



Formal Frames:
Game Design for Art Education on
Formal Analysis in Museum Context

Master Thesis

Integrated Product Design

Maggie Xuan Gou

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Formal Frames: Game Design for Art Education on Formal Analysis in Museum Context

Author

Xuan Gou

MSc Integrated Product Design

Faculty of Industrial Design Engineering
Delft University of Technology

Supervisory Team

Dr. Maarten Wijntjes (Chair)
Dr. Willemijn Elkhuizen (Mentor)

Several First Words...

It's hard to believe that my master's studies are almost over, and all the memories are coming back to me. I still vividly remember the first time I met Maarten. He introduced me to his magical Synoptor, which completely changed my opinion of viewing pictorial arts. Although my final design took a different direction, his support, encouragement, and respect throughout the process made me confident I was on the right path, allowing me to truly enjoy the last six months of university.

I'm also incredibly grateful for the chance to work with Willemijn as my mentor. Her sharp and meticulous feedback was crucial in helping me complete my thesis. I'd like to extend my gratitude to Vera from the Mauritshuis education department. Even though our interactions were brief, she always gave her best.

I want to thank my parents for traveling all the way to Europe to see me, participating in my testing, and unconditionally supporting my passion.

And lastly, to my dearest friends—Ari, Caleb, Carlo, Matteo, Ni, Paul...—as promised, you're all here in my acknowledgments. You guys are the reason Delft became such a special place in my heart.

Wishing you all the best!

Maggie Gou Xuan



Preface

A story from my dad...

It's been a year and a half since I've been away from home, so this winter, my parents decided to visit me in the Netherlands. Of course, exploring the museums here is a must.

My dad, is a technical person and a history enthusiast. Throughout my first 20 years, going to museums with him always turned into historical lecture. He'd point to a painting and say, "Hey, Maggie, see that painting? It tells the story of the French Revolution. Let me tell you about this part of history, etc. etc."

This time, we found ourselves in Mauritshuis. Standing in front of Johannes Vermeer's famous work, "Girl with a Pearl Earring," my dad was absorbed in contemplation. Suddenly, a gasp of surprise escaped from his mouth:

"Look at the **white dot**, how magical! Just a dot makes the pearl shine! That brush called **highlight**, isn't it?"

My dad, actually just realized some principle about formal analysis here. But how did he learn all about this? It clearly brought him joy. As a designer, I can't help wondering how can I design a set of tools which allows museum visitors like my dad to learn about the formal analysis and to support this new way of enjoying art?



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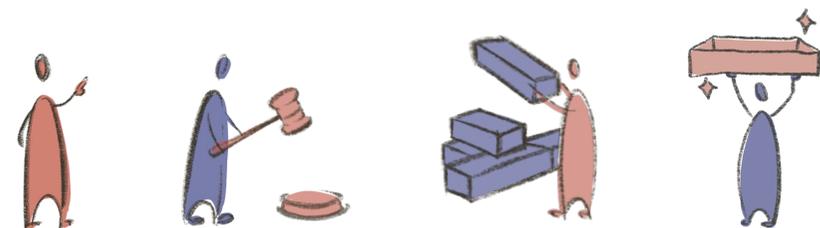
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*All illustrations are made by myself and all pictures are taken by the myself unless stated otherwise



1

Introduction

In this chapter, you will gain an overall introduction to my graduation project, as well as an understanding of the approach employed throughout the process.



Project Introduction

Art occupies a vital role in society and culture, providing a diverse range of visual expressions. In the context of art education, the appreciation of art generally follows two distinct approaches: one that concentrates on the content depicted within the artwork, and another that emphasizes the visual information itself. The latter approach often utilizes formal analysis, a method that carefully examines visual elements such as color, line, texture, and composition. This method, requiring minimal prior knowledge of art history and widely employed by art historians and scholars, is particularly accessible to a broad audience of art enthusiasts. However, my research indicates that museum education rarely prioritizes this approach when engaging with visitors.

The goal of this project is to address this gap by introducing formal analysis to museum visitors who are keen to deepen their understanding of pictorial art. This initiative aims to enrich the visitor experience by enabling individuals to uncover more subtle details within artworks and to discuss art with greater confidence.

After several rounds of ideation, I developed an educational and interactive board game, *Formal Frames*, which adopted the concept of gamification to facilitate formal analysis. The game provides an entertaining format in which players ask questions about the formal elements of paintings, encouraging them to reconsider and develop a deeper appreciation for artworks through the medium of play.

Upon the project's conclusion, I assessed the game's impact on the museum experience, receiving predominantly positive feedback. Nonetheless, as an educational tool, *Formal Frames* still has several aspects that require further refinement in future iterations.

Project Approach

This research employed a mixed-methods approach, structured around the Double Diamond design process (Figure 1.1), which is widely recognized for its effectiveness in guiding creative problem-solving. The Double Diamond framework consists of four distinct phases: Discover, Define, Develop, and Deliver.

In the **Discover** phase, the research began with a comprehensive exploration of existing literature on formal analysis in art education and the application of interactive technologies in museums. This phase also included qualitative field observations in various art museums and interviews with museum professionals, aiming to gather insights into current practices and the challenges associated with engaging visitors.

The **Define** phase involved analyzing the data collected during the discovery phase to identify key themes and specific issues related to the application of formal analysis in museum settings. This phase focused on narrowing the research scope to clearly define the design challenge: developing an interactive tool that would enhance visitors' ability to engage with formal analysis.

In the **Develop** phase, the focus shifted to the ideation and prototyping of the interactive design. Drawing on the insights gained from the earlier phases, various design concepts were generated and refined through iterative testing and feedback from potential users. This phase emphasized exploring different interactive elements and game design principles that could make formal analysis more accessible and engaging.

Finally, in the **Deliver** phase, the most promising design, the interactive and educational board game *Formal Frames* was refined and implemented. The developed prototype was tested within a museum setting, and its effectiveness was evaluated based on user feedback and observation. This phase also included a critical reflection on the design process and the identification of potential areas for further development.

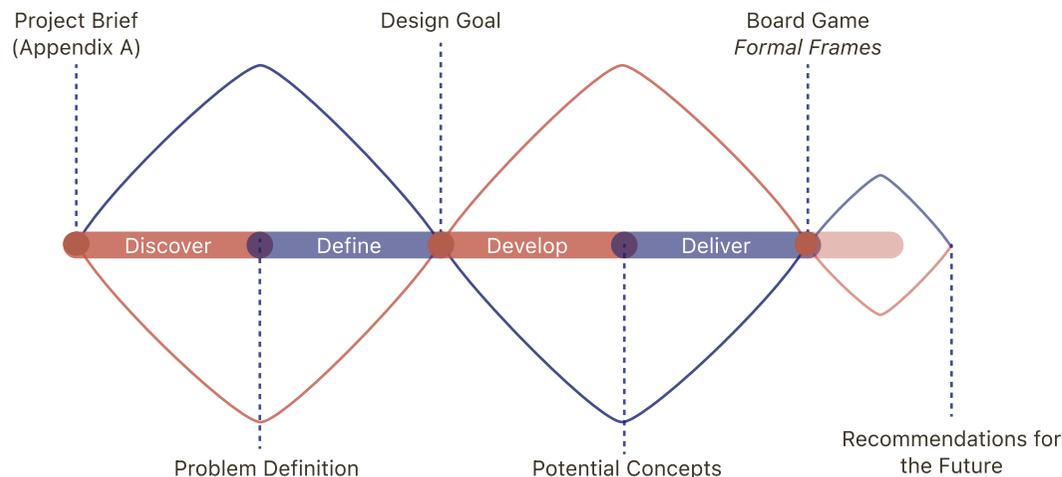
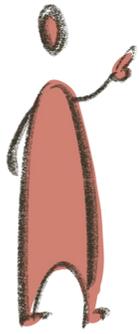


Figure 1.1 The Double Diamond



2

Discover

In this chapter, I employed a variety of research activities to explore the topic of formal analysis in art education within the museum context from multiple perspectives. This approach aimed to gain a deeper understanding of the context, in order to identify challenge and opportunity in the project.



Introduction

Overview

In the discovery phase, five primary fields were examined (Figure 2.1). Within the domain of **art education**, formal analysis was identified as the central topic. Additional frameworks, such as visual thinking strategies and Discipline-Based Art Education (DBAE), were also explored.

To gain a thorough understanding of the (art) **museum context**, research activities including observations and informal interviews with museum visitors were conducted. These efforts aimed to uncover insights into visitor behavior and their museum-visiting habits.

The intersection of art education and the museum context highlighted the topic of **art education within the museum setting**. To investigate this area, a preliminary formal analysis was conducted by myself in a museum, supplemented by several interviews with museum educators. Additionally, current educational methods were evaluated through an analysis of the museum's audio guide.

Given that the project focuses on the development of a physical toolkit, an investigation into **optical devices** was undertaken to inform the design process. To ascertain the applicability of these devices within the museum context, an exploratory experiment was conducted in laboratory setting to examine their impact on visual perception and awareness of formal elements (see Appendix B).

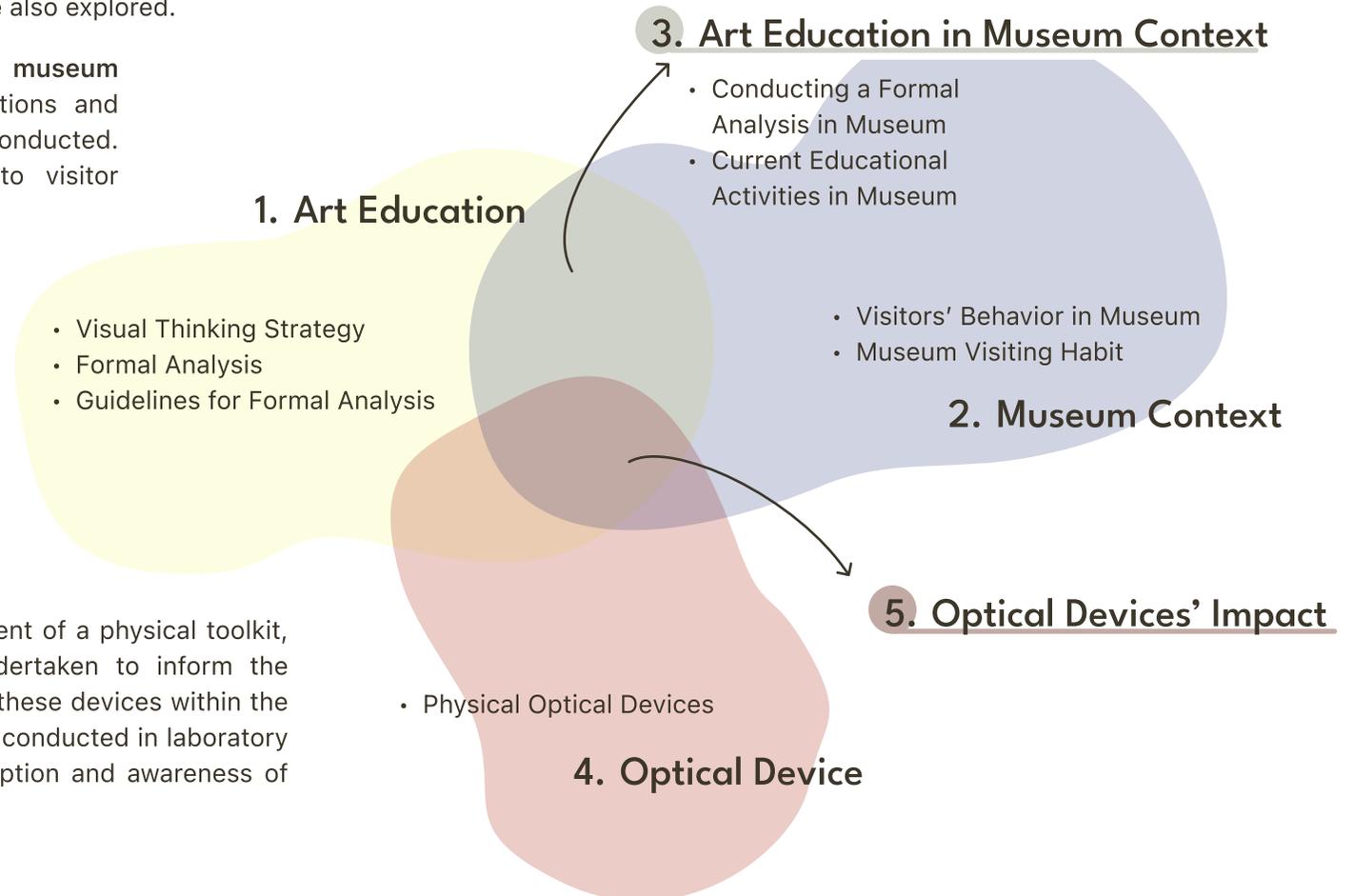


Figure 2.1 An Overview of Research Field

Art Education

Literature Review

Introduction

Before designing a toolkit to promote the formal analysis framework, it is essential to understand the framework itself and its associated educational systems. Therefore, conducting research during this preliminary discovery phase is crucial. To maintain focus and avoid getting lost in the vast body of existing literature, the following research questions have been formulated to guide the investigation into formal analysis:

Research Questions

1. What are the frameworks/theories/approachers used in art education?
2. What is formal analysis?
3. What are the benefits of using formal analysis as a framework?
4. How to conduct a formal analysis?
5. How is formal analysis applied in (museum) art education?

The aim is to address these questions through a literature review, drawing on a variety of sources, including academic papers, books, museum websites, YouTube channels, and open-source education programs offered by art education organizations.

In addition to research related to formal analysis, it is also important to explore effective educational and learning strategies. Therefore, literature on learning styles will also be examined to inform the design of this project.

Frameworks in Art Education

Art is a fundamental component of society and culture, encompassing a diverse range of visual expressions. Art education plays a crucial role in helping individuals understand these cultural and visual manifestations (Gil-Glazer, 2017). Over time, educators have developed various frameworks within the field of art education to enhance this understanding.

One significant framework is Discipline-Based Art Education (DBAE), developed in the 1980s by the J. Paul Getty Trust. DBAE integrates four distinct disciplines: art production, art history, art criticism, and aesthetics. This approach aims to provide students with practical skills, historical knowledge, critical analysis abilities, and a philosophical understanding of art (Kim, 2006).

Another influential framework is Visual Thinking Strategies (VTS), a research-based teaching method described by Yenawine and Miller (2014). It emphasizes the relevance of art across various disciplines, suggesting that art serves as a medium through which fundamental questions about the world are explored. This approach connects what viewers see directly to their feelings, fostering a deeper engagement with visual stimuli and in the end connecting to its cultural contexts (Hailey, 2014).

In the postmodern era, self-centered frameworks like Creative Self-Expression have gained popularity (Kim, 2006). This approach prioritizes personal expression and emotional engagement over structured analysis, focusing on the individual's internal experience and the therapeutic aspects of making art.

The analysis of images in art education is typically divided into two categories: formal analysis and iconography (Wijntjes & Van Middelkoop, 2024). These categories encompass two primary approaches: visual/formal analysis and context/content analysis respectively. In this project, the focus lies on visual/formal analysis.

The Benefits and Value of Using Formal Analysis as a Framework

Formal analysis offers numerous benefits as a framework in art education, making it a valuable tool for both educators and students. One of the key advantages is its accessibility. Since minimal background knowledge is required to begin describing how the elements of art are displayed, formal analysis is ideal for non-art professionals to analyze artworks effectively (Bresler, 1992). This approach democratizes art appreciation, enabling a broader audience to engage with and understand visual art.

In art education, formal analysis serves as a fundamental method for teaching students how to observe and articulate the visual aspects of artworks. It is often the first step in a broader art historical methodology. This approach is widely used by art historians, critics, and educators to help students and audiences understand the intrinsic qualities of artworks, independent of their historical context or content (Kim, 2006). By focusing on the elements and principles of art, formal analysis offers a comprehensive and technical view of how artworks are constructed and how they convey meaning (Nodine et al., 1993).

Moreover, formal analysis promotes a deep understanding of visual language, which is a fundamental skill in art education. It encourages analytical thinking and attention to detail, skills that are highly valued in modern education (Sheridan et al., 2023). This method provides clear and systematic ways to evaluate and discuss art, making it easier to teach and learn. Through formal analysis, students learn to observe meticulously and articulate their observations effectively, which is essential for a deeper appreciation and understanding of art.

Furthermore, formal analysis fosters critical thinking and analytical skills by encouraging students to dissect and interpret the visual components of art. As mentioned in the book *Looking at Pictures* (Woodford, 2024), comparisons can clarify characteristics of style. With the ability of observing, the learners can not only appreciate art but also develop skills that are transferable to other areas of study and professional life (Gale, 2023), such as movie production, graphic design and photography.

Conducting a Formal Analysis: Guidelines and Steps

Conducting a formal analysis involves a structured approach to understanding and interpreting artworks. Guidelines provided by educational organizations and research centers serve as valuable resources for this process. Here, I will use the method introduced in *Introduction to Art: Design, Context, and Meaning* as a foundational guide. According to Sachant (2016), a formal analysis consists of four aspects: description, analysis, interpretation, and evaluation (Figure 2.2).

The method begins with description, which entails providing a direct, literal account of all elements within the artwork. This step involves meticulously noting the composition, line, shape, space, tone, form, texture, color, and pattern (The J. Paul Getty Museum, 2011). The objective is to observe and document these elements without inferring any deeper meaning or context initially.

Following the description, the next step is analysis. In this phase, the relationships between the elements and the application of design principles such as balance, emphasis, and movement are explored. For instance, balance involves the distribution of visual weight among objects, colors, textures, and space (The J. Paul Getty Museum, 2011).

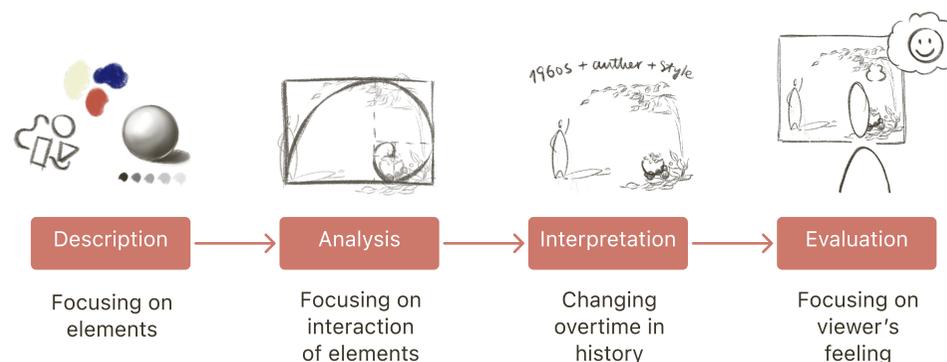


Figure 2.2 Formal analysis from *Introduction to Art: Design, Context, and Meaning* (2016)

By examining how these elements interact and complement each other, viewers gain insight into the structure and organization of the artwork. Once viewers understand how the elements interact, they proceed to interpretation. This step involves drawing on personal perspectives to find meaning in the artwork. Contextual information, such as the visual culture of the artist's period or significant historical events, can enrich this process (Darda & Chatterjee, 2023). Viewers are encouraged to incorporate their background, education, and ideas when engaging with the artwork (Cronin & Dobbie, 2023). It's important to note that interpretations may evolve over time or with subsequent viewings. Moreover, considering interpretations from a broader perspective highlights how the meaning of objects can shift across different time periods and cultures (Sachant, 2016). This underscores why formal analysis is a valuable tool for art historians in tracing the evolution of human creativity over time (Accessible Art History, 2022).

Finally, evaluation marks the conclusion of the formal analysis process. This step involves reflecting on the artwork itself and the viewer's reactions, including feelings, preferences, and emotional engagement. Evaluation encompasses a subjective assessment that can vary greatly among different viewers, adding a personal dimension to the analytical process.

By following these steps: description, analysis, interpretation, and evaluation, viewers can conduct a thorough and insightful formal analysis of artworks, deepening their understanding and appreciation of visual art.

Contextual Relevance and Broader Applications

In a museum environment, conducting a formal analysis of actual artwork, rather than relying on internet images or pictures in books, encourages individuals to scrutinize the work closely. This close examination often leads to the discovery of elements they may not have previously noticed (Hodge, 2015). Such detailed observation significantly impacts the way pictorial art is perceived, as research indicates that describing the elements—the initial step of formal analysis—enhances viewer engagement with the artwork (Bown, 2023). Certain elements also subtly influence observation, such as the relationship between canvas size (scale) and viewing distance, which affects the museum experience. Larger canvases tend to entice viewers to return to the painting, creating a more interactive and immersive experience (Carbon, 2017).

Beyond the museum context, formal analysis is applicable to everyday images such as photographs, sketches, and movie scenes. This broader application highlights its value as a skill and mindset, enhancing creativity and sensitivity to visual information in daily life (Cronin & Dobbie, 2023). By enhancing a deeper understanding of visual stimuli across various contexts, formal analysis enriches the viewer's interpretive abilities and aesthetic appreciation, thereby promoting both creativity and visual awareness.

Apart from these insights, research into art education textbooks reveals a gap in content regarding the interaction between artwork and visual culture, as well as the experience of visual images that can foster visual enjoyment (Kim, 2022). This gap suggests a need for a more comprehensive approach in art education that integrates the broader cultural and experiential aspects of visual art, thereby maximizing the educational potential of formal analysis.

Existing Guidelines for Formal Analysis

Introduction

The examination of existing guidelines provided a valuable opportunity to explore diverse educational approaches to formal analysis. The guidelines selected for this study represent a range of regions and educational traditions. The guidelines from the J. Paul Getty Museum and The Kennedy Center reflect the art education system in the United States, while those from the TATE Museum and the book *Thinking about Art* by Penny Huntsman exemplify the European tradition. All four sources are readily accessible to students, art enthusiasts, and general visitors, making them significant reference points for this analysis.

Given the distinctiveness of Eastern pictorial arts and the fact that this project is rooted in the Western art education system, the study did not extend to examining Eastern art education systems. However, to gain a broader understanding of how formal analysis is communicated to younger audiences, the guidelines from Turton School, which are designed for a 7th-grade art class in the UK, were also included in the case study. Additionally, the Vision and Depiction framework, which integrates visual perception science with pictorial art, was analyzed to provide a more comprehensive perspective.

The primary objective of this research activity is to identify patterns in how these institutions and frameworks define and explain formal analysis terms and how they tailor this information for different audiences. Moreover, the study aims to gather insights and inspiration for developing effective educational materials on formal analysis, ensuring that they are both accessible and engaging for diverse learner groups.

Guideline from The Kennedy Center



(The Kennedy Center & Glatstein, 2019)

The formal analysis guideline from The Kennedy Center provides a "word wall" featuring vocabulary related to art elements and design principles.

The guideline is divided into two parts: elements and principles.

- Elements: Line, Shape, Form, Color, Space, Texture, Value.
- Principles: Balance, Contrast, Movement, Emphasis, Pattern, Proportion, Unity.

Based on this teaching handout, the researcher created a table (see next page, Figure 2.3) to understand the definitions of the terms, analyze the relationships between elements and principles, and highlight the characteristics of each element.

Discussion and Conclusion from The Kennedy Center Guideline:

- The elements interact with each other to achieve the principles.
- Notably, composition and light are mentioned in the explanations of some principles and elements but are not separately discussed as distinct elements.

Elements

Line →

thick and thin, long and short, curved and straight

Defines contour or the edge of an object
Creates space and form
Creates pattern when repeated

Shape →

organic or geometric, positive or negative, objective or non-objective, distorted or extended

Creates pattern when repeated
Creates rhythm when repeated
Creates emphasis when varied in size
Creates balance when varied in placement

Form →

symmetrically or asymmetrically, can be open or closed, can be organic and/or geometric

Is shape with dimension
Creates pattern when repeated
Can be studied for its historical and cultural significance

Color →

warm or cool

Can be mixed from red, yellow, and blue
Gives the illusion of distance (space?)
Be mixed for intensity and value
Express moods and feelings

Space →

two or three-dimensional
positive and negative
can be distorted

Can be displayed by overlapping shapes
Can be displayed by color
Can be shown by proportion

Texture →

real or simulated
natural or man-made

Can form a surface
Can achieve emphasis
Can be affected by lighting conditions.

Principles

Balance →

Balance is created in a work of art when textures, colors, forms, or shapes are combined harmoniously.

Contrast →

Contrast is the use of several elements of design to hold the viewer's attention and to guide the viewer's eye through the artwork.

Movement →

Movement is the way a viewer's eye is directed to move through a composition, often to areas of emphasis. Movement can be directed by lines, contrasting shapes, or colors within the artwork.

Emphasis →

Emphasis is created in a work of art when the artist contrasts colors, textures, or shapes to direct your viewing towards a particular part of the image.

Pattern →

Pattern is the repetition of a shape, form, or texture across a work of art.

Proportion →

Proportion is created when the sizes of elements in a work of art are combined harmoniously.

Unity

Unity is created when the principles of analysis are present in a composition and in harmony. Some images have a complete sense of unity, while some artists deliberately avoid formal unity to create feelings of tension and anxiety.

Why composition is not mentioned in this guideline?

Why pattern is a principle not an element?

Why light is not in the elements?

Elements

Principles

Content related

Questions raised by me

Figure 2.3 Visualized guideline from The Kennedy Center (The Kennedy Center & Glatstein, 2019)

Guideline from The J. Paul Getty Museum



The J. Paul Getty Museum

(the J. Paul Getty Museum, 2011)

The J. Paul Getty Museum and The Kennedy Center share the same system of formal analysis (Figure 2.4), the elements and the principles are the same, even the explanation for principles uses the same text. However, the elements are described differently.

This institution summarizes the elements of art as the building blocks used by artists to create a work of art. In this guideline, the element color is explained in details with the three characteristics: hue, value and intensity. It also introduces how to create the colors on the color wheel by mixing primary colors or secondary colors. Noteworthy, in this guideline, the educators including the light of the painting in the color. This is how color is presented: 'Color is light reflected off of objects' and 'White is pure light; black is the absence of light'.

Line

be horizontal, vertical, or diagonal; straight or curved; thick or thin

A mark with greater length than width.

Elements

Shape

geometric, like squares and circles; or organic, like free-form or natural shapes

A closed line. Flat and can express length and width.

Principles

Content related

Form

Forms are three-dimensional shapes expressing length, width, and depth. Balls, cylinders, boxes, and pyramids are forms.

Space

Characteristics
two or three-dimensional
positive and negative
can be distorted

Space is the area between and around objects. The space around objects is often called negative space; negative space has shape. Space can also refer to the feeling of depth. Real space is three-dimensional; in visual art, when we create the feeling or illusion of depth, we call it space.

Texture

Characteristics
real or simulated
natural or man-made

It is the surface quality that can be seen and felt. Textures can be rough or smooth, soft or hard. Textures do not always feel the way they look; for example, a drawing of a porcupine may look prickly, but if you touch the drawing, the paper is still smooth.

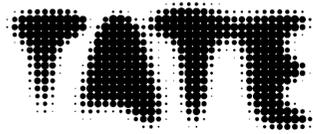
Color

Color has three main characteristics: hue (the name of the color, such as red, green, blue, etc.), value (how light or dark it is), and intensity (how bright or dull it is).

Color is light reflected off of objects. White is pure light; black is the absence of light. Primary colors are the only true colors (red, blue, and yellow). All other colors (secondary colors and intermediate colors) are mixes of primary colors. Complementary colors are located directly across from each other on the color wheel. Complementary pairs contrast because they share no common colors.

Figure 2.4 Visualized guideline from The J. Paul Getty Museum (the J. Paul Getty Museum, 2011)

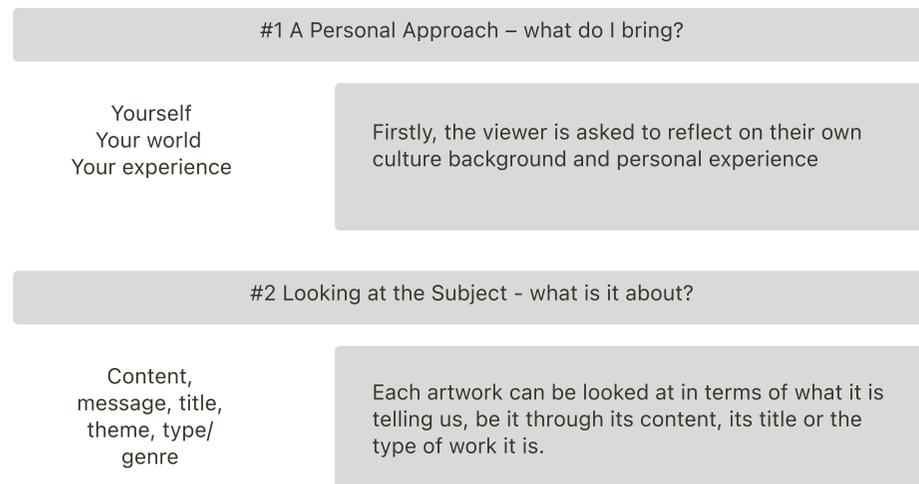
Guideline from TATE Museum



(TATE Museum & Charman, 2012)

The guideline is called "Ways of Looking." It technically is not a guideline for formal analysis; instead, it is more like a step-by-step tutorial for gallery visitors on a way of looking at a painting. However, some viewing strategies similar to formal analysis are given to the students.

The guideline is visualized in the flow chart below (Figure 2.5). In the third step, which is more related to formal analysis, it will be explained in detail on the right side of the page. In this guideline, instead of explaining terms with words, it asks inspiring questions to aid viewers to think about what they see from the art work.



Formal Aspects

Content

#3 Looking at the Object - what can I see?

Elements

- shapes
- marks
- surface
- scale
- space
- materials
- process
- composition

The pattern of structuring the questions:

- What [the element] can you find in the painting?
- > What is the characteristic of [the element]?
- > Why do you think the creator used [the element]?
- > What effects does [the element] create?
- > If it was changing [the element], what changes might have occurred?

For composition: How is the work organized or put together?

#4 Looking at the Context – relating the work in the Gallery to the wider world

- when, where, who, history, other arts, other fields of knowledge, the present, the hang, interpretation, the environment

Investigating when, where and by whom a work was made can reveal more about it. To read the work simply in terms of the artist's biography, or by an assumption of what the artist's intentions were, is not the only way of looking at a work of art. Researching the context within which the work was produced will tell us more.

Figure 2.5 Visualized guideline from TATE Museum (TATE Museum & Charman, 2012)

Guideline from the Book Thinking About Art

Thinking About Art

A Thematic Guide to Art History
Penny Huntsman

(Huntsman, 2015)

In this book a toolbox for conducting a formal analysis is given to the readers. Without explaining all the elements with either text or visuals, it provides a list of questions (Figure 2.6), they are designed to help the viewers describe and analyze formal elements of works of art.

The formal elements, or features mentioned in this guideline are Composition, color, pictorial space, light and tone, form, line, scale and pattern/ornament/decoration.

According to the book, an understanding of these formal elements is also essential to respond to and analyze form, style and function. Broadly, application of the Toolbox aids a fuller appreciation of all forms of arts.

3

Pictorial Space

(The illusion of three-dimensional space on a flat picture plane/surface.)

Is there a convincing sense of depth in the painting (an illusion of real three-dimensional space)? Does the illusion of space look realistic or unrealistic?

Are the objects/figures located in the pictorial space or just piled on top of each other, or flat on the surface?

Do the objects/figures diminish in size to suggest space?

Does the ground plane tilt naturalistically or non-naturalistically?

Is our viewpoint high or low?

Is our viewpoint close or far away? Do we have a narrow view or a panoramic view?

Is the space detached from us or connected to ours?

4

Light and Tone

Is the painter's illusion of light used naturalistically?

Is the light source depicted in the painting? Where is it? Is there more than one light source? Are there any shadows cast? Are they cast in a naturalistic way (e.g. in the correct direction)? Is the source natural (e.g. sun, window) or unnatural (e.g. candle)?

Does the light heighten realism? Is it used symbolically? Is light used dramatically (with strong contrasts, of highlights and shadows (i.e. **chiaroscuro**)?)

Is shading used to model form? What is highlighted and why?

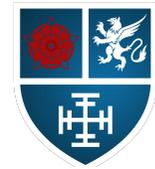
Are the gradations from light to dark subtle?

Does the light emphasise texture?

Is the effect three-dimensional or flat?

Figure 2.6 Example of Some Inspiring Questions From *Thinking About Art* (Huntsman, 2015)

Guideline from Turton School



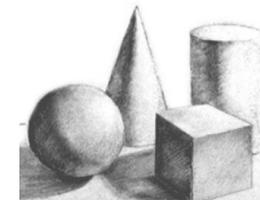
Turton School

(Turton, 2021)

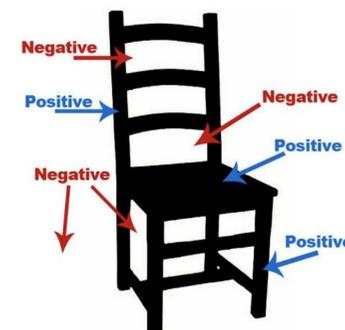
This guideline is designed for a 7th grade art class in the UK. It incorporates numerous visuals (figure 2.7) to explain key terms and includes several follow-up questions to help students better understand the concepts. The issue with this approach is that, as a compulsory subject, it places more emphasis on the understanding of academic concepts rather than encouraging students to express their personal feelings and experiences related to art.



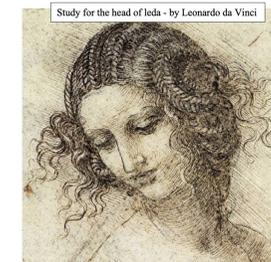
Concepts about light



Example of forms



Explanation about negative and positive shapes



Explanation about different types of lines

Figure 2.7 Illustrations and Examples from Turton School's Art Class Handout (Turton, 2021)

Framework of Vision and Depiction

(Wijntjes & Van Middelkoop, 2024)



Compared with traditional formal analysis, this framework bridges the gap between visual arts and visual perception science. It highlights the concept of "twofoldedness" of a painting which emphasizes the dual nature of viewing artworks: both medium, the physical objects and motif, the representations (Figure 2.8). This idea was from visual perception theories.

Prior to engaging with the formal elements of a painting, it is essential to differentiate between medium and motif, thereby enabling a insightful and structural understanding of both the material properties and the depicted con:

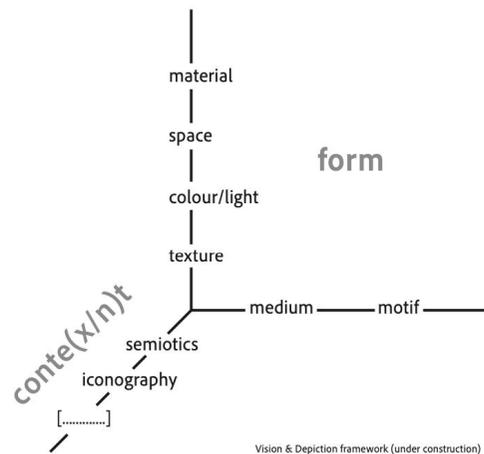


Figure 2.8 Framework to analyze the form and content of pictures from Vision and Depiction (Wijntjes & Van Middelkoop, 2024)

Insights from Existing Guidelines

Focus and Communication Methods in Art Education Guidelines

Each educational guideline analyzed exhibits a unique focus and method of communication tailored to its target audience. The Kennedy Center and The J. Paul Getty Museum prioritize clear explanations of art elements and principles, enabling viewers to understand and accurately describe visual experiences using specific terminology. In contrast, the TATE Museum's guidelines provide a broader approach, guiding viewers through the entire process of viewing an art piece, with an emphasis on connecting personal experiences and cultural backgrounds to the artwork.

Contextual Approaches in Art Analysis

The TATE Museum's approach stands out in its "looking at the object" step, which, like the book *Thinking About Art*, employs straightforward yet thought-provoking questions. This method encourages reflection on the elements of art, though the elements discussed in the TATE guidelines are often more context-related and less rigidly defined than those in The Kennedy Center and The J. Paul Getty Museum guidelines. For example, terms like "the marks" and "process" in the TATE guidelines are more contextual and demand a deeper understanding of the background to be effectively addressed.

Visual Aids and Formal Aspects in Education

The integration of visuals with text is a proven strategy for effective communication, especially for younger learners, as demonstrated by the handout from Turton School. This method is particularly beneficial in school programs. Additionally, the Vision and Depiction framework, with its emphasis on the distinction between medium and motif, offers significant value in helping learners grasp formal analysis terms more thoroughly.

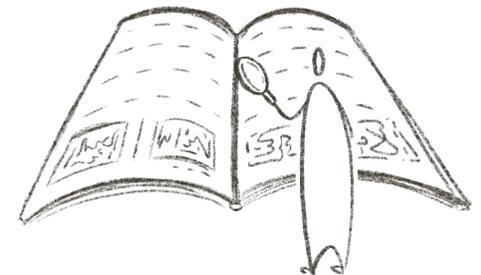
Challenges and Considerations in Guideline Design

Despite their clarity and inspiration, current guidelines lack an interactive dimension. Once viewers grasp the concepts of the elements, they are left to memorize the information or take notes to discuss art pieces confidently in the museum. This approach may lead to a sense of satisfaction and pride when sharing insights, but it can also be overwhelming, especially when the guidelines are detailed and comprehensive, catering primarily to art enthusiasts. For the general museum visitor, such depth may be unnecessary and daunting.

The format of questions in these guidelines also varies significantly. While some questions are open-ended, encouraging personal interpretation, most are closed or multiple-choice, providing a wealth of information but limiting the opportunity for viewers to use their own language and personality in describing what they see. An excess of questions can also lead to frustration, highlighting the need for a balance between professional depth and practical usability.

Potential Future Design Insights

To better engage viewers in thinking about art, a potential approach involves combining three methods of presenting knowledge: a concise, one-sentence explanation with clear illustrations of terms, followed by inspiring questions to stimulate critical thinking. These insights could greatly influence the future design of educational materials, making them both accessible and engaging for a wider audience.



Museum Context

Introduction

In addition to consulting existing literature and scholarly works, I undertook field research to gain a deeper understanding of the contextual dynamics within museum settings. This research comprised both **observations** and **interviews** conducted in various museums.

Through observations and interviews, I analyzed visitors' behaviors and interactions within the museum context. This involved a detailed examination of visitors' mannerisms, as well as their engagement with the displayed artworks. The short interviews were designed to elicit visitors' perceptions of the artwork and to identify specific elements that captured their attention. Additionally, casual conversations were held to gather insights into their general museum habits. These interactions provided data on the extent of visitors' awareness regarding the art elements in the paintings and their routines during museum visits.

The culmination of this research was the development of a **journey map** of the museum visit experience. It offers a depiction of the typical visitor's experience, highlighting key points and areas of engagement within the museum environment.



Selection of Museums

In selecting museums for this study, I chose four distinct institutions: Mauritshuis, Depot Boijmans Van Beuningen, Stedelijk Museum, and Rijksmuseum, each with its unique focus and specialty.

The Mauritshuis in The Hague primarily houses 17th-century Dutch paintings, boasting a renowned collection featuring world-famous Dutch painters such as Rembrandt, Vermeer, and Steen. Notably, masterpieces like Vermeer's "Girl with a Pearl Earring" attract visitors from around the globe.

The Depot Boijmans Van Beuningen in Rotterdam functions as a warehouse and workspace dedicated to the storage, maintenance, restoration, and study of art pieces. Visitors can gain insight into the curation and presentation of exhibitions within this facility.

The Stedelijk Museum in Amsterdam is a contemporary art museum, showcasing works that differ significantly in content, style, and era compared to the other two museums.

The Rijksmuseum offers the richest collection and enjoys the greatest renown. Its wide-ranging exhibits attract a diverse audience, making it highly valuable for observation and interviews.

These distinct collections necessitate varied audience and educational approaches, enriching the overall scope and depth of the research. Several research activities took place in these museums (Figure 2.9).

	Observation & Interview	Auto-ethnography	Interview with Educational Department
Mauritshuis	✓	✓	✓
Depot Boijmans Van Beuningen	✓		✓
Stedelijk Museum	✓		✓
Rijksmuseum	✓		

Figure 2.9 Overview of research activities' sites

Observation and Interviews in Museums

Research Question

How do visitors behave in a museum context?

What are the interactions between museum visitors and pictorial artworks?

Method

Initial Observation Approach

The observation methodology initially lacked a specific focus, apart from parameters such as group size, the duration spent observing individual artworks, and interactions with the environment. However, from the gathered data, several key aspects emerged:

1. Social Context
2. Content: This included the paintings, museum text (introductions on the wall and labels), audio guides, and other educational tools.
3. Behaviors: This encompassed visitor movement within the space, time spent on each painting, and behavior patterns among different group sizes.

Sites and Duration

The research activities were conducted at four museums:

1. Mauritshuis (The Hague)
2. Rijksmuseum (Amsterdam)
3. Stedelijk Museum (Amsterdam)
4. Depot Boijmans Van Beuningen (Rotterdam)

Observations at each location lasted approximately three hours, all conducted in the afternoon on both weekdays and weekends.

Interview

The primary goal of the interviews was to explore visitors' interests in elements within the paintings, aiming to deepen the understanding of how museum visitors engage with and interpret pictorial art. Initially, questions focused on what participants saw in the paintings and which elements caught their attention. However, during the research, this approach evolved into a more casual conversation about their museum visiting habits, including who they visit with and their overall experience.

This shift in questioning arose because initial, element-focused questions often led participants to provide responses they assumed the researcher wanted to hear, introducing bias. Conversely, starting the conversation with broader, personal storytelling and then transitioning to brief discussions about the painting in front of them yielded more natural and authentic responses. This approach not only provided insights but also allowed my scope to expand from a narrow focus on artwork engagement to encompass the entire museum visit experience.

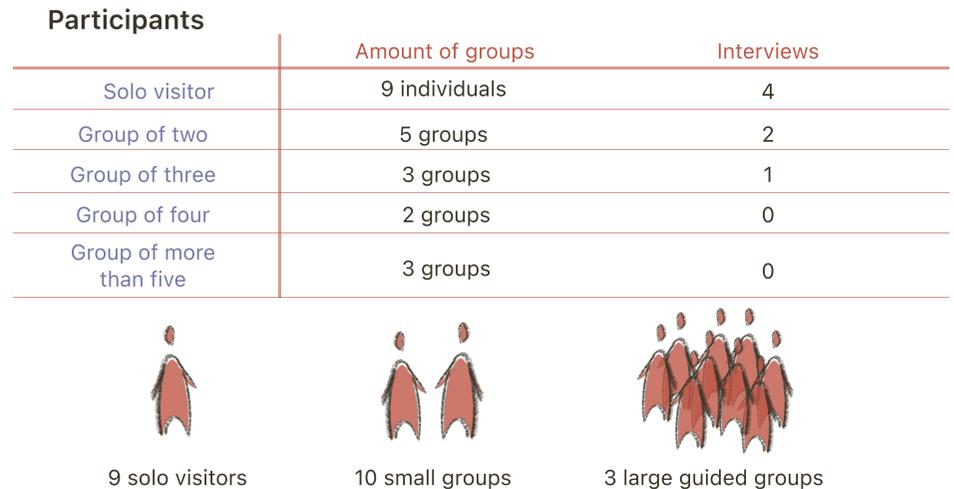


Figure 2.10 Composition of the subjects

A total of 36 individual visitors and small groups were observed during the study. Among these, 27 individuals formed 10 small groups consisting of 2-4 people, while the remaining 9 individuals explored the art independently (Figure 2.10). Out of these solitary visitors and small groups, 7 participated in interviews. Additionally, three guided tour groups were observed from a distance, each comprising approximately 7, 10, and 15 participants, including adults, children under 5 years old, and middle/high school students, respectively, in accordance with museum regulations.

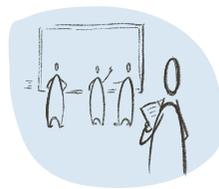
Insights

Overall Museum Experience

Regarding the overall museum experience, some participants mentioned that they do preliminary research on exhibitions before their visit. This preparation helps them navigate the museum purposefully and ensures they don't miss the museum's highlights. When it comes to special exhibitions focused on a particular artist, such prior research becomes even more crucial. However, due to the limited number of interviews, it is difficult to determine if this is a common practice, but the phenomenon does exist.

During the visit, solo visitors expressed that visiting alone allows them to set their own pace and explore more freely. Some mentioned that while they sometimes wish to visit with a partner as a quality social activity, but they often choose other activities due to their partner's lack of enthusiasm for art. For small groups of 2-4 people, participants highlighted that discussions during the visit are particularly enjoyable and memorable. They generally found that social experiences in groups make the museum visit more interesting. They suggested that groups of 2-3 people are ideal, as this size fosters deeper discussions and ensures everyone is engaged.

After the museum visit, some interviewees noted that they always purchase a small item from the gift shop, such as a postcard or a magnet, to remember the exhibits that left a strong impression on them. Additionally, some participants mentioned that they struggle to recall their museum experiences from six months or a year ago, which they find quite frustrating.



Engagement with Informational Equipments

Engaging with museum text or informational text next to paintings is another notable activity. According to short interviews conducted, visitors find this text helpful in understanding the context, meaning, and historical style of the paintings, particularly when the artist is renowned. Larger paintings tend to elicit behaviors of moving back and forth to obtain a comprehensive view of both details and the overall composition (see next page, Figure 2.11). They also get more attention compared to the smaller scaled ones in the same exhibition hall (see next page, Figure 2.12), as mentioned in the literature review.

Audio guides and museum apps are widely used among visitors, with 7 out of 15 groups opting for handheld devices, excluding those with tour guides. Notably, within these groups, a pattern emerges where one individual listens to the audio and conveys information to others, or they listen collectively and discuss after completing a session.

Viewing Behaviors and Group Dynamics

Interactions with pictorial arts vary significantly and are influenced by the age and interests of viewers, as well as whether they are part of a guided tour. One of the most commonly observed activities is taking photos, with 12 out of 17 groups—including individuals taking photos of the paintings, informational text, and using paintings as backgrounds. Cameras, phones, and digital smartwatches (mainly used by children) are the primary tools employed for this purpose.

In terms of time spent viewing paintings, groups tend to engage in more in-depth discussions compared to individual visitors. Solo visitors typically follow the exhibition hall's arrangement, viewing paintings sequentially. Conversely, group visitors structure their visit based on collective interests, often skipping certain paintings to focus on preferred works. Group visitors appreciate discussions that spark interesting topics, making the experience more memorable, whereas solo visitors enjoy interpreting artworks at their own pace.

Large guided groups, particularly those of middle/high school students, may exhibit varied levels of engagement. While some students attentively listen to educators' stories, others chat with friends or remain disengaged. Tours for young children involve interactive elements like wooden puzzle pieces to maintain their attention. Adults, compared to younger visitors, tend to be more reserved in interacting with guides, preferring to listen rather than actively participate.

Challenge of Intended Interaction

Some intended interactions with museum exhibits may not occur as expected. For instance, an attempt to encourage tactile exploration of a 3D printed piece of "Girl with a Pearl Earring" resulted in limited engagement (Figure 2.13), possibly due to ingrained habits of not touching museum exhibits. Communicating intended interactions effectively poses challenges for museum educators.

Focused Elements

Interviews revealed that viewers are drawn to light sources and contrasts in paintings, with brighter and more contrasting elements capturing attention. Participants sometimes search for hidden details in darker areas of paintings, likening the experience to solving a puzzle (Figure 2.14). Elements such as lines and shapes, may require explicit cues for recognition by viewers.

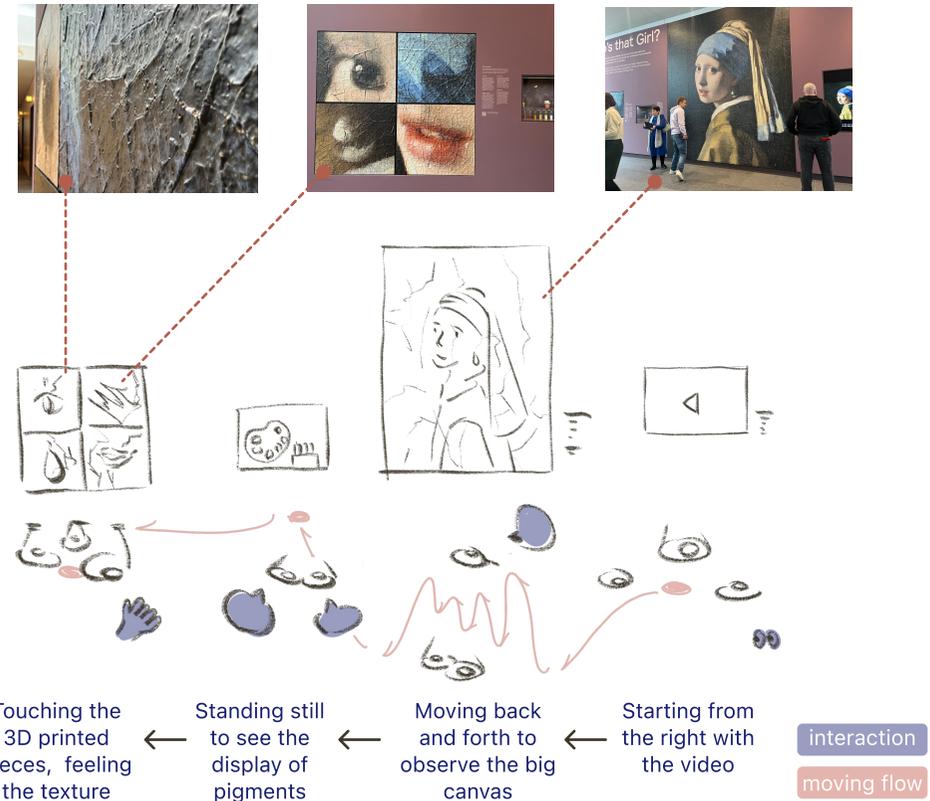


Figure 2.13 Viewer's moving flow in front of 3D-printed *Girl with a Pearl Earring*



Figure 2.11 The visitor moving back and forth to view a large scale painting



Figure 2.12 The larger paintings get more attention than the smaller ones in the same hall



Figure 2.14 Visitors looking into details of the dark part of the painting

Journey Map

After conducting interviews and observations at the museum, I gathered significant insights into the experiences of museum visitors. To systematically organize this information, I created a journey map (Figure 2.15) based on the results of previous research activities.

The journey map not only highlights several pain points in the museum experience but also expands the scope of analysis to include the phases before and after the visit.

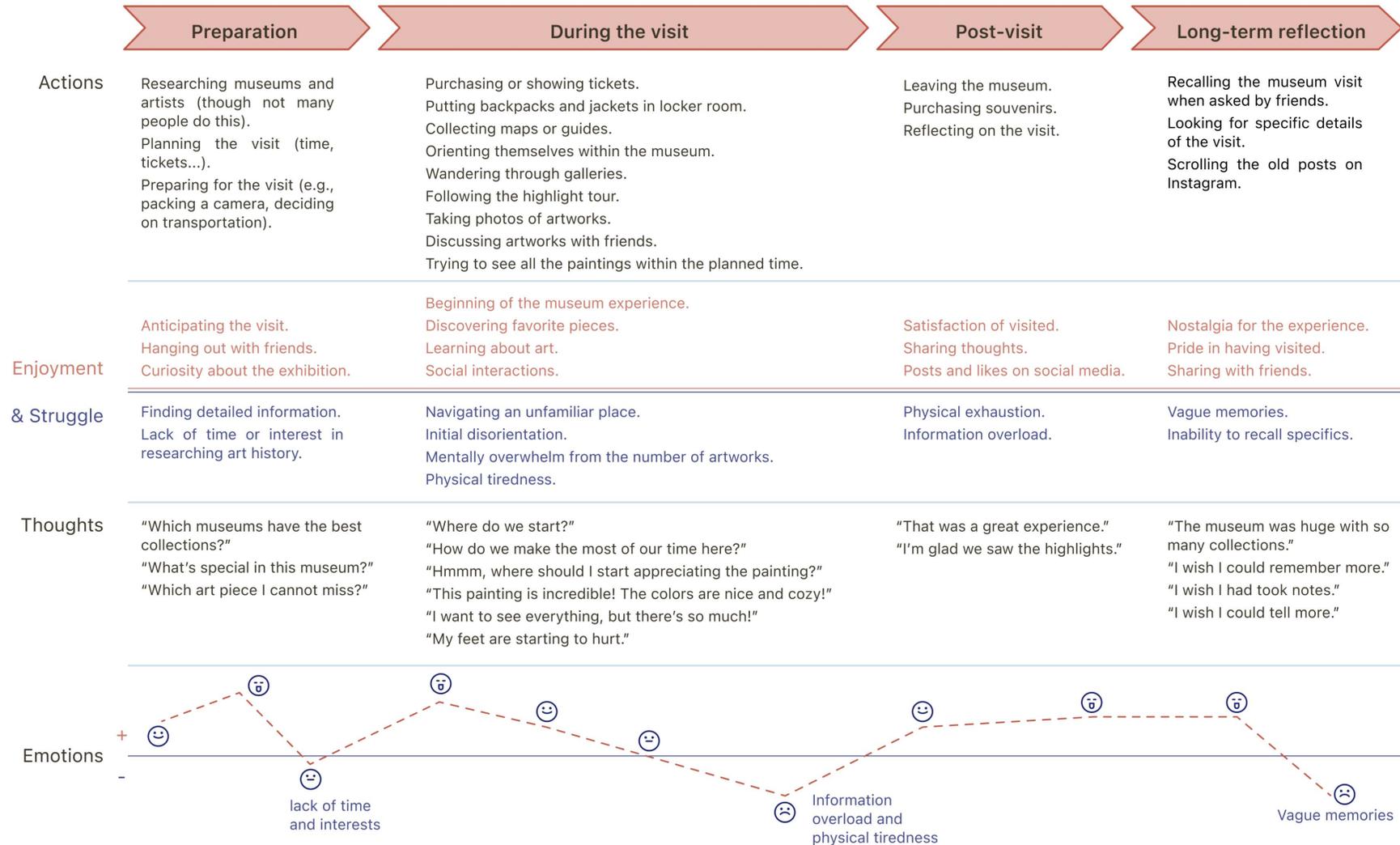


Figure 2.15 Journey Map of Museum Visiting

Art Education in Museum Context

Introduction

Three distinct research activities were undertaken in this section: **an auto-ethnographic study of the museum experience, interviews with museum educators, and an analysis of tour guidance.**

To gain a deeper understanding of user experiences within the museum setting, I conducted an auto-ethnographic study by immersing myself in a museum visit as a potential user. This method allowed for the development of empathy towards future users, thereby informing the design process from a user-centered perspective. The primary objective of this research was to capture the subtleties of the museum experience from the visitor's viewpoint, ensuring that the insights gathered would directly inform the design process with real-world relevance.

In addition to the auto-ethnographic study, interviews were conducted with educators and experts from the education departments of several prominent Dutch museums, including Mauritshuis, Depot Boijmans Van Beuningen, and the Stedelijk Museum. These interviews aimed to explore how art education is structured within these museum settings and to assess the role of formal analysis within their educational frameworks. The insights gained from these interviews provided a comprehensive understanding of current educational programs and illuminated the integration of formal analysis in their pedagogical approaches.

Complementing these research activities, I conducted an analysis of the highlight tour guidance provided by Mauritshuis. This analysis sought to identify patterns in the incorporation of formal elements within museum education. By examining the content of the guidance, I aimed to discern the methods employed to communicate formal aspects of art to visitors, thereby gaining further insight into the educational strategies utilized by the museum.



Auto-ethnographic Research



Interviews with Education Department in Museum



Analysis of a Museum Guidance Text

Auto-ethnographic Research

Introduction

Before the project progressed further, I conducted autoethnographic research. Autoethnography is a qualitative method that uses the researcher's personal experience to describe and critique cultural beliefs, practices, and experiences, acknowledges the researcher's relationships with others, and employs deep self-reflection (Poulos, 2021).

It is important to note that this research activity took place before I had thoroughly reviewed the guidelines on formal analysis. Chronologically, this activity occurred before the literature review. This approach was intentionally chosen to minimize my potential biases as the researcher. By simulating the experience of an ordinary museum visitor who does not have prior knowledge of formal analysis, I aimed to better empathize with potential users and identify the challenges they might face.

Research Question

What is the experience of a novice doing a formal analysis?

What are the struggles?

Method

The research activities were conducted at the Mauritshuis in The Hague. During a museum visit, I performed formal analyses of three paintings, with the entire visit lasting approximately three hours. The time dedicated to describing and recording the formal analyses was about one hour. In selecting the paintings, I focused on still-life paintings to minimize the influence of the paintings' content on my analysis. In the process, no guideline was referred.

Insights

During my analysis, which included both observation and noting down my thoughts (Figure 2.16), I spent approximately 15 minutes on each painting. The prolonged observation revealed numerous details often overlooked during casual visits. While still life is not my preferred genre, the extended engagement time and meticulous examination of formal elements increased my interest in these works. By examining the elements one by one allowed me to view the paintings more deeply from a technical and objective standpoint. Besides enhancing my observation experience, I also encountered some challenges during the description, note-taking, and further understanding of the artwork.

Firstly, finding the right terms to describe the art piece occasionally disrupted the flow of analysis. Secondly, while documenting insights, I struggled to maintain a structured approach. My observations were primarily guided by the natural progression of my gaze across the painting, leading to a somewhat fragmented understanding. While this might not be an issue for casual visitors, it poses a challenge for students engaged in systematic learning or designers seeking inspiration.

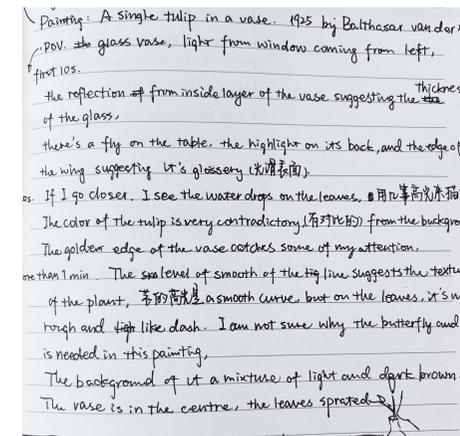


Figure 2.16 Notes from the analysis



Educational Programs in Museums

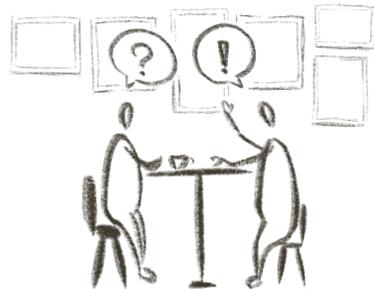
Research Questions

- What are the current education programs in museums?
- What is the position of formal analysis in art education programs?
- What is the trend of the future art education in museums?

Method and Setting

Each interview session lasted between 30 to 40 minutes and was conducted both online and on-site, with permission from museum educators to record the discussions. The interview format typically involved a brief introduction to the project (approximately 3 minutes), followed by a 25-minute interview segment, concluding with a closing section. Interviews were structured to explore the general goals of museum education, current education programs, and future trends and plans.

Questions for each interview were tailored based on information gathered from the museum's official website, with room for improvisation and follow-up inquiries during the conversation. In addition to voice recordings, I used a structured note-taking template to document key insights and observations from the interviews.



Insights

Current Programs

Based on the interviews with museum educators, the current education programs offered by the museum are thoughtfully designed to cater to diverse target groups, including children, teenagers, adults, and families.

For children from 4 to 12, guided tours are provided to spark their interest in art, art history, and visual culture, fostering visual appreciation from a young age. According to one educator, "We want them to feel welcome and to feel at home with art and contemporary art and feel like it's part of them, even if they don't talk about art at home." Teenagers benefit from collaborations with school programs, where instructions provided by the museum help students understand and engage with artworks found in their textbooks, thus enriching their cultural education.

Adult visitors are given the freedom to explore the museum at their own pace, with options such as mobile apps, audio guides, and guided tours available to enhance their experience. One educator emphasized, "Adult visitors are given the freedom to explore the museum themselves... We would invite them to download the App. With the App, they can listen to the story behind the painting while viewing, they can also collect the paintings they like and read the introduction again at home." It is also mentioned, even if the museum provides variety of choices, the classic or the highlight tour is selected.

Family-oriented programs incorporate interactive elements to engage visitors of all ages, fostering shared experiences and learning opportunities. Such as, one of the program is collaborating with families to create artworks based on their family culture, and publish it to the community, so that everyone have the access to interact the original artwork.

Recognizing the varied interests, backgrounds, and needs of their visitors, museum educators strive to gather more information to tailor programs accordingly. An educator stated, "We try to be inclusive for everybody that wants to come to the museum and make it enjoyable for everybody... Let visitors enjoy the museum and feel like they belong here and that it's their art as well."

These education programs are delivered through a combination of physical and digital mediums. Guided tours remain a staple, supplemented by special events such as themed conversations, lectures, and talks that align with seasonal themes, social topics, or temporary exhibitions.

Overall, the museum views education as a social responsibility, aiming to create a welcoming environment where visitors feel a sense of ownership over the artworks. Through these programs, visitors gain deeper knowledge of visual culture, cultivate greater interest in art, and develop heightened visual and cultural sensitivity.

Formal Analysis' Position in Museum Education Programs

The interviews with the educators suggested that formal elements are already incorporated into educational programs, although they're not always explicitly outlined as specific methods for analyzing artworks.

Different types of art receive varying levels of attention regarding the discussion of art elements. Still-life paintings, for instance, are often discussed in more detail compared to narrative paintings like history paintings. Educator suggests that still-life paintings are good starting points for learning about formal analysis. Similarly, contemporary art, known for its emphasis on visual aspects, provides an ideal platform for exploring formal analysis due to its reduced emphasis on narrative.

Formal analysis is fundamental for understanding artworks, as suggested by a museum educator who advocates beginning the analytical process with sensory observations. This approach is seen as practical from both educational and communicative perspectives, grounding the analysis in tangible observations.

Engaging in formal analysis requires patience from viewers, a quality that appears to be less common among younger visitors compared to older ones. To address this, some guides are trained to encourage visitors to take their time observing artworks and expressing their impressions through descriptive language. Visitors are also prompted to articulate their interpretations and emotional responses. Research done in the museums indicates a positive link between the duration of engagement with artworks and the strength of the connection formed, with formal analysis leading to longer periods of viewing. Consequently, formal analysis holds potential for increasing visitor engagement and fostering a sense of ownership, which aligns with the broader goals of educational programs.

Balancing interpretation with objective analysis of art elements presents a nuanced challenge in museum education, given the inherent connection between contextual narratives and artistic elements.

The target audience for formal analysis encompasses a diverse demographic spectrum, although smaller groups may yield more effective educational outcomes. Some museums are exploring the use of mindfulness tours to emphasize formal analysis as a central aspect of educational engagement.

In conclusion, formal analysis is commonly interwoven into educational programs, albeit often without explicit specification. It serves as a fundamental tool for understanding and communicating artworks. Despite challenges such as balancing interpretation with objective analysis and addressing differences in visitor patience, formal analysis remains a cornerstone for enhancing engagement in the museum context. Its potential for integration into museum education is evident.

Other Topics and Inspirations from the Interviews

AI Generation

In the era of the generative AI, the power of words is paramount, as they enable people to generate images, videos, and even three-dimensional structures. The ability to describe objects with words has become a significant skill, with formal analysis being a prime example. By combining this skill with generative AI technology, human creativity has potential to be maximized.

Learning Styles

Learning styles were also discussed during the interviews, with dialogue and conversation highlighted as one of the most effective methods for learners to absorb knowledge. Although tracking the impact of these methods can be challenging, the topic of education opens up another angle for exploring the project.

Needs from the audience

The diverse expectations and needs of visitors were another common topic mentioned in the interviews. Often, visitors may not be fully aware of their own needs and may opt for the most popular or convenient options, such as highlight tours. Optimizing programs to meet the audience's needs is a challenging task.

“ARTISTS ARE ALWAYS IN A DIALOGUE WITH EACH OTHER AND WITH THEIR PREDECESSORS ABOUT THE 'HOW'. FORMAL ANALYSIS HELPS YOU TO DISCOVER THIS ARTISTIC DIALOGUE AND THIS DIALOGUE ALWAYS TELLS YOU SOMETHING ABOUT THE ISSUES THAT WERE AT STAKE AT THE TIME THE WORK WAS MADE.”

Analysis on an Museum Audio Guide

Introduction

In discussions with museum educators, the frequent mention of museum audio guides or apps highlights their significant role in educational outreach. One educator noted that while these tools include content related to formal aspects of art, a deeper investigation is necessary to assess their effectiveness. To this end, the research delves into one of the most popular audio tours at the Mauritshuis: the "Highlights Tour" (Figure 2.17). This tour features 16 renowned paintings from the 15th to 17th centuries, offering both audio narration and museum text. By analyzing the text, this study aims to determine the extent and manner in which formal aspects are integrated into museum education through these digital tools.

Method

The text and audio narration from the Highlights Tour were extracted for analysis. The study quantifies the proportion of content related to formal aspects by counting sentences that reference these elements and calculating their percentage relative to the total content.



Figure 2.17 The most popular audio tours at Mauritshuis: Highlights Tour

Results

The bar chart (Figure 2.18) illustrates the percentage of formal elements referenced in the museum texts and audio guides from the Highlights Tour at Mauritshuis. These percentages were determined by counting the sentences that specifically addressed formal aspects of the artworks.

Overall, formal elements do not constitute the majority of content in the introductions for the artworks. The highest proportion, approximately 50%, was found in the audio guide for "Still Life with Wild Strawberries." Notably, the audio guides generally contained more references to formal elements than the written texts, with an average of 18.33% in the audio guides compared to 10.67% in the text information. It is important to note that the data exhibits characteristics of a small sample size, leading to some estimations in the proportions. For instance, if one sentence out of five mentioned formal elements, the proportion was estimated with consideration for the overall context.

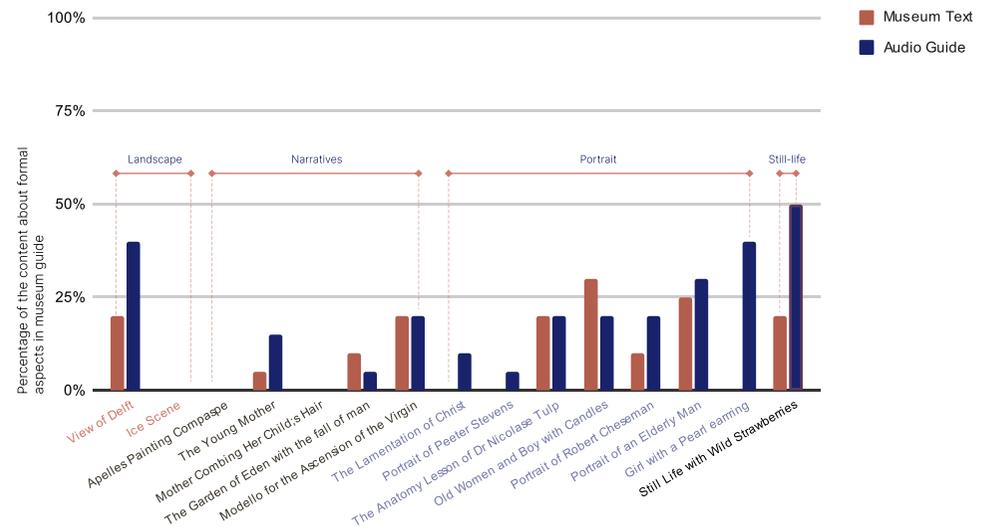


Figure 2.18 Percentage of Formal Elements in Museum Text and Audio

Insights

Formal Analysis Related Text in Different Genres

The analysis of the 16 paintings, which span four genres—landscape, narrative, portraiture, and still life—revealed that portraits and still-life paintings generally include more discussion of formal aspects compared to landscapes and narrative works. However, due to the relatively small sample size, it is difficult to establish a definitive pattern regarding the prevalence of formal elements in different genres on a broader scale.

Formal Analysis Related Text about Different Styles

The focus on formal elements also varies depending on the artist's style and technique. For example, in the landscape genre, Vermeer's *View of Delft*, renowned for its meticulous use of color and light, included more references to drawing techniques and formal elements. In contrast, Hendrick Avercamp's *Ice Scene*, although noted for its depiction of winter scenes, focused more on the artist's personal biography, particularly his experiences as a deaf and mute individual. This suggests that the narrative surrounding the artist can significantly influence the emphasis on formal analysis.

Structure of the Text

The analysis of the museum guides and audio introductions reveals a consistent structure in how the information is presented. Typically, the content begins with a description of the painting's subject matter, detailing objects, narratives, figures, and notable details. This is followed by information about the artist and the cultural and historical context of the period. The discussion usually concludes with an examination of the artist's style and drawing techniques, indicating that while formal elements are considered, they are often secondary to the narrative and contextual information.

Challenge in Balancing Content and Forms

Although formal elements are referenced in most of the artworks, they rarely take center stage in museum education. The challenge now lies in determining how to effectively integrate formal analysis within the broader context of art interpretation. Enhancing the prominence of formal elements in educational tools could enrich the learning experience by providing a more comprehensive understanding of the artworks beyond their narrative content.



Conclusion

In art education, various frameworks exist, among which formal analysis stands out as a method that translates visual information into verbal descriptions. Its advantage lies in its accessibility; even those without extensive knowledge of art history can quickly grasp its principles. Currently, numerous institutions have developed formal analysis guidelines. However, these guidelines often lack interactivity, making it challenging for readers to engage with the information. Additionally, formal analysis has not been widely promoted among general museum visitors. Most current museum education programs focus on the content and themes of paintings, with formal aspects receiving minimal attention and often only as a secondary aid to understanding content. Conversely, if formal analysis were presented as an independent method or a starting point for analyzing artwork, it could provide viewers with numerous clues for deeper interpretation.

Research on potential users reveals that museum visits encompass more than just the time spent viewing exhibits. Pre-visit research and post-visit reflection are integral parts of the museum experience. During the viewing process, visitors tend to notice certain elements, such as color and light depiction, but their understanding is often superficial. They lack comprehension of other elements, like pictorial space. However, when exposed to information about these elements, visitors quickly grasp the concepts and apply them in their observations and descriptions of artworks.

Experimental data on the influence of optical devices on the perception of formal elements (Appendix B) show that while most tools affect participants' perceptions, the extent of this impact varies among individuals, making it difficult to draw uniform conclusions. In contrast, simply providing textual guidelines significantly increases participants' awareness of formal elements. This leads to more structured and detailed descriptions of artworks, focusing on more visual information. Additionally, the guidelines enhance participants' confidence in discussing art. Thus, guidelines have demonstrated considerable potential in preliminary research.

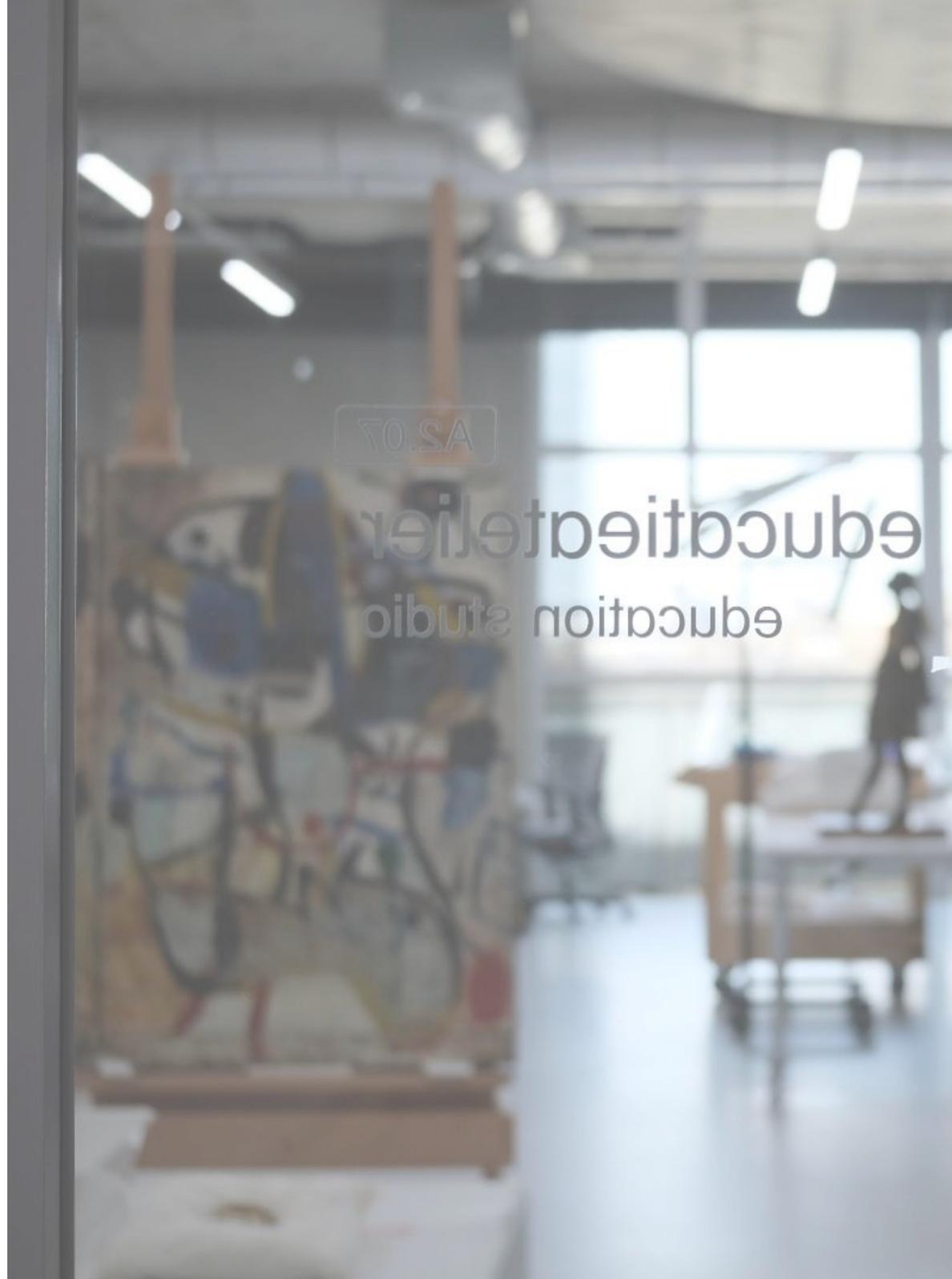




3

Define

Building on the understanding and analysis of the context from the previous chapter, I identified the challenges. In this chapter, I define the opportunity, the goal and the requirements of the design, laying the foundation for the subsequent design process.



Problem Definition

In current museum education programs, tools and guidelines are provided to visitors, often embedding the approach of formal analysis within contextual explanations. However, as a visual strategy requiring minimal prior knowledge, formal analysis has great potential in aiding public museum visitors to understand artworks and the visual language they employ. Unfortunately, the way museums currently present formal elements lacks engagement, leading to short-term memories that are hard to recall in the future.

Therefore, there are two primary aspects the researcher would like to highlight and address in the design: awareness and understanding of formal elements and the promotion of an active and interactive learning experience.

Awareness and Understanding of Formal Elements

Formal elements constitute the language of artists, which they use to depict sensory, narrative, and even imaginative worlds. Without an awareness of these elements, the audience may overlook significant information within the artwork. Conversely, developing knowledge of formal elements enriches the viewing experience and fosters visual literacy. Most importantly, it cultivates a mindset for understanding art and aesthetics that can be applied to every aspect of life.

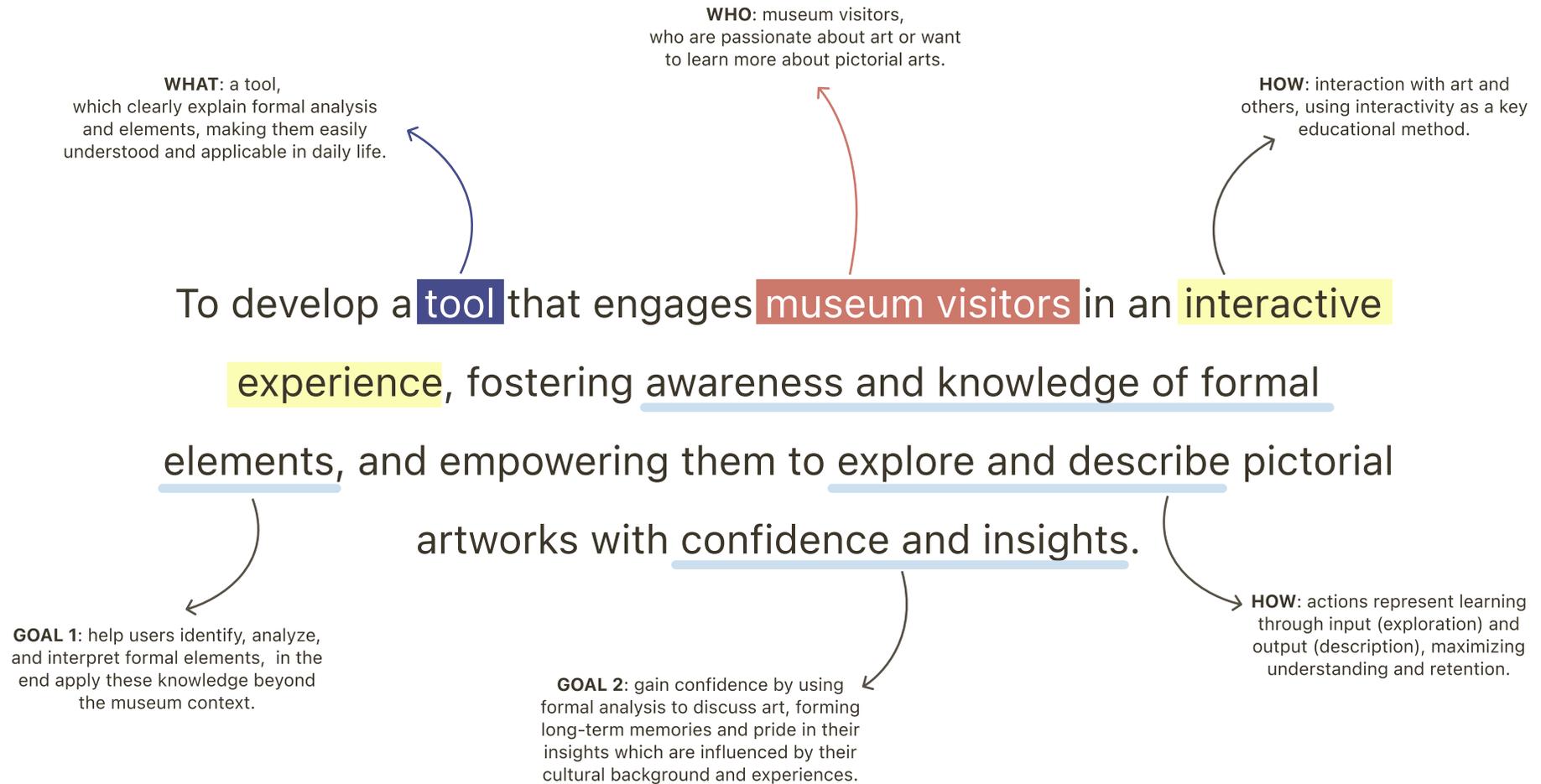
Active and Interactive Learning Experience

The study by Yannier et al. (2021) demonstrated that active learning empowers students to take control of their learning by prompting them to generate thoughts and receive feedback through interactive settings, rather than passively absorbing information. This approach is considered more efficient and engaging for learning.

The museum context is particularly well-suited for establishing an active and interactive learning experience due to its social responsibility and the diverse learning needs of its visitors. By providing engaging interactions with specific paintings, museums can help visitors build personal connections, creating unforgettable experiences. Ultimately, visitors should form long-term memories about the visits and the knowledge they learnt.

Design Goal

According to the problem definition, a design goal has been framed that outlines the desired effect to be achieved with the design. A detailed explanation of the Design Goal is provided in Appendix C.



Design Requirements

Introduction

According to the design goal and the desired qualities, I defined detailed design requirements to ensure that they could be used as criteria to evaluate the future concepts.



The product should...

1. Mind-on Learning

- Engage viewers mentally by encouraging thinking and reflection.
- Provide clear guidelines with clear explanations, inspiring questions, and representative visuals to aid understanding of formal elements.
- Empower users to confidently express their insight and interpretations of artworks out loud.

2. Hands-on Learning

- Include hands-on activities in the toolkit for users to experiment with formal elements.
- Incorporate physical or analog tools to assist users in observing elements, enhancing or reducing the perception of elements.
- Create an experiential learning opportunity that forms episodic memories
- Allow users to apply their new knowledge.

3. Self-guided Exploration

- Facilitate self-guided exploration for individuals or groups.
- Promote interaction among group members and encourage conversation and discussion.

4. Variety of Users' Needs

- Customize the toolkit based on users' interests and the genre of paintings.
- Support different learning styles and provide a range of sensory experiences.
- Adapt for use in various scenarios, including exhibitions, homes, and movie frames, to enhance users' sense of ownership of the artwork.

5. Usability and Durability

- Ensure portability and compactness for easy carrying in museums.
- Design for convenience across different exhibits
- Enable multiple uses, for example, drawing and paint removal.
- Use materials that can withstand frequent handling.

Introduction

In the development and delivery phase, I employed the Creative Diamond 2.0 framework, as outlined in *Road Map for Creative Problem Solving Techniques* by Heijne and Van Der Meer (2019). This approach encompasses three phases: diverging, reverging, and converging (Figure 4.1).

During the diverging phase, I utilized Brainstorming and Flower Association techniques (Heijne & Van Der Meer, 2019) to generate 29 distinct ideas. In the reverging phase, these ideas were clustered into 10 categories. Ultimately, three concepts were selected as the foundation for further development in the second round. Following this, I engaged in informal interviews and concept pitches with target groups to gather insights. Using these insights, I applied the Harris Profile (Harris, 1961) to evaluate the ideas, leading to the selection of one concept based on its score. This initiated a third round of diverging to refine and enhance the most promising concept. All ideation activities were conducted by myself.

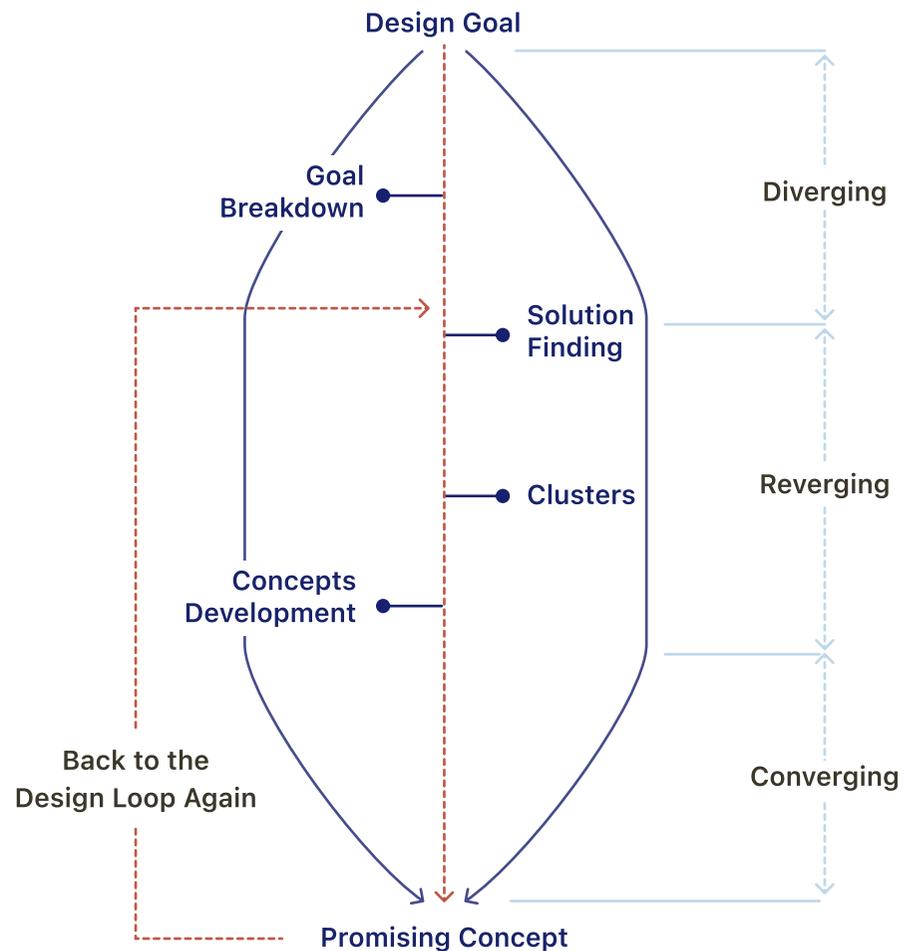


Figure 4.1. Developing process overview

Diverging

Goal Breakdown

In the diverging phase, I began with the design goal:

To develop a tool that engages museum visitors in an interactive experience, fostering awareness and knowledge of formal elements, and empowering them to explore and describe pictorial artworks with confidence and insights.

Before initiating solutions, I commenced the ideation process by breaking down the design goal into several key concepts. Considering the **interactive experience** and the objective of fostering awareness and knowledge of formal elements as **educational components**, I employed the Flower Association method (Figure 4.2) to eliminate initial and obvious ideas derived from previous research.

The concept of creating an event-like experience to form episodic memory through the association of interactive experiences holds potential in user experience design. Feedback systems, either the feedback from the partner or the tool, seems to be a critical inspiration as well. From the association of education, language, puzzle, and board game, were highlighted as potential formats for the interaction, aiming to foster a sense of attachment among the viewer and the artworks.

Following the initial round of brainstorming, several solutions emerged. By synthesizing keywords and integrating insights from the discovery phase, a second round of ideation was conducted, focusing more intensively on the development of solutions.

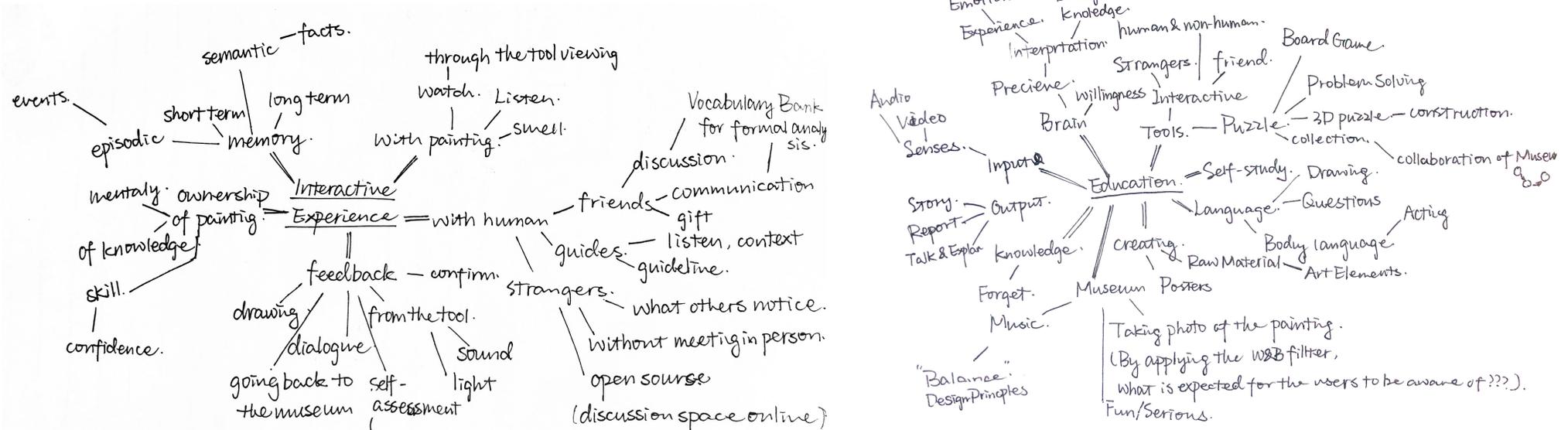


Figure 4.2 Flower Association on Interactive Experience and Education

Solution Finding

The brainstorming here does not adhere strictly to academic and scientific research methodologies. Rather, it reflects the creative process wherein I, as a user experience and product designer, intervened and synthesized the information gathered during the discover phase. This approach incorporates designer intuition alongside the analytical insights derived from the research.

The brainstorming session generated 29 different ideas (Figure 4.3). These ideas were displayed on post-it notes on the wall to facilitate the subsequent clustering process, known as "Reverging." This method allowed for an effective organization and synthesis of the ideas, highlighting key themes and directions for further development.

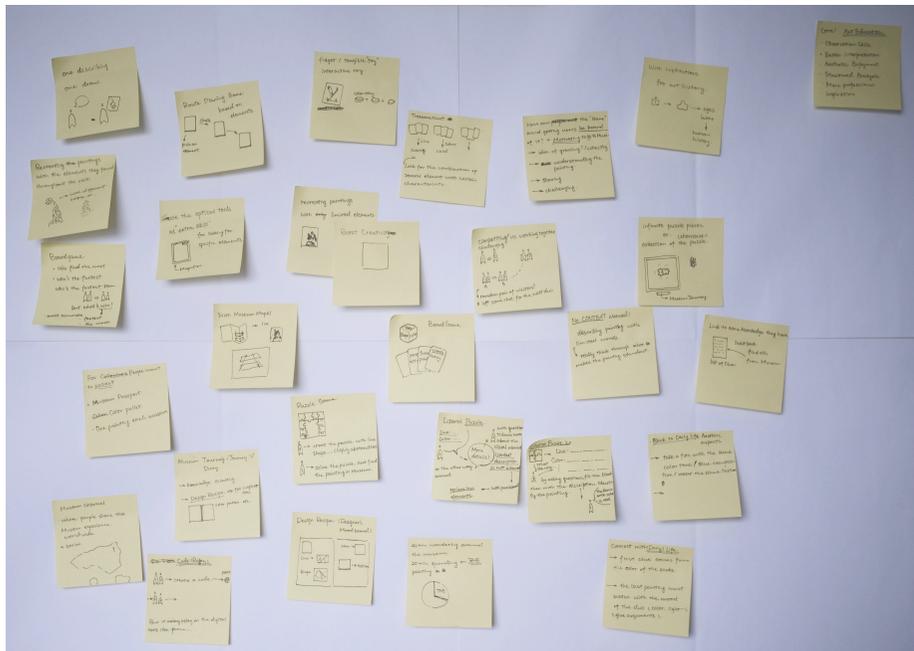


Figure 4.3 29 Ideas

Reverging

Clusters

Based on the brainstorming session, the generated ideas were categorized into ten distinct categories (Figure 4.4): Board Games (Win/Lose) Game Mechanism, (Re)-Creating, Interacting with Other Visitors Randomly, Physical Tools Involved, Route Planning, Transforming Literal and Visual Information, Puzzle Solving, Connecting to (Daily) Life, and Journey/Diary. The detailed ideas included in each cluster can be found in Appendix D.

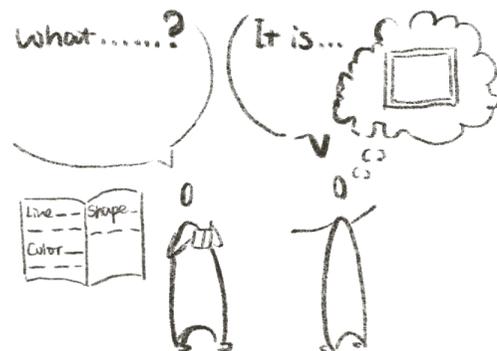


Figure 4.4 Clustered Ideas

Concept Development

During brainstorming, it became clear that using game mechanics and applying principles of serious game design and gamification could significantly enhance the user experience in this project. Gamification and serious games both involve using game elements for purposes beyond entertainment (Schnabel, Tian, & Aydin, 2014); in this case, to educate users about formal analysis. By applying these theories in the design, it can make educational content, which is sometimes perceived as dry and abstract, more engaging and accessible.

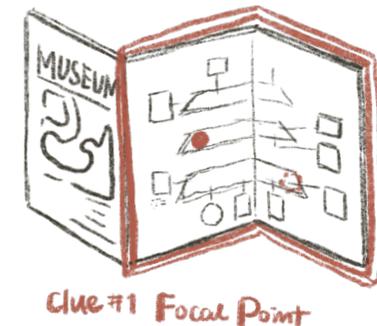
Moreover, game factors facilitate the formation of long-term memories, allowing users to apply acquired knowledge in their daily lives and cultivating an appreciation for art through formal analysis. Consequently, based on the clusters generated during brainstorming, three concepts (figure 4.5) around a game during the museum visit were developed.



1 Formal Hunters:
A Museum Treasure Hunt Game



2 Elements Mosaic:
A Museum Puzzle Game



3 Formal Way:
A Museum Route Planning Game

Figure 4.5 Three Concepts

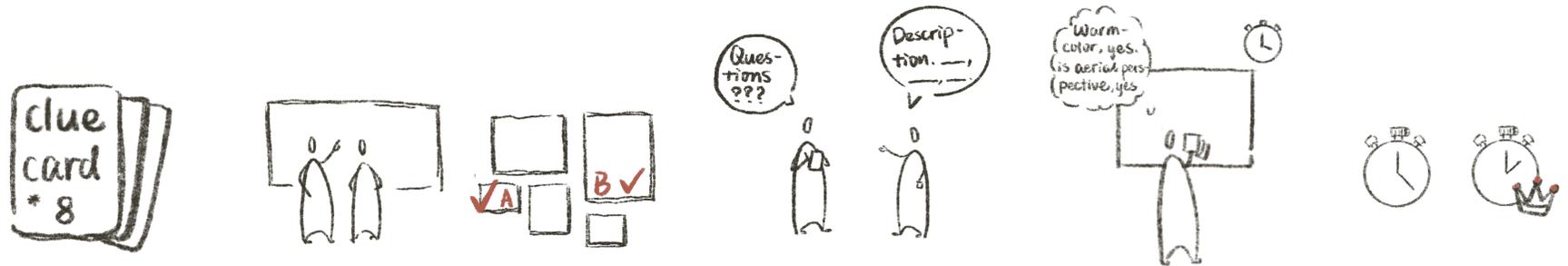
Concept 1 - Formal Hunters

A Duo Museum Treasure Hunt Game

Introduction

Elements Hunters, an exhilarating museum game where art, strategy, and the formal elements collide. In this game, players delve into the depths of the museum, embarking on a quest to uncover hidden masterpieces using only their wits and a handful of clues about formal elements. Each player assumes the dual role of partner and opponent, collaborating with their counterpart to decode cryptic descriptions and reveal the chosen artwork. With careful negotiation, strategic questioning, and keen observation of Line and Shape, Color and Light, Form and Space, and Texture, players race against the clock to claim victory (Figure 4.7).

Game Flow



<p>Game</p>	<p>Setup: Each player receives 8 blank clue cards at the start. Clues are based on formal elements.</p>	<p>Selection Phrase: Each player explores the museum as normal visit. However, to prepare for the game, the players should select an artwork that they are interested in or can relate the most to, for the other player to find.</p>	<p>Question Phase: The Seeker asks questions to the other player to obtain clues.</p>	<p>Searching Phrase: Players use the obtained clues to find the artwork.</p>	<p>Winning: Less time + correct painting</p>
<p>Education Focus</p>	<p>Clues are focused on formal elements. No content allowed.</p>	<p>Enhancing the experience: Giving players opportunity to explore the exhibition and find their interested piece with clear purpose.</p>	<p>With limited questions to get the important features, focusing on finding the potential priority features of a painting.</p>	<p>Focusing on the accuracy in transforming visual information to literal information and the other way around.</p>	<p>Focusing on Interaction and playfulness</p>

Figure 4.6 Overview of Formal Hunters

Detailed Game Rule

Each of the two players acts as both a partner and an opponent, helping each other find THE chosen painting through verbal descriptions.

Setup

1. Clue Cards: Each player receives 8 blank clue cards at the start. Clues are based on four formal elements: Line and Shape, Color and Light, Form and Space, and Texture (both Physical and Implied Texture). Each clue card can contain two clues, making a total of four clues per formal element.

Game Flow

1. Selection Phase (10 minutes):
 - Each player explores the museum for ten minutes and selects an artwork for the other player to find. Players can negotiate to limit the exploration area.
2. Question Phase (5-10 minutes):
 - The Seeker (Player A) asks questions to the other player to obtain clues. Clues are limited, so players must think strategically about their questions to efficiently identify the artwork.
3. Searching Phase (10-15 minutes):
 - Players use the obtained clues to find the artwork. The player who finds the artwork in the shortest time and identifies it correctly wins the round.

Winning and Losing

- The player who uses less time and correctly identifies the artwork wins and keeps all their clue cards.
- The losing player must discard one clue card.

Disputes

Focusing on communication of the duo, and spark deeper discussion around the chosen paintings

- If a player believes they cannot find the artwork due to unclear descriptions, they can challenge the round.
- In a contested challenge, if the description is clear and precise, the player who couldn't manage to find the artwork loses one clue card.
- If the challenge is uncontested, the player who gave the unclear description loses one clue card.

Game Duration

- Each round lasts approximately 30 minutes.

Tips: Players should consider how to ask questions and provide clues carefully to enhance the game experience.

Concept 2 - Elements Mosaic: A Duo Museum Puzzle Game

Introduction

Elements Mosaic is an engaging and educational museum puzzle game designed to deepen players' appreciation of art through hands-on experience and detailed observation. In this game, duo visitors will explore the museum and, instead of paying equal attention to every painting, select a painting that captivates them. They will then recreate it on a puzzle board (Figure 4.7) by focusing on its formal elements.

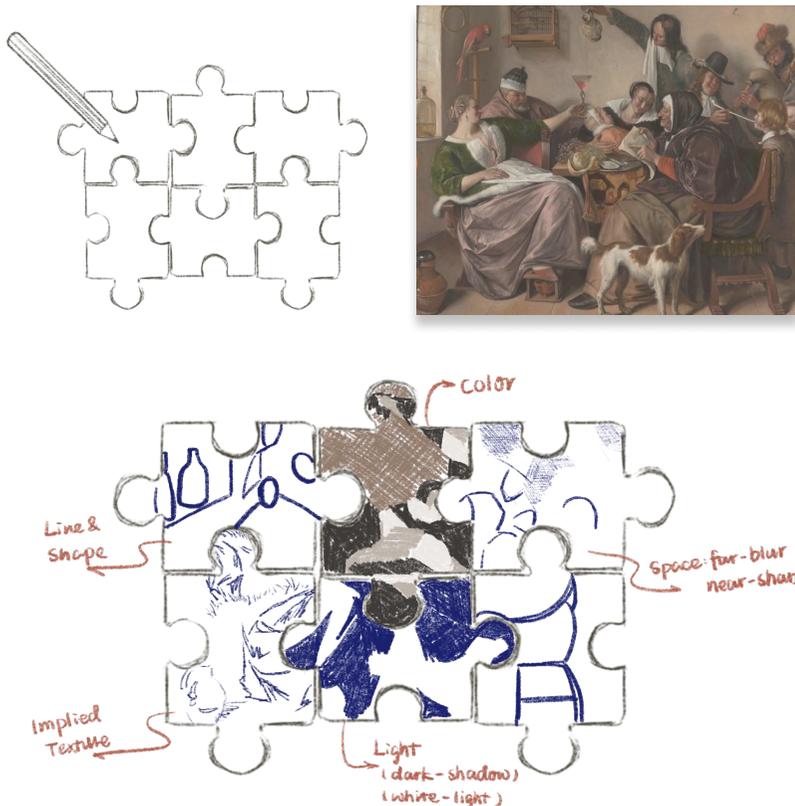


Figure 4.7 Intended Usage for the Puzzles

Game Flow

Setup

- Two players each carry a set of blank puzzle boards, each consisting of more than 6-9 pieces, into the museum.

Selecting a Painting

- During the museum visit, players start with normal visiting, choosing a painting they find most interesting or feel most connected to.

Creating the Puzzle

- Each player uses their puzzle board as a canvas to recreate the chosen painting.
- Players reframe the original painting according to the size of the puzzle pieces.
- Players need to think strategically about which element to represent on each puzzle piece to make it distinctive and representative of the original painting.
- Players are suggested to simplify the original artwork part by part, focusing on and depicting one formal element (e.g., color, line, shape, texture) on each puzzle piece.

Solving the Puzzle

- Once player A has created their puzzle, player B's job is to find the matching painting in the museum.

Winning Rule

Competitive Aspect

- Players are both opponents and partners. The player in the duo who identifies the painting correctly in the shortest time wins.

Team Challenge

- The combined total time taken by both players can be used to challenge the times of other pairs.

Concept 3 - Formal Way: A Museum Route Planning Game

Introduction

Formal Way invites players to explore the museum in an engaging and unique way. Using formal elements such as lines, shapes, colors, lights, forms, spaces and textures as their compass, players will navigate through the museum's collection, discovering artworks that connect by these fundamental aspects of artwork. Armed with a museum map and a keen sense of observation, players will embark on a journey that is both educational and personalized. This game encourages collaboration, deepens appreciation for art, and transforms the museum visit into an unforgettable adventure.

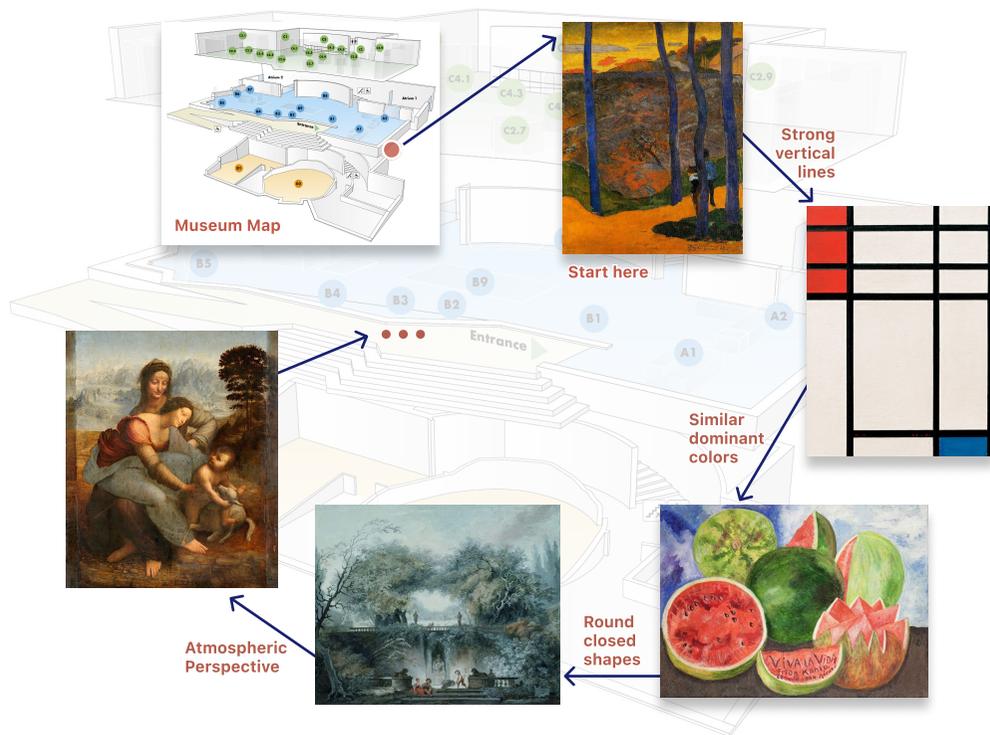


Figure 4.8 Example of How to Play the Game

Game Flow

Preparation

- Visit the ticket office to get a floor plan of the museum.
- Bring a pen or pencil to mark on the map.

Choosing the starting point

- Use the color of the player's outfit as the starting clue. Begin the tour with the first artwork that shares the same color tone as the outfit.
- Mark this artwork on the museum map and note down why the journey started with this particular piece.

Exploring the Museum

- Analyze the artwork focusing on formal elements such as line/shape, color/light, form/space and textures.
- Decide the next artwork to visit based on these formal elements
- Discussing the painting with formal aspect to decide which way to go next
 - E.g.1 What is the dominant line in the painting? The next painting they are looking for should have the same angled lines.
 - E.g.2 How is the sense of space achieved? If this one is by using light and shade, they are looking for another painting that also depicts space using the same methods.
- Viewers should always note down the painting they discussed and what clue led them to this special painting.
- Continue this process, using formal elements to guide exploration from one artwork to the next.

See an example in Figure 4.8.

This is a collaborative exploration. There are no right or wrong paths; the aim is to create a personalized and meaningful museum tour based on observations and discussions.

Converging

Introduction

Based on brainstorming, clustering, and concept development, three relatively feasible and practical solutions were identified. It was time to make a selection. In this converging process, I used two methods: UALo (Isaksen and Treffinger, 1985) and Harris Profile (Harris, 1961), to make the subjective selection as evidence-based as possible. The design process is not linear but circular, so after this round of converging, a potential solution will undergo a new round of diverging.

Methods

UALo Method

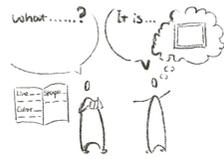
The UALo method, which stands for Unique, Advantages, Limitations, and Overcoming Limitations, is a creative problem-solving technique that evaluates and strengthens options using a positive and convergent mindset. Developed from the ALU method by Isaksen and Treffinger (1985), UALo builds on principles from Synectics and integrates ideas of affirmative judgment and protecting novelty from Parnes, Noller, and Biondi.

Harris Profile

The Harris Profile is an evaluation method used to compare design concepts based on defined design requirements. Designers often use intuition to filter design solutions, and the Harris Profile visually represents these subjective factors (Van Boeijen et al., 2020) to facilitate the comparison of proposed design concepts.

Compared to the requirements defined in the chapter, I added accessibility. While drafting these game rules, I found some concepts engaging but difficult to illustrate even for someone familiar with formal analysis. This would be even more challenging for viewers with less frequent exposure to art, contradicting the purpose of the experience design. Designs that fail to make formal analysis easily understandable would be unsuccessful. Therefore, I prioritized this requirement. Engagement and active learning reflect the requirements for mind-on and hands-on learning, respectively, and are crucial for learning effectiveness. Self-guided exploration relates to user experience during use. Portability is a practical consideration since the current concepts are set in museum environments. Lastly, customization addresses the varying needs of users, such as adjusting game difficulty based on players' knowledge of formal elements.

Comparison of Concepts



Formal Hunters:
A Museum Treasure Hunt Game



Elements Mosaic:
A Museum Puzzle Game



Formal Way:
A Museum Route Planning Game

Harris Profile

Importance of criteria ↓

	-2	-1	+1	+2
Accessibility	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engagement	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Active Learning	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Self-guided Exploration	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Portability	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Customization	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

	-2	-1	+1	+2
Accessibility	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engagement	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Active Learning	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Self-guided Exploration	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Portability	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Customization	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

	-2	-1	+1	+2
Accessibility	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engagement	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Active Learning	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Self-guided Exploration	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Portability	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Customization	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

UALo

Unique Advantages

Involving the traditional formal analysis
With the challenging mechanism in the game, the visitors can start a deeper discussion on the painting.

Opportunity for creating and recreating
Potential advantage for collectors
Extra fun for people who like to draw

Make use of the museum map
Personalize the museum map
Break the normal routine of museum visiting

Limitation

No physical tools involved
The format is too serious that reminds some audience about school assignment

Not everybody likes drawing, the insecurity of drawing something may reduce the confidence of talking about art
Too many painting tools needed
Hard to document the description in text

Planning the route involves more professional knowledge about formal elements
Less accessible for visitor who's new to the formal analysis concept
Hard to document the description in text

Overcoming limitation

Creating an online platform where visitors can interact with other visitors remotely
Add optical tools as game elements

The dual visitors can choose from if they'd like to create the puzzle or solve the puzzle

Provide the information of the elements
Clear examples for designing the route
More guidance for the process

Figure 4.9 Harris Profiles and UALo

Diverging Round Two

Introduction

From the previous design loop, the "Museum Hunter Game" emerged as the most promising concept in terms of meeting the requirements. However, during the UALo analysis, I identified some areas for improvement. While the game is engaging, its game structure can feel a bit too serious. When pitching this idea to potential players, some remarked that the current game mode reminded them of middle school art homework. If an experience evokes unpleasant memories, it can demotivate users and diminish their interest in the design. Therefore, the presentation of the game warrants further exploration.

Moreover, there is room to improve accessibility. Formulating questions can still be challenging for many players. I also noticed a lack of physical elements in the overall design. To address these issues, I initiated a second round of diverging based on the evaluation of the current concept.

In this round of diverging, I employed two main strategies:

1. Enhancing the Existing Concept: Adding more elements to the "Museum Hunter Game" to address the identified deficiencies.
2. Simplifying to Core Principles: Stripping the current concept down to its fundamental principles and developing new concepts from these principles.

Under the first strategy, the addition of interaction elements with other unfamiliar visitors resulted in two expansion concepts. Guided by the second strategy, I developed a game design that appears to be in an entirely different direction.

A Formal Elements Edition of Guess Who

Given the challenges associated with enhancing accessibility, I have opted to distill the game to its core principle: transforming highly academic and potentially tedious guidelines into an engaging question-and-answer format designed to solve a puzzle. This approach encourages interaction between two "learners," who, through a process of back-and-forth discussion and inquiry, collaboratively analyze the formal aspects of one or more artworks.

The concept draws inspiration from the classic game *Guess Who*, a two-player board game originating from the Netherlands (Figure 4.12), where players attempt to guess the identity of each other's chosen character by asking yes-or-no questions (Wikipedia, 2024). In the original game, the questions focus on content-specific details, such as "Is the person wearing a hat?" However, in the formal elements edition, the questions are intentionally restricted to the formal aspects of paintings.

Moreover, yes-or-no questions, by their nature, are essentially statements that can convey substantial information. By leveraging this characteristic, many of the more tedious points from the guidelines can be seamlessly integrated into these questions, thus presenting the information to the players in a more engaging and interactive manner.

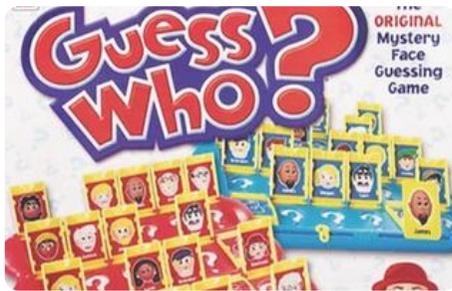


Figure 4.12 Original *Guess Who* Game (Wikipedia, 2024)

To evaluate the potential of this concept, I have once again created a Harris profile and compared it with Formal Hunter 2.0 (Figure 4.13). To enhance accessibility, consider integrating the guidelines into the board game as advantageous elements that players can use to win. In a gaming environment, players are more likely to lower their defenses against learning, thereby absorbing knowledge subconsciously.

So far, the Formal Elements Edition of *Guess Who* appears to be the most promising approach for effectively conveying knowledge. By carefully selecting the wording in the game's guidelines, this method can significantly improve knowledge accessibility while maintaining an enjoyable and engaging learning (gaming) experience.

The specific design and iterative development of the game will be discussed in detail in the next chapter.

	Formal Hunters 2.0				Formal Elements Edition of <i>Guess Who</i>			
	-2	-1	+1	+2	-2	-1	+1	+2
Accessibility	■	■	□	□	□	□	■	■
Engagement	□	□	■	■	□	□	■	■
Active Learning	□	□	■	■	□	□	■	■
Self-guided Exploration	□	□	■	■	□	□	■	■
Portability	□	□	■	■	□	□	■	□
Customization	□	□	■	□	□	□	■	■

Figure 4.13 Harris Profile



5

Deliver

Focusing on the most promising concept identified in the previous chapter, this chapter delves into the detailing process, including several rounds of iteration. With follow-up user tests, some suggestions for the future of the project are raised.



Educational Board Game: Formal Frames

Introduction

Before delving into the iterative development of the game, it is essential to provide a brief overview of the game itself and its components. This will facilitate a smoother understanding of the design process described in the subsequent sections.

Formal Frames is an educational two-player card game where each player selects a secret painting from a set of painting cards. The players take turns asking yes-or-no questions about the formal aspects of their opponent's painting, aiming to eliminate options on their board by flipping down paintings that do not match the answers. Content-related questions, such as "Does your painting have animals?", are not allowed. The objective is to guess the opponent's painting before they guess yours, with each player allowed two guesses. An incorrect second guess results in an immediate loss.

The game encourages players to think critically about the questions they ask. However, to prevent players from feeling overwhelmed by the challenge of generating questions, aids like clue cards and element cards are provided. These aids are utilized differently depending on the selected difficulty level, helping players engage with the game's educational content without becoming discouraged.



2 Rule Book

The rule book (Figure 5.3) in *Formal Frames* serves not only to explain the game rules but also as a key tool for introducing players to formal analysis and the formal elements of art. It explicitly prohibits content-related yes-or-no questions and offers different levels of difficulty (Figure 5.4) to accommodate players with varying educational backgrounds.

In short:

By asking **yes or no** questions in turns, your task is to figure out which the painting your friend picked for you.

But hold on - asking *if there's a person in the painting* is too easy. This game is all about the formal aspects of the painting, also known as formal analysis.

But, What is Formal Analysis?

It is mainly used in the academic world, but don't worry if you know nothing about art history. As Chandler and Munday (2011) mentioned in A Dictionary of Media and Communication, formal analysis is all about identifying and describing the formal features (colors, lights, space...) of an artwork and how they relate to each other. It doesn't focus on the content or the cultural or historical context.

So, Rule No. 1: No Questions About Content

You can't ask about the content in the paintings. No "Is there a dog in it?" type questions allowed! **If your opponent does so, you can skip their question, and they lose one round of questioning.**

Then, What Questions Are Allowed?

There comes the **Rule No. 2: You May Ask All the Questions About Formal Elements** - the building blocks of visual art.

These elements include: lines, colors, light, pictorial space, etc. In the academic world, various frameworks exist, but as a player, you don't need to worry about that. You will be equipped with inspiration: the game set includes clue cards printed with questions and vocabulary. Let them inspire you!

Tips:

You are always encouraged to challenge your friend about the meaning of their question because even if the formal aspects of a painting are objective, there are still chances that you two interoperate terms and perceive visual information differently.

When you are not sure, **discussion is explicitly encouraged!**

● Short introduction of the game mechanism

● Definition of formal analysis, introducing the focus

● By limiting the questions outside of the content of paintings, highlighting the educational purpose of focusing on formal elements

● Further introducing what questions are allowed in the game, also further introducing the formal elements

● Discussion during the game is an important way for players to get deeper insights about the formal elements and terms, also an opportunity for players to get to know each other better, like how to interpret visual informations

I just heard about formal analysis



- Shuffle the element cards with clue cards.
- Take turns drawing one clue card from the stack and asking the question written on the card.
- Each clue card can only be used once per game.
- If you get an element card, generate a question based on the card's information.

I know formal elements



- Shuffle the element cards with clue cards.
- Before starting, each player draws 5 cards from the stack.
- Using one card per round and drawing a new card after using one.
- Each clue card can only be used once per game.
- If you get an element card, generate a question based on the card's information.

I am knowledgeable in this field



- For experienced players, play without the clue cards.
- Ask questions freely, but you cannot repeat questions that have already been asked.
- (Optional) To make it more challenging, limit the number of question rounds to 4-6.

I am a Pro



- Use only the element cards.
- Before each round of questioning, draw a card to specify an element to focus on.
- All questions in that round must be about that specified element.
- Players can use each element multiple times.

Figure 5.3 Rule Book

Figure 5.4 Difficulty Levels

3 Clue Cards

The clue cards, some shown below (Figure 5.5), are the most educationally significant components of the game. It contains seven formal elements of art: composition, lines, shapes, colors, lights, space and texture. Initially conceived as guidelines, they were adapted into clue cards to enhance feasibility and accessibility. Each card contains a question focused on formal analysis, accompanied by an example to clarify the terms used. These 50 cards challenging players' understanding and application of the terms in the questions, helping them to judge and eliminate paintings that do not match the statements.

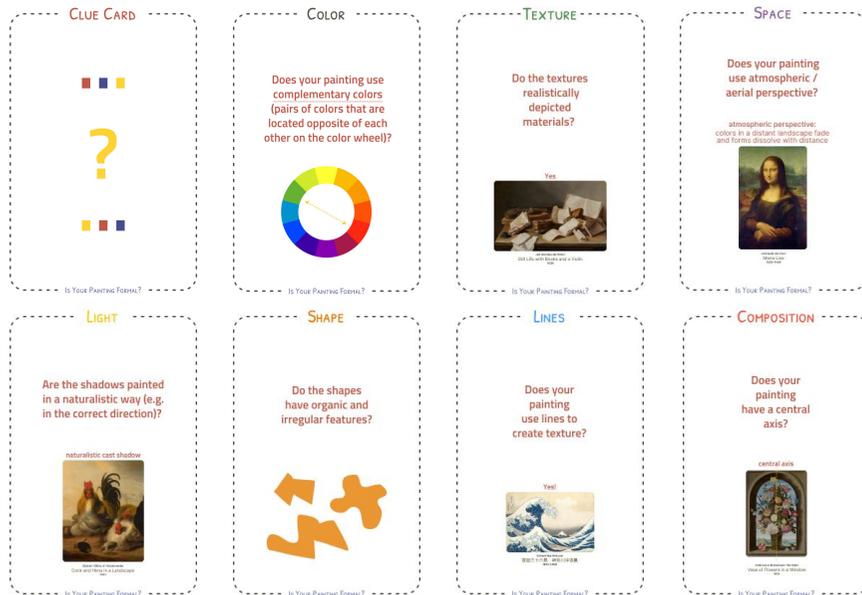


Figure 5.5 Examples of clue cards

5 Chance Cards

Chance cards (Figure 5.7) introduce unexpected elements that can significantly alter the progression of the game. This addition aims to increase the game's dynamism and enhance player engagement.

4 Element Cards

Similar to clue cards, element cards (Figure 5.6) are designed to help players learn formal analysis, it also contains the seven elements. However, unlike clue cards, each element card provides detailed information about a specific formal element. When a player draws an element card, they can formulate a question related to that element based on the information provided. Element cards offer players some freedom to customize their questions. Compared to clue cards, which contain only one predefined question, element cards require players to assimilate the knowledge on the card, understand it, and then generate relevant questions, further strengthening their comprehension of formal elements.

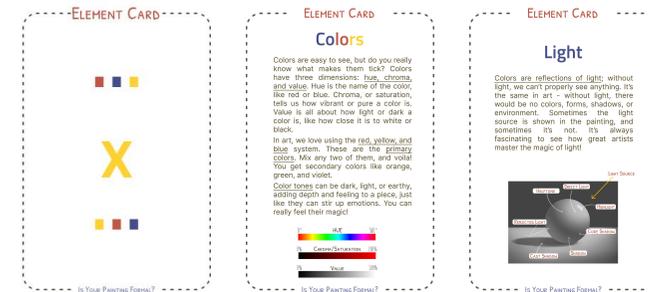


Figure 5.6 Examples of element cards



Figure 5.7 Examples of chance cards

Development of Formal Frames

Overview

Reflecting on the final design of Formal Frames, we can now examine the process that shaped the game into its current form. The development of the game was structured into three primary sections: Validation of Game Mechanism, Iterations of Game Components, and User Tests. The timeline for this development process is depicted in Figure 5.9, and the number of participants involved in each test is detailed in Figure 5.10 (next page).

An iterative loop (Figure 5.8) was employed throughout the development process. Based on feedback from the tests, I incorporated board game design strategies sourced from the Internet and conducted preliminary trials with the revised designs. During these trials, I closely observed participant interactions and collected relevant data.

After each trial, I conducted brief interviews to capture the participants' experiences, with a particular focus on identifying critical points of confusion or difficulty. The insights gathered from both observations and interviews were then synthesized to guide subsequent iterations, ensuring that each version of the game was progressively refined based on user feedback.

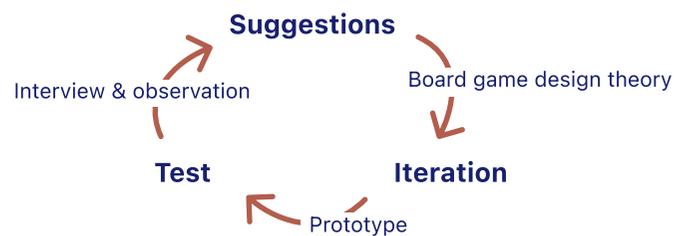


Figure 5.8 Iterative loop



Figure 5.9 Timeline of Game Development

In the Validation of Game Mechanism phase, the initial test focused on concept validation using a low-fidelity printed prototype and guidelines adapted from institutional sources, which were also used in the exploratory experiment. At this stage, the game rules were not fully developed, so the rules of the game "Guess Who" were employed as a foundational framework.

After successfully validating the core mechanism of the board game, the second round of testing concentrated on the development of individual components, particularly the rule book and guidelines for analysis. Several iterations were conducted based on the test results, with three key areas of refinement: improving readability, clarifying game rules, and integrating game elements informed by board game design theory to enhance the overall user experience.

Following the development and refinement of the individual game components, the final phase of the evaluation focused on assessing the game's overall impact on players' perceptions of art. This phase comprised both a controlled laboratory experiment and a test within a museum setting. In addition to user testing, an interview with a museum educator was conducted to explore the potential future applications of the game and its integration into educational practices within museum contexts.

	Amount of pairs	Number of Participants
Validation of Game Mechanism	2 pairs	4
Iterations of Game Components (Rule Book)	2 pairs	4
Iterations of Game Components (Guideline)	2 pairs	4
User Test (Lab Setting)	3 pairs	6
User Test (Museum Setting)	3 pairs	5

Figure 5.10 Participants for Each Test

Validation of Game Mechanism

Introduction

This round of testing aims to validate the selection of paintings for the game set. Three sets of paintings were chosen from the Mauritshuis collection (<https://www.mauritshuis.nl/en/our-collection/>). Since the collection primarily features works from the 16th and 17th centuries, it offers numerous choices within the same genre, resulting in less distraction from the content of the paintings.

Research Question

- Is the game feasible?
- Are the selected paintings appropriate for players with varying levels of prior knowledge?

Equipments and Materials

- Game set (Figure 5.11): including rule book, painting sets and guidelines (detailed game components see page X).
- Cameras and tripods for recording the sessions.

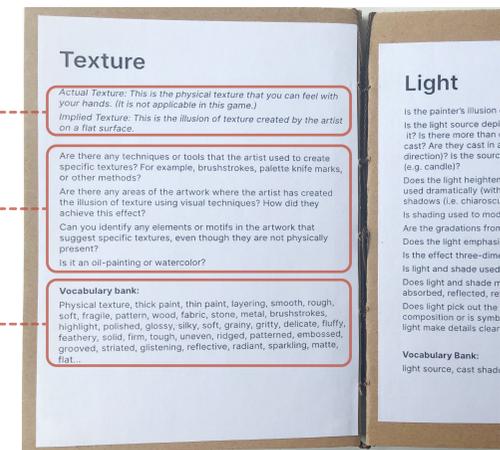
**At this stage of the game design, it's important to note that the clue cards were still in the form of guidelines, and the painting set had not yet been finalized.*



Painting set B: 32 paintings covering 2 genres (still-life and genre)



Painting set A: 32 paintings covering 6 genres - still-life, portraits, interior scenes, landscapes, genre, and historical / methodology / religious narratives



Short introduction about the element

Inspiring questions

Vocabulary for describing the element

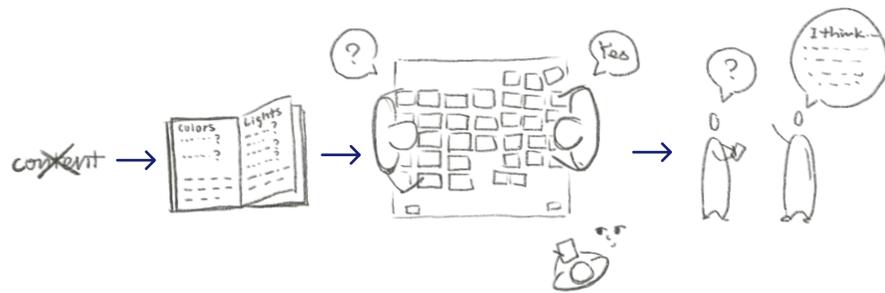


A6-sized booklet with 7 elements: composition, lines, shapes, forms, pictorial space, lights and textures

Figure 5.11 The First Game Settings provided to the players

Procedure

Orally introduce the game rules to the participants, making it clear that questions about the content are not allowed. Provide the participants with the guidelines, suggesting that they use these as inspiration if they struggle to formulate good questions during the game. Allow them to play two rounds: the first with the painting set featuring six genres and the second with an alternative set. Throughout the gameplay, observe the participants, taking notes on any inspiring points without interrupting the flow of the game. Finally, conduct a brief, informal interview after the game to gather insights into their experience.



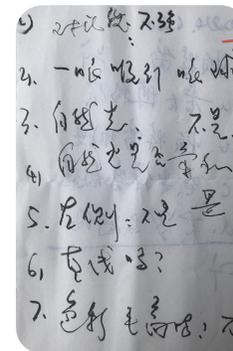
Results and Insights from Observation

The Guess Who game mechanism proved working, with participants typically needing 5-7 rounds of questioning to find out the final result. And all of them made it within three guesses. On average, each game session lasted approximately 30 minutes. The painting set featuring only still-life and genre scenes posed significant challenges, even for participants with prior knowledge of formal analysis concepts, while the set with more diverse genres was more manageable for the players.

“ IF IT WEREN'T FOR THE GAME, I WOULD NEVER HAVE LOOKED AT THESE PAINTINGS SO CLOSELY!”



(1)



(2)

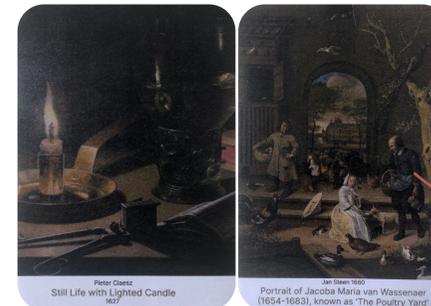
The note from one player:

1. The contract of the colors
2. Focal point obvious?
3. Natural light source? No.
4. Lights are soft?
5. Light source comes from left?
6. Straight lines?
7. Wide range of color? No.

“ THE GUIDELINE IS HELPFUL, BUT ALSO HARD TO READ ”



(3)



(4)

The resolution of the printing was not high enough to view the details, especial the dark color tones

Figure 5.12 Screenshots from Recordings of the Tests

Several observations were noted regarding the game mechanism and participant behavior:

- The rule specifying that only questions about formal elements are allowed was not sufficiently clear.
- Participants' questions predominantly focused on colors and lighting.
- Although the questions in the guideline were helpful, the booklet was somewhat difficult to read, especially when participants were engaged in the game and not prepared for extensive reading.
- The game encouraged participants to examine the paintings more closely, particularly when comparing two very similar styles. (Figure 5.12.1)
- Playing the game increased participants' familiarity with the paintings and sparked their curiosity to view the original artworks in museums.
- There were occasional long pauses before participants asked questions.
- The game was designed for yes or no questions, but differences in vocabulary understanding often led to discussions rather than straightforward answers.
- The formal elements, especially those concerning pictorial space and textures, were not always clear to the players.
- The vocabulary provided in the guideline seemed to be less noticeable and helpful.
- One participant took notes of the questions asked to avoid making incorrect guesses and to keep track of which paintings had been considered. (Figure 5.12.2)

Suggestion for next iteration

The next iteration should be focused on the development of the guideline and clarify the game rules:

- Improve the readability
 - Group the information on the guideline, separate the text into short introduction of the element, questions can be used for the game, and the vocabulary. For vocabularies, either visually more attractive or fit them in a better way into the guideline.
 - Add more visuals
 - Minimize the text (Figure 5.12.3)
- Rules regarding to questions permitted need to be introduced in a clear, understandable and friendly way
- Game flow:
 - Notes can be a feature having potential.
 - Adding more social elements, like challenging the questions, or encouraging discussion and review of the game.

Painting quality could be improved. (Figure 5.12.4)

Iterations of Game Components

In this round of development, rather than making overarching changes to the entire game, I focused on separating the rule book and guidelines, addressing each component individually. This approach facilitated rapid testing and iteration, ultimately enhancing the feasibility and accessibility of the game.

Rule Book Development

Introduction

There is a clear distinction between game rules and the rule book. Rules are the in-game conditions that guide player actions and can be found on various game components like cards, pieces, or the board. In contrast, the rule book is the primary document designed to teach players how to play, containing some but not all rules. It conveys both the mechanics and the intent behind the game (Rollins, 2019). In this case, the rule book also serves as a vehicle for introducing knowledge of formal analysis.

Suggestions from Previous Test

- It's essential to include clear written rules that specify the types of allowed questions, ensuring players understand both the game mechanics and its educational goals.
- Communicating Formal Analysis in the Rule Book Formal analysis, while important for the game, is not common knowledge. To ensure comprehension, it should be presented in a reader-friendly, accessible manner.

First Iteration of the Rule Book

The basic game mechanism of *Formal Frames* is adapted from the core rules of Guess Who (Hasbro, n.d.), where players ask yes/no questions to deduce the identity of the other player's character—here, a painting. The principle of querying objective characteristics is preserved, with players focusing on formal elements and objective information in the painting, excluding content-related questions.

Given the familiarity of most participants with the original Guess Who rules, integrating formal analysis into the rule explanation is crucial. To improve readability and minimize cognitive load, it is important to simplify the rules (Sunwall, 2024). However, as Whitenton (2013) suggests, while some intrinsic cognitive load can engage users, only irrelevant visual information poses issues. Thus, careful use of visual clusters can help avoid information overload in the rule book (Figure 5.13).

Rule Book Design

Briefly introduce the game at the very beginning of the rule book.

Rule books need to give players enough information to play a game, even if only halfway read (Rollins 2019).

By asking questions to arise the interests of the players, then using plain language from dictionary to explain the concept.

Use present tense, active voice, and second person when writing rules (Rollins 2019).

Using bold font and icon to visualize the text and emphasize the important rules, so that even a glance of the card can see the information.

Rule books need to be concise, visual, and skim-able. (Rollins 2019).

Using the underlines to highlight the concept about formal analysis.

Hinting that there are other rules mentioned in other parts of the game.

Rules can be in rule books, on cards or pieces, or on the board itself. (Rollins 2019).

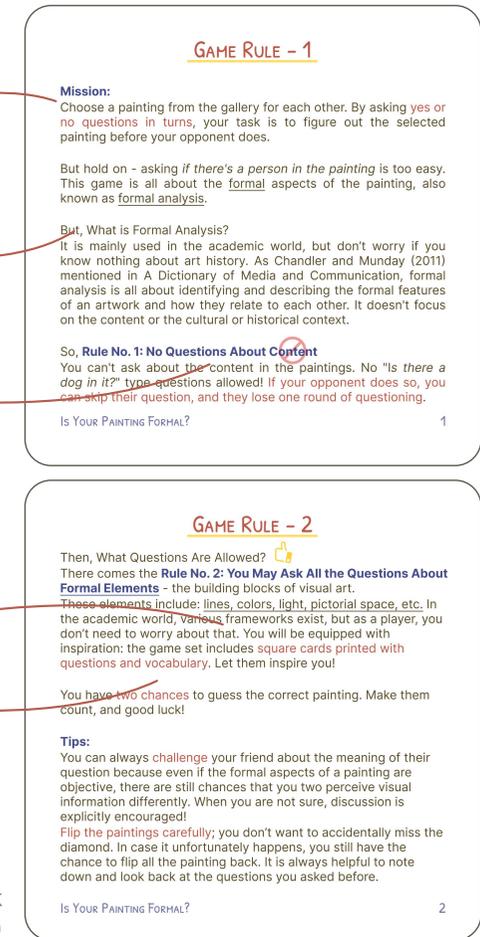


Figure 5.13 First Edition of Rule book Based on Guideline from Rollins (2019)

Feedback from user test

The rule book received highly positive feedback for its clarity and ease of reading. Participants found the educational function of introducing formal analysis to be particularly evident. This is demonstrated by the fact that 3 out of 6 participants explicitly asked whether the game was designed to teach users how to appreciate paintings from a different perspective. This suggests that the rule book effectively conveyed its educational intentions, aligning with the participants' perception of the game as a tool for enhancing their understanding and appreciation of art.

However, it is important to note that the test might be biased by the fact that participants were only reading the rule book without interacting with other game elements. Further testing is required to evaluate the rule book in conjunction with other components of the game to ensure comprehensive assessment and validation.

“ IS THE GAME TRYING TO TEACH PLAYERS TO VIEW PAINTINGS IN A DIFFERENT WAY?”

“ THE ICONS ARE VERY CATCHY, SO I NOTICE THE NO CONTENT RULE AT THE FIRST GLANCE.”

Clue Cards Development

Introduction

The guideline in this game serves as a crucial element, bridging the fun and playful aspects with the serious and professional educational purposes. Balancing the academic rigor of describing formal elements with accessibility and ease of understanding is both a challenge and a primary focus in the guideline's development.

To effectively teach the audience about abstract elements, the guideline may need to contain substantial information, posing a risk of information or cognitive overload. Conversely, the game's goal is to provide players with knowledge through an engaging and entertaining experience. Therefore, achieving a balance between comprehensive educational content and maintaining player engagement is of great importance.

In the guideline's development, four iterations (Figure 5.14) were made from the initial version:

1. Transferring the booklet into double-sided element cards.
2. Separating the introduction of the elements from the inspiring questions.
3. Rule improvement
4. Improving the professional content.

Suggestions from Previous Test

The initial version (see page 55, Figure 5.11) of the guideline imparted an excessive sense of seriousness, resembling a textbook rather than a game guide. The lack of visual elements, coupled with an abundance of text, made it challenging to read and resulted in reader fatigue. Additionally, the volume of information presented was overwhelming, making it difficult for players to read everything and to select from the inspiring questions provided. Several terms within the guideline were difficult to understand, and the vocabulary used did not capture much attention. Consequently, the guideline failed to invite players to engage with it; some players merely glanced at it before setting it aside.

Timeline of Iterations

Short introduction about the element

Inspiring questions

Vocabulary for describing the element

Starting Point: Text book

Texture

Actual Texture: This is the physical texture that you can feel with your hands. (It is not applicable in this game.)

Implied Texture: This is the illusion of texture created by the artist on a flat surface.

Are there any techniques or tools that the artist used to create specific textures? For example, brushstrokes, palette knife marks, or other methods?

Are there any areas of the artwork where the artist has created the illusion of texture using visual techniques? How did they achieve this effect?

Can you identify any elements or motifs in the artwork that suggest specific textures, even though they are not physically present?

Is it an oil-painting or watercolor?

Vocabulary bank:

Physical texture, thick paint, thin paint, layering, smooth, rough, soft, fragile, pattern, wood, fabric, stone, metal, brushstrokes, highlight, polished, glossy, silky, soft, grainy, gritty, delicate, fluffy, feathery, solid, firm, tough, uneven, ridged, patterned, embossed, grooved, striated, glistening, reflective, radiant, sparkling, matte, flat...

CLUE CARD

COMPOSITION

Is your painting symmetrical / asymmetrical?

symmetrical

Is YOUR PAINTING FORMAL?

ELEMENT CARD

Colors

Colors are easy to see, but do you really know what makes them tick? Colors have three dimensions: hue, chroma, and value. Hue is the name of the color, like red or blue. Chroma, or saturation, tells us how vibrant or pure a color is. Value is all about how light or dark a color is, like how close it is to white or black.

In art, we love using the red, yellow, and blue system. These are the primary colors. Mix any two of them, and voila! You get secondary colors like orange, green, and violet.

Color tones can be dark, light, or earthy, adding depth and feeling to a piece, just like they can stir up emotions. You can really feel their magic!

HUE 180°

Chroma/Saturation 100%

Value 100%

Is YOUR PAINTING FORMAL?

Separated element cards and inspiring questions

The problem from the last iteration was the users were presented with too much information in one go. That resulted the overlook and fatigue in reading. So this version separated the element and questions, and limiting the use of words. On top of that, one question was taking up one card, so the player only need to process one question at one time.

However with this new format, the game mechanism related to questioning remain to be updated to fit this format of inspiring questions.

From this version on, the inspiring questions are presented as Clue Cards, while the elements are presented as Element Cards.

Development of guidelines/ element cards

Front side

About the element

Inspiring questions

Vocabulary blocks

Back side

Questions You Might Need:

Colors

Colors are easy to see, but do you really know what makes them tick? Colors have three dimensions: hue, chroma, and value. Hue is the name of the color, like red or blue. Chroma, or saturation, tells us how vibrant or pure a color is—think of those soft, muted Monet colors, which are less saturated. Value is all about how light or dark a color is, like how close it is to white or black.

In art, we love using the red, yellow, and blue system. These are the primary colors. Mix any two of them, and voila! You get secondary colors like orange, green, and violet.

Color tones can be dark, light, or earthy, adding depth and feeling to a piece, just like they can stir up emotions. You can really feel their magic!

Questions About Colors

Colors

Are the colors...
descriptive (represented as it is seen)?
luminous (brighter than the surrounding visual field), like a flame?
earthy (e.g. ochre, burnt umber, burnt sienna)?
painted in blocks or blended?
used for psychological effect (e.g. blue for emotional coolness/melancholy)?
used symbolically (e.g. blue for heaven)?
creating a sense of calm, excitement, or anxiety?

Does your painting...
use a wide range of colors or a limited palette?
use complementary colors (pairs of colors that locate opposite each other on the color wheel)?
contain a good amount of primary/secondary colors?
use the natural colors of the objects?
use monochrome (different tones of a single hue)?

Vocabulary bank:

hue chroma value

blue orange yellow green red purple

primary colors secondary colors

complementary colors

Double sides elements cards

Additional visual information was incorporated, including color icons to capture players' attention. The content was clustered into three distinct spaces: introduction, inspiring questions, and vocabulary. Words were presented in blocks, indicating that these elements are optional to read, rather than presenting a continuous chunk of text that could confuse readers about the information's relevance.

User test

To quickly test the new iteration and gather feedback, the game was played using only 6 paintings and the element cards.

Feedback from the user test

The double-sided format did not facilitate information retrieval as intended; in fact, two participants overlooked one side of the card. However, the card format successfully reduced the sense of being lectured, and the word blocks garnered more attention. Despite this, users remained confused about how to incorporate the words into their questioning.

Further development

The third version is the most promising iteration according to the principles of UX design (Yablonski, n.d.). Before conducting an impact test, several modifications are necessary: first, discussing with art educators to confirm the accuracy of the knowledge; second, testing with potential users to check the accessibility of the Clue Cards and then updating the game rules and mechanisms to align with how the information is presented to the players.

Figure 5.14 Development from Guidelines to Clue Cards and Element Cards

Incorporation of Beneficial Randomness

By separating the explanation of elements and potential questions, new opportunities for the board game emerged. Previously, the game was categorized as a strategic game, emphasizing decision-making abilities, such as choosing which element to inquire about and devising the most effective strategies to narrow down choices.

Incorporating card drawing and randomized events, as suggested by Filimowicz (2024), introduces elements of chance. These mechanics can enrich game dynamics and make the gameplay more engaging and relaxed. This shift not only diversifies the gameplay experience but also appeals to a broader audience by blending strategy with luck.

To increase the game's randomness and excitement, I added cards that provide players with advantages, such as:

- Double Question Card: Allows the player to ask two questions in a row.
- Extra Guess Card: Grants an additional opportunity to make a guess.

These cards are inspired by the "Chance" cards in Monopoly (Hasbro, Inc., n.d.), which introduce unexpected elements that can significantly impact the game's progression. This addition aims to make the game more interesting and enhance player engagement.

Integration of Element Cards

Element cards can be used as functional cards, similar to those in the UNO game. When a player has an element card, they can ask any question about that element. For instance, in UNO, the black, 4-color card allows the player to choose any color. In this game, drawing an element card allows the player to ask any question related to that element, based on its introduction.

Players may choose to save element cards until the end to ask precise questions that eliminate multiple options. Alternatively, they might use them early to reduce the number of options on the table. Encouraging players to strategically use their questions can enhance engagement from a game mechanics perspective.

User Tests

Introduction

This round of test will encompass two experimental settings: a laboratory environment and a museum context.

Laboratory Setting: In this controlled environment, I observed the impact of gameplay on participants' ability to describe artworks. The focus was on how engagement with the game influences players' understanding and articulation of formal aspects of the artworks before and after the gameplay.

Museum Context: Participants engaged with the game a few days prior to their visit to the museum. I accompanied them to the museum, conducting observations and interviews to explore how the game experience influences their museum visit. This allowed me to assess any shifts in their appreciation and interpretation of artworks as a result of their prior engagement with the game.



Laboratory Test

Research Questions

1. Can the players learn new knowledge in the short term?
2. Can the players apply the new knowledge while appreciating a painting?
3. Can the players gain more confidence in discussing art?

Method

The independent variable in this study is whether the participants were exposed to the game. Initially, participants were asked to describe painting set A (see page +2, Figure 5.16, red). After playing the game, they described painting set B (see page +2, Figure 5.16, blue). The chosen paintings were of high resolution, and participants were informed that they could zoom in for details.

To minimize the influence of the paintings' content, two similar paintings were chosen. Furthermore, the order of the paintings was switched between groups, meaning the first group described set A first, while the second group began with set B.

The description process was recorded using a voice recorder, which provided the primary data for analysis. To assess their confidence in discussing art, participants were also asked to rate themselves after describing each painting.

Since the game is designed for interaction between pairs and previous research indicates that museum visitors often prefer to visit in pairs, the description task was structured as a team activity. Thus, participants were expected to describe the painting together, inspiring each other through discussion.

Participants

Participants who had not participated in any prior tests were recruited to ensure their unfamiliarity with the concepts. Two pairs of participants were recruited for this study.

Materials and Equipment

- Game Set (see page xx): Includes two sets of paintings, element cards, chance cards, clue cards, and a rule card.
- iPad: Used by participants to zoom in and view the paintings while describing them.
- Voice Recorder: To record the participants' descriptions.
- Questionnaire: For participants to rate their performance.
- 8 paintings: For participants to describe, with one set serving as a baseline and the other for comparison to assess the game's impact.

Painting Selection

Each set of paintings consists of 4 works (see next page, Figure 5.16) representing different styles: Late Gothic style, which depicts space through diagonal lines that appear to recede, creating a simple illusion of space that may seem irrational to modern eyes (Harris, n.d.); pencil sketches, which highlight the contrast between white and black and use lines to create texture and space; 17th century Dutch paintings, where artists aimed for realism by applying precise and natural light, colors, and space; and Oriental paintings, which primarily use lines and blocks of color, focusing on texture and color rather than light and shadow to present space.

Procedure

The entire test took approximately 40 minutes (Figure 5.15). After obtaining consent, participants began by describing one set of the paintings (each painting has a 2-minute of time-limit). They then played the game against each other while I observed and took notes. Following the game, participants engaged in a reflection session to discuss any issues or disagreements that occurred. Finally, they described the second set of paintings together. The experiment ended with a follow-up interview about the experience.

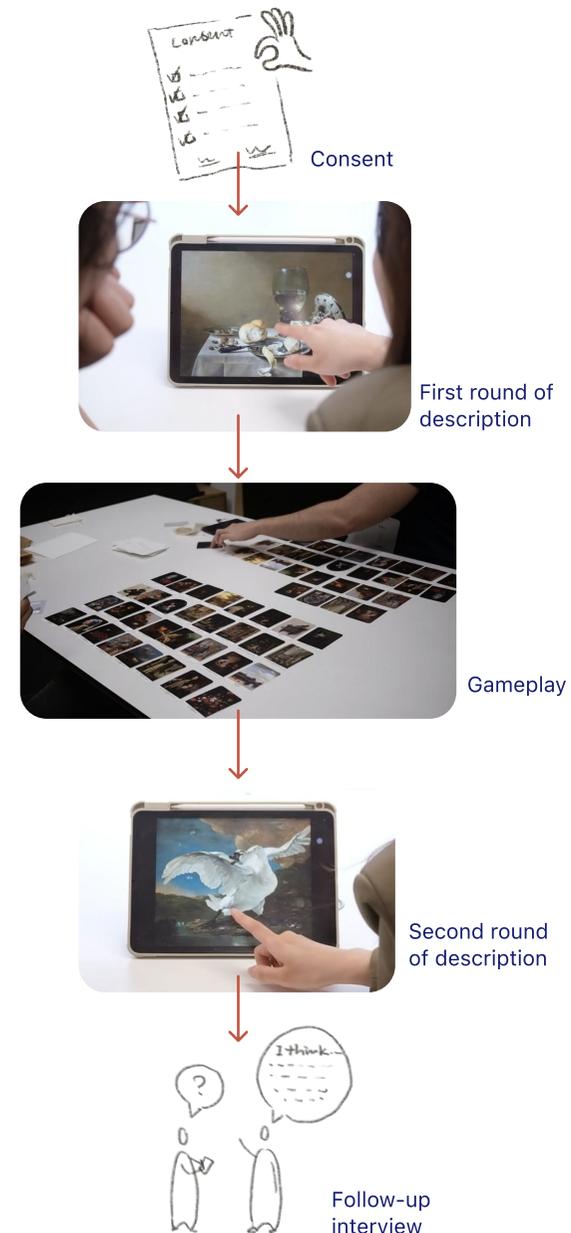


Figure 5.15 Procedure of the Laboratory Test

Late Gothic style



The Saint Elizabeth's Day Flood
Master of the St Elizabeth Panels
c. 1490 - c. 1495



The Martyrdom of Saint Lucy
Master of the Figdor Deposition
c. 1505 - c. 1510

Pencil Sketches



Hendrik Voogd
Liggend kalf
1788 - 1839



Hendrik Voogd
Staande koe
1788 - 1839

17th century Dutch paintings



A. Pieter Claesz
Still Life with Tazza
1636



The Threatened Swan
Jan Asselijn
c. 1650

Oriental paintings



Katsushika Hokusai
De Yodo rivier in maanlicht
1831 - 1835



Katsushika Hokusai,
Nakahara in de provincie Sagami
1831 - 1835

Painting Set A

Painting Set B

*Paintings from Rijksmuseum and Mauritshuis
<https://www.rijksmuseum.nl>
<https://www.mauritshuis.nl>

Figure 5.16 Paintings Selection

Insights

Proportion of Formal Aspects in Descriptions Increased

By transcribing the audio recordings of the 2-minute descriptions, I analyzed the content with the help of AI. The transcribed text was fed into a chatbot, which calculated the percentage of form-related content. The initial descriptions contained an average of 29.78% of form-related content, while the second round of discussions showed an increase to 51.58%.

Using the Terms from the Game

All participants incorporated terms from the clue cards during their second round of descriptions. The most frequently used terms were those discussed during the game. Participants mentioned that employing these terms enabled them to express their visual observations with greater confidence. Some participants noted that, although they might have previously noticed certain formal aspects, they lacked the vocabulary to articulate these observations effectively. After acquiring the terms, they subconsciously began to pay more attention to the formal elements.

Observation of Formal Elements to Understand Content

In the second round of descriptions, the content of the paintings was still a primary focus, but it was often discussed in relation to formal elements. For example, one participant described a painting by noting, "The colors are mainly dark blue, and the overall saturation is quite low to me, which gives the river a calm appearance." This shows how participants began their discussions with formal elements they had learned from the game. One group even developed a pattern, starting their discussion with a prominently emphasized element, such as the depiction of light in a still life, and then moving on to the specific objects depicted. They found this approach both interesting and novel to them, as it provided a new way of observing the resemblance in the paintings.

Combining Observation of Formal Elements with Art History

One participant, who possesses considerable knowledge of art history, mentioned that she had always been passionate about understanding the content of paintings but had seldom focused on the formal elements before playing the game. Previously, she perceived these elements as self-evident and had not contemplated the deliberate design choices made by the artists. She stated, "I have always observed the results of these elements, but I never considered how the artist actually created these results." This indicates a shift in her perspective, as she now recognizes the intentionality behind the formal elements used in the artworks.

Test in Museum Context

Research Question

What is the impact of the game on the general museum experience, including the preparation and reflection aspects?

Method

The independent variable in this test is whether the participants played the game. The baseline is the participants' prior museum habits, gathered through an initial interview. By comparing responses from interviews conducted before and after the museum experience, I gained insights into the game's impact on the general museum experience. Additionally, the initial interview and gameplay were organized 1-2 days before the museum visit to observe potential long-term effects of the game.

Participants

Participants who had not participated in any prior tests were recruited to ensure their unfamiliarity with the concepts. Three pairs of participants were recruited for this study.

Materials and Equipment

- Game Set (see page xx): Includes two sets of paintings, element cards, chance cards, clue cards, and a rule card.
- Voice Recorder: To record the interviews.
- Camera: To record observations in the museum.

Process

To assess the potential long-term effects of gameplay within a short timeframe, this research activity was divided into two phases: engaging with the game and visiting the museum.

Gameplay

The gameplay took place one or two days before the museum visit. Before starting the game, an interview was conducted to gather information about the participants' previous museum experiences, serving as a baseline for comparison with their post-game museum experience. Participants were then invited to play the game. As an observer, I refrained from guiding the gameplay and only provided clarification on game rules when explicitly asked by the participants. All other aspects of the gameplay, such as questioning, guessing, and eliminating options, were observed without interference.

Museum Visit

The museum visit took place at the Mauritshuis in The Hague, with each group of participants spending 1-2 hours exploring the museum. During the visit, I remained an observer and did not interfere with their activities. Prior to the visit, participants were explicitly instructed to ignore my presence as much as possible and to conduct their visit naturally and independently.

After the museum visit, a follow-up interview was conducted to discuss their experience. The interview was semi-structured, focusing on several key aspects: the overall experience compared to previous museum visits, the impact of the game on their museum experience, and their understanding and application of formal analysis.

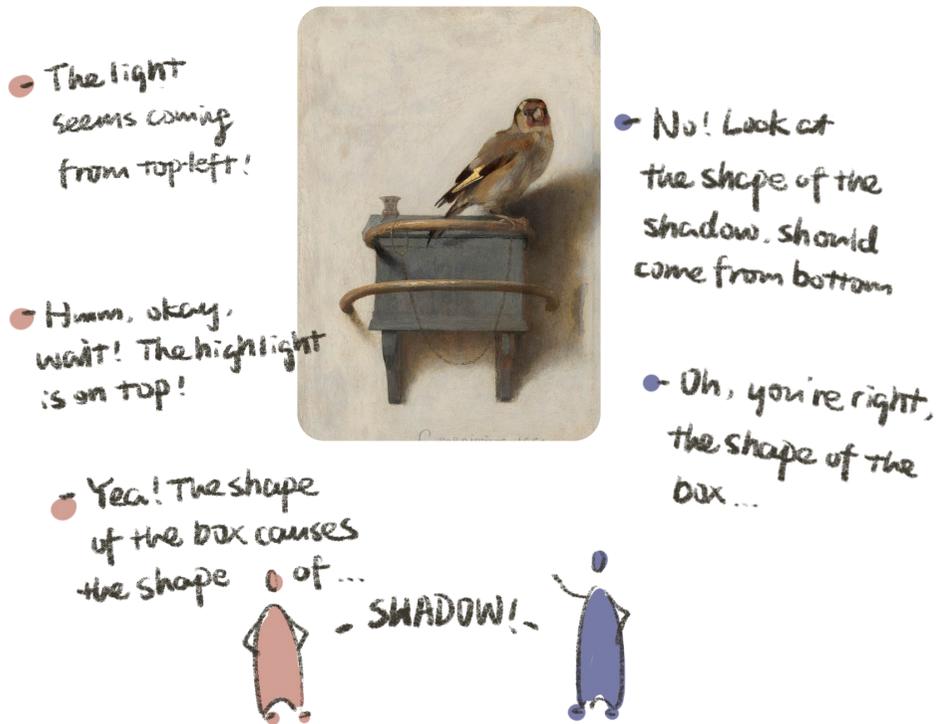
Some of the pre-prepared interview questions including the followings:

- How do you feel about your overall museum experience after playing the board game compared to past visits?
- How did the board game impact your understanding of formal analysis in pictorial art?
- Can you provide an example of something new you learned from the game that you applied in the museum?
- Did you feel more confident discussing the artworks with others after playing the game? Can you provide an example?

Insights

Expanded Attention to Formal Elements

In prior tests and interviews, most participants primarily focused on formal elements such as light and color. However, during observations of the museum visit, I noted a significant increase in discussions related to the use of lines, shapes within the compositions, and systems of perspective. Participants themselves reported a more in-depth attention to formal aspects during the follow-up interviews. One group, for instance, engaged in a detailed five-minute discussion about the depiction of light and shadow in *The Goldfinch* (Carel Fabritius, 1654). One participant later remarked, "If I hadn't drawn the 'light' element card during the game, I wouldn't have observed so carefully the direction of the light and the shape of its projection—this is truly fascinating."



Familiarity with Paintings Mitigates Museum Visit Fatigue

Although exposing participants to artworks they might encounter in the museum beforehand introduced a potential bias, it yielded positive feedback. Participants noted that this familiarity helped them combat the fatigue commonly experienced during museum visits. One participant mentioned that museum visits are generally tiring, but in this instance, recognizing the paintings from the game energized him. Others noted paying special attention to the artworks featured in the game, which fostered a stronger connection to the pieces (Figure 5.17). This multiple exposure to the paintings not only deepened their impressions of the artworks but also made their overall museum experience more memorable.



Figure 5.17. Discussing on the painting they saw during the game

Increased Confidence and Enjoyment in Discussing Artworks

Participants indicated that, compared to previous museum experiences, they felt more confident when discussing artworks with their companions. Since both had played the game and were familiar with most of the concepts, their discussions resonated, leading to barrier-free and deeper conversations, which they found highly enjoyable. One participant also noted the satisfaction of being the more knowledgeable person in their group, explaining artworks to a companion with less background knowledge. The use of the game's terminology and concepts during these discussions reduced their anxiety about making mistakes.

The Game's Discussion Process Aids Long-Term Knowledge Retention

During the museum visits, participants frequently referenced discussions from the gameplay, applying those topics to the artworks they were viewing, which demonstrated their ability to transfer knowledge across different contexts. This transfer of learning extended beyond the artworks themselves; for instance, one participant even commented on my jacket (Figure 5.18), noting that it had a red hue and that the color was highly saturated. This example underscores the participants' heightened awareness and application of formal analysis concepts in everyday observations.



Figure 5.18 My jacket

Limitations of Printed Cards in Conveying Original Artwork Details

The quality and size limitations of the printed cards in the game resulted in some details being overlooked, particularly the physical texture of the paintings, such as the thickness of oil paint layers or the fine cracks due to aging. When participants encountered the original works in the museum, they found them even more impressive. One participant stated that this realization further motivated her to visit the museum in person. Scale was also noted as an important element, with participants often expressing surprise at the actual size of the paintings (Figure 5.19).

This painting is so tiny in real life!!!



Figure 5.19 Realizing the scale of the real painting

Developing an Intuitive Sense for Formal Elements

More than 24 hours after the gameplay, some participants mentioned that they had forgotten some of the more specialized terms they had learned, but they still retained an understanding of their meanings. While they might not have been able to articulate these concepts using technical vocabulary, they could still recall the ideas when viewing the artworks.

Potential Applications of the Card Game

Most participants found the opportunity to preview the artworks through the game to be intriguing, but some also expressed a desire to purchase the game set as a souvenir of their museum visit. I observed that many museum gift shops sell standard decks of cards featuring images of the museum's collection (Figure 5.20), yet these products do not directly enhance the museum experience or contribute to art education. This suggests that there is a market gap for educational interactive card games in museum settings.



Figure 5.20 Cards in museum gift shop

The Future...

Overview

Regarding the future development of the educational board game *Formal Frames*, several suggestions have emerged from user tests, surveys and interviews. These recommendations are derived from three key stakeholders: the users, museum educators, and myself as the designer.

Feedback from participants was collected through surveys, which included ratings interest in various proposals (Figure 5.21), such as playing the game digitally online or with collections from different museums. There were 20 participants who had experience with the game filled in the survey about the future of the game.

Opinions from museum educators were gathered through a 45-minute interview with an educator from the Mauritshuis. The discussion focused on the board game, feedback, and its potential application in the museum setting.

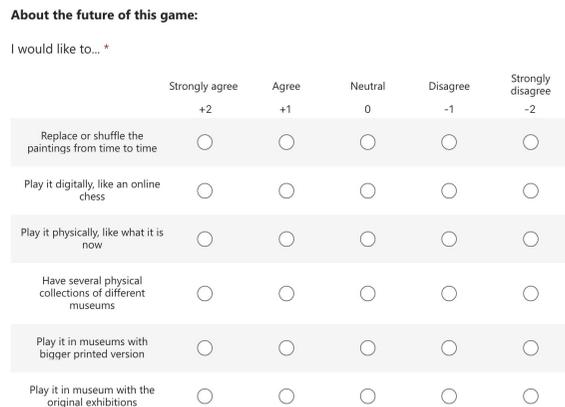


Figure 5.21 Alternative Proposals for the Future of the Game

Opinions from Players

Method

A concise survey was distributed to all participants who had engaged with the game, including those involved in the validation of the mechanism, development of the rule book, and iterations of the guidelines. In total, 20 participants provided preference scores for several proposed game adaptations. The rating system was structured as follows: a score of +2 indicated a strong preference for the proposed adaptation, while a score of -2 indicated strong disagreement with the suggested approach (Figure 5.22).



Figure 5.22 Rating System

Results and Insights

The sum and average values provide an overview of participants' general preferences (Figure 5.23 and Figure 5.24), while the analysis of variance and standard deviation offers insight into the distribution of their opinions (Figure 5.25).

The option "Have several physical collections from different museums" received the highest score of 30, with all participants giving positive ratings. Closely following were "Replace or shuffle the paintings from time to time" and "Play it physically," which scored 25 and 27 points, respectively. Participants expressed that the primary reason for their interest in these options was the potential fatigue associated with repeatedly using the same set of paintings. They suggested that periodically introducing new artworks or allowing for the exchange of paintings with other players could offer a refreshing variation. Additionally, participants noted that the act of flipping over eliminated options during gameplay was particularly satisfying.

	Replace or shuffle the paintings from time to time	Play it digitally	Play it physically	Have several physical collections of different museums	Play it in museums with bigger printed version	Play it in museum with the original exhibitions
Sum	25	-2	27	30	16	12
Mean	1,25	-0,1	1,35	1,5	0,8	0,6
Variance	0,618	2,411	0,976	0,474	1,116	1,726
Standard Deviation	0,786	1,553	0,988	0,688	1,056	1,314

Figure 5.23 Data Regarding the Preference Scores

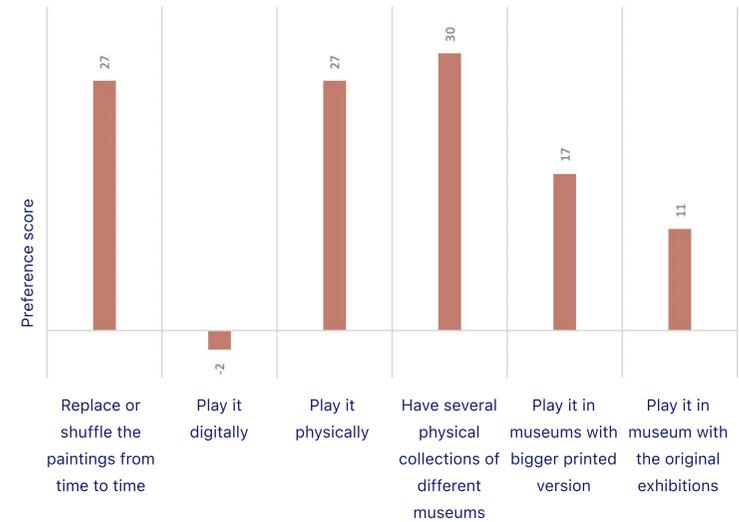


Figure 5.24 The Sum of Preference Scores for Each Alternative Proposal

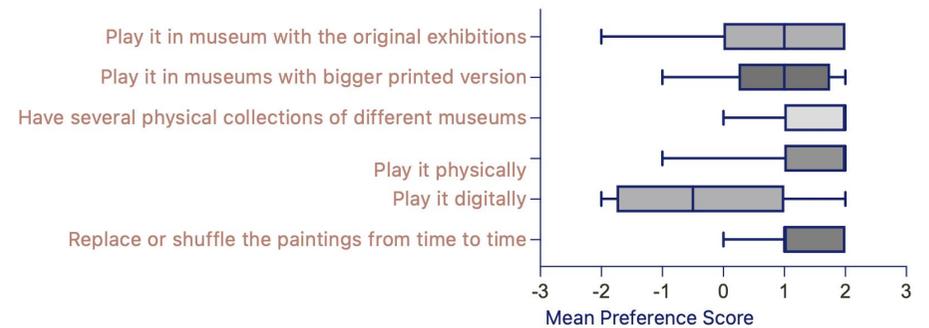


Figure 5.25 Sum Preference Scores for Alternative Proposals

Feedback from Museum Educator

Introduction

At the end of the project, it is valuable to gather feedback from museum educators. However, due to time constraints, I was only able to speak with one of the educators I had interviewed previously. In this section, I conducted an open interview with this educator.

Research Questions

1. How applicable is this game for integration into museum education?
2. What improvements can be made to better fit the museum context?

Method

The interview was conducted online and lasted approximately 45 minutes. I began by presenting the final design and potential future plans for integrating the game into the museum context. This was followed by a discussion of the ideas. The results were qualitative, as the interview was not strictly structured or based on a predetermined list of questions, but rather conducted as a spontaneous discussion.

Insights

General Feedback from the Museum Educator

The feedback received was generally very positive. From an educational perspective, the educator viewed the concept as innovative, engaging, and a promising method for communicating the knowledge of formal analysis.

- "... at least for me, I might forget the terms, but I will still be able to see colors better. So even if you forget what the warm and cold colors were, you still have the feeling that you know it. That's very fascinating..."
- "You really learned to look differently."
- "You really give them art education in a pressure cooker. It is such a simple concept, I can see people learning so much about visual arts in this way."

Simple but Effective Interaction

The game is described as a very personal journey, allowing players to engage in direct interaction with the artworks, enhancing their perception. It is also social, as players participate together, yet it maintains a competitive aspect.

Meeting Different Needs

From the museum educator's perspective, the game fulfills various needs, appealing to different types of players. Because museum educators encounter a diverse range of visitors daily, they value and prioritize addressing the varied needs of individuals. This game accomplishes that by offering different elements to trigger various interests. For example, for those interested in artworks, it provides a new way to view paintings; for those who enjoy gaming, it offers an engaging and interactive experience, allowing them to enjoy the competitive aspect even if they are not particularly fond of pictorial art.

Improving for Larger Groups for Museum Experience

From the perspective of integrating the game into museum education programs, the educator suggested developing the game for larger groups. For example, six players could be divided into two groups of three. Each group would pose questions to the other. Within each group, members might have different interpretations of the questions, leading to in-depth discussions to arrive at a unified answer. Although communication between groups might be reduced, the internal discussions within each group could still achieve the educational objectives.

Recommendations

While the game has garnered positive feedback through various testing phases, numerous aspects can be further refined to enhance its educational value and deliver a more engaging user experience.

Enhancing the Professional Content of the Game

The content on the game cards was developed without the depth of expertise required for advanced art analysis. However, this enhancement must be carefully balanced with the need for clear and accessible communication. The articulation of terms and their explanations could be further refined to ensure that they are both precise and understandable, particularly for individuals without extensive backgrounds in art .

Refining Design Details

Several design elements within the board game warrant further consideration. For instance, decisions regarding whether to include the artist's name, the title of the artwork, and the date of creation on the painting cards require additional user testing to determine their impact on the overall educational experience.

Diversifying the Painting Sets

The current selection of paintings is highly focused on 15th to 17th-century Dutch masterpieces, characterized primarily by a realistic style. The homogeneity in artistic style has increased the game's difficulty, which some participants have found to be excessively challenging during testing. Future developments should consider incorporating a wider variety of artistic styles to modulate the game's difficulty. Additionally, the provision of thematic card sets based on different museum collections has been shown to be an effective strategy for enhancing the game's appeal.

Application of *Formal Frames*

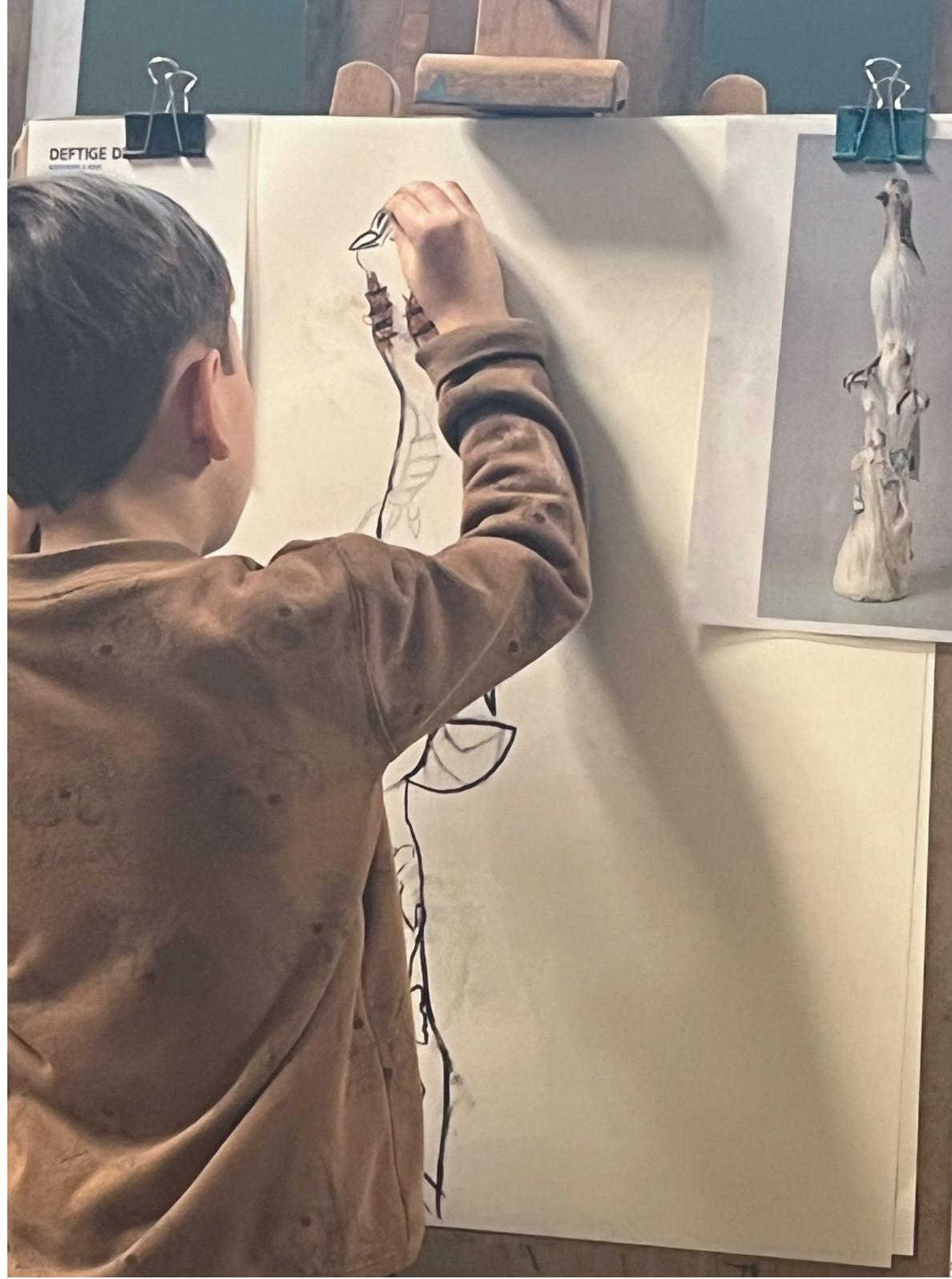
During the final phase of user testing, it was observed that prior exposure to the paintings before a museum visit could significantly enhance the visitor experience. However, the current design of the game presupposes that players would acquire the game from the museum gift shop after their visit. To resolve this temporal misalignment, a simplified digital version of the game could be offered on the museum's ticket booking platform, allowing visitors to engage with the game prior to their museum visit.

Future Testing and Impact Assessment

It is inherently challenging to eliminate biases during the testing process. The most notable bias in this study arises from the fact that many participants recruited for testing had backgrounds in design or art. To achieve more objective and generalizable feedback, future testing should aim to recruit a more diverse sample of museum visitors, encompassing a broader range of educational backgrounds and levels of prior exposure to art. This approach will provide more comprehensive insights into the game's effectiveness across different demographic groups.



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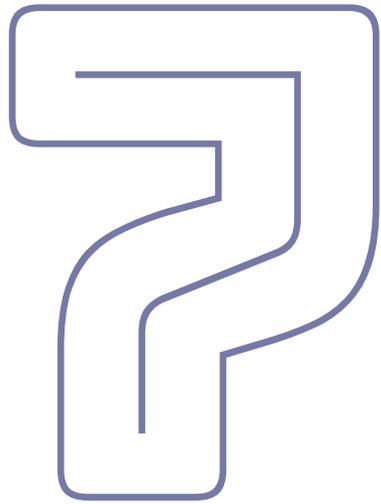
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Appendix



Appendix A - Project Brief



IDE Master Graduation Project

Project team, procedural checks and Personal Project Brief

In this document the agreements made between student and supervisory team about the student's IDE Master Graduation Project are set out. This document may also include involvement of an external client, however does not cover any legal matters student and client (might) agree upon. Next to that, this document facilitates the required procedural checks:

- Student defines the team, what the student is going to do/deliver and how that will come about
- Chair of the supervisory team signs, to formally approve the project's setup / Project brief
- SSC E&SA (Shared Service Centre, Education & Student Affairs) report on the student's registration and study progress
- IDE's Board of Examiners confirms the proposed supervisory team on their eligibility, and whether the student is allowed to start the Graduation Project

STUDENT DATA & MASTER PROGRAMME

Complete all fields and indicate which master(s) you are in

Family name	<input type="text" value="Gou"/>	IDE master(s) IPD	<input checked="" type="checkbox"/>	Dfl	<input type="checkbox"/>	SPD	<input type="checkbox"/>
Initials	<input type="text" value="X.G."/>	2 nd non-IDE master	<input type="text"/>				
Given name	<input type="text" value="Xuan"/>	Individual programme (date of approval)	<input type="text"/>				
Student number	<input type="text" value="5808901"/>	Medisign	<input type="checkbox"/>				
		HPM	<input type="checkbox"/>				

SUPERVISORY TEAM

Fill in the required information of supervisory team members. If applicable, company mentor is added as 2nd mentor

Chair	<input type="text" value="Maarten Wijntjes"/>	dept./section	<input type="text" value="HCD"/>
mentor	<input type="text" value="Willemijn Elkhuisen"/>	dept./section	<input type="text" value="SDE"/>
2 nd mentor	<input type="text"/>		
client:	<input type="text"/>		
city:	<input type="text"/>	country:	<input type="text"/>
optional comments	<input type="text"/>		

- ! Ensure a heterogeneous team. In case you wish to include team members from the same section, explain why.
- ! Chair should request the IDE Board of Examiners for approval when a non-IDE mentor is proposed. Include CV and motivation letter.
- ! 2nd mentor only applies when a client is involved.

APPROVAL OF CHAIR on PROJECT PROPOSAL / PROJECT BRIEF -> to be filled in by the Chair of the supervisory team

Sign for approval (Chair)

Name _____ Date _____ Signature 

CHECK ON STUDY PROGRESS

To be filled in by **SSC E&SA** (Shared Service Centre, Education & Student Affairs), after approval of the project brief by the chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total _____ EC

Of which, taking conditional requirements into account, can be part of the exam programme _____ EC

<input type="checkbox"/>	YES	all 1 st year master courses passed
<input type="checkbox"/>	NO	missing 1 st year courses

Comments: _____

Sign for approval (SSC E&SA)

Name _____ Date _____ Signature _____

APPROVAL OF BOARD OF EXAMINERS IDE on SUPERVISORY TEAM -> to be checked and filled in by IDE's Board of Examiners

Does the composition of the Supervisory Team comply with regulations?

YES	<input type="checkbox"/>	Supervisory Team approved
NO	<input type="checkbox"/>	Supervisory Team not approved

Comments: _____

Based on study progress, students is ...

<input type="checkbox"/>	ALLOWED to start the graduation project
<input type="checkbox"/>	NOT allowed to start the graduation project

Comments: _____

Sign for approval (BoEx)

Name _____ Date _____ Signature _____



Personal Project Brief – IDE Master Graduation Project

Name student Xuan Gou

Student number 5,808,901

PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSIGNMENT

Complete all fields, keep information clear, specific and concise

Project title A Pictorial/Formal Analysis Toolkit To Support Art Education Of Understanding Pictorial Arts In Museums

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

Introduction

Describe the context of your project here; What is the domain in which your project takes place? Who are the main stakeholders and what interests are at stake? Describe the opportunities (and limitations) in this domain to better serve the stakeholder interests. (max 250 words)

This graduation is concerned with design for art education, specifically addressing the contribution of tangible/material artifacts facilitate so called 'formal analysis'. In the context of understanding a pictorial art piece, there are two paths: form and content/context. Contextual and/or content-related analysis refers to learning about an artwork's (art) history, the artist, (style) periods, iconography, societal context, etc. This perspective is often found in (formal) art education, but both paths require substantial prior knowledge for such interpretations. This, in turn, makes them less suited for wide application (e.g., for the general museum visitor).

Alternatively, the formal path concentrates on the visual aspects of pictorial artworks, requiring less prior knowledge. Formal analysis can start with some elements from the basis of this framework, including line, color, shape, texture, and space. With an understanding of these elements, audiences can further elaborate on the medium and motif. The medium includes the physicality and representational surface of the artwork, while the motif pertains to recurring themes within the pictorial space, emphasizing specific content and symbolic elements.

In this project, the analysis process with these elements will be highlighted. Currently, it is more common to analyze at the theoretical level. Therefore, the challenge is to make formal analysis more accessible as a means to understanding art. To achieve this, a toolkit will be developed. In the end, with its support, a system of art education in the formal analysis aspect will be explored.

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introduction (continued): space for images

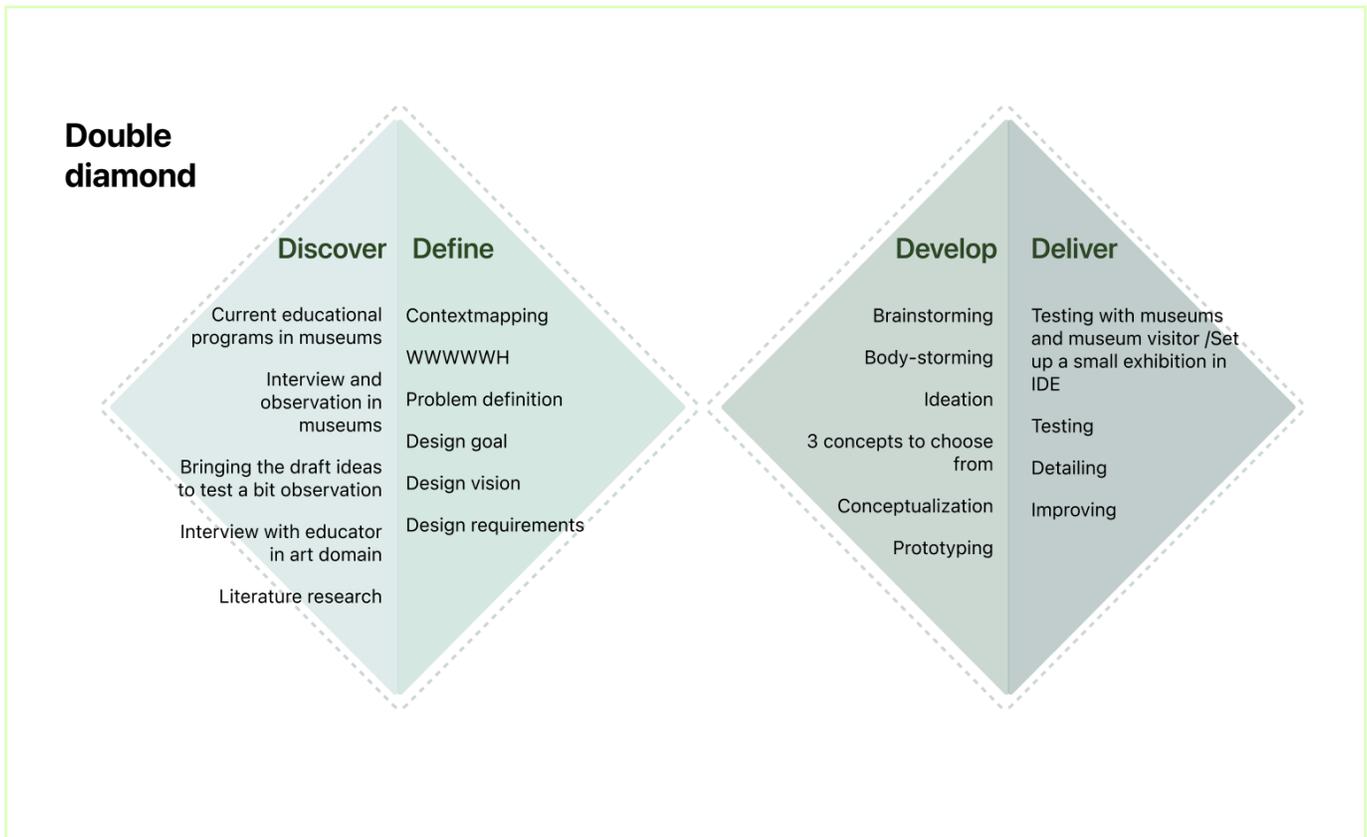


image / figure 1 Double Diamond

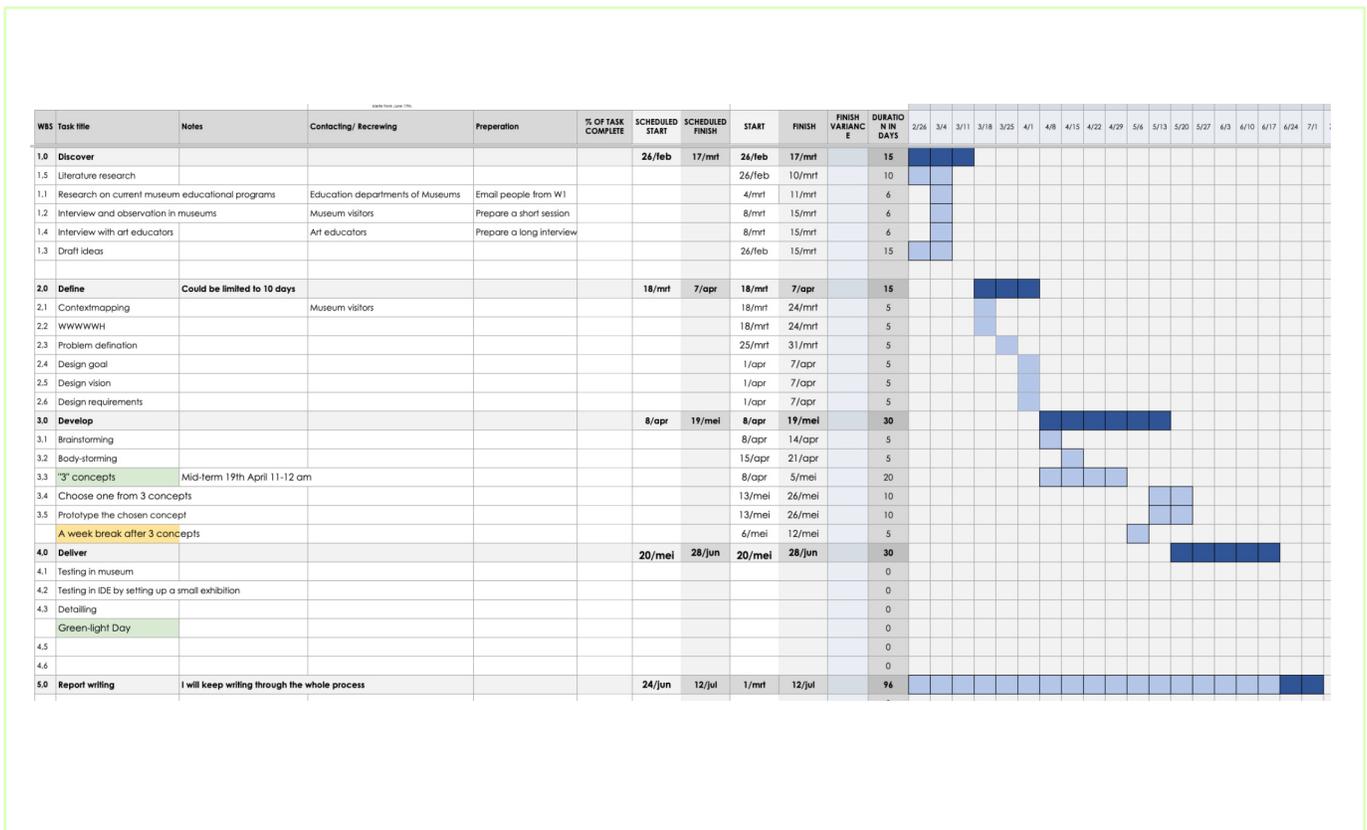


image / figure 2 Overview of schedule

Personal Project Brief – IDE Master Graduation Project

Problem Definition

*What problem do you want to solve in the context described in the introduction, and within the available time frame of 100 working days? (= Master Graduation Project of 30 EC). What opportunities do you see to create added value for the described stakeholders? Substantiate your choice.
(max 200 words)*

In the context of art education, the project seizes the opportunity to address the lack of physical tools for formal analysis, which results in the neglect of elements within the framework in most cases. Taking Vermeer's painting "Girl With the Pearl Earring" as an example, people generally understand it as a depiction of a girl wearing a pearl earring, often overlooking the precise usage of light and color, key aspects that contribute to its excellence and fame. Additionally, concerning the museum experience, there is the challenge of brief museum engagement, where visitors typically spend less than 9 seconds in front of an artwork (Luiten, 2021). This fleeting attention span arises from the need for interpretive cues, as art appreciation, especially in formal analysis, often eludes audiences. The project aims to extend this limited engagement by transforming a glance into a lasting encounter via the toolkit. Moreover, the current trend in museum interaction solutions leans towards digital interactive screens, posing a disruptive factor that diverts attention away from the actual physical artwork in exhibitions. To address this issue, the project focuses on the development of non-digital toolkits to enhance the experience of pictorial art. In summary, the primary task is to enhance the visual education and appreciation of pictorial art by using tangible, non-digital artifacts. The goal is to heighten awareness of formal art elements like texture, light, and color, ultimately creating a more engaging experience for audiences.

Assignment

This is the most important part of the project brief because it will give a clear direction of what you are heading for. Formulate an assignment to yourself regarding what you expect to deliver as result at the end of your project. (1 sentence) As you graduate as an industrial design engineer, your assignment will start with a verb (Design/Investigate/Validate/Create), and you may use the green text format:

Develop a non-digital toolkit to enhance the (guided) art education experience in the formal analysis for museum-visitors within museums.

Then explain your project approach to carrying out your graduation project and what research and design methods you plan to use to generate your design solution (max 150 words)

The graduation project will follow the framework of the double diamond. There will be four phases: discover, define, develop, and deliver. In the discovery phase, the goal is to understand the context, including current educational programs in exhibitions, a deeper understanding of visual analysis in pictorial arts, methods of art education, and other related topics. Simultaneously, observations and interviews will be conducted in several museums in the Netherlands. Using the insights gained, the researcher will define the goal and vision by employing Contextmapping and WWWWH methods. Meanwhile, design requirements and testable targets should also be defined. Once the above goals are settled, methods like brainstorming and body-storming will be used to aid ideation. A milestone in the development session will be three solid concepts, and simultaneously, some low-fi prototypes will be made to test and evaluate the concepts. To choose among them, the Harris Profile will be used as a tool to provide solid arguments. When a satisfying concept is identified, more prototypes and iteration within the chosen concept will follow. During the iteration, user tests will be conducted around the experience and prototype, preferably testing in a museum scenario (although a suitable museum for testing still needs to be found). Otherwise, a small exhibition around pictorial art will be set up in the faculty as a testing environment for both the toolkit and educational experience.

Project planning and key moments

To make visible how you plan to spend your time, you must make a planning for the full project. You are advised to use a Gantt chart format to show the different phases of your project, deliverables you have in mind, meetings and in-between deadlines. Keep in mind that all activities should fit within the given run time of 100 working days. Your planning should include a **kick-off meeting, mid-term evaluation meeting, green light meeting and graduation ceremony**. Please 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 course activities).

Make sure to attach the full plan to this project brief.
The four key moment dates must be filled in below

Kick off meeting	<u>23 Feb 2024</u>
Mid-term evaluation	_____
Green light meeting	_____
Graduation ceremony	_____

In exceptional cases (part of) the Graduation Project may need to be scheduled part-time. Indicate here if such applies to your project

Part of project scheduled part-time	<input type="checkbox"/>
For how many project weeks	
Number of project days per week	

Comments:

Motivation and personal ambitions

Explain why you wish to start this project, what competencies you want to prove or develop (e.g. competencies acquired in your MSc programme, electives, extra-curricular activities or other).

Optionally, describe whether you have some personal learning ambitions which you explicitly want to address in this project, on top of the learning objectives of the Graduation Project itself. You might think of e.g. acquiring in depth knowledge on a specific subject, broadening your competencies or experimenting with a specific tool or methodology. Personal learning ambitions are limited to a maximum number of five.

(200 words max)

As a museum enthusiast and designer, I've long been captivated by the prospect of engaging in a project intertwined with the museum experience, which aligns with my passion for designing in educational or cultural settings and sets the stage for my future career. Currently enrolled in Integrated Product Design (IPD), my previous projects have predominantly been product-oriented. Therefore, the opportunity to explore service-related design for the culmination of my master's program holds significant interest.

My design interests fall within the gray area between IPD and Design for Interaction (DFI), where understanding how users perceive intended ideas is the most intriguing part of the process. Collaborating with DFI students in the last three semesters has left an indelible impression on me, exposing me to valuable methods like context mapping, service blueprinting, and diverse perspectives on design and data collection.

Integrating both IPD and DFI skills, methods, and mindsets, I am highly motivated to witness the process and outcomes of the last project of my master's study. On a personal development note, writing my master's graduation thesis in English, being my first official academic paper, poses a challenge, but it is a necessity for my future academic pursuits. Embracing the unknowns of graduation, including taking on leadership roles and managing stress, I believe skills will naturally evolve through these experiences.

Appendix B - Exploration on Optical Devices

Introduction

The initial aim of this project was to design a physical tool that would assist museum visitors in better understanding and experiencing formal elements. To achieve this, I conducted a preliminary investigation into optical devices that influence visual perception.

The research comprised two primary activities. First, I created a technology map (tech-map), which cataloged relevant technologies within the optical devices domain. The primary purpose of this tech-map was to gain an understanding of these technologies and serve as a repository of potential tools that could be referenced throughout the project. It also provided a foundation for future brainstorming sessions.

Inspired by the tech-map, I conducted an exploratory experiment on optical tools, selecting nine devices to test their impact on observers' visual perception of formal elements in artworks. In this experiment, the optical tools were the independent variables. Additionally, to explore the effect of guidelines on the observers' recognition and understanding of formal elements, the provision of formal analysis guidelines was introduced as another variable. This exploratory experiment significantly influenced the development direction of the project.

Tech-Map

Introduction

The tools listed in the table (Figure B.1) are considered optical devices that can impact the visual perception of the audience. They were categorized into four aspects based on formal elements: lines and shapes, colors and light, space and forms, and texture. This table was not created to be an in-depth analysis but rather a preliminary overview, serving as a foundational understanding for subsequent design and testing.

Line/Shape	Color/Light	Space/Form	Texture
Frame	Color filter	Structure lines	Touch
Shape puzzle	B&W camera	Transparent overlay	3D print
Thread with grids	Glass prism	Synoptor	Magnifier
Ruler	Color wheel	Claude glass	Sample book
Shape overlay	Color pattern	Fish eye lens	Sensory wall
Block puzzle	Mosaic processing	Magnifier	Sound trigger
Grid	Black box	Overlapping planes	
	Polarizing filter	Mirror	

Figure B.1 Tech-map

Exploratory Experiment on the Impact of Optical Devices and Guideline

Introduction

From the Tech-Map, I identified various optical tools that could potentially influence people's perception when viewing visual information from paintings. While some of these tools are commonly used in photography and other fields, they are not specifically designed for human eyes. To investigate how the eyes and brain respond to these effects, I conducted an exploratory experiment.

Research Question

How does the guideline influence the audience's viewing of pictorial arts?

How does the guideline influence the confidence in describing a painting?

What effects do the optical tools have on the viewer's perception of formal elements? To what extent do these effects manifest?

Method

This research activity employed a controlled experimental design, yielding both qualitative and quantitative results. The experiment tested the influence of guidelines and optical tools on perception through controlled variables. The experiment consisted of two phases: the first phase assessed the impact of guidelines on painting descriptions, while the second phase evaluated the influence of optical tools on visual perception.

For the guideline testing, participants were divided into an experimental group and a control group. The experimental group received a text guideline on formal analysis, while the control group described the paintings without any guidelines.

For the optical tools testing, all participants rated their perception of elements before and after using the tools. A score of 0 indicated no effect, negative values indicated a decrease in perception, and positive values indicated an enhancement. The comparison was based on observations with and without the tools.

Participants

Participants were recruited from TU Delft through flyers and group chat announcements. The only recruitment criterion was the absence of known medical optical problems, such as color blindness. A total of 10 participants were enrolled.

Materials and Equipment

The optical tools (figure B.2) included a normal mirror, a pair of 3D glasses (manufactured by American Paper Optics, LLC, Bartlett, Tennessee, www.3dglasonline.com), a pair of 3D glasses with blue and red filters, color filters (red and blue), magnifier sheets, a black box, a polarizing filter, and a pair of reading glasses.

The experiment took place in the Vision Lab in the IDE faculty, using a laboratory setup that featured the painting "Still Life with Flowers (1723)" by the Dutch artist Jan van Huysum (1682-1749), printed on a 1.2m x 1.6m canvas under normal white light.

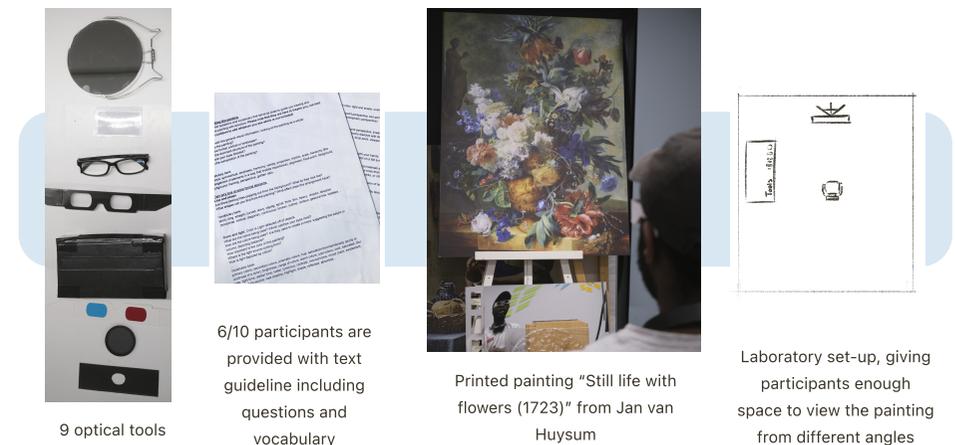


Figure B.2 Experiment set-up

Procedure

The entire procedure lasted approximately 40 minutes. Upon arrival at the Vision Lab, participants provided informed consent and completed a brief demographic questionnaire. Following this, the task was introduced, and the concepts of formal elements were explained to the experimental group through a handout, while the control group received no such instruction.

Participants initially observed and described the painting without any optical tools, converting their visual observations into detailed oral descriptions, which were recorded. Then, the optical tools were introduced sequentially. Participants used each tool to view the painting again, described the differences compared to viewing without the tool, and rated the effects on each formal element. Follow-up questions were posed to understand how each tool influenced their perception. This process was repeated for all the optical tools.

Data Collection

Participants' descriptions of the painting were recorded. The effects on perception of each element were rated using digital Microsoft Form questionnaires. Data on participant demographics and museum engagement were collected at the beginning of the questionnaires.

Data Analysis

Qualitative data were analyzed using thematic analysis, while quantitative results were processed in Microsoft Excel. The quality of painting descriptions was evaluated by the percentage of formal elements included and the number of elements mentioned.



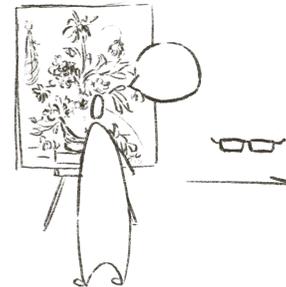
Consent
Brief
introduction



Museum Habits



Introduction of basic idea of
formal analysis
(with experimental group only)



Describing the painting "Still life
with flowers (1723)" from Jan
van Huysum



Using different tools viewing the
painting again and rating the obvious
level of different elements

Insights

Museum Visitation Habits

The survey results provide valuable insights into museum visitation habits. Nine out of ten participants prefer visiting museums as a duo and enjoy visiting galleries. All participants indicated a preference for going to museums with friends.

The purposes for visiting museums are varied, with the most popular reasons being to appreciate art (formal aspects) and learn about culture (content level). Additionally, some participants noted that museum visits are a quality and valuable way to spend time with friends and family, highlighting the social aspect as a key component of the museum experience. One participant, who rarely visits museums, mentioned that their lack of motivation to visit museums stems from a perceived absence of entertainment in some galleries. Many participants expressed a desire to gain inspiration from museum visits, although this preference was influenced by their design education background, as 8 out of 10 participants had such a background.

	Without Guideline	With Guideline
Time to Complete Description	3 minutes and 30 seconds	11 minutes and 32 seconds
Mentioning Line	2/4	4/6
Mentioning Shape	0/4	3/6
Mentioning Color	4/4	6/6
Mentioning Light	1/4	6/6
Mentioning Form	2/4	6/6
Mentioning Space	3/4	6/6
Mentioning Texture	1/4	6/6

Figure B.3 Amount of Participants Mentioning the Certain Formal Element

	Without Guideline	With Guideline
Confidence score	3,25	4,33

Figure B.4 Confidence Score

Performance in Conducting a Formal Analysis

During the description, the group without a guideline primarily discussed colors and space, while shapes, light, and texture were less frequently mentioned. In the group with the guideline, shapes and lines received less attention compared to other elements. On average, the group with the guideline identified 6.17 formal elements out of 7, whereas the group without the guideline identified only 3.25 elements out of 7. Therefore, the presence of guidelines significantly increased the attention to various formal elements.

In terms of the structure and depth of the descriptions, participants in the experimental group followed the guideline prompts to discuss each element sequentially. They provided more detailed and technical descriptions of the elements, utilizing the vocabulary list provided by the guideline. Conversely, the control group's descriptions were limited to visually striking objects within the painting, often focusing on the depicted items without delving into technical aspects or terminology. Their discussions predominantly centered on colors and lacked logical structure, typically narrating what they saw without deeper analysis.

Time Spent

Participants without a guideline spent an average of 3 minutes and 30 seconds completing the experiment, while the group with a guideline took an average of 11 minutes and 32 seconds. The latter group took additional time for closer observation and detailed detection.

Confidence Score

After describing the paintings, participants rated their performance. The control group had an average confidence score of 3.25 out of 5, whereas the experimental group, guided by the guideline, reported higher confidence with an average score of 4.33 out of 5. This indicates that the guideline helped participants feel more confident in their descriptions of the paintings.

Optical Tools

The experiment collected two sets of data (Figure B.5), with the absolute value sums representing the influence of each optical tool on the visual perception of the formal elements, regardless of whether the influence was enhancing or diminishing. This principle is akin to observing a bird in the forest: a stationary bird is difficult to notice, but any movement immediately catches the observer's attention. In this context, the principle of change attracting attention applies. The other dataset displays the direct summation, which may yield negative values: positive values indicate enhanced perception of the element, while negative values indicate diminished perception.

Before discussing the impact of optical tools on each element, a cross-comparison of the charts reveals that Reading Glasses are the optical tool with the most significant impact on all elements. However, they only enhance the perception of color. This is because viewing a painting from a distance with Reading Glasses causes all details to blur except for the colors, which become more pronounced. Notably, the Blackbox also enhances the perception of all elements to varying degrees. According to participants, this is because the Blackbox helps to reframe the painting, focusing on a smaller area and reducing the overwhelming effect of the entire depiction.

Regarding the perception of lines and shapes, Reading Glasses had the greatest impact, but this was in the form of diminished perception. Comparing the absolute value sum with the direct sum reveals that although the absolute value sum for the mirror was high, its direct sum was nearly zero. Similarly, the 3D glasses with color filters resulted in a direct sum of zero, suggesting a lack of consensus among individuals.

For the perception of forms and space, the mirror and 3D glasses had a positive impact, while other tools had negligible effects. The bar chart for colors and lights showed more consistent results among participants, with interesting observations regarding the red filter. Many participants reported that the red filter removed all colors, making them perceive the painting as a black-and-white image (with red hues), thus impairing their ability to discern colors. Conversely, while the blue filter muted the colors, participants could still perceive them. The perception scores for textures were less consistent, with the magnifier sheet being the only tool that enhanced texture perception significantly.

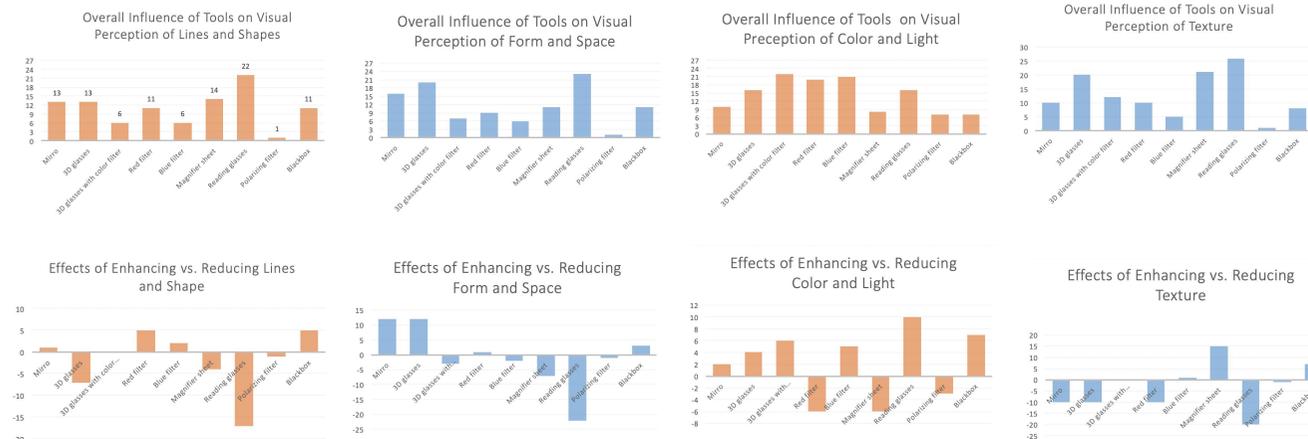


Figure B.5 Influence of Tools on Visual Perception of Formal Elements

Overall, the optical tools tested in the experiment did not provide sufficient evidence to identify any tool with consistently remarkable effects on the perception of elements. Although some tools did influence perception, the majority of the data indicated that these effects varied among individuals, making it challenging to derive a unified pattern and limiting the applicability of these tools. Nevertheless, this experiment is crucial for the subsequent design process, as it suggests that toolkits should lean more towards educational guidelines to be effective

Appendix C - Design Goal

To develop a **tool** that engages **museum visitors** in an **interactive experience**, fostering awareness and knowledge of formal elements, and empowering them to explore and describe pictorial artworks with confidence and insights.

Tool: The tool should provide clear and accessible explanation about the formal analysis and formal elements to make sure the audience understand them and can even apply the knowledge in other aspects in life.

Engage: The design should be designed to welcome users to engage with it. Furthermore, it should enable visitors to keep the tool, as ownership of the tools tends to foster greater enthusiasm for exploration and bold engagement.

Interactive experience: The design should aid users in interacting with pictorial arts and people, and even facilitate social interactions. Applying interactive education has proven to be the most effective way of acquiring knowledge.

Awareness and knowledge of formal elements: By using the design, users should be able to identify the art elements, analyze the relationship between the elements, and interpret them in conjunction with contextual information provided by the museum. In addition to gaining instant knowledge from specific paintings, awareness of art elements should form a mindset for viewing things in daily life.

Explore and describe: These two actions represent the process of input and output. The act of exploring emphasizes using the tool to absorb information from the paintings, while the description process emphasizes outputting the results of analysis and learning. Combining input and output in a learning process will maximize effectiveness.

Confidence: This echoes the act of describing pictorial arts. At a psychological level, users understand what they are discussing because they can utilize formal analysis as a guideline and strategy. By sharing their insights about the art, they take pride in the painting as well as in themselves. The combination of input and output should be able to form a long-term memory.

Insights: This refers to the process of exploring pictorial arts. From a physical standpoint, with the tool aiding formal analysis, users should be able to extract more visual information from the pictorial arts. Additionally, insight can also reflect their cultural background and life experiences.

Appendix D - Brainstorming

infinite puzzle pieces, or (showcase) collection of the puzzle.

For Collectors: People want to collect!

- Museum Passport.
- Colors, Color pallet.
- One painting each museum.

Museum Journey.

Puzzle Game

- create the puzzle, with line shape... (highly abstract)
- solve the puzzle, and find the painting in Museum.

PUZZLE SOLVING / CREATING

INTERACTING WITH OTHER VISITORS RANDOMLY

With instructions for our history

Museum Channel - where people share their Museum experience worldwide.

ages later human history

create a code

use the optical tools as extra skill for looking for specific elements

Board Game

Board Game (WIN/LOSE)

frager / tangible "toy" interactive toy

coloring

ROUTE PLANNING

20 min wandering around the museum

20 min spending on 1000 paintings

Both Museum Maps

Look for the combination of several elements with certain characteristics.

Route Planning Game based on elements

Line

Color

Shape

Texture

Design Recipe (Designer's Mood board)

Museum Journey (Journey / Diary)

Knowledge collecting

Design Recipe for inspiration time

color palette etc.

Back to Daily Life Aspects

take a foto with the same color tone / same composition / use the same texture

Link to some knowledge they have

find out from Museum list of clues

PHYSICAL TOOLS INVOLVED

frager / tangible "toy" interactive toy

coloring

ROUTE PLANNING

20 min wandering around the museum

20 min spending on 1000 paintings

Both Museum Maps

Look for the combination of several elements with certain characteristics.

Route Planning Game based on elements

Line

Color

Shape

Texture

Design Recipe (Designer's Mood board)

Museum Journey (Journey / Diary)

Knowledge collecting

Design Recipe for inspiration time

color palette etc.

Back to Daily Life Aspects

take a foto with the same color tone / same composition / use the same texture

Link to some knowledge they have

find out from Museum list of clues

GAME MECHANISM (COREDRIVES)

How can we ~~prevent~~ the "game" avoid getting users the board of it? + Motivation to go to Muse

idea of growing? / collecting

understanding the painting

Sharing

challenging.

Care! Art Education

- Observation Skills.
- Better interpretation.
- Aesthetic Enjoyment.
- Structured Analysis.
- More professional.
- Inspiration.

No CONTEXT allowed!

describing painting with limited words.

really think through what makes the painting stand out.

competing vs. working together

challenging

A vs B

random pair of visitors? A left some clue for the next duo

(RE)-CREATING

recreating paintings with only limited elements.

Boost Creativity

Recreating the paintings with the elements they found throughout the visit.

With different colors, or.

LITERAL VISUAL

one describing one draw.

Literal Puzzle

Line: ...

Color: ...

with question to learn more about the visual element

More details? (context description is not allowed)

or the other way around

retrievalless elements.

with precision

Literal Puzzle 2.0

Line: _____

Color: _____

Shape: _____

Texture: _____

by asking questions, fill the blank then with the description, identify by the painting.

The drawn color is red.

JOURNEY / DIARY

Museum Journey (Journey / Diary)

Knowledge collecting

Design Recipe for inspiration time

color palette etc.

Back to Daily Life Aspects

take a foto with the same color tone / same composition / use the same texture

Link to some knowledge they have

find out from Museum list of clues

CONNECTING TO (DAILY) LIFE.

Connect with Daily Life

first clue comes from the color of the bricks.

the last painting must match with the mood of the day (color, light, space, environment).

Back to Daily Life Aspects

take a foto with the same color tone / same composition / use the same texture

Link to some knowledge they have

find out from Museum list of clues