

Spline is a free 3D design software with real-time collaboration to create web interactive experiences in the browser. By using Spline, researcher can design 3d interactive model and share the model via a link

p5*

P5.js

p5.js is a JavaScript library that is often used for creative coding, interactive graphics, and visualizations. By using p5.js, researcher can import realistic images and design the interactive elements via code

5.4 EXPERIMENTS BASED ON HYPOTHESES

interactivity

To validate hypothesis 1(The level of interaction will affect the online user experience. More interaction, better user experience.) and 2(The level of interaction will affect the user's judgment of the light. With more interaction, users rate the light experience higher.), the researchers used spline software to produce models with high interaction and models with low interaction. The low interactivity model is an animation of the lighting changes, and the user cannot change the lighting color by himself. In the high-interaction model, the user can freely move the light position and modify the light color.

Low interactivity
https://my.spline.design/1animation-4fd68781f325724a8075b2a988e9e6a4/

High interactivity
https://my.spline.design/miniroomartcopy-ca462ec9c8e24340c008d5749dde11ec/

content of image - Home like feeling

To validate hypothesis 3: The factors of the image content(furniture style, character in the photo, etc.) will affect the online user experience and hypothesis 4: The factors” of image content(furniture style, character in the photo, etc.) will affect the user's judgment of the light. the researchers used Spline software to make prototypes with different home-like feelings. In the high home like feeling model, there will be puppies in the room, and the puppies will follow the cursor to move. However, since it was difficult to distinguish whether this improved interactivity or home like feeling after adding the dog following cursor interaction, the home like feeling model was subsequently abandoned for measurement in the second user test.

Low Homelike feeling
https://my.spline.design/miniroomartcopy-ca462ec9c8e24340c008d5749dde11ec/

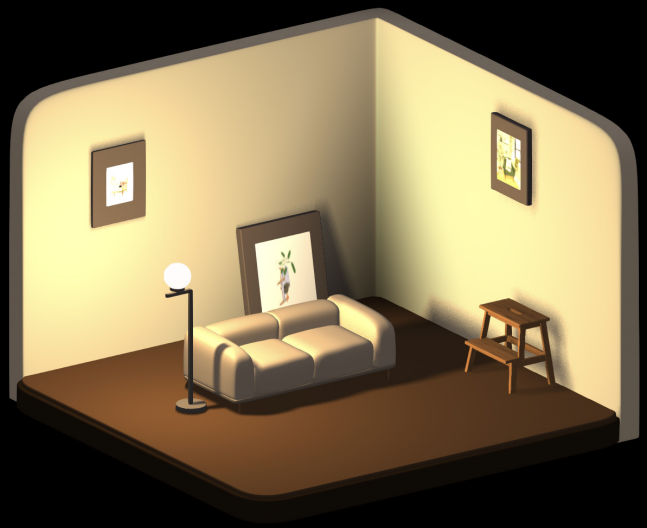
High Homelike feeling
https://my.spline.design/miniroomartcopycopy-73c2910a50edd757619e7f17409d088f/

content of image - Abstraction

To validate hypothesis 3 and hypothesis 4. the researchers used Spline and P5.js software to make prototypes with different abstraction levels. Two different realistic models are made by 3d model and photo. In order to distinguish more between different levels of abstraction, more realistic photo models were selected for the later testing.

Abstract model
https://my.spline.design/miniroomartcopy-ca462ec9c8e24340c008d5749dde11ec/

Realistic model - 3d model
https://my.spline.design/totorocopy-8151e8002b01e334d820db742ed00535/



Realistic model - photo
https://editor.p5js.org/yuliubox/full/QziyzoLE9

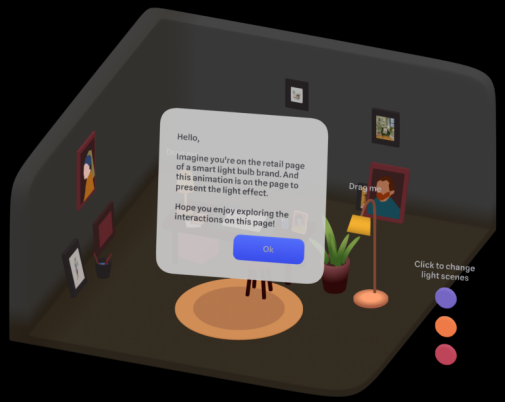
5.5 SECOND USER TEST SETUP

After experiments, three different prototypes were chosen to be tested.

Model 1: A low-interaction abstract prototype
Before entering the model, a scenario-guided pop-up is added, and participants are guided to an online shopping site scenario. In this model, the user only sees lighting changes and can rotate the model but cannot change the lighting color or position.

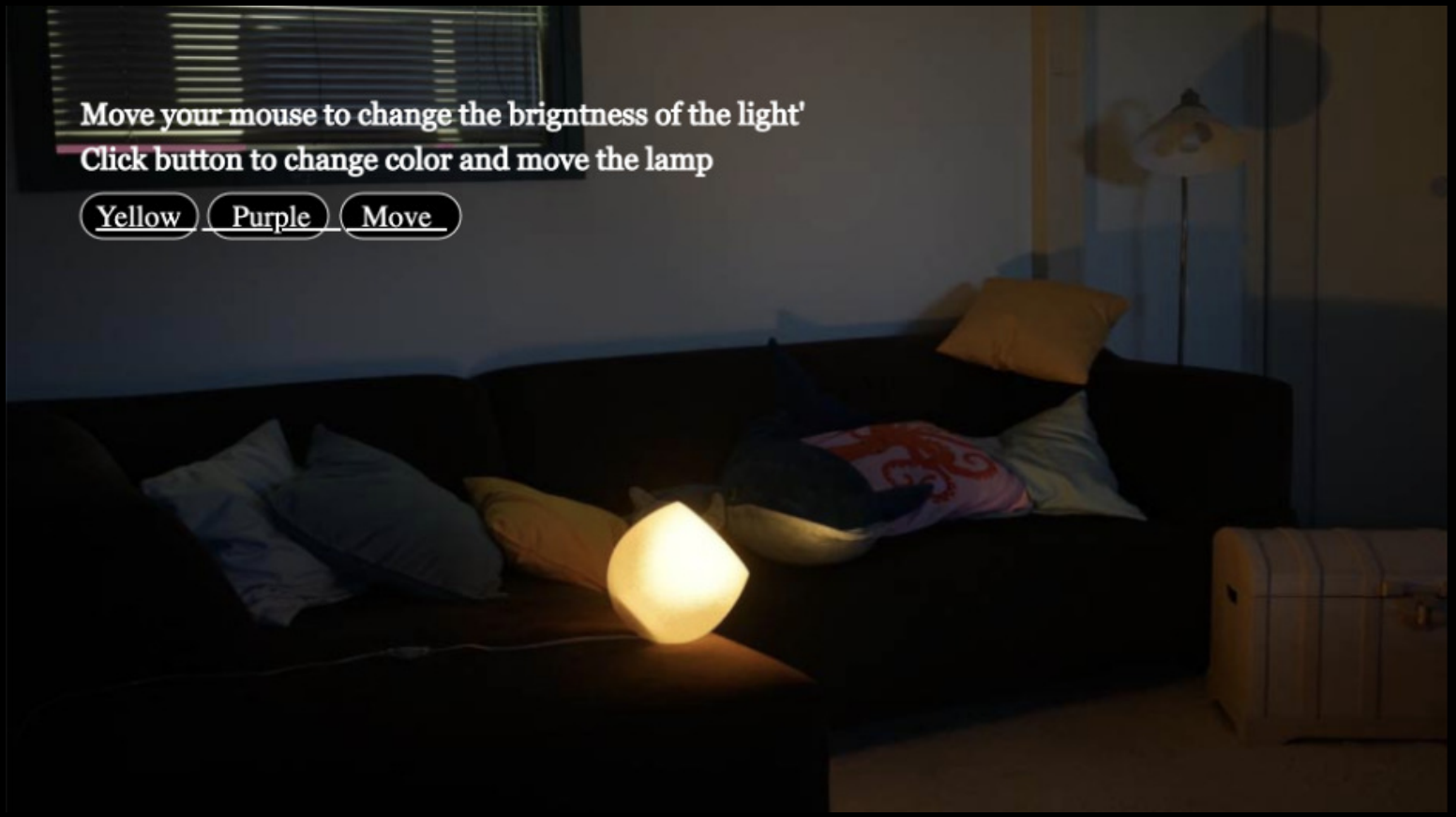
A low-interaction abstract model
https://my.spline.design/version11marchdarkanimation-da0f4533ba82ef7172323ec280845da3/

Model 2: High-interaction abstract prototype
After entering model, hints such as "drag me!" will also appear for the guidance of interactive components. The scene with model one remains the same, the user can change the light color by their own operation and move the position of the lamps by mouse, rotate the model and watch different perspectives.



High-interaction abstract model
https://my.spline.design/version124aprcopycopycopy-1efb4c17121719f6d33fe503f77cdf03/

Model 3: Highly interactive realistic prototype
The real use of the scene, the user can change the color of the light and move the position of the lamp through the operation of the mouse.



Highly interactive realistic model
https://editor.p5js.org/yuliubox/full/QziyzoLE9

5.6 TEST PROCESS

After creating the 3 models, a shareable user step-by-step page was created with Notion(https://boiling-iris-6b8.notion.site/User-test-1fd6bfe3080144a2a341bb2165550c35?pvs=4), and a pivot test was conducted before formal testing. In the second user test, the same two questionnaires were used as in the first test (light experience side without Spaciousness on light section and user experience side) The online test presentation sent to the user consists of the following steps:

Part 1: Test background introduction and personal information filling. At the beginning of the test, project information, partner brand information and notes were introduced

Part2：Experience the three models. To avoid users being influenced by the order in which the models appeared in the questionnaire web pages, the researcher decided to rearrange the order of the models for every five people placed. Users experienced three different models in random order and fill out three questionnaires on user experience and light experience, in which they can leave comments and score their experience.

part3: Interview
Some users were randomly selected as interviewees and answered the following questions:
1. which model do you like more and why?
2. How do you think the interactivity of the model affects your experience?
3. How do you think the abstract nature of the model affects your experience?
4. what improvements do you expect from the model?

5.7 PILOT TEST BEFORE THE USER TEST

Some practical suggestions were obtained by inviting a participant who had never participated in a test before (including a first-time user test) to conduct a pivot test:

- added an introduction to the brand with Philips hue, added a brand banner

- Added guidance for first-time users within the model, including situational guidance and button guidance

5.8 RESULT OF USER TEST

A total of 26 questionnaires were distributed. In the second user test, 20 valid answers were received, and 8 people were interviewed. The participants in this test were between 22 and 29 years old, from China, Iran, Romania and other countries, with education levels ranging from undergraduate to graduate, and using Philips hue brand products from 0 to 3 years.

6 Analysis

6.1 ANALYSIS FROM THE INTERVIEWS (FIG.17)

MODEL 1 ANIMATION

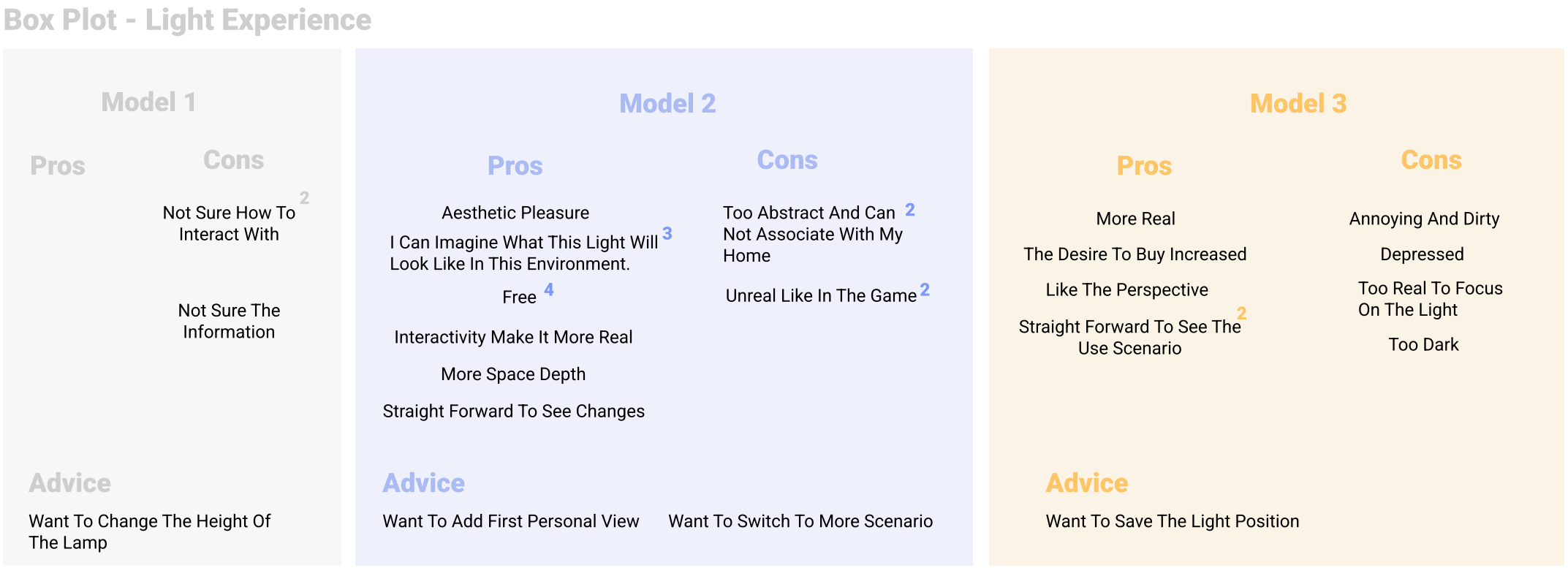
Model 1 received negative reviews, with users not knowing how to interact with the model and what kind of information the model conveys.

MODEL 2 3D MODEL

The majority of people interviewed preferred Model 2 (7 out of 8 chose it). Respondents liked the interactivity of Model 2 (4 people expressed similar views) and thought that Model 2 was very imaginative (3 people expressed similar views), but wanted more specific scenarios that also offered multiple views and more options for use scenarios.

MODEL 3 REALISTIC PHOTO MODEL

Participants' views on model 3 were extreme and personal, with positive comments on straight forward to see thee use scenario (2 comments) and negative comments on hating the scene style (including comments on lighting, emotions brought by the scene, etc.)



2 Multiple people mentioned the same opinion

Fig.17 Interview result

6.2 ANALYSIS FROM THE QUESTIONNAIRE - USER EXPERIENCE

Fig.18 Result of the user experience questionnaire

The results of protype 1: Animation, prototype 2: interactive, prototype 3: realistic model can be found in the contents of Figure 18. By comparing the results of model 1 and model 2, **it can be found that the higher interaction gives a huge improvement in user experience** (more people agree with statements), which verifies the hypothesis 2 (The level of interaction will affect the online user experience. More interaction, better user experience.)

Comparing the results of Model 2 and Model 3, it can be found that there is no significant difference between the results of the first to the third item (more people agree with the statement), but there is a significant difference in the results of the fourth item: The visual images represented to a broad set of situations, which **proves that the style of the scenes has a significant impact on people's user experience in terms of imagination.** This is also evidenced in the subsequent user interviews.

6.3 ANALYSIS FROM THE QUESTIONNAIRE - LIGHT EXPERIENCE

By comparing the results of prototype 1, 2, and 3 on the box plot, we can analyze the structure of the light experience questionnaire into two aspects: evaluative on light and perceptual clarity on light. in evaluative on light , we can compare the three sections and we can find that model 2 has the best light experience (the lowest value). Meanwhile, by comparing models 1 and 2, we can find that we also confirm hypothesis 1 that the **interaction level will have an impact on the Light experience**. Analyzing from the perceptual clarity on light, we can find that model 3 has the worst experience, which is also answered later in the user interview, related to the **quality of the pictures and the furnishing of the scene.**

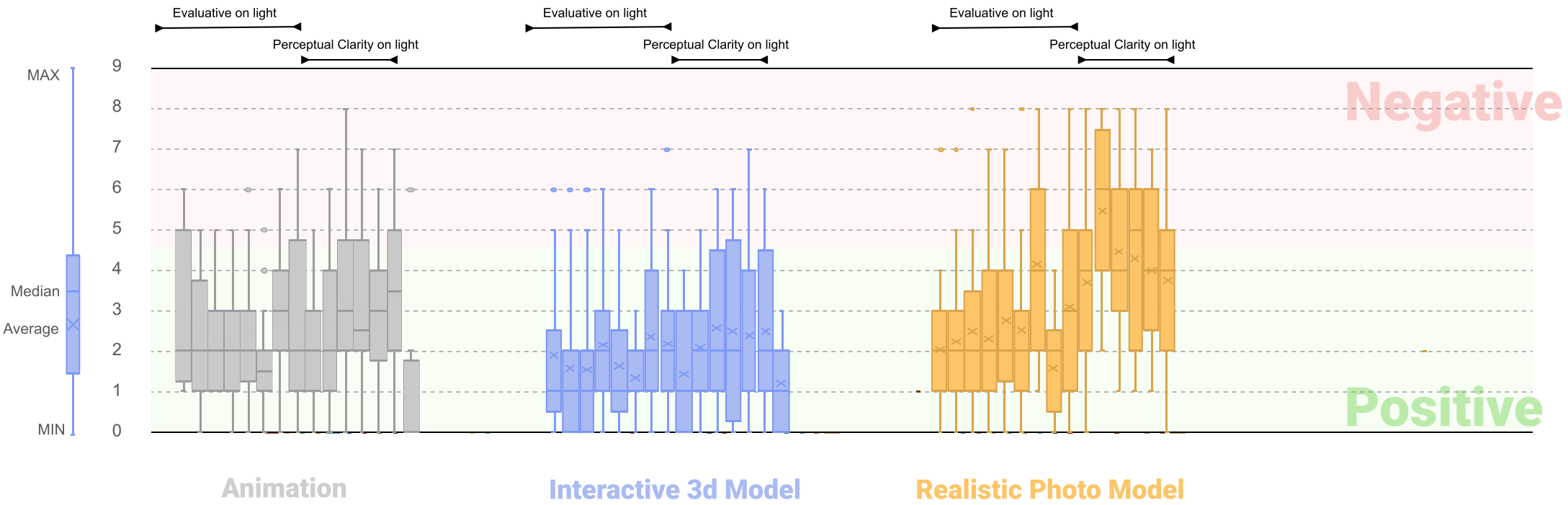


Fig.19 Result of the light experience questionnaire

6.4 TAKEAWAYS FROM SECOND USER TEST

From the user experience side:
By comparing the result of Animation and Interactive model, we can find higher interactivity, higher user experience level.

By comparing the result of realistic photo and 3d model, we can find more abstraction, more imagination

From the light experience side:
Overall, the interactive model have the best light experience. Perceptual clarity in real life highly depends on the environment/light setup/ image quality

Overall:
Outstanding interactivity can stimulate the user's imagination to gain best experience

Balancing the abstraction and realism to avoid the images' noise. When viewing real pictures, users are sometimes influenced by furniture style, color tone, photo quality, etc. Thus, how to choose a appropriate, general display environment for shooting will become very important

6.5 ANSWER THE RESEARCH QUESTIONS

- Hypothesis 1: The level of interaction will affect the online user experience. More interaction, better user experience.
This hypothesis is correct. By comparing the performance of models with different interactivity in the UX questionnaire, the models with high interactivity have better user experience.

- Hypothesis 2: The level of interaction will affect the user's judgment of the light. With more interaction, users rate the light experience higher.
This hypothesis is correct. By comparing the performance of models with different interactivity in the light questionnaire, the models with high interactivity have better light experience.

- Hypothesis 3: The factors of the image content(furniture style, character in the photo, etc.) will affect the online user experience.
The abstraction of the image will affect the user experience. For users, a model with high abstraction will stimulate their imagination and associate them with more usage scenarios.

- Hypothesis 4: The factors" of image content(furniture style, character in the photo, etc.) will affect the user's judgment of the light.
The abstract nature of the images will affect the lighting experience, and for users, the figurative scenes are easily affected by other factors such as the quality and the brightness of the images. The light effects presented may not be as good as the abstract models

From the test results, we can see a trend that light experience and user experience are positively correlated and they influence each other.

6.6 LIMITATION OF SECOND USER TEST

Due to technical limitations, the web pages made with p5.js technology are not as smooth as those made with spline, thus affecting the user experience.

CHAPTER 7

Guideline For Online Lighting Products Experience

In this section, the researcher summarizes the previous research and proposes guidelines to improve the online lighting shopping experience. Guidelines provide recommendations in terms of visual content, interactivity and light, with corresponding examples

7 Design Guideline

7.1 APPLY THE GUIDELINES

Guidelines can be applied to evaluate existing online retail platform for smart lighting products against the guidance. Identify areas where the design falls short or where improvements can be made. This may involve reviewing the visual content quality, interactivity, user flow, and overall user experience.

Based on the findings from the design audit, prioritize the design enhancements that align with the guidance. Determine which elements will have the most significant impact on improving the online retail experience for your specific target audience.

Depending on the needs of the market users, guidelines can be interpreted differently, for example, if the market is a single region, then creating an image content with homelike feeling should be the the home image that fits the characteristics of the market. However, if you are dealing with multiple markets, you should be careful to choose images that are too geographically specific.

7.2.1 HOME-LIKE FEELING

“I like those images, there are people involved in and I have more emotion connection with them” — *Participant 5 from first user test*

The feeling of being at home is a result of personal experiences and emotions that develop gradually over time. It encompasses elements such as independence, security, self-identity, autonomy, and cherished memories. From Rijnaard’s research(2016), 15 factors were identified that impact the sense of home. As a consequence of the process of clustering of factors, three main themes emerged as follows:
(a) Psychological aspects, which include behavioral, cognitive, and emotional components.
(b) Social aspects, which include home as a place of connection and socialization.
(c) The built environment, which includes the layout of a space, its interior design, and the surroundings.

According to these three themes, following qualities of a home-like feeling picture can be conducted:
1. A sense of authenticity and not overly polished(Psychological aspects)
2. Add characters and storylines to images to create emotional links with views(Social aspects)
3. Add seasonal, holiday and other elements(Social aspects)
4. Avoid choosing overly stylized images when dealing with global markets(The built environment)

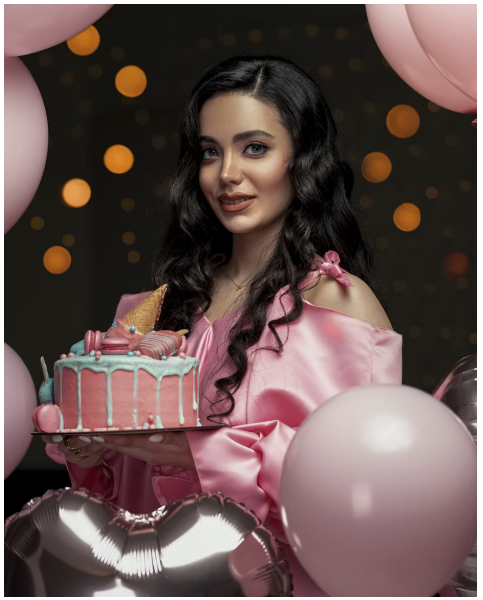
DON’T

DO

7.2.2 TRUSTABLE

“The pictures look unreal, like photoshopped photos”
— Participant 7 from first user test

It’s important to make trustable product images for customers to make the purchase choice. First of all, the product should **be displayed in real-life situations or settings** that align with its intended use. Pictures need to present lifelike details, a real picture is more important than a perfect picture. In addition, it is essential for a product to have **multiple angles and scenes to show**, which can significantly enhance the authenticity of the product images. What’s more, Investing in **high-resolution product photography** that accurately captures the details, colors, and textures of the product can demonstrate the commitment to quality and build trust with customers. Lastly, including **customer reviews and testimonials** alongside your product images. Genuine feedback from satisfied customers adds credibility and helps potential buyers feel more confident about their purchase.



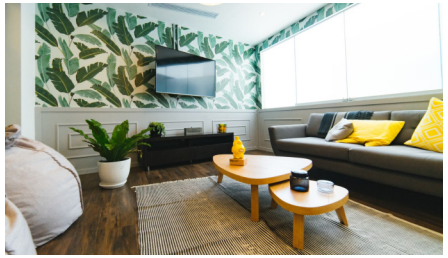
DON’T

DO

7.2.3 STORYTELLING

“The images here are more immersive, they are presented in a storytelling way” — *Participant 5 from first user test*

Using images in a storytelling manner can be a powerful way to engage customers and influence their purchase decisions. Keeping the **consistency of the characters, showing the product through multiple angles and adding the stories** can better describe the product features, create a brand atmosphere, and stimulate the imagination of consumers



DON’T

DO

Based on the results of first and second user tests, abstract visual information inspires people's imagination and avoid unnecessary distractions caused by pictures. However, user might feel too abstract and to associate with their home. Therefore, it is important to balance the abstraction and realism of the product display.

7.2.4 VISUAL ABSTRACTION

"The resolution of the picture is low and unclear" — *Participant 7 from first user test*

"I won't buy a lampshade like this" — *Participant 1 from first user test*

Key point is reducing image noise and emphasizing the product. Firstly, choosing a clean and uncluttered background can help the product stand out and ensures that the focus remains on its features and benefits. Pictures should avoid presenting complex backgrounds, furniture decoration styles and color matching. Overly stylized scenes/designs should be avoided in the images, and the items displayed in the images should be carefully chosen to keep the style simple and visually display the products. In addition, the use of color should also be kept careful to avoid noisy associations for users. Use the Proximity principle in the Gestalt principle(Todorovic, 2008) to arrange the furniture in the picture. By focusing and dispersing the furniture in the picture to guide the customer's eyes to focus on the effect of the product.

DON'T

DO

7.2.5 SEMANTIC IMPORTANCE

In order to avoid the unrealistic, game-like feeling brought by excessive abstraction, designers need to pay attention to whether the abstract graphics affect the semantic expression of the image. Like the illustration drawn shown in Fig.20(Christoph Niemann - the Abstract-O-Meter | Facebook, n.d.), it's essential to find a perfect position on the abstract-o-meter. Exploring the correlation between visual information and its corresponding linguistic semantic meaning continues to be an ongoing and intricate research domain, Zitnick and Parikh(2013) created 1,002 sets of 10 semantically similar abstract scenes with corresponding written descriptions and raised the question:" Is photorealism necessary for the study of semantic understanding?" People can imagine scenes based on simple graphics or cartoons. Besides, noisy low-level object detections is removed when use abstract images. Thus, For the selection of scenes in images, if real images are to be used, the individual elements of the image must be selected carefully. Based on Zitnick and Parikh's research (2013), there are various sets of features affect semantic importance:

1. **Occurrence**: objects such as the bear, dog, girl or boy are more semantically meaningful than background objects such as tree.
2. **Person attributes**: human expression and action are important attributes, with expression being more crucial.
3. **Co-occurrence of the objects, Relative spatial location Depth ordering**: other useful features for contextual reasoning about scenes.

Besides, from first and second user test, there are some features are also important in retail industry:

4. **Adapt to market demand**: In the process of product display, it is a very important purpose to trigger users' empathy to stimulate consumption, therefore, the scenes corresponding to the pictures should be adapted to the market

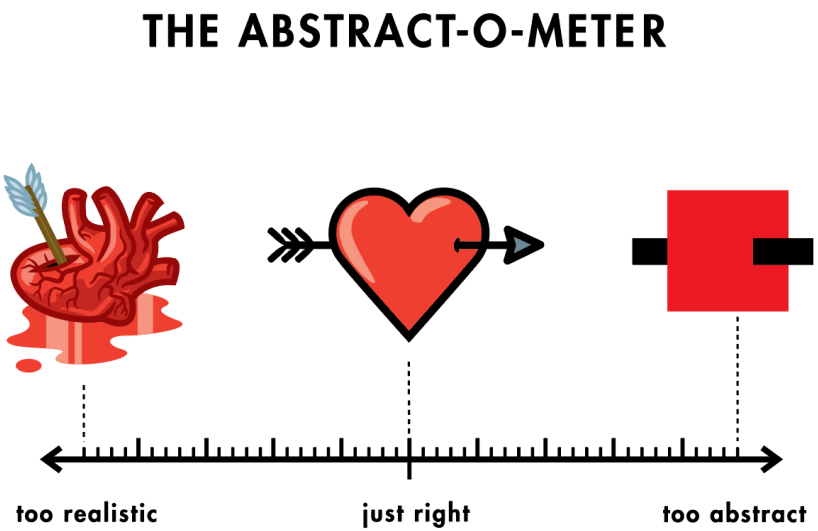


Fig.20 Abstraction meter

7.3 INTERACTIVE PRODUCT DISPLAY

Based on the results of first and second user tests, as the interactivity of the display model improved, the users rated the lighting and user experience higher. Therefore, it is important to increase the interactivity of the product display, through the interaction of the user can intuitively see the effect of lighting products, location, function, etc.

Intuitive

Users are unconsciously click the app interface -participant 1,5,6

As observed, participants unconsciously clicked on the app components in the images during the test, and users were satisfied with the features that they can press the button to switch different color scenes in the hue website, as this interaction met their expectations after seeing the images. Therefore, creating an intuitive interaction can increase user satisfaction.

Efficient

“Information and interaction way didn't fit quite well” — Participant 1 from first user test

After the user pressing the button in the Amazon page, there is a continuous repetition of information appearing. Thus, users feel that the process of accessing information is not smooth and efficient. On the product information page, it is intuitively important to combine interaction with product information. The interaction should make it easier for users to understand the product usage scenarios, features and other specific information.

Free

“I'm not sure how many lights are in this image” — Participant 4 from first user test

As mentioned in the quote, a light animation does not visually tell the user the location, quantity and other information of the light. Users expect to experience the features to customize the number of lights, move the light position, etc.

7.4 IMMERSIVE LIGHT VIBE

light environment

“I will locate the light in different position like on the ceiling” — *Participant 1 from first user test*

Users want pages that provide more usage scenarios and stimulate their imagination.

Personal taste

“I won’t buy a lampshade like this” — *Participant 1 from first user test*

Personalization of scenarios can create a deeper link between the user and the product and, at the same time, avoid unnecessary negative emotions from the user.

Layers of light

“Offline offers rich layer of light” — Participant 7” — *Participant 7 from first user test*

In the process of using the light products offline, participants experienced more details of the lighting scene and they enjoyed the process of lighting up, off and changing colors. These features can provide a higher level of immersion if they are implemented in the online display.

CHAPTER 8

Design Implementation

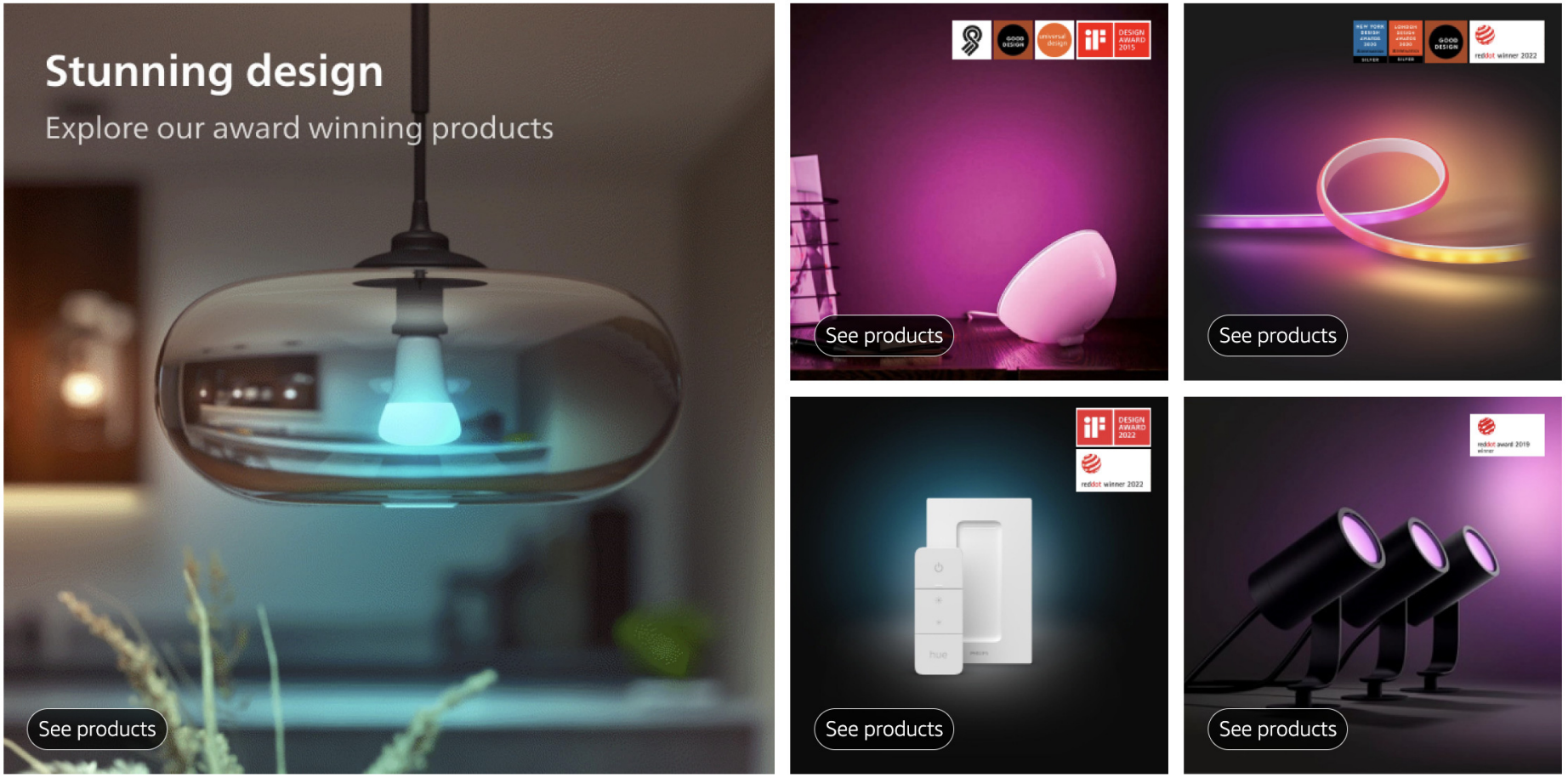
This short chapter shows the recent updates made in the Philips Amazon Store by following guidelines

8.1 HOME-LIKE FEELING

To provide consumers with a more **home-like feeling**, a variety of user scenarios have been added to the "More reasons to love Hue" section of the new amazon store to allow users to engage with it, which is now live on Amazon store(American store.)

8.2 TRUSTABLE IMAGES

To provide consumers with a more **trustable images**, a variety of winning products have been added to the "stunning design" section of the new amazon store.



CHAPTER 9

Discussion & Reflection

This last chapter concludes the project by reviewing and reflecting the project. The first section discusses the contributions, strengths, and limitations of the project. Next, the section dives into identified opportunities for the future.

9 Discussion

9.1 CONTRIBUTIONS

The guidance contributes to creating a more engaging and informative online retail experience for smart lighting products. It empowers retailers to effectively communicate the features and benefits of these products, facilitate personalized exploration and visualization, and evoke an immersive light vibe that resonates with potential customers. These contributions lead to increased user satisfaction, improved purchase decision-making, and a stronger connection between customers and smart lighting products.

Interaction in the process of presenting smart lighting products is essential. Through the rich interaction, users get more sense of the light position, type and usage senario.

In addition, due to the specific nature of the online lighting display, the user is easily influenced by other factors in the room. Thus, guidance gives an overview of how to reduce noise and effectively convey product information in this context.

9.2 LIMITATIONS

However, through the whole research process, there are some limitations could create potential bias.

Firstly, due to the difference of the tools, the realistic photo prototype is not stable as the other two prototypes. This may interfere with the user's perceptions.

Besides, because of the concentration of test subjects between the ages of 19 and 30, the test results may not accurately represent the experiences, preferences, and behaviors of a broader and more diverse user population. Different age groups may have distinct needs, perceptions, and expectations when it comes to the online retail experience for smart lighting products. Therefore, the findings may not fully capture the perspectives of target groups.

9.3 FUTURE WORK

Through the recent weeks and months of design and research, several opportunities have emerged that warrant further exploration. These opportunities are presented here as potential areas for future work, without any specific ranking or order.

(a)Study how guidelines can be applied to more design aspect of the user interface design. While the previous study focused on product presentation, there are more factors to consider in interface design, such as user flow and information architecture. By applying guidelines across the entire process, combining online web and offline retail experiences, allows users to have a more complete brand story experience

(b)Dig interaction possibilities on different devices. The guidelines have the potential to be applied to tablets and phones. For example, it is possible to put the interactive 3d model into the app of offline experience store(see Fig.21).

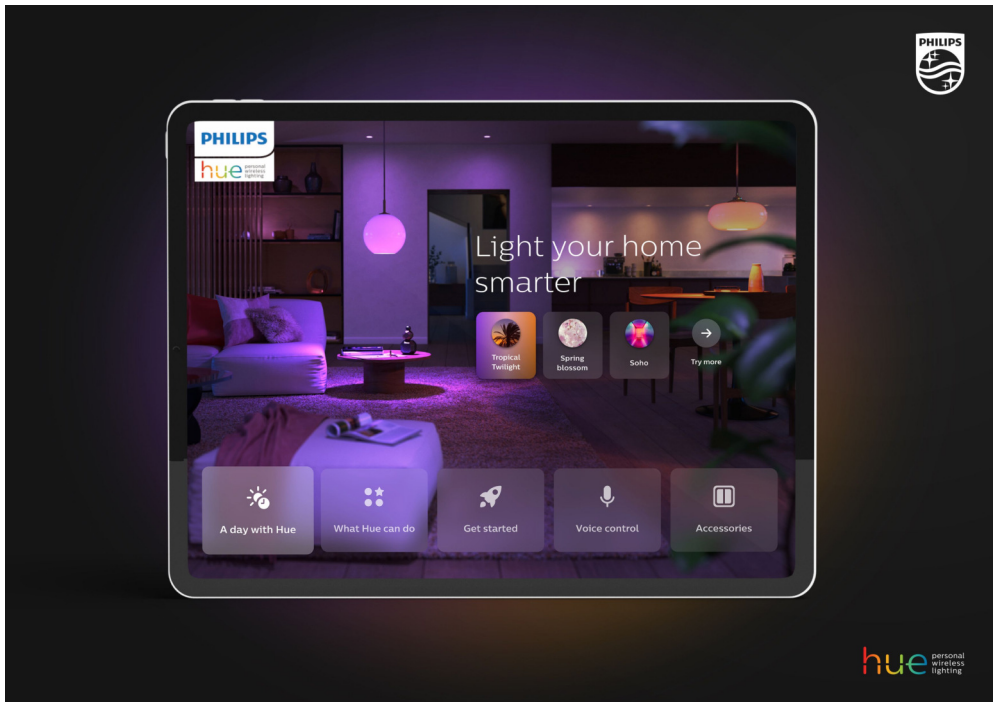


Fig.21 App for retailers

(C) Create a more personalized model
According to interviews in the second user test, many respondents were expecting more personalized features. From this feedback, I also created a variety of background colors(see Fig.23) and different furniture(see Fig.22) to match the use scenarios. In the future, how to create a more immersive and interactive prototype on the web can also be a research object.

Fig.22 Living room scene
https://my.spline.design/version11marchdarkcopy-a2b65ee54855c65b2164acb7ae76767f/

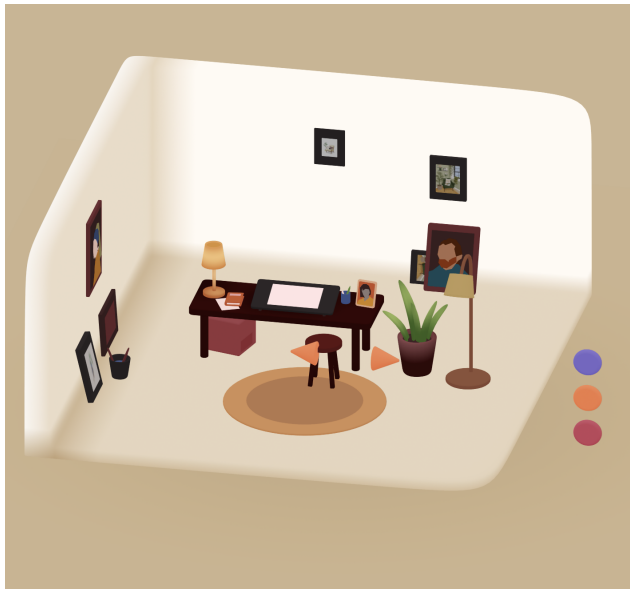


Fig.23 Scene in different color
https://my.spline.design/version11marchdarkcopy-224f3620a16c6e376a29007d4f08d580/

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Appendix

FIRST USER TEST

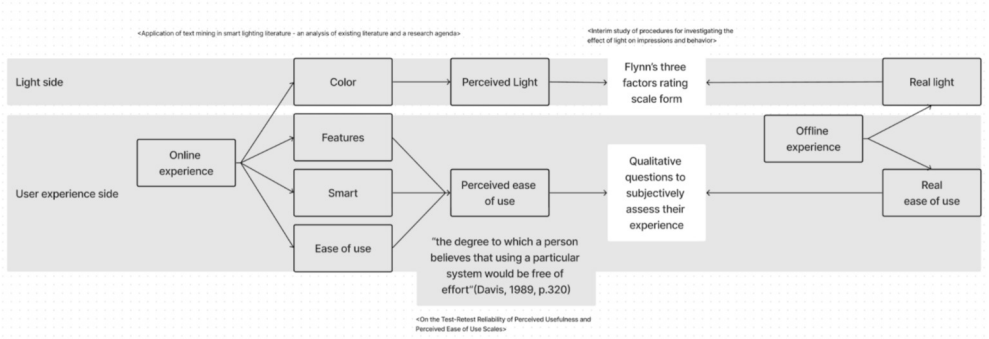
Script of user test

Explanation of testing
In the beginning, I will explain what will happen during testing and how long it will take. We will also tackle things like privacy and important notes to mention.

Privacy
“Thank you for being here with us today. If it’s OK with you we would like to record the test by video. The recording is for our processing and transcription only. Everything will be anonymized and it will be impossible to relate anything you say back to your person.
You also have the option where we anonymize your face in the footage. In the consent form, you can read more about it. For knowing our users better, please also fill out your personal information sheet.”

Part1: Online design element test
“Imagine you are now shopping online, you will explore these two sites, please experience first and then fill out the questionnaire. Please think aloud during your exploration and tell me about your experience with the website. There are no right or wrong answers, this study focuses on your opinion and perception.”
“Please read the task 1 card (Figure 5) and start the task with the first material”
“After testing with Material 1, use Material 2 and follow the same task steps in the card.”

Part2: offline experience test
“Please read the task 2 card (Figure 6) and use the app to change the scene in the room”



Compare experience

“ After replicating the light, How do you feel about the same light scene online and offline?”
“How did you perceive the interaction with the online store/website? (e.g., Name 2 things you liked and 2 you did not like.)
“Which of the two online materials do you prefer and why?”
“What was better in-store / what was better in the website? what was better offline?”
“What could be improved to create a more realistic impression of the product?”
“How did you perceive the interaction with the real product and app?”
“What do you think is the difference between the online and offline experience?””
Thank you for joining us today, if you feel like there is any question about today’s test, you can contact us.”

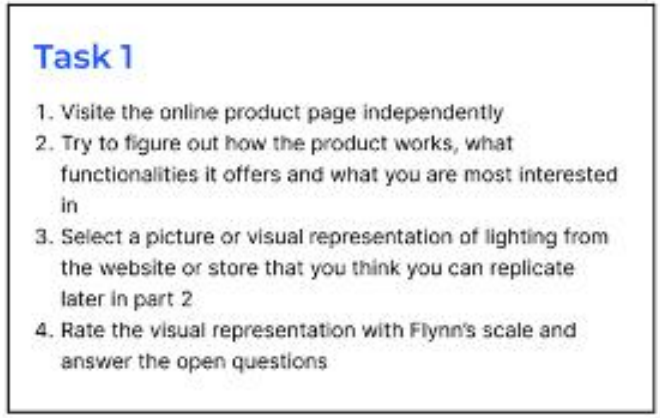
Questionnaire for the test

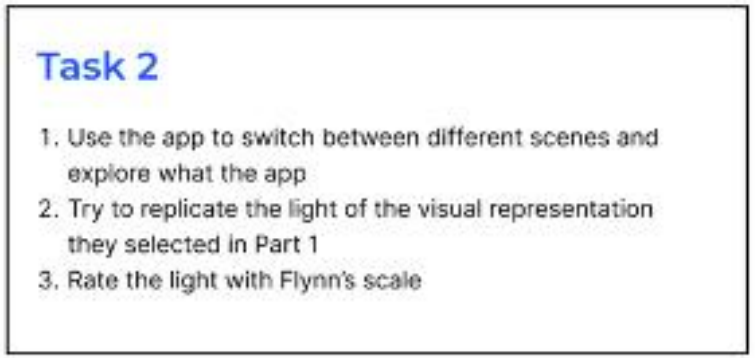
Statement questionnaire

https://forms.gle/2baQ8efSQ6ooWEiCA

Flynn’s scale questionnaire

https://forms.gle/eNRaRXmgtQzEH1Br9





CONSENT FORM

This research is conducted as part of the MSc study Industrial Design Engineering at TU Delft.
Students: Yu Liu
Contact person: Yu Liu
Informed consent participant
I participate in this research voluntarily.
I acknowledge that I received sufficient information and explanation about the research and that all my questions have been answered satisfactorily. I was given sufficient time to consent my participation.
I can ask questions for further clarification at any moment during the research.
I am aware that this research consists of the following activities:

1. Interview
2. Questionnaire
3. Observation
4. Conduct tasks

I am aware that data will be collected during the research, such as notes, photos, video and/or audio recordings. I give permission for collecting this data and for making photos, audio and/or video recordings during the research. Data will be processed and analysed anonymously (without your name or other identifiable information). The data will only be accessible to the research team and their TU Delft supervisors.
The photos, video and/or audio recordings will be used to support analysis of the collected data. The video recordings and photos can also be used to illustrate research findings in publications and presentations about the project.
I give permission for using photos and/or video recordings of my participation: (select what applies for you)
c in which I am recognisable in publications and presentations about the project.
c in which I am not recognisable in publications and presentations about the project.
c for data analysis only and not for publications and presentations about the project.

I give permission to store the data for a maximum of 5 years after completion of this research and using it for educational and research purposes.
I acknowledge that no financial compensation will be provided for my participation in this research.
With my signature I acknowledge that I have read the provided information about the research and understand the nature of my participation. I understand that I am free to withdraw and stop participation in the research at any given time. I understand that I am not obliged to answer questions which I prefer not to answer and I can indicate this to the research team.
The researchers take the applicable COVID-19 measures into account. I confirm to respect the COVID-19 measures taken and will follow instruction about these provided by the researchers.

I will receive a copy of this consent form.

_____ _____
Last name First name

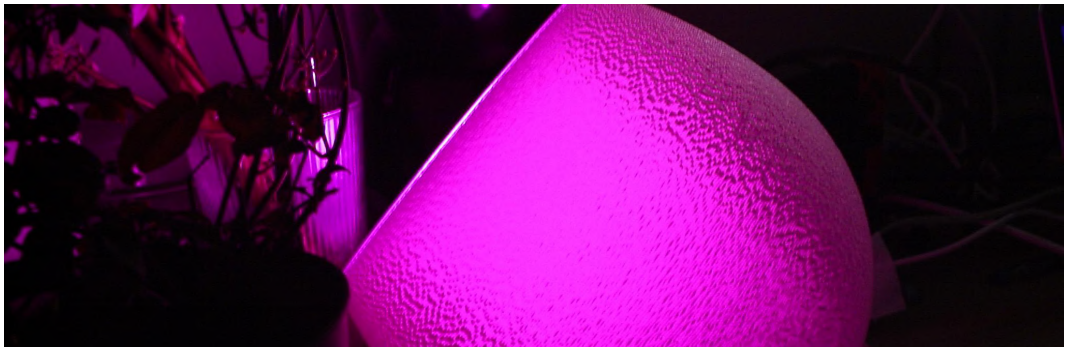
___ / ___ / 2021 _____
Date (dd/mm/yyyy) Signature

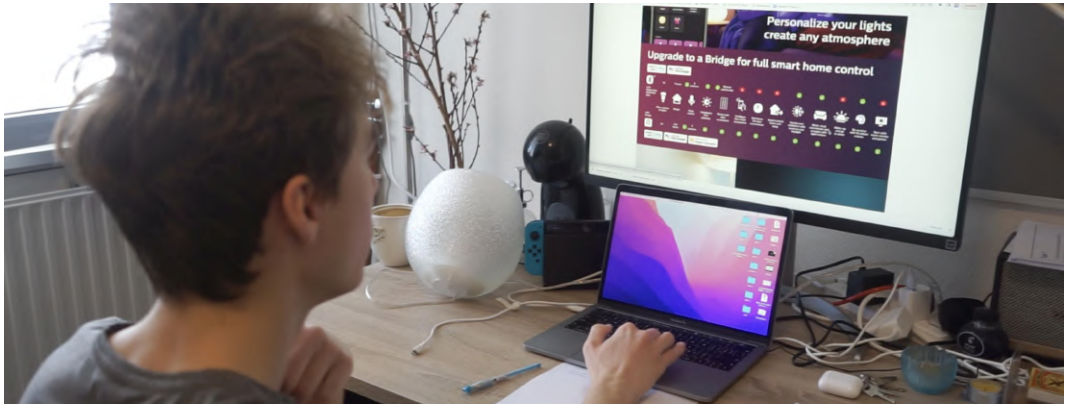
UX QUESTIONNAIRE

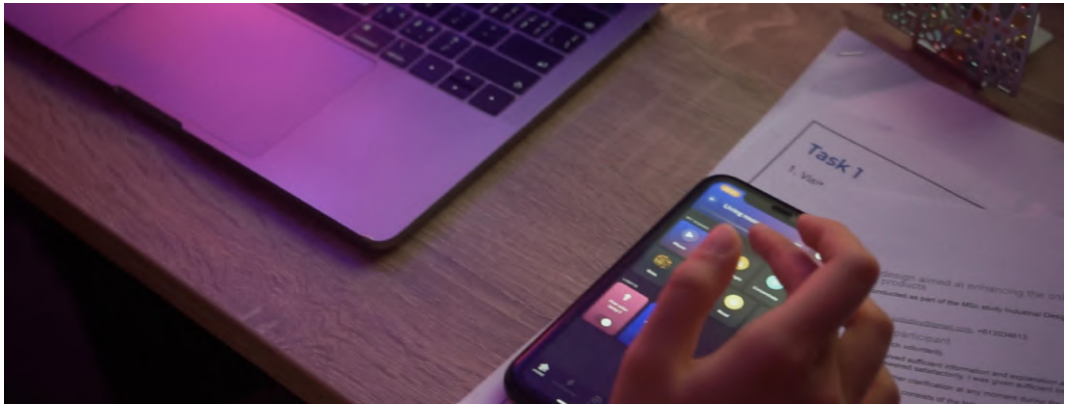
Offical websit	me to explore the interaction	representations of the products were	the product will look in my own apartment	represented to a broad set of
Participant 1	4	4	3	3
Participant 2	2	3	3	3
Participant 3	4	4	3	2
Participant 4	2	3	3	3
Participant 5	2	2	4	3
Participant 6	3	4	3	4
Participant 7	2	2	4	1
Participant 8	2	4	3	3
Participant 9	2	2	1	1
Participant 10	2	3	4	2
Amazon website	me to explore the interaction	representations of the products were	the product will look in my own apartment	represented to a broad set of
Participant				
Participant 1	3	3	3	4
Participant 2	1	2	1	1
Participant 3	2	3	1	3
Participant 4	2	2	3	3
Participant 5	3	3	3	3
Participant 6	1	2	1	1
Participant 7	1	2	3	1
Participant 8	2	4	3	4
Participant 9	4	2	3	4
Participant 10	1	4	3	4

LIGHT QUESTIONNAIRE

Offical website		Evaluative on light	Evaluative on light	Evaluative on light	Evaluative on light	Evaluative on light	Evaluative on light	Evaluative on light	Evaluative on light	Evaluative on light	Perceptual Clarity on lig	Perceptual Clarity on lig	Perceptual Clarity on lig	Perceptual Clarity on lig	Perceptual Clarity on lig	Perceptual Clarity on lig	Spaciousness on light	Spaciousness on light	Spaciousness on light
Participant 1	website	3	2	4	3	2	1	1	4	3	2	6	4	4	4	1	7	4	7
Participant 2	website	1	0	1	0	1	0	7	0	1	7	6	7	7	7	2	3	5	3
Participant 3	website	2	1	3	3	1	0	3	1	2	5	5	5	5	6	1	2	3	1
Participant 4	website	2	1	2	3	2	2	6	2	3	2	3	3	3	6	2	6	6	6
Participant 5	website	4	5	4	2	4	3	2	2	4	3	2	2	4	5	1	2	3	3
Participant 6	website	4	0	0	0	0	0	0	4	0	0	4	6	6	6	2	6	6	6
Participant 7	website	2	4	4	6	2	4	1	1	4	3	3	2	3	4	1	6	6	4
Participant 8	website	1	0	0	3	1	0	0	1	0	4	1	3	3	4	0	1	4	2
Participant 9	website	1	1	4	5	2	2	1	2	7	7	5	6	6	6	0	0	1	1
Participant 10	website	4	2	2	2	3	3	1	1	5	2	2	2	6	5	1	2	3	2
	website																		
Participant 1	amazon	7	7	7	2	7	2	1	2	1	7	4	0	0	0	0	1	4	4
Participant 2	amazon	1	3	2	2	3	3	3	5	4	2	2	3	2	6	4	5	6	6
Participant 3	amazon	1	1	2	2	3	2	4	3	4	2	4	4	4	4	0	1	1	3
Participant 4	amazon	3	4	4	4	4	4	4	4	5	3	3	3	3	3	3	3	3	3
Participant 5	amazon	1	1	1	1	2	2	2	1	3	2	1	1	1	2	0	2	2	2
Participant 6	amazon	6	6	6	6	5	2	2	1	7	6	8	7	6	7	2	6	2	4
Participant 7	amazon	1	0	1	1	1	3	0	0	1	2	4	2	2	0	0	5	6	5
Participant 8	amazon	1	2	2	2	3	3	1	1	4	2	4	3	3	2	2	6	7	6
Participant 9	amazon	4	2	2	2	2	2	1	1	1	1	1	1	1	6	0	6	6	6
Participant 10	amazon	5	4	4	5	4	3	1	2	1	2	2	1	1	4	0	2	2	2
Participant 1	offline	6	0	1	1	1	0	4	3	3	5	0	1	0	0	0	4	4	4
Participant 2	offline	0	1	1	0	0	1	2	0	2	5	2	3	3	6	1	2	6	5
Participant 3	offline	1	1	2	2	3	2	4	3	4	2	4	4	4	4	0	1	1	3
Participant 4	offline	3	4	4	4	4	4	4	4	5	3	3	3	3	3	3	3	3	3
Participant 5	offline	2	2	1	2	1	3	2	1	1	2	2	2	2	2	1	1	3	2
Participant 6	offline	2	6	2	1	1	1	7	1	1		7	7	7	7	1	7	7	7
Participant 7	offline	2	5	5	6	6	2	6	3	6	1	2	2	1	7	1	7	7	7
Participant 8	offline	1	0	1	1	1	3	0	0	1	2	4	2	2	0	0	5	6	5
Participant 9	offline	3	3	3	3	3	4	3	2	2	5	6	6	6	6	4	5	5	6
Participant 10	offline	1	1	0	0	1	0	3	1	2	2	3	3	4	5	1	4	4	3







INTERVIEW TRANSCRIPT

Transcript can be found in https://drive.google.com/file/d/1sDgH21YqW8BqRtFqJM1bnmF36PeKbT1D/view?usp=sharing

DL - Paticipant 7.txt

GL - Paticipant 6.txt

HC - - Paticipant 8.txt

QX - Paticipant 10.txt

Radu - Paticipant 9.txt

RZ - Paticipant 3.txt

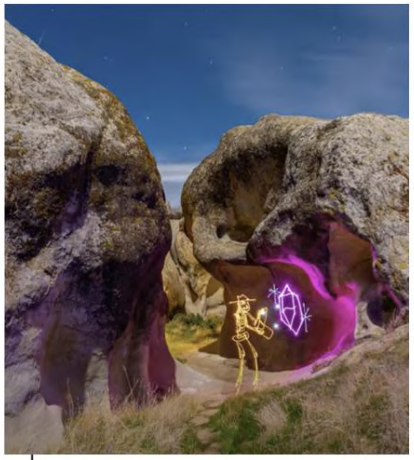
Xueer - Paticipant 2.txt

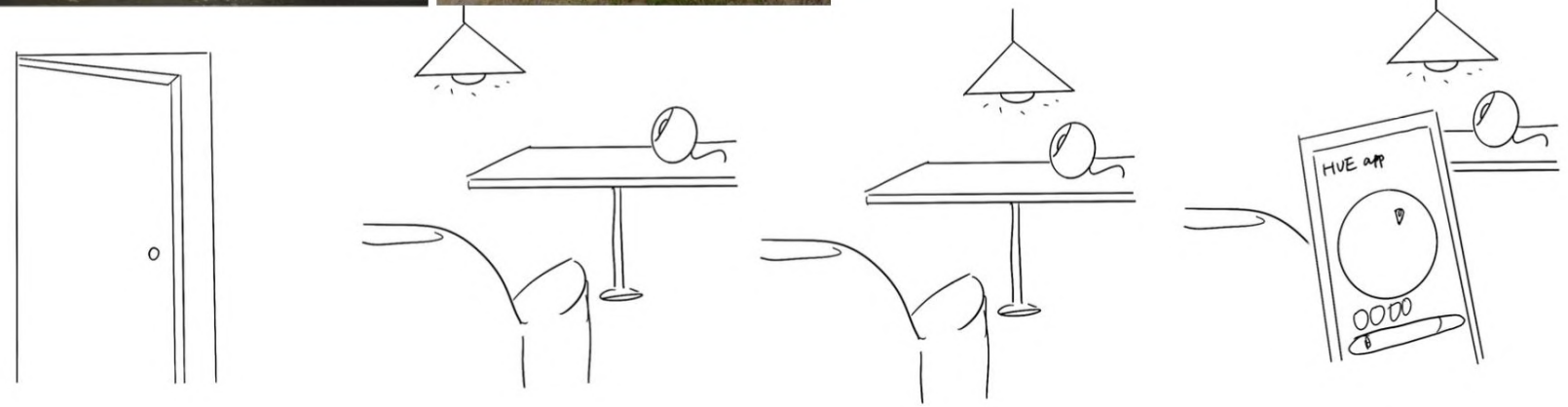
YC - Paticipant 5.txt

YJC - Paticipant 4.txt

YW - Paticipant 1.txt

Use a storytelling way to show the usage scenario





SECOND USER TEST

User Introduction

Hi, thank you for join my test! You are being invited to participate in a research study titled “A conceptual design aimed at enhancing the online retail experience of smart lighting products”. This study is being done by Yu Liu from the TU Delft as a master's student
This project collaborate with brand Philips Hue, Philips Hue is a line of color-changing LED lamp and white bulbs which can be controlled wirelessly.
You can follow the steps below and finish the test, and it will take you about 20 minutes. Please note, all the test should be done on a laptop and use the browser Chrome to insure best experience.
Step 1. Fill out the Information Sheet
Information Sheet link:
https://forms.gle/EaGMYBxnDHJgNfvKA
Step 2. Experience prototype 1: Interactive model
Prototype 2: interactive model https://my.spline.design/version124aprcopycopycopycopy-1efb4c17121719f6d33fe503f77cdf03/
After experiencing the prototype, please fill out the questionnaire
https://forms.gle/1w14bRWqUsQ77uG47
Step 3. Experience prototype 2: P5.js prototype
Prototype 3: P5.js prototype with real images**(Refresh the page if the website is stuck!!!)** https://editor.p5js.org/yuliubox/full/QziyzoLE9
After experiencing the prototype, please fill out the questionnaire
https://forms.gle/Qj4uRM7PHh69TYxv5
Step 4. Experience prototype 3: Animation
Prototype 1: Animation https://my.spline.design/version11marchdarkanimation-da0f4533ba82ef7172323ec280845da3/
After experiencing the prototype, please fill out the questionnaire
https://forms.gle/Sr9Pp9jZMdXbANa9A
Thank you for participating in our user test. We appreciate your involvement and valuable feedback!

Interview transcript

Participant 3
More like 3 (p5.js), because more real, more warm, more able to make me think of the real use of the scene and the future of this lamp to enhance my life, the desire to buy increased
Very need to be able to adjust the mobile, mobile because you can refer to the effect of placing in different positions, as well as different combinations, directly open two actually weak referability, can not see which light to where the light
Abstraction has aesthetic pleasure, but lower abstraction makes me more associated with their own living environment, so that I really think about the practical significance of the lamps and lanterns rather than just appreciate the page effect

Participant2
I think the first one (interactive model) is good, you can switch the angle, but the light does not feel like I can control it myself, and I do not quite understand the relationship between the change of the light and my mouse position (I feel no relationship)
The second my operation and the relationship between the change of light is very intuitive, although the model through the mold
The third is very annoying feeling dirty picture living in that room will be depressed can not afford to pay the electricity bill feeling
But the third picture is very real The first two are not realistic modeling, but I think it does not affect the effect of the light and my imagination of the light I feel that my imagination can be brainstormed
Suggestions for improvement I think the second one is good if you can add more ways to interact with it would be better

Participant 4

Prefer the third (interactive prototype)

After is because he may, well, first of all, he can let me to move that. One or two lights, and then you can adjust its brightness, and then I think, well, I'll be more, well, I'll just feel like I can imagine what this light will look like in this environment.

It's the second problem is the first circle when I can only see, well, it's a few lights inside that little scene, and then it's changing colors, but I'm not quite sure. What makes him change, so I'm just, well, not quite sure how he actually interacts, and he has different colors, and I'm not quite sure which light has this color, then. So it felt a little bit strange, and then the second prototype I remember is that you are in the actual scene, and then you can. Change its a color, well, then I can actually see how the actual scene of its color will change, but because its brightness is still relatively low, and then it is equivalent to a little more ambient light, and then it is still relatively dark environment, only the place where the light is brighter.

I personally will be more than still prefer, the kind of photos, because I feel that the modeling of the more abstract, so I will not be particularly able to associate with my home. With this light when the actual a situation, because I think it is your prototype two words, it is at home inside a picture, and then I can feel it may be for some of the surrounding. Material above it will also have a different light, and then the light on the walls will also have a different light, but if it is in that modeling of that 2D, that 3D one, that is the kind of animation prototype inside, then it feels like all of its materials are. Well, similar walls, walls and tables are the same sense of texture, and then it will feel it abstract some, and then you can only feel that there are these colors and this brightness, but actually. On the actual real scene, it may be the color in different materials on the radiation out of the texture is different, and it gives a person with the feeling may also be different. And then there may be, for example, you. Picture two, it seems to have something to block, and then it will also produce some different feeling, but you are in a your circle center one and three inside the words, I remember that is the whole room will actually be affected, and then. Well, I feel that is the whole of that little animation will be affected, and then it's not as realistic. I would probably choose one, I would still like to have, um, in the picture or provide a few more different kinds of atmosphere in the home, and then you would have the lights. Well, you can adjust its color, and you can adjust its brightness, and then the location is that I think the location, I personally do not say that there is that much need for the location, right. It is mainly the brightness and its a color may be adjustab

Participant 1

1. which prototype do you like better and why?
I like 2 (interactive model), the freedom of interaction is very high, not stuck frame is very silky smooth
2. How does the interactivity of the model affect your experience? Interactivity means you can move the light position to adjust the brightness, etc.
The ability to freely choose the placement and color of the lights makes the whole experience more driven to the actual, high degree of freedom makes the experience more immersive
3. How does the abstraction of the model affect your experience? High abstraction is modeling, low abstraction is pictures
If it is a high-model model, it feels like the abstraction level is not very low? But I think it is more important to build "space" to make people more immersive, modeling makes the space more deep
4. If it were you, how would you do the design/what would you suggest for improvement?
I would make the environment also modular and interactive

Participant 8

1. which prototype do you prefer and why?
The 3D interactive model provides a more complete view to let me feel the overall lighting of the room, but probably because of the perspective, the second prototype allows me to feel and think more intuitively about how the lights hit the room, but overall the first prototype is a more complete experience and easier for me to adjust the position of the lights myself.
2. How does the interactivity of the model affect your experience? Interactivity means that you can move the lights around to adjust the brightness, etc.
I think a very good point is that the position of the lamp can be changed at will, and the light effect with it also changed, so I can feel the light effect more intuitively, the brightness adjustment is not perfect, the third gear is too bright to cause the room is overexposed, if it can be changed to a linear slide adjustment may be better?
3. How does the abstract nature of the model affect your experience? For example, the content of the photo is more concrete, the modeling is more abstract
The photos are more concrete so that I can more easily imagine the effect of light in the room, abstract more like the feeling in the game
4. If it were you, how would you do what design / what suggestions for improvement?
I think on the basis of the first model to improve the light brightness adjustment mechanism, so that the brightness adjustment is more smooth, and then it is possible to figuratively some, too abstract I a little into the scene

Participant 17

The first problem is that I like the last one the most (im), I feel that he can arc a little higher, because I can change the position of the light, and then it also has a corresponding change in light and shadow, I will know more clearly ah. If placed in accordance with my own preferred way, it will be what kind of
And then the second point, I will interact, I will imagine a different use of the scene well, let's say I study, or ah, I in the normal ah, brush the phone or party time. I will imagine this cinema, and then let's say when studying, I will ah, observe that my writing desk, how is the brightness of it, and then it's the color of the apparent display is how the.
The third point is that I feel that I personally would be better to be more abstract, because if the photo, it will have a lot of details, and then the realism is higher, it is more difficult for me to put it. Imagine it as a space of my own, but let's say the modeling kind is ah, it will be less detailed, then I may imagine to imagine easier to put. He becomes a space of my own, right?
And then the fourth point, ah, the first I feel that it may be possible to be divided into different scenes, let's say you may be a living room, and then there is a study or bedroom will also be good. Or is divided into what a one-bedroom two-bedroom such. Then the second is not quite sure if that home home can be moved, or if there will be some outdoor park or other impact.

Participant 18

The third (interactive model)
If you are imagining the light application in your own home, I like the first person figurative a little interaction
I did not feel much lighting experience, only feel the stage art experience hahahaha
I hope to be able to replace different lamps or bulbs, you can choose your own parameters, and then you can switch scenes and perspectives is the best! I want to experience the first-person perspective After all, if you pick lamps for your own home, you still want to see the atmosphere in which you are

Participant 16

1. like that only a sofa model, the atmosphere and a better sense of reality (im). (The small room, the one with the desk, is more interesting to interact with and has a stronger sense of design, but there is no way for me to relate it to a realistic use scenario) 2. By moving the light source and adjustable color can improve the accuracy of my choice of lighting. (That is, I can know which lighting effect I need) 3. (Answer 1. Bracketed content) Not so much to restore the reality of the abstract illustration model will make me lack of immersion, can not associate with the use of lighting in my home scene, and can not enhance my desire to buy and choose it. I just feel like playing a mini-game. 4. Maybe add the effect of lighting in three views, or add the character to use the light source, it may be more interesting

RAW DATA FROM UX QUESTIONNAIRE

Interactive model_ Second user test_light

Your participa	The website a	The visual rep	I can imagine	The visual ima	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The environm	The environm	The environm	The environm	The environm	The environm
3	4	3	4	4	3	2	2	2	1	1	1	3	1	1	1	1	1	1	0
1	4	4	4	3	0	0	0	3	2	1	4	3	0	0	4	0	1	4	0
4	2	2	1	2	5	4	4	5	4	3	0	4	4	5	6	6	6	2	0
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19	3	3	2	2	2	2	2	2	4	2	3	2	0	1	4	4	4	5	2
15	4	4	4	4	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0
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9	3	3	1	2	1	1	1	1	1	1	4	1	1	5	5	0	3	2	1
21	4	4	4	3	0	0	0	0	0	2	2	1	0	1	3	4	4	3	2
20	4	4	4	4	0	0	0	0	0	0		1	0	0	0	0	0	0	0
	4	4	4	4	1	1	0	1	0	1	1	1	2	2	6	5	5	5	1
8	3	4	2	3	5	3	2	5	2	3	1	5	3	5	5	5	2	6	2
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22	3	3	3	2	2	2	2	3	3	2	2	3	2	3	2	2	2	3	2
5	4	3	3	3	6	5	5	3	5	2	2	7	3	2	2	6	6	2	2
13	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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7	3	2	1	4	2	1	2	2	1	3	6	5	2	1	0	1	1	1	2
24	3	3	3	3	2	2	2	3	2	1	2	2	3	2	1	1	1	1	2
26	3	4	4	3	1	1	0	0	1	1	4	2	3	2	1		1	2	2

P5.js model_ Second user test_light

Your participa	The website a	The visual rep	I can imagine	The visual ima	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The environm	The environm	The environm	The environm	The environm	The environm
3	4	3	4		1	1	1	0	0	2	1	0	1	1	3	2	2	1	3
1	4	3	3	3	2	3	4	2	4	0	4	0	3	0	8	3	3	6	0
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2	1	1	4	1	7	7	8	7	7	8	8	3	8	8	8	8	8	2	8
10	3	2	1	2	3	3	5	5	4	4	8	2	7	8	8	8	8	7	4
19	3	3	3	2	2	2	2	2	2	2	3	3	2	5	5	6	5	3	5
15	3	3	4	2	2	2	2	3	2	2	3	1	3	5	5	4	6	6	5
9	2	3	3	2	3	3	2	4	4	5	6	4	6	4	6	4	2	1	6
20	4	4	4	4	1	1	1	1	1	1	2	1	0	1	2	1	1	1	0
17	3	3	3	2	3	3	3	2	5	2	6	2	5	3	8	8	7	6	6
8	4	3	4	3	2	2	4	3	2	3	5	3	2	5	5	3	5	3	5
6	2	2	2	2	4	4	3	4	5	3	5	3	4	4	6	3	3	4	4
22	3	3	2	2	1	2	2	1	3	2	3	1	2	4	5	4	3	3	5
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23	4	4	4	3	2	2	2	1	1	1	2	2	1	5	6	4	5	4	4
26	4	2	3	3	2	1	2	1		4	7	2	6	6	7	6	6	6	5
13	3	2	3	3	1	1	1	1	1	1	1	1	1	1	3	2	2	4	1
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7	4	3	4	1	1	1	1	2	2	3	2	0	0	1	6	6	2	5	5
24	2	3	2	3	4	5	4	4	5	3	4	2	4	3	5	4	5	4	4
26	4	4	4	3	0	0	0	0	0	0	2	1	0	3	2	4	4	2	1

RAW DATA FROM UX QUESTIONNAIRE

Animation model_ Second user test_light

3	3	3	2	2	5	3	2	2	2	1	1	3	1	4	2	2	3	2	0
1	4	3	4	3	2	3	3	0	2	1	4	6	4	6	8	1	3	7	0
2	3	4	4	3	4	2	2	2	2	2	4	4	2	2	3	1	1	1	0
10	1	4	3	3	2	2	1	2	3	2	4	2	3	1	2	2	2	2	1
19	3	3	2	2	1	3	3	3	3	1	3	1	1	3	5	5	4	5	2
15	4	4	4	4	2	1	1	3	0	0	2	1	1	1	2	0	0	1	0
9	1	2	1	1	1	1	1	1	4	2	6	1	2	1	2	3	5	5	0
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17	1	3	2	2	5	3	2	2	3	2	6	3	2	5	5	7		6	1
8	1	3	2	3	3	4	2	3	2	3	1	5	1	5	3	5	3	5	1
	3	2	3	3	2	2	2	1	2	2	2	2	2	2	1	2	2	2	1
22	1	2	2	2	6	5	4	5	5	5	4	5	3	4	2	2	3	4	0
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4	1	2	1	2	5	4	4	4	3	4	0	3	3	6	6	6	6	0	0

RAW DATA FROM LIGHT QUESTIONNAIRE

	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The lighting e	The environm	The environment in	The environm	The environm	The environm	The environm
Animation	5	3	2	2	2	1	1	3	1	4	2	2	3	2	0
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Animation	1	3	3	3	3	1	3	1	1	3	5	5	4	5	2
Animation	2	1	1	3	0	0	2	1	1	1	2	0	0	1	0
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Animation	1	1	1	0	1	0	0	1	0	0	1	2	2	2	0
Animation	2	2	2	2	2	1	3	1	1	2	2	2	2	2	0
Animation	5	3	2	2	3	2	6	3	2	5	5	7		6	1
Animation	3	4	2	3	2	3	1	5	1	5	3	5	3	5	1
Animation	2	2	2	1	2	2	2	2	2	2	1	2	2	2	1
Animation	6	5	4	5	5	5	4	5	3	4	2	2	3	4	0
Animation	6	5	5	3	6	2	2	7	5	1	6	3	6	4	6
Animation	2	2	3	2	2	2	2	2	2	2	4	4	4	3	2
Animation	2	1	1	1	1	0	3	0	1	1	0	1	1	1	2
Animation	1	0	1	0	0	0		0	1	3	4	5	3	6	0
Animation	1	1	1	1	1	1	3	2	1	3	4	4	1	7	2
Animation	6	5	5	5	6	1	3	5	4	2	3	3		4	0
Animation	5	4	4	4	3	4	0	3	3	6	6	6	6	0	0
Interactive	3	2	2	2	1	1	1	3	1	1	1	1	1	1	0
Interactive	0	0	0	3	2	1	4	3	0	0	4	0	1	4	0
Interactive	5	4	4	5	4	3	0	4	4	5	6	6	6	2	0
Interactive	1	0	1	1	1	1	4	1	1	1	1	1	1	1	1
Interactive	1	1	1	3	1	1	4	2	3	3	6	6	7	6	2
Interactive	2	2	2	2	4	2	3	2	0	1	4	4	4	5	2
Interactive	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0
Interactive	5	6	6	6	1	0	2	0	0	5	2	2	1	0	0
Interactive	1	1	1	1	1	1	4	1	1	5	5	0	3	2	1
Interactive	0	0	0	0	0	2	2	1	0	1	3	4	4	3	2
Interactive	0	0	0	0	0	0		1	0	0	0	0	0	0	0
Interactive	1	1	0	1	0	1	1	1	2	2	6	5	5	5	1
Interactive	5	3	2	5	2	3	1	5	3	5	5	5	2	6	2
Interactive	1	1	1	1	3	1	3	2	2	2	2	3	1	3	1
Interactive	2	2	2	3	3	2	2	3	2	3	2	2	2	3	2
Interactive	6	5	5	3	5	2	2	7	3	2	2	6	6	2	2
Interactive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interactive	2	1	1	2	2	2	1	1	0	3	3	3	3	5	3
Interactive	2	1	2	2	1	3	6	5	2	1	0	1	1	1	2
Interactive	2	2	2	3	2	1	2	2	3	2	1	1	1	1	2
Interactive	1	1	0	0	1	1	4	2	3	2	1		1	2	2
P5.js	1	1	1	0	0	2	1	0	1	1	3	2	2	1	3
P5.js	2	3	4	2	4	0	4	0	3	0	8	3	3	6	0
P5.js	0	2	3	1	3	3	8	0	5	5	8	8	6	6	4
P5.js	7	7	8	7	7	8	8	3	8	8	8	8	8	2	8
P5.js	3	3	5	5	4	4	8	2	7	8	8	8	8	7	4
P5.js	2	2	2	2	2	2	3	3	2	5	5	6	5	3	5
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P5.js	3	3	2	4	4	5	6	4	6	4	6	4	2	1	6
P5.js	1	1	1	1	1	1	2	1	0	1	2	1	1	1	0
P5.js	3	3	3	2	5	2	6	2	5	3	8	8	7	6	6
P5.js	2	2	4	3	2	3	5	3	2	5	5	3	5	3	5
P5.js	4	4	3	4	5	3	5	3	4	4	6	3	3	4	4
P5.js	1	2	2	1	3	2	3	1	2	4	5	4	3	3	5
P5.js	1	1	1	4	2	3	6	2	4	3	6	4	5	5	3
P5.js	2	2	2	1	1	1	2	2	1	5	6	4	5	4	4
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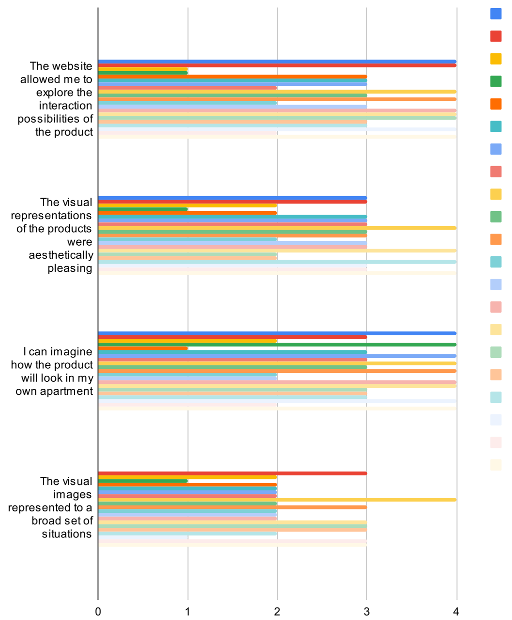
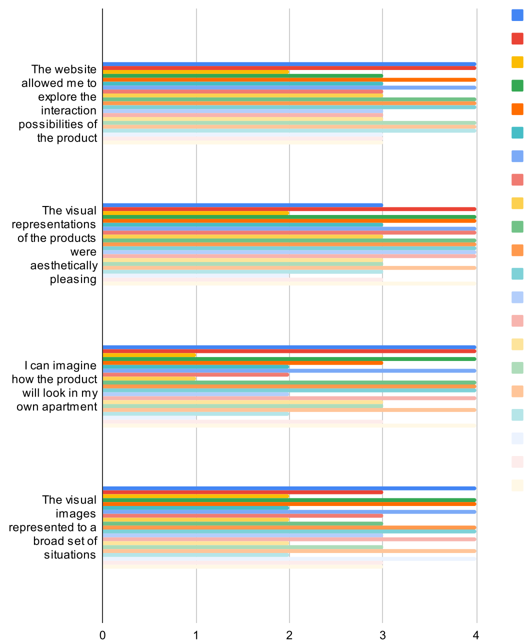
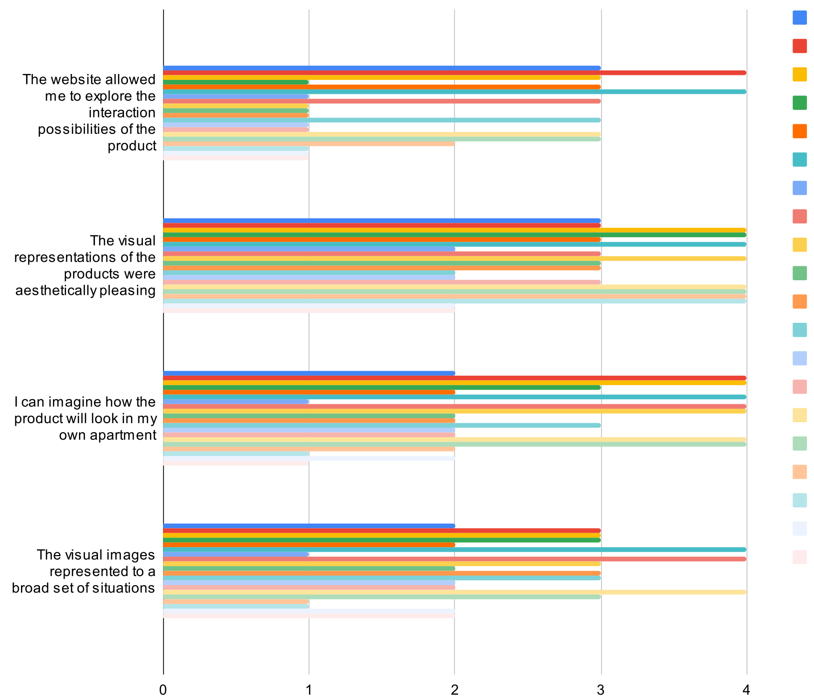
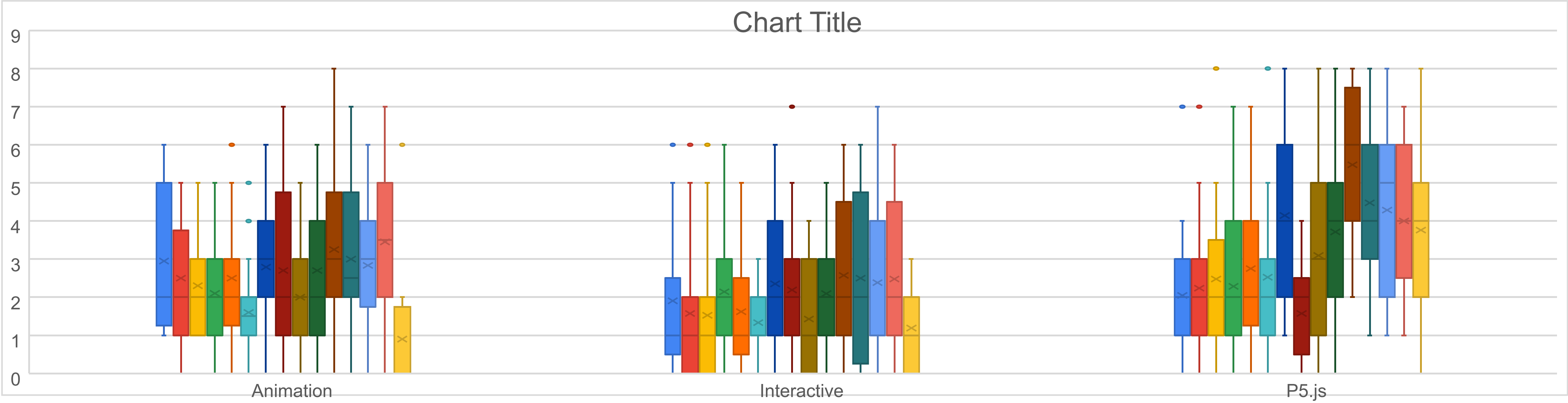
P5.js	1	1	1	2	2	3	2	0	0	1	6	6	2	5	5
P5.js	4	5	4	4	5	3	4	2	4	3	5	4	5	4	4
P5.js	0	0	0	0	0	0	2	1	0	3	2	4	4	2	1

ORIGINAL GRAPH

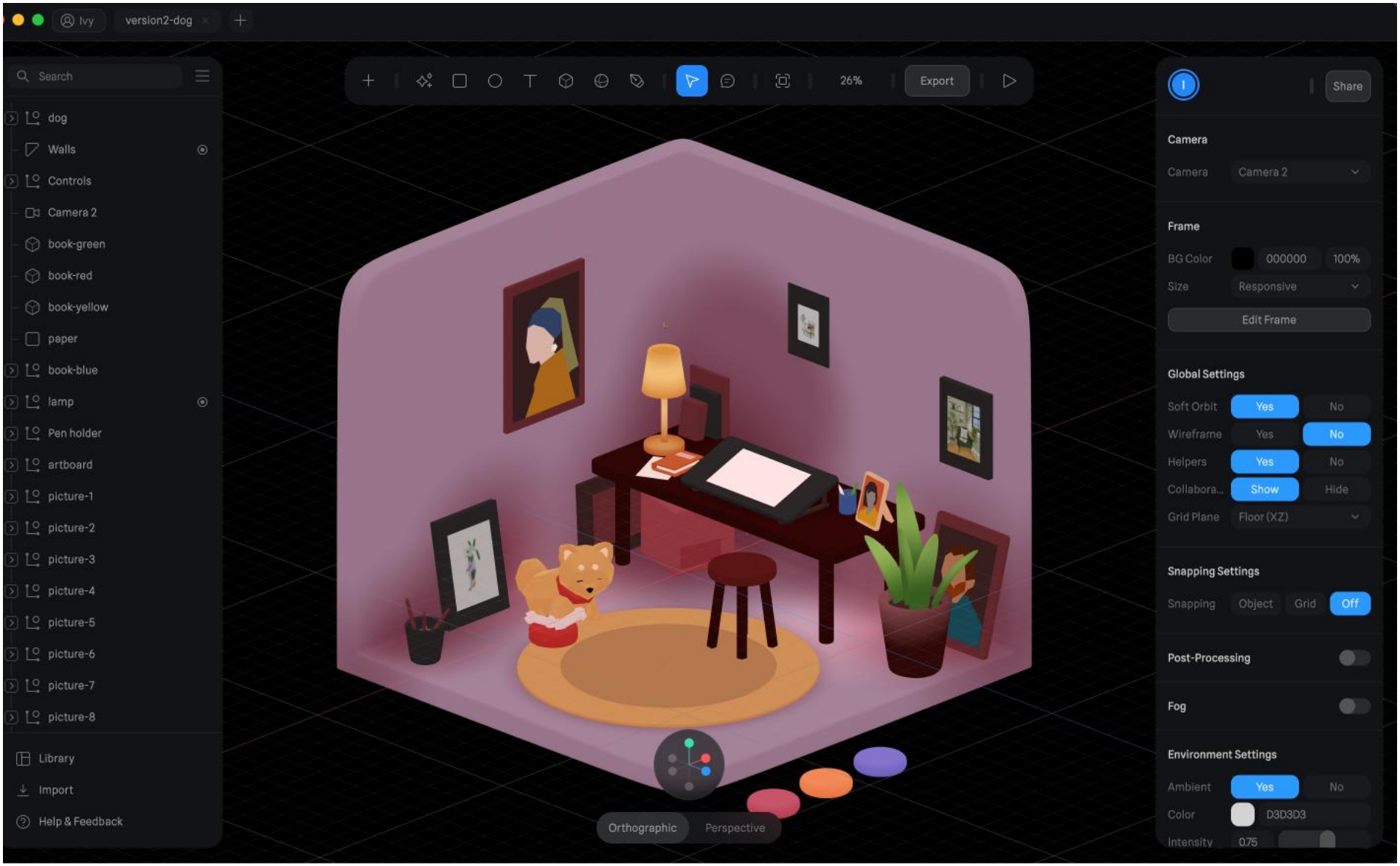






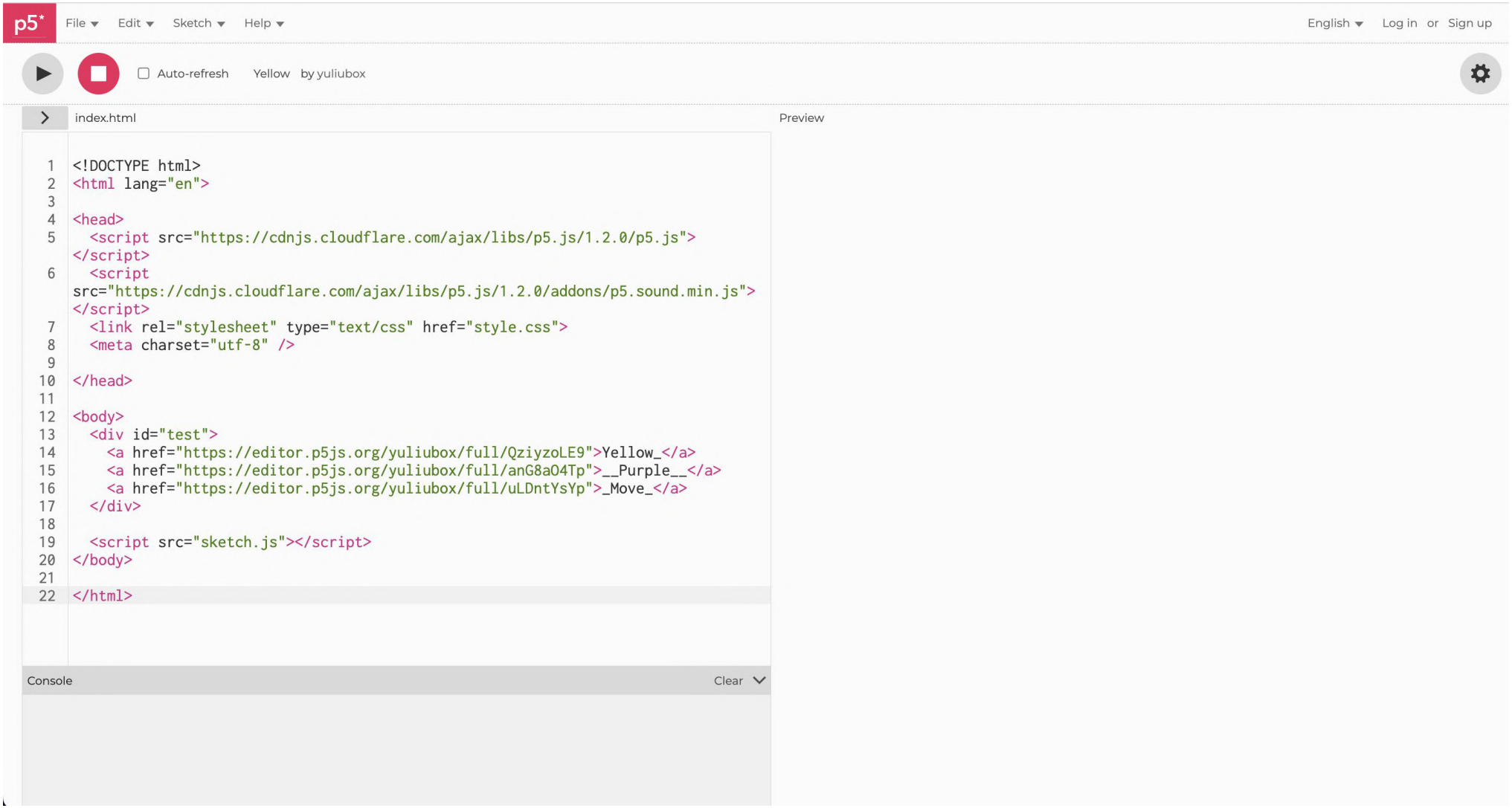


SPLINE SCREENSHOT



P5.JS SCREENSHOT

HTTPS://EDITOR.P5JS.ORG/YULIUBOX/SKETCHES/QZIYZOLE9



A conceptual design aimed at enhancing the online retail experience of smart lighting products

project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 16 - 01 - 2023

06-07-2023 end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

The Internet plays a vital role in revolutionizing the commercial world, people get used to gathering information and making purchases on the Internet. However, there is a difference between the online representation of the product and the actual product. When users do online shopping, how do they perceive the character of smart lighting products? The perceived quality is related to the product itself and online presentation which effects customer value, it indicates that the perceived quality of a good product will increase customer value. (Lukmanul Hakim, 2017).

Current smart lighting companies in the market present products in different various ways. And the official website and amazon store are the main entrance for online purchasers, Images and videos are widely used on the online website to give users a more elaborate experience. Multimedia presentations are effective marketing tools that can empower any E-commerce site whether it is selling products or services (Manvi&Venkataram, 2005). To better understand the product, They can be divided into different categories: Appearance, Lighting effect, and Interaction. For a smart lighting brand, “Appearance” indicates the physical dimension, shape, and materials used of the products. “Lighting effect” is related to the brightness and colorfulness of the lightbulbs, and “Interaction” is related to smart home functions, such as the function “Circadian clocks”: the light will light up and dim out in morning and night. As a smart lighting product, “Interaction” is related to “Lighting effect”, such as the “Ambience” feature: smart lightbulb can create suitable lighting conditions for reading, eating and gaming by using the app. Thus, the research aims to discover the relationships between different online presentations and the perception on the character “Interaction” and “Lighting effect”.

This project collaborates with the Smart lighting brand Philips Hue, and the future design solution will also combine with the brand identity and target user. Philips Hue is a consumer LED lighting system that can be controlled from a smart device. After the First Wave of solid-state lighting, where combinations of blue LED chips and phosphors generate acceptable white light efficiently, but leave the full electronic potential of LEDs largely untapped (Karlicek, 2012). The smart lighting system is created with the new control and communications methods in Second Wave. The Hue system was released in October 2012 as an Apple Store exclusive. And The product Hue Bridge is the central device for controlling home devices. The latest system allows to control a home's lighting via a mobile app on a smartphone or tablet computer, but can also be controlled by a voice control function and it’s often for ambiance, security, and entertainment use at home. Under consideration of the current usage scenario, the interaction will not involve virtual reality technology to present the product. Recording the behavior of several users helps industries to discover habits and tendencies of user, which can lead to even better and effective decisions to improve business profit and its market coverage.(Chetna Gupta&Adwitiya Sinha, 2017). Through the research, I will study customer behavior.

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PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

Phillips Hue is a lighting system that is experienced differently depending on the environment. As Every consumer has a different interior, it is hard to imagine how the Hue system will look. This is a problem that is not only caused by the product being 'online'. However, the advantage of an actual shop is that users can test the system in a generic interior space. The direction of this project to create a generic shop experience online and explore directions where online can be an advantage.

The first part of this project is to find a comparable way to evaluate the psychophysical model of light qualities and online retailing design elements. Then do a lot of prototyping in different media to build an experimental design that helps to quantify optimized expectations. In the planning, 50 working days will be invested in this phase.

For the design solution part, 30 days plan to be invested and the communication decisions or assumptions concerning 'what', 'when', 'why' and 'how' to communicate" will be made. (Stephanidis,1997). If possible, I will conduct an A/B test on Philips Hue Amazon store to gather more quantitative results. The main challenge on this stage will be making a testable plan for the design solution which fits the current context and brand identity.

In the last 20 working days, the main work will be documentation and preparing the presentation material.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

Psychophysical model about Light qualities and online retailing design elements, and several tests will be made to conclude the model
Guideline for improving online retailing experience, communication decisions or assumptionsconcerning 'what', 'when', 'why' and 'how' to communicate" will be made

Initials & Name Y.L. Student number 5576970

Title of Project A conceptual design aimed at enhancing the online retail experience of smart lighting products

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, andplease indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 15-2-2023 06-07-2023 end date

Graduation project plan

	Months	February					March				April				May			June					July
	Calendar Week	6	7																				
	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23(100 workdays
Imp	Kick of Meeting	15.Feb																						
	Midterm Evaluation										6.April													
	Green Light Meeting																			8.June				
	Graduation Defence																							6.July
Anal	Literature Study						15.March																	
	Build virtual prototype 1st				3.March																			
	Pre test, improve and user test								31.March															
	Analysis										6.April													
	Conclude model												28.April											
Ide	Ideation													5.May										
	Build prototypes for guidelines														19.May									
	test the protype																19.May							
	Conclude guideline																		31.June					
Dev	Build new amazon element and apply																		31.June					
	Test in amazon page/ protype test																			8.June				
	Conclude																				15.June			
	Final Thesis + Showcase																						30.June	

Initials & Name Y.L. Student number 5576970

Title of Project A conceptual design aimed at enhancing the online retail experience of smart lighting products

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

Career opportunities: Smart lighting systems are still a relatively new and rapidly evolving technology, which means there are ample opportunities for innovation and creative problem-solving. Creating an attractive online experience to sell smart lighting products will be a fresh experience for the customer

Creative expression: Learn in-depth knowledge about P5.js and create an interactive online experience. P5.js is a powerful and flexible programming language that allows you to create interactive and visually stunning experiences. By learning in-depth knowledge of P5.js, you can use your programming skills to create a wide range of digital art and interactive experiences, providing you with a creative outlet to express your ideas and imagination.

User Experience Design ability: One of the most critical aspects of designing an online interactive retailing experience is creating a positive and engaging user experience. Learning about UX design principles and best practices can help me create a digital storefront that is intuitive and easy to use for customers, which can improve their overall satisfaction and increase the likelihood of them making a purchase.

Lighting Design: Proper lighting can enhance the visual appeal of a website or digital product. By learning lighting design principles, I can effectively use light and shadow to create depth, texture, and contrast, making your online experience more visually interesting and engaging.

Reference

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FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

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