

# Meet Van Gogh in the City: Designing an Interactive Art Experience with Mixed Reality

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**Master thesis** | MSc. Design for Interaction

**Yuan Gong**

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Two years ago, I started my Master's study at TU Delft, believing that the essence of life is experiencing. I wanted to meet talented people and learn new perspectives. I had an incredible journey through which I embedded design thinking into the essence of life. I now see life as the process of prototyping, an active way of experiencing - trying, reflecting, strengthening, and growing. At this moment, I want to thank everyone who has helped me along my way.

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Many thanks to you all who have been part of my project. Thank you for your thoughts, ideas, supports, helps and the moments we shared.



Yuan Gong

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You don't stop dancing  
because you grow old  
You grow old  
because you stop dancing

...



# Executive summary

The project aims at designing an engaging art experience outside the Van Gogh Museum (VGM) for young people. The experience should achieve the design goal of triggering young people's interest in Van Gogh and his art through experiencing the connections between his personal stories and his painting style and technique in a mixed-reality environment.

Before defining this design goal, research was conducted through literature review, context and user research (Contextmapping), and existing XR products analysis. Through literature review, the factors of relevance and participation of enhancing engagement and their relation to emotional connection are found. It provides a clear objective for user research in the VGM context - figuring out the desired content of the museum for young people and how they would like to interact with the content. Specific qualities of interaction and desired content are figured out based on the needs of young people. Among all three extended reality technology, mixed reality is selected due to its potential to enable diverse interaction and be more accessible by the target group.

Based on insights gained from the research phase, the design goal and design criteria are formulated, validated, and prioritized based on the results of a questionnaire.

In the ideation phase, ideas are generated and prototyped from both technological and context perspectives, which lead to three important results: Feasible design elements by MR, the understanding of the

essential aspects of MR, and a structure of four phases of interaction that help build the design elements into a complete journey.

A converging concept is created, tested, and discussed with participants and clients with all the insights above. The insights result in a content structure, providing a logical way of organizing content during the experience through layered information with a coherent storyline. It reduces the cognitive effort needed to process the information so that it engages young people more.

Based on the structure of four phases of interaction and user test insights, the final concept is created. The interactive prototype is built with Java, a programming language. The prototype is used for the final concept evaluation.

The concept is then evaluated and validated by both the field test and the control test, using observation, questionnaire, and interview combined to evaluate to what extent the design achieved the design goal and criteria. Limitations and recommendations for improvements are discussed at the end of the evaluation chapter.

Overall, the design is an interactive art experience (installation) that brings the content of VGM to the public environment, approaches young people, and triggers their interest in the connection between Van Gogh's stories and art with Mixed reality.

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# CHAPTER 01

## Introduction

| Method: literature review, Case study

In this introductory section, the **preliminary research is conducted, which helps in forming the design brief.**

A general overview of the project and its context are given, which includes a description of the background, the clients (Van Gogh Museum or VGM), reasons behind the selection of the target group, the impact of novel technologies in the museum context, and the aim of this project. In addition, a visualization of the content structure of the report is provided.

*'If something in yourself says "you aren't a painter"  
- IT'S THEN THAT YOU SHOULD PAINT...'*

*- Vincent van Gogh*

## 01.01 Visitor Needs & Engagement

Each visitor comes to museums with different needs and motivations. As J. Falk (2016) mentioned in his visitor identity theory, there are five different identities regarding people's expectations of visiting museums. A curiosity-driven visitor might be interested in various aspects of the museum content than those with specific learning objectives. Socially motivated visitors are satisfied when others who they accompany enjoy the visit. There are also experience seekers who see the museum as an important destination and just want to have fun in their experience, etc.

Despite the diversity of people's needs, it has been a long time since museums as educational institutes focusing purely on delivering knowledge, which limits their ability to reach broader audiences and constraints visitors from having a more enriched experience besides learning new knowledge.

Realizing the importance of serving the diversity of visitor needs, museums today are shifting from purely focusing on their educational role of delivering knowledge to creating an engaging visitor experience on top of their educational purpose. Figure 1 illustrates this transition in detail.

**Two interconnected dimensions jointly affect visitor engagement - the level of participation and relevance of content.** While the level of participation is increasing, the role of the audiences is changing as well. They are becoming active content contributors of the museums, rather than passive knowledge receivers, generating content that is more

relevant to themselves. Further investigation of these two dimensions and their relation to the context of VGM will be conducted in the following chapters through literature review and user research.

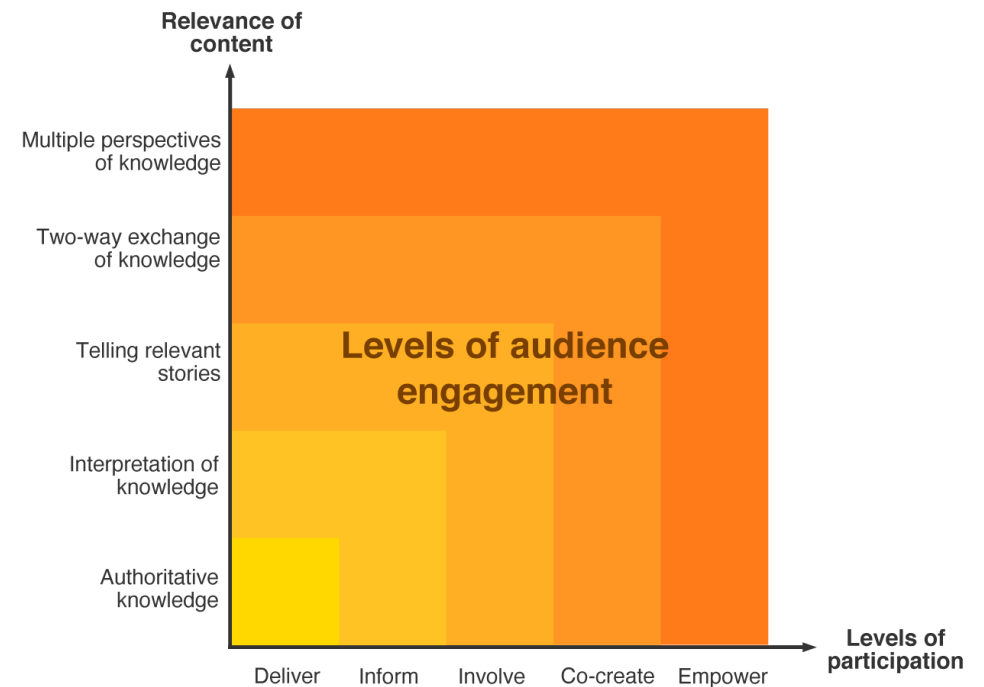


Figure 1. Audience engagement by relevance of content and levels of participation, based on Spectrum of Audience Engagement (Morris Hargreaves McIntyre, 2015)



## 01.02 The Van Gogh Museum & Its Mission

Van Gogh Museum (VGM), the client of the graduation project, is the most popular museum in the Netherlands. In 2019, the museum attracted more than 2.1 million visitors from 110 different countries (VGM Annual Report 2019). The mission of the museum in its Strategic Plan (2021- 2024) is to *inspire a diverse audience with the life and work of Vincent Van Gogh and his time*, which means to use the content of the museum to reach people who are less involved and strive to become a more inclusive museum.

VGM has made great efforts to attract a broader audience. Research has been conducted with young people who have a migrant background in Amsterdam (Vermeulen et al., 2019), which shows the museum's endeavor in cultural engagement. Programs are intentionally designed for specific target groups. **Vincent on Friday** (Figure 2) is a unique event hosted by VGM to cater younger audience, with various themes

related to Vincent's life and art. The museum also invites creative talents inspired by Van Gogh. **Van Gogh Dreams**, a series of installations with an immersive narrative, allows people to experience Van Gogh's emotional journey while he was in Arles (1888-1889), without using paintings, which is appreciated more by experience seekers (Figure 3). **Meet Vincent Van Gogh**, another installation that uses an interactive approach and fully automated audio guide that targets families and schools (Figure 4). In addition, the VGM website presents the essentials of the museum's content, in which a section named **Unravel Van Gogh** uncovers secrets of paintings concealed in and under the paint (Figure 5).

While developing the programs, VGM strives to reach a broader audience by facilitating the emotional connection between its audience and Van Gogh through his artworks and life, which is also a requirement of this graduation project.



Figure 2. Vincent on Friday



Figure 3. Van Gogh Dreams



Figure 4. Meet Vincent Van Gogh



Figure 5. Unravel Van Gogh

## 01.03 Young Adults as the Target Group

As mentioned in 01.02, **projects have been developed to expand the audience base, but few of them are for young adults.** Vincent on Friday is an example that successfully attracted younger people to the inside of the museum, however, the opportunities outside the museum remain to be explored.

Besides, growing up with new technologies, **the younger generation is shaped by the technologies and employs different ways of obtaining information than the older generation** (Jones, Jo & Martin, 2007). They are used to actively collect desired information from multiple sources instead of only listening to experts. Thus, they appreciate the museum experience that allows them to try and learn things in an interactive way and being immersed in the process. However, **due to the nature of art museums and galleries, including VGM, the level of interactivity inside the museum is limited**, which is one of the reasons that art museums usually have difficulty attracting younger people (Birchfield, et al., 2008).

Therefore, **young adults (age 18-30) are selected as the target group of the graduation project.** With the context outside the museum, the project will explore the possibility of bringing the museum content either to the city or people's homes to approach young people in a favorable way.

## 01.04 Technology in Museum Context

Among the cases in 01.02, the majority involves new technologies. Novel technologies are considered to be promising for reaching broader audiences while creating engaging visitor experiences (Vermeeren et al., 2018). Firstly, **technologies can assist the learning experience and make it more engaging** (Charitonos et al., 2012). It enhances visitors' intrinsic motivation to learn. Secondly, technologies can **provide a personalized experience**, serving the needs of different people (Roes et al., 2009). Thirdly, technologies are powerful tools to **reach people who cannot visit the physical museum** (Vermeeren et al., 2018). Therefore, novel technologies are gaining more attention in the museum industry.

Among the technologies, extended reality (XR), including augmented reality (AR), mixed reality (MR), and virtual reality (VR), are quickly becoming a norm in the museum industry. Besides the general advantages of emerging technologies, XR can enable a more immersive experience and rich interactions, creating more engaging experiences (MuseumNext, 2021). When XR experience is designed properly, it brightens the spotlight on the exhibits rather than becomes the spotlight. However, complaints of the XR experience also emerge. For instance, some art museums make a digital twin of their physical museum and simulate the on-site experience online without adding extra value to the new experience. Such experiences fail to satisfy the users because visitors miss the feel of being in front of authentic artworks.

**A question arises: How to make use of the full potential of XR technology to empower art museums, meanwhile, provide a more engaging experience to young people?**



## 01.05 Design Brief of the Project

Combining all aspects above, the brief of the graduation project is formed:

To design an **engaging experience** that **facilitates emotional connections** between young people (age 18-30) and the content of Van Gogh Museum (Van Gogh's stories and his artworks), based on the use of **XR technology** outside the museum.

## 01.06 Initial Research Questions

The keywords in the aim of the project result in several research quotations, which will be addressed in the following chapters:

1. What factors contribute to an engaging experience?
2. How to facilitate emotional connection?
3. What is the relation between emotional connection and engagement?
4. Which XR technology is most suitable for this project?

## 01.07 Visualization of Content Structure

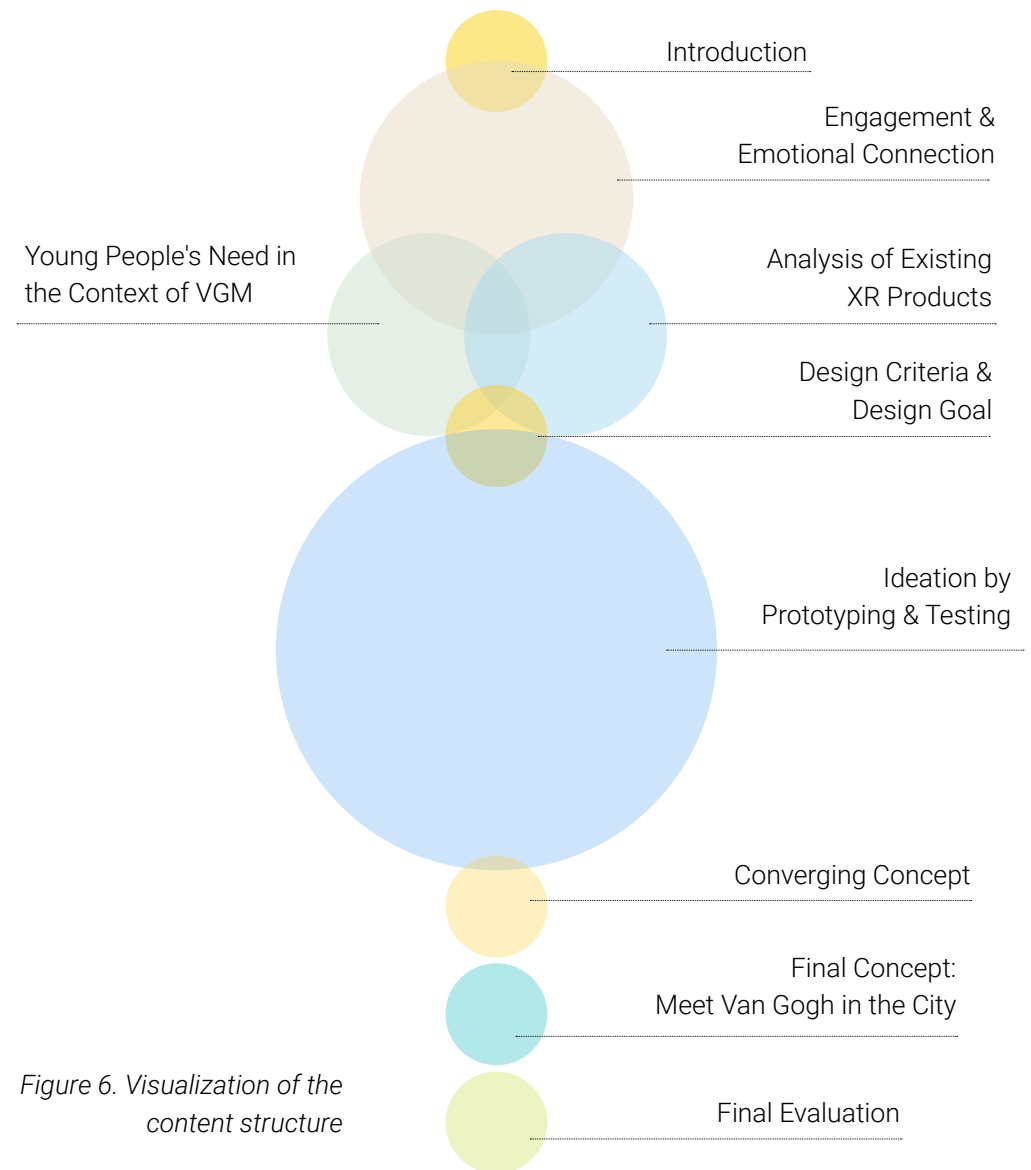


Figure 6. Visualization of the content structure

## CHAPTER 02

# Engagement & Emotional Connection

| Method: literature review

To design an engaging experience, one needs first to understand what factors contribute to the experience. In this chapter, literature in various fields is being reviewed (Figure 7), which starts from figuring out the definition of engagement in consumer behavior.

The relation of the elements of the definition of engagement is found through a literature review of visitor participation in museology, relevance theory in cognitive science. The findings are supported by papers

about young people's needs in their museum experience. The results from the literature review suggest that **designing playful interaction with relevant content with an emphasis on the specific needs of young people is a promising direction for this project.**

Moreover, emotional connection and the process of achieving it are discussed based on the findings from empathy theory in psychology. In the end, the possible leverage point to facilitate/initiate emotional connection is proposed.

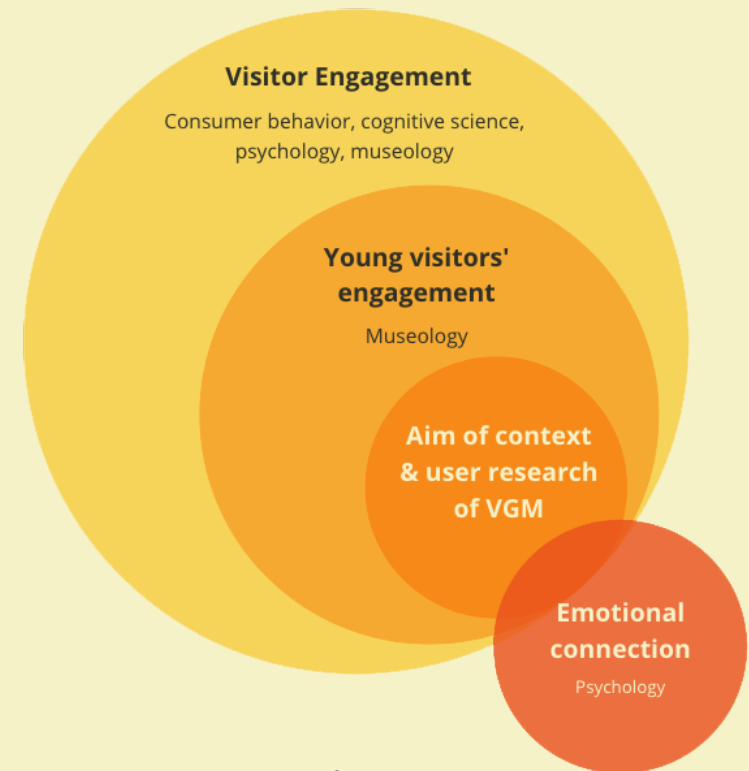
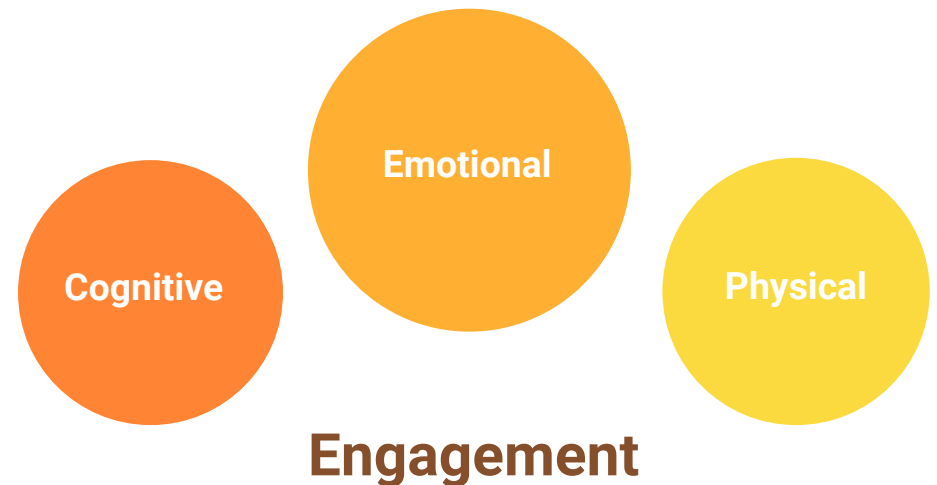


Figure 7. Structure of literature review and fields the review covers

## 02.01 What is Engagement?

The definition of engagement has been discussed by scholars in various fields. Museum visitors as customers of museums, their engagement can be explained by definition from the consumer behavior perspective. Patterson et al. (2006) define **"customer engagement"** as **"the level of a customer's physical, cognitive and emotional presence in their relationship with a service organization."** This definition makes it explicit that "facilitating emotional connection" in the aim of the project is only one of the three aspects that may contribute to creating an engaging experience.

However, 1) is there a connection between physical, cognitive, and emotional presence, and how do they affect each other? 2) How to enhance them to achieve an engaging experience? To find answers, theories in cognitive science and museology are reviewed in 02.02.



## 02.02 Visitor Engagement by Participation & Relevance

In the museum context, physical, cognitive, and emotional presences in the definition of engagement are achieved by visitor participation and the relevant content. In 02.02, the mechanisms behind the two factors are investigated, giving direction to the context and user research in Chapter 03.

### 02.02.01 Visitor participation

Participation enhances engagement. In the book *The Participatory Museum* (Simon, N., 2010), Simon mentioned that visitors feel they are engaged and respected participants when the passive museological experience can be transformed into an active shared one. The experience offers visitors a legitimate way to contribute to the institution, share things of interest, connect with others, and even become the co-creators of the contents of the museum, etc.

During participation, in which the three aspects of engagement: physical, cognitive, and emotional presence, are interwoven and support each other, people create new values to themselves, to other participants, and even to non-participants, which in return, enhance their engagement. **But what kinds of participation are desired by young people?**

### 02.02.02 Relevance theory

Relevance is a trigger for participation because searching for relevance is a basic feature of human cognition. When the information is relevant, people would be more likely to start processing the information, therefore, achieve proper understanding and be involved in the process. However, what is relevant information? Based on the definition of

relevance by Wilson & Sperber's (2004) in cognitive science, there are two criteria when information is seen as relevant: 1) The information leads to a "positive cognitive effect." 2) The effort required to process the information is relatively low.

**The positive cognitive effect is a meaning-making process.** Individuals yield conclusions that matter to them by connecting the relevant information to the existing information they had in mind. The conclusion can be an answer to their questions, improve their knowledge on a specific domain, resolve a doubt, or correct a mistaken impression, etc. (Wilson & Sperber. 2004). Therefore, figuring out **what contents of VGM relevant to the target group most and can trigger their meaning-making process is necessary for the context and user research.**

**Lowering cognitive effort can be achieved by designing for the playful experience.** Vermeeren & Calvi (2019) argues that making the process of meaning-making itself more playful and enjoyable can be a way to help people focus on the process rather than the result, therefore, reduce the perceived cognitive effort and enhance their intrinsic motivation to learn. The playfulness in an experience can be achieved by interactions that are attractive to the target group and meet their needs, which points out a promising direction for this project - **Designing for relevant experience through playful interaction.** However, "playful" is an abstract term that might be interpreted differently by different people. **What does playful experience mean to young people? In context and user research chapter (Chapter 03), specific qualities of interaction appreciated by the target group will be explored.**

## 02.03 Needs of Young People in Museum Experience

Before investigating the context and target group, existing museological research targeting young people was reviewed, which in general explains why young people are less frequent visiting museums than other age groups.

### 02.03.01 Needs for active participation

Young people seek interactive museum experiences. Because their heavy use of new media and technology shapes their behavior, they can gather information from multiple sources, share and customize materials autonomously through interactive media. However, in a traditional museum visit, they have top-down and passive experience, which underrepresents their value and identity, therefore, not attractive to them (Cantini, E., 2015). **How to make the content of VGM speak to young people by taking advantage of new technology? What specific technology is most suitable in this context?**

### 02.03.02 Needs for relevant content

Young people have poor perceptions of museums. They see museums as boring, didactic, unapproachable, and preoccupied with the past, in contrast to their interest in the present and future, which points out a mismatch between the culture of museums and the identity of young people (Mason & McCarthy, 2006). **Is connecting the content of museums to trends in society or the daily life of young people a good way to approach them?**

These findings are consistent with the theories of visitor engagement, which provides concrete direction for subsequent research.

## 02.04 Emotional Connection

Facilitating emotional connection is proven to be important in enhancing engagement; however, the pathway to achieving this effect still needed to be figured out.

### 02.04.01 What is an emotional connection?

Emotional connection happens when emotions become associated with objects, things, places, periods, and other elements in people's lives. Once people have formed an emotional connection with an object, scenario, thing, or a person, etc., by sensing it again, the same emotion is often evoked (Komninos, 2020). **This definition suggests that familiarity or similarity could be the bridge from irrelevance to emotional connection.**

### 02.04.02 Why does VGM want to achieve emotional connection?

Emotional connection **scales up the impact of Van Gogh**. Because we, as humans, have the capacity to think about another person and "stepping into their shoes," as a result, form some ideas about their sensations without experiencing the exact same stories (Bloom, 2018). This makes facilitating emotional connection have great potential to scale up the influence of Van Gogh's stories and art, making the content of VGM relevant to more people.

Achieving emotional connection has a **more profound impact on people**. Experience with emotions involved beyond the superficial one with only fun and sensation, creating strong and enduring effects on people. Not that fun or playfulness is less valuable; they are the qualities

of the experience that help achieve emotional connection, a deeper level of relevance.

### 02.04.03 How to achieve emotional connection?

Emotional connection is mentioned in psychology in empathy. Kouprie and Visser (Kouprie & Visser, 2009) propose a process of empathizing, which consists of four phases: discovery, immersion, connection, and detachment, during which both emotional and cognitive elements are involved and interwoven. To achieving emotional connection, only the first three phases are relevant. Therefore, the process is adapted to Figure 8. **The first two phases, discovery and immersion, serve as a foundation or pre-steps for achieving emotional connection.** More cognitive and emotional efforts are needed from the beginning to the end of the pathway.

**For young people who see the contents of VGM as irrelevant to them, the first phase, which requires less cognitive and emotional effort, can be the leverage point for this graduation project.**

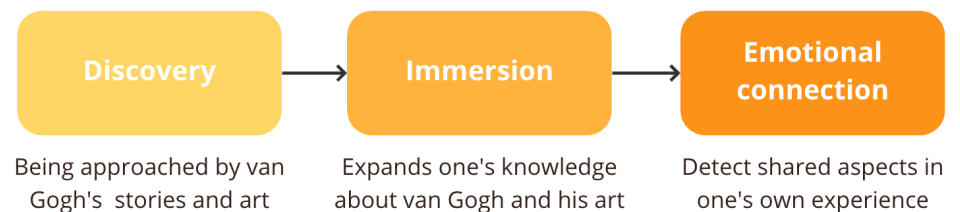


Figure 8. The pathway to achieve emotional connection

## 02.05 Conclusion of Chapter 02

In this chapter, three out of four initial research questions at the end of Chapter 01 are answered:

### 1. What contributes to an engaging experience?

Active participation and relevant content involve visitors physically, cognitively, and emotionally.

### 2. How to facilitate emotional connection?

Emotional connection is achieved through a process, including discovery, immersion, and finally, emotional connection. Considering the target group of this project, who are usually less engaged in the art and stories of Van Gogh, emotional connection can be facilitated by initiating the process from the discovery phase (Figure 9), so that young people who enter the discovery phases would be more likely to progress to the next phase and finally achieve emotional connection in the future.

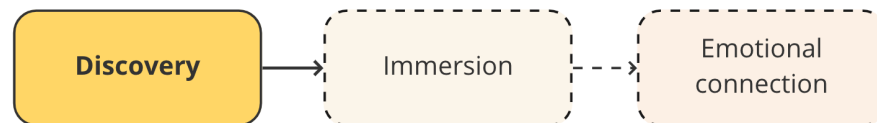


Figure 9. Facilitating emotional connection by initiating the process from the discovery phase

### 3. What is the relation between emotional connection and engagement?

Emotional connection is one of the factors that can enhance engagement. Physical, cognitive, and emotional factors are indispensable in the process of improving engagement.

The fourth question from Chapter 01 (Which XR technology is most suitable for this project?), together with four new questions from this chapter, will be answered in the following chapters. They are listed below:

1. What are the **contents most relevant and** appreciated by young people? (Chapter 03)
2. What are **qualities of participation/interaction** desired by young people? (Chapter 03)
3. Is connecting the content of the museum to the **trends in society or the daily life of young people** desired ways to approach most young people? (Chapter 05)
4. Which **technology of XR** is **most suitable** for this project? (Chapter 04)
5. How to **take advantage of new technology** and make the content of VGM speak to young people? (Chapter 04)



## CHAPTER 03

# Young People's Needs in the Context of VGM

| Method : Contextmapping with generative booklet & interview

In Chapter 02, visitor participation and relevance of content, the two crucial factors in enhancing engagement and achieving emotional connection, are investigated, leaving two new questions for this chapter:

1. What are **the most relevant and appreciated contents** for young people?
2. What are the **qualities of participation/interaction** desired by young people?

In Chapter 03, young people's experience with Van Gogh museum, other art museums or galleries, and other types of museums is investigated through Contextmapping to answer

the questions. Researching experience of broader types of museums helps discover people's needs beyond only their perception of what VGM on-site experience should be.

Although the project focuses on creating the experience outside VGM in an extended reality environment, it is helpful to learn from their on-site museum experience. Knowing what needs are fulfilled and not in the physical museum suggests the design opportunity of this project - **to take advantage of the new medium, strengthen the satisfied needs, and fulfill unmet needs outside the museum.**



## 03.01 Uncover Young People's Motivation

The needs of young people reflect on their motivation. Why are they less motivated to visit museums? To answer this question, **comparing their motivation for visiting museums to what they experienced in museums might help**. Whether there is a discrepancy between these two? What do they appreciate? What are their unmet needs of both interaction and relevant content? Answering these questions will provide a concrete direction for designing the new experience outside the museum.

Three research questions are developed from questions above for further exploration of both relevant contents and engaging interaction, ranging from various types of museum experiences to VGM specific one (Figure 10):

RQ1.What motivates young people to visit **museums in general**?

RQ2.What do young people like/dislike in **art museum** visits?

RQ3.What do young people appreciate/expect in their **VGM experience**?

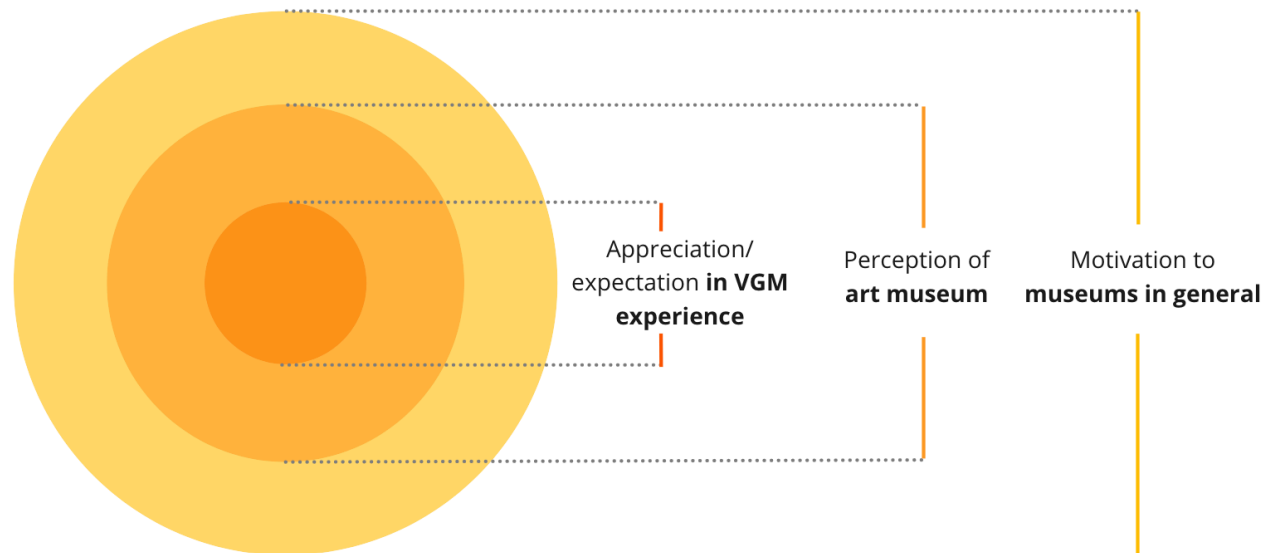


Figure 10. The scope of Contextmapping

### 03.01.01 Method

Contextmapping (Sanders & Stappers, 2012), a qualitative research method, was used to find out the needs of young people that are sometimes tacit and latent and can hardly put into words. Participants recalled memories of their museum experience or imagined what they would like to experience in the future, with the support of generative booklets (representative pages of the booklets see Figure 11, full booklets see Appendix A-a). Another strength of the method is insights from the research are supported by quotes of participants, which are excellent sources of inspiration for the ideation phase.

### 03.01.02 Participants

Eight participants from the target group with various cultural backgrounds and ages were recruited for the generative research. Four participants have been to VGM, and four have not (participants' background see Appendix A-b). Having the two groups of participants provides a comparison of their needs in visiting VGM - **Whether there are differences in their needs, if so, how do the needs result in different motivations and expectations?**

#### This is how I experienced Van Gogh Museum

Why did you visit this Museum? What did you expect? What happened? What content in the museum impressed you most? Try to map on the timeline. Please feel free to explain when, with whom, what you did, how you think and feel, etc. You can use the images/words on slides 4 & 5 to help you express your thoughts and emotions in the experience.



Map out the **experience** of participants who have been to VGM on a timeline

#### Create your own experience of Van Gogh Museum

If the Van Gogh Museum becomes attractive to you, could you imagine the experience of visiting the museum? What kind of experience you would like to have in relation to Van Gogh and his artworks? What characteristics should it have? How would you experience it? etc... It does not have to be realistic! Think about things interest you. You can use the images/words on slides 4 & 5 to express your desired experience.



I would like to visit Van Gogh Museum, if...

because...

I would like to visit Van Gogh Museum, if...

because...

I would like to visit Van Gogh Museum, if...

because...

I would like to visit Van Gogh Museum, if...

because...

Map out the **expectations** of participants who have not been to VGM

#### Is Van Gogh Museum relevant to you?



Looking back to my experience to Van Gogh Museum (VGM), I was impressed by

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Would you like to visit Van Gogh Museum again? Why or Why not?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



I think Van Gogh Museum is a place where

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Questions related to **relevance** for participants who have been to VGM

Figure 11. Representative pages of the booklet. full version of the booklets see Appendix A-a

## 03.02 Procedure of the Contextmapping

The Contextmapping consists of three main steps (Figure 12), sensitizing participants and interviewing about the content in the booklet, and analyzing data for results.

### 03.02.01 Memory recollection and future expectation by sensitizing

Participants filled out the booklets a few days before the interviews, giving them enough time to recall the experience and imagine the desired future.

Here are the contents of the booklets and the goal of data collection of each page:

1. **Introduction** of the project and **background of participants (e.g., age)** to make sure they belong to the target group.
2. **General museum experience:** frequency & motivations (Falk, 2016) to briefly understand what type of visitor they are.
3. **Experience with VGM on a timeline** (for those who have been to VGM) to figure out both contents and interactions liked or disliked by young people. **Or create a dream VGM experience** (for those who have not been to VGM) to determine their expectations for their possible future VGM visit.
4. Questions about **people's impression of VGM** compare with their motivation and see whether there is a gap between these two.
5. **Experience with AR/VR/MR** in and out of museum context **and their views on them**, which provides general understanding for the technologies, a starting point for the existing product analysis in the next chapter.

### 03.02.02 Deep dive into the needs by individual interview

Semi-structured interviews were conducted individually after participants finished the booklets. One on one interview allows more in-depth inquiry on the reason behind the direct answers. The interviews took place in Zoom, an online video conference platform and in-person, depending on the convenience of the participants.

Participants answered what impressed them in the VGM visit or what they expect to experience in their future visit. Besides, they were asked what aspects of other museums they like, such as science, historical or industrial museums, where more interactive approaches of conveying knowledge are applied. **The insights from the experience of diverse museums open up new possibilities of experiencing art outside VGM.**

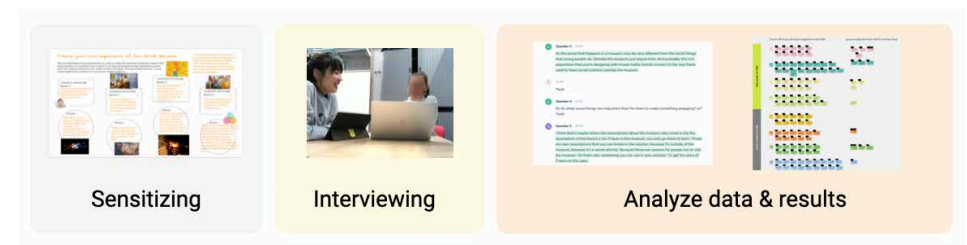


Figure 12. The process of the Contextmapping

### 03.03 Pattern in Context from Data Analysis

#### **Answer to RQ1: What motivates young people to visit museums in general?**

Generally speaking, young adults visit museums for **leisure purposes**. They **seek playful and relaxing experiences while wanting to discover something new**. However, their impression of the art museum visit is that the experience requires **high cognitive effort**, and a proper visit should involve **conscious learning**. The contradiction between young people's motivation and impression demotivates them to visit museums (Figure 13).

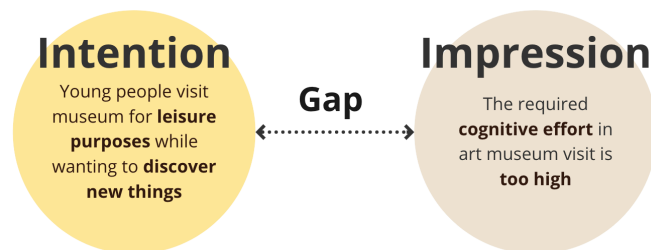


Figure 13. The gap between young people's intention and impression of art museum experience

Through data analysis (For initial analysis of quotes, see Appendix B-c), the following five clusters related to the engagement of young people in their on-site museum visit are figured out:

1. Reasons behind young people's **impression of art museums visit**
2. The **relevant content** of VGM to young people
3. Preferred ways of the **content presentation**
4. Preferred **interactions** with the content
5. **Emotional connection** in the process of meaning-making

Based on relevance theory (Wilson & Sperber, 2004), a pattern (Figure 14) emerges from the analysis. The relevance of the content, presentation of the content, and interactions with the content are three indispensable elements that affect perceived effort in meaning-making.

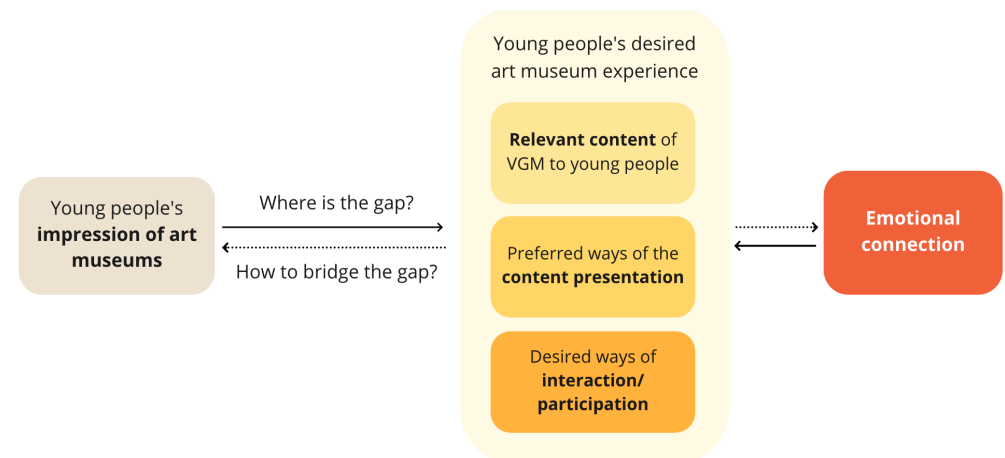


Figure 14. Pattern of the needs of desired in art museum experience

## 03.04 Five Clusters in the Pattern

*Answer to RQ2: What aspects do young people like or dislike in their art museum visits?*

### Cluster 1: Young people's impression of art museums

The analysis in 03.03 explains why young people dislike visiting art museums in general. More specific reasons are presented below:

#### 1) Unfamiliar content described in a didactic way

The content in many art museums is from hundreds, even thousands of years before, which is far from the contemporary life that young people are living. Understanding such content usually requires a lot of background knowledge of many other fields. Moreover, the labels in the museums usually provide dry facts, if not little information, demotivating young people from trying to understand the artwork.

#### 2) Isolated facts presented in the form of text

The artworks are usually presented based on styles or years. This way of presentation makes it difficult for people to make connections between artworks and contextualize them.

#### 3) Limited ways of interacting with the content

Due to the constraints of art museums, limited ways of interacting with art are allowed. Some participants indicated that art museums are boring and static, where they need to read texts on labels all along, which is tiring and distracts them from experiencing the artwork itself. The relatively passive experience increases the perceived cognitive effort.



## Answer to RQ3: What do young people appreciate or expect in their VGM experience?

The RQ3 is answered by the combination of **Cluster 2, 3 and 4** in the following pages.

### Cluster 2: Relevant content of VGM to young people

Four types of content are considered most relevant to young people listed below, consistent with findings in the literature (Mason & McCarthy, 2006) and previous research conducted by VGM with a target group that overlapped with this project (Vermeulen et al., 2019).

#### 1) Content related to experience & daily life of young people

When recognizing something in the content related to their own life, young people become curious and want to learn more. It can be masterpieces or stories of Van Gogh they knew early in their childhood and connect to their experience. This familiarity triggers their interest to learn more.

#### 2) Content related to the trends in society

The content associated with the trends or issues in the contemporary world has young people's interest, which is found in the literature (Mason, D. D., & McCarthy, C., 2006). Things happening in the present are easier to perceive relevance. Therefore, they are willing to interpret and reflect on the content and make new meaning.

"I had many notebooks with his painting as their cover."

"I knew him early in my life, so when you look at his paintings, they bring me back to the past, when I was in high school."

"For me, art is a very important tool to translate current issues, ideas, or trends to an audience in a way that cannot be done in any other medium..."

#### 3) Personal stories of Van Gogh

People love to obtain information about Van Gogh through his stories rather than facts. Information is conveyed more vividly and effectively by storytelling. Stories help people empathize with Van Gogh as a person and help them understand his art from a deeper level.

"Tell the story of the artist or about the painting itself, but also give you space to fill it in for yourself, or let us reflect on yourself..."

"You might think Van Gogh was a genius and far away from your life. But when I noticed that he painted many paintings in a short time. I thought he was talented, but he was also hardworking."

#### 4) Painting style & techniques of Van Gogh

The style and techniques applied in Van Gogh's paintings speak to people's imagination and inspire them for their creative process. The emotional quality in Gogh's painting opens the door to the spiritual world of the artist and shows how he saw reality.

"I feel like I can use this for my own creative process. I actually took photos of the color, just of the paintings for color palettes as well."

"I like his art style because he is not one who strives for perfection... But it still comes out very beautifully... a style that resonates with me personally."

### Cluster 3: Preferred ways of the content presentation

Apart from content itself, the presentation of content also matters. Young people are interested in seeing each painting in a timeline and connecting each painting and its backstories. These aspects keep them focused and help them digest and remember the information.

#### 1) Presenting the painting in a timeline

Young people appreciate the museum presenting paintings in a coherent timeline, which helps them construct the context around each painting and encourages them to continuously see the next one, through which they have an overview of the artistic development of Van Gogh.

"Being in the museum is more immersive...you see stuff, and how they kind of...chronological design everything and you learn step by step."

#### 2) The connections between Van Gogh's painting style and the backstories.

Young people are interested in the connection between Van Gogh's personal stories and the transitions of his painting style. For instance, what did the painter want to express when he did certain things to the painting? It helps people learn the context the artist was in and understand the painting beyond the superficial level.

"It's not just about what he shows on the painting, but also about what was happening during that time."

"It tells you who Van Gogh is...why he did a certain painting or what is the context of a certain painting...So that is very important to me in terms of going to a museum"

### Cluster 4: Desired ways of interaction/participation

How people interact with the content of the museum affects their engagement. Playful interaction and proper ways of participation designed for young people can improve people's engagement, endorsed by the literature of The Participatory Museums (Simon, 2016) and Relevance by Play (Vermeeren & Calvi, 2019).

#### 1) Involving physical interaction enhances engagement

Young people appreciate the interactivity in contemporary art museums and science museums. They can touch and feel the exhibits and sometimes even be part of the experience, through which a more immersive experience is achieved. Identified in the literature that learning by doing achieves a better learning outcome (Roussou, 2004). Although the possibility of physically interacting with artworks inside the VGM is constrained, the art has to be seen from a distance; physical interaction is promising to be incorporated in an extended reality environment.

"What I like about science museums is they make complicated things very easy to understand. You can just experiment with those kinds of things."

#### 2) Sharing ideas with friends increase intrinsic motivation to learn

Sharing interpretation, reflection, or inspiration generated from artworks with friends is crucial for young people. What is objectively described on labels might not be the most important to them; young people care more about how their friends think, through which they understand each other better.

"When I visit museums with friends, I like to talk with them about what I saw. Even if I am alone, I would take pictures and send them to my friends."

"I know a lot about Van Gogh and other people don't know, or they know and want to discuss. I like to share knowledge with friends."

### 3) Multisensory experience keeps people focused

Multisensory experience is more immersive. Compared to the experience with only visual inputs, museum experience with auditory and tactile elements help people immerse in the process and not get distracted easily. Acquiring information from various channels also creates more memorable experiences.

"It's like an experience where you walk through... those rooms were kind of magical...background music, which is very soothing and relaxing, and also inspiring..."

"You're looking at the painting and listening to the audio...it is more immersive. If it's purely just visual... I would be distracted by other moving things in the vicinity..."

### Cluster 5: Emotional connection in the process of meaning-making

People build an emotional connection with Van Gogh in different ways. Some participants are emotionally connected with him because they **know a lot of his personal stories**. A small percentage of participants connect with him through **understanding his art and feeling the emotions in his paintings first**. Either way, empathy plays a role in building the emotional connection.

Based on the literature on empathy, emotional connection is the highest level one can connect with others. The relevance of the content, contextualized presentation of the contents, and desired ways of interaction can trigger young people's interest in Van Gogh as a person and/or his art, therefore, motivate them to discover more while making new values that matter to themselves. **During the process, for each person, emotion and cognition are involved in various degrees, but not everyone can reach the level of emotional connection.** Emotional connection only happens when people discover shared aspects with Van Gogh and resonate with him in the process of meaning-making.

"I feel like we have a similar personality as well....it's like, if I would meet with him one day and talk with him...quite understand each other."

"..the things he is painting like floors, and the colors he uses give me a feeling that he is a very warm, sensitive person. "



### 03.05 Conclusion of Data Analysis

Comparing the needs of people who have been to VGM and those who have not, most of them are the same. However, the only difference that affects people's attitude towards visiting art museums is **whether they can perceive relevance** (Simon, N., 2016) from the content in the museum to their own life.

The relevance of content derives from various aspects: people's experience with the artworks, the stories of the artist they have learned, their interests in painting techniques or the connection between the idea behind the paintings and the issues in the contemporary world, etc. Young people who do not like art museums generally find it **challenging to figure out the personal relevance of the contents**. Apart from the content itself, how the content approaches people also matters. **Young people appreciate the contextualized content and more possibilities of interacting with it, which are ways that improve perceived relevance.**

Cluster 5 about emotional connection shows that emotional connection is the highest level one can connect with Van Gogh. **For the young people who feel Van Gogh is irrelevant to them, triggering their interest in Van Gogh and his art might be the good beginning step for facilitating the emotional connection** (Figure 15).



Figure 15. From trigger interest to emotional connection

### 03.06 Conclusion of Chapter 03

Young people see visiting museums as leisure activities without specific learning objectives. They seek playful and relaxing experiences while wanting to discover new things. Therefore, they would feel hesitant to visit museums when the perceived cognitive effort is too high in the experience.

To bridge the gap, the new experience designed in the extended reality environment should consider three main aspects: a) relevant content, b) presentation of the content, and c) various interactions with the content to successfully approach young people. While a) and b) are already applied by VGM in the museum, **c) can hardly be achieved in physical VGM due to many constraints but can be realized in the extended reality environment.** All three aspects contribute to a playful and engaging experience, which serves as the basis for forming the design criteria and design goal in Chapter 04.

Based on the pathway of achieving emotional connection, triggering young people's interests in Van Gogh and his art is selected as the leverage point of facilitating emotional connection of this project.

# CHAPTER 04

## Analysis of Existing XR Products

| Method : Literature review, Case studies & Questionnaire

Chapter 03 concludes young people's needs for diverse interaction and relevant content in the experience. In this chapter, the existing XR products are reviewed and analyzed. **As the medium of design, technology is more than a carrier of content and interaction but shapes them as well.** Therefore, setting the design criteria requires not only knowing users' needs but also a deeper understanding of the capacity of XR technologies, which is achieved by analyzing the strengths and constraints of products within the XR family in this chapter.

What is XR exactly? In this chapter, **XR is defined as the range of technologies in between "the complete real" to "the complete virtual" in the concept of reality** (Figure 16), including AR, MR, and VR.

Products designed for museum context, as well as other fields, are analyzed. For each technology, several products are analyzed, focusing on the user experience empowered or constrained by specific technology; as a result, conclusions of the common strengths and weaknesses of each technology are made at the end of the section.

The analysis suggests feasible interactions can be achieved by these technologies and how the existing way of interacting with the technologies might fulfill the target group's needs (desirability) and clients' consideration (viability).

Finally, **MR is selected** as the most suitable one for the graduation project.

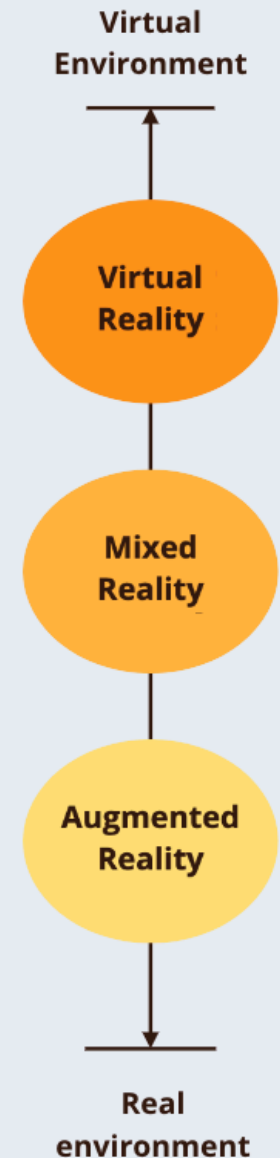


Figure 16. Reality-Virtuality Continuum, based on Milgram and Kishino (1994)'s Mixed Reality on the Reality-Virtuality Continuum

## 04.01 AR Use Cases

In this graduation project, **AR is defined as a real-time direct or indirect view of a physical real world environment that has been augmented by superimposing virtual computer generated information to it** (Carmigniani, et al., 2011). Six use cases are selected and analyzed, covering AR applications in museum context, entertainment and healthcare.

### 04.01.01 AR in museum context

#### 1) The MET Unframed

The Met Unframed is a digital twin of The Metropolitan Museum of Art (Figure 17), inviting online visitors to explore their digital galleries, play games, and unlock digital masterpieces as rewards that can be displayed at visitors' homes through AR (Figure 18). (metmuseum.org., n.d.)

##### + Strength(s):

- Accessible anywhere and anytime
- Create relevance by bringing the masterpiece into visitors' environment

##### - Constraints:

- The experience of the gamified elements separate from the core of the value of the content
- Limited variations of the tasks: users may get bored quickly.

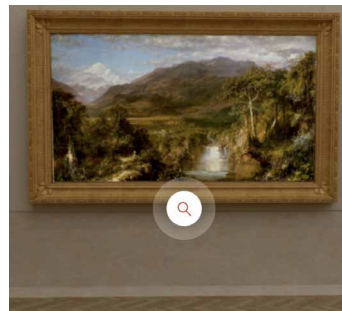


Figure 17. Digital twin of The Met

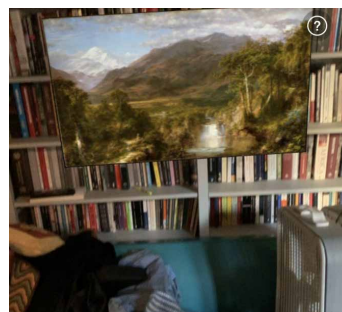


Figure 18. Digital masterpieces displayed at visitors' home

#### 2) Moco Play

Moco Play is an AR experience used in Moco Museum. Visitors can point their mobile phones/tablets at the artworks and watch them come to life on their screens through AR animations of the original artworks (Figure 19). (Moco play app. Moco Museum., n.d.)

##### + Strength(s):

- Playful interactive digital content makes the artworks come to life

##### -Constraint(s):

- The use of phones distracts visitors from focusing on the actual artwork.

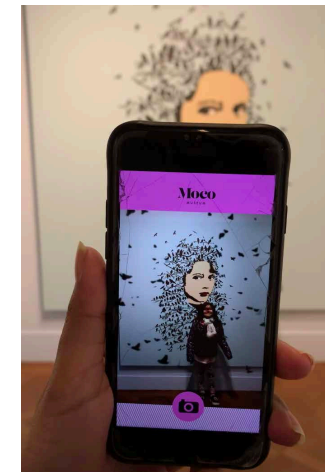


Figure 19. Animated artworks by Moco Play

#### 3) Unreal City

Unreal City is London's biggest public festival of augmented reality art featuring 36 sculptures arranged as a walking tour along the River Thames (Figure 20). To see the artwork, people need to arrive at the right spots and use the app to catch the artwork. (Acute Art., n.d.)

##### + Strength(s):

- Making art more accessible

##### - Constraints:

- Limited interactivity with the artworks

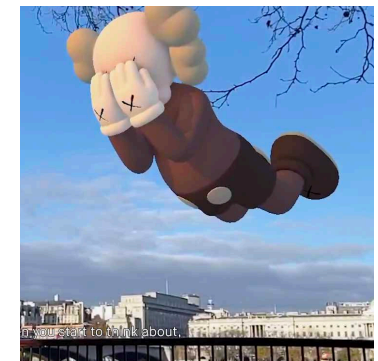


Figure 20. A sculpture along the River Thames

#### 4) GuideBOT

GuideBOT is an innovative indoor navigation system that works with visual recognition and positioning based on 3D scans without additional hardware installations. Visitors are being navigated for a distance of about 300 meters with multiple floor levels (Figure 21).

##### + Strength(s):

- Indoor intuitive way finding

##### - Constraint(s):

- The use of phones distract visitors from paying attention to surroundings.



Figure 21. Using GuideBOT in a museum

#### 04.01.02 AR in other fields

##### 1) Entertainment: Mark AR

Mark AR is an app that allows users to design and create whatever images they want and place them upon whichever location they choose (Figure 22). After being placed, anyone in the area can see the creations through the app. (AR social network. Mark.)

##### + Strength(s):

- Social features enhance people's motivation to create images

##### - Constraint(s):

Highly rely on social features without

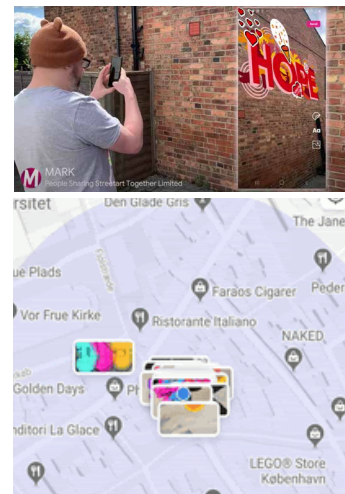


Figure 22. Create images(top).  
Artworks on map (bottom)

playful interaction. If no one is using the app in the vicinity, users may quit quickly.

##### 2) Healthcare: AccuVein AR

AccuVein is a handheld device that can scan the vein network of a patient. AR technology converts the heat signature of a patient's veins into an image that is superimposed on the skin (Figure 23), making the veins easier for clinicians to locate. (AccuVein Inc., 2020)

##### + Strength(s):

- Visualizing information for practical problem solving



Figure 23. Visualiation of vien on skin by AccuVein

#### 04.01.03 Conclusion of strengths and constraints of AR

While each product has its unique strength(s) and constraint(S), a typical pattern of the technology's strength(s) and constraint(S) emerges: AR can link the virtual information to the real world without devices other than a phone or tablet, making AR an excellent tool to bring the content inside the museum into the cities or people's homes. However, the limited interactivity with the overlaid digital content in AR makes it limited to fulfill the needs of young adults of having active participation, such as involving physical interactions identified in Chapter 03.

## 04.02 MR Use Cases

While the exact definition of MR is less universally agreed on both in academia and industry (Speicher, Hall, & Nebeling, 2019, May), MR usually refers to interactive digital content that is blended with reality.

**MR follows the two criteria in this project: 1) Digital content is overlaid on objects in the real environment. 2) Physical actions (head and body movements/gestures/speech) as real-time inputs for interactive digital media systems, with perceived 3D physical space as the canvas for video, audio, or haptic outputs.** Six MR products are analyzed, covering the context of the museum, business, and gaming.

### 04.02.01 MR in museums context

#### 1) PRESENCE

PRESENCE is an interactive artwork that encourages physical interaction and immersion. In Figure 24, space scans visitors by recording their presence in shadow. The interactions between visitors and artwork create constantly changing visuals. Visitors are not only looking and observing but also touching, feeling, and moving, which makes them aware of their presence in a unique manner. (Studio Roosegaarde. Presence., n.d.).

##### + Strength(s):

- Multi-senses experience for better immersion



Figure 24. PRESENCE by Daan Roosegaarde at Groninger Museum

#### 2) Body Paint

Body Paint is an art installation using projection with movement tracking that allows visitors to express themselves through movement and dance (Figure 25). The installation interprets people's physical gestures into evolving compositions, providing an interactive experience captured through the motion and energy of the body (Wonderspaces Philadelphia., Body Paint, n.d.).

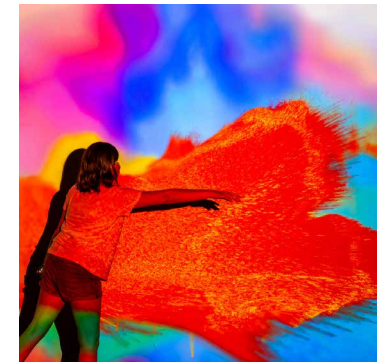


Figure 25. BODY PAINT Memo Akten (Photo by Devon Hutchins)

##### + Strength(s):

- Showing people's creativity through expressive interaction
- Visualizing the energy of the motion of the body for better immersion

##### - Constraint(s):

- Focusing purely on visuals and interactions without deeper level information integrated.

#### 3) R&D project by THÉORIZ

The project is enabled by large-scale projections overlaid on the wall and floor of a room with body tracking. The projection changes along with people's movement as you interact with them. The experience offers environments, such, pushing down walls (Figure 26),

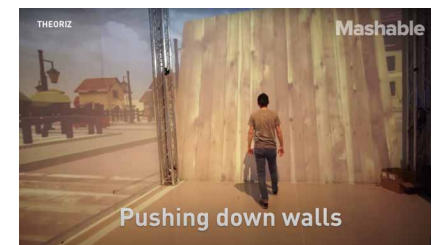


Figure 26. Pushing down walls



jumping onto surfaces(Figure 27), etc.  
(THÉORIZ studio, n.d.)

#### + Strength(s):

- Transforming environment for better immersion by large scale Interactive projection

#### - Constraint(s):

- The effects of interaction are purely visual without deeper meaning

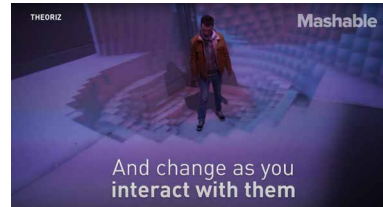


Figure 27. Jumping onto surfaces

#### 4) Create a Chemical Reaction

Create a Chemical Reaction is an interactive projection, which allows visitors to learn chemistry by grabbing atoms from the periodic table and combining them to cause chemical reactions (Figure 28). The interaction is achieved by using specially-tagged pucks (Figure 29). (Pattern Studio, Create a Chemical Reaction, 2010)

#### + Strength(s):

- Well-integrated knowledge and interaction for a playful learning experience
- Instant feedback enhances the motivation of learning



Figure 28. The product generated by a chemical reaction



Figure 29. Visitor browsing the period table using a puck

#### 04.02.02 MR in other fields

##### 1) Business: Spatial

Spatial uses the space around people to create a shareable augmented workplace. Remote users can collaborate, search, brainstorm and share content as if they were in the same room (Figure 30). (Spatial. How Work Should Be., n.d.)

#### + Strength(s):

- An intuitive way of collaboration.
- Increase connectedness between colleagues.

#### - Constraint(s):

- Expensive peripherals (e.g., Hololens, Magic Leap, etc.) is required.

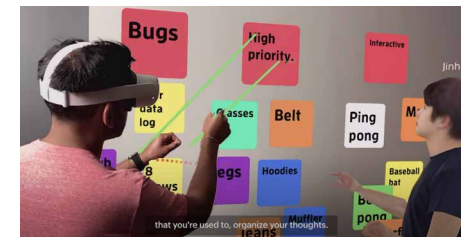


Figure 30. Work collaboratively using Spatial in MR environment

##### 2) Gaming: Angry Birds First Person Slingshot

Angry Birds FPS takes the towers of the classic Angry Birds games and drops them right in the surroundings of the player. The players can walk around and inspect the tower to find weaknesses in the pigs' defenses and use the handheld controller to destroy the pigs (Figure 31).

#### + Strength(s):

- Experiencing the physical property of game elements while playing

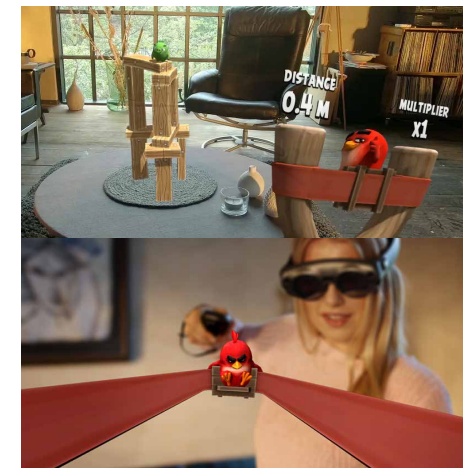


Figure 31. Playing Angry Birds with Magic Leap

- Immersive gaming experience without being isolated from reality
- **Constraint(s):**
  - Expensive equipment (e.g., HoloLens, Magic Leap, etc.) is required.

#### 04.02.03 Conclusion of strengths and constraints of MR

MR is the technology that possesses both characteristics of AR and VR. While users can physically interact with the digital content and are immersing in the experience, the expensive peripherals, such as HoloLens, are not necessities. Movement tracking sensors combined with projection are an alternative to provide an interactive MR experience. Therefore, considering the potentials of interactivity for users and the viability from clients' perspective, MR has the potential to be the suitable technology for this graduation project.

## 04.03 VR Use Cases

**VR is an interactive and immersive experience with the feeling of presence in a simulated autonomous world** (Fuchs & Bishop, 1992). In a VR experience, users are tracked in real-time and can interact with the environment. The Interaction can vary from looking around to interactively modifying the world (Burdea & Coiffet, 2003). Six VR products are selected and analyzed, covering their applications in the museum context, training, gaming, and social media.

### 04.03.01 VR in museums context

#### 1) Hold the World

Hold the World is a VR experience of the British Natural History Museum. Users can virtually enter various rooms of the Museum. In each room, Sir David Attenborough sits opposite the users, inviting them to examine several rare specimens (Figure 32). Specimens can be seen up close and manipulated in a way that until now had never been possible.

(Explore the Museum's Collection with Sir David Attenborough, 2018)

#### + Strength(s):

- Scientifically accurate models of specimens
- Look at specimens from any angles and manipulate them

#### - Constraint(s):

- Making a 3D hologram is time-consuming
- Expensive peripherals (e.g., Oculus rift) are required



*Figure 32. The virtual Sir David discusses the Museum's blue whale skeleton in the Earth Sciences Library*

## 2) Art Plunge

Art Plunge is a VR art gallery that allows people to experience world-famous paintings. Some paintings are enriched by adding fun details, enabling users to be in the environment of the paintings and look around (Figure 33), an experience that can hardly achieve in art galleries or museums. (Art Plunge | Stepping INSIDE Famous Works of Art in VR (w/ Fun Facts!), 2019).

### + Strength(s):

- Fulfilling users' curiosity by seeing the extension of the paintings

### - Constraint(s):

- Limited interactivity with the content in the VR environment
- Expensive peripherals (e.g., Oculus) are required

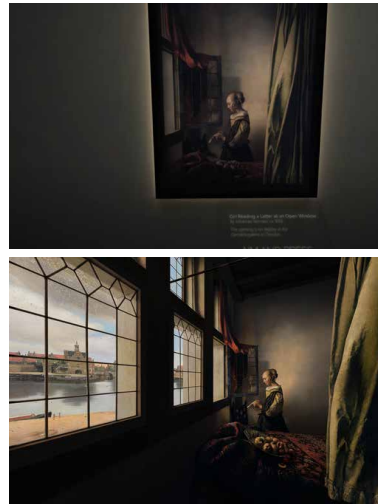


Figure 33. Original painting (top)  
Extended environment of the painting (bottom)

## 3) Modigliani VR

The Modigliani VR is the recreation of artist Amedeo Modigliani's final Parisian studio (Figure 34). The studio still exists, but almost 100 years after the artist's death, its appearance has changed a lot. Through comprehensive research, the environment is recreated. In this

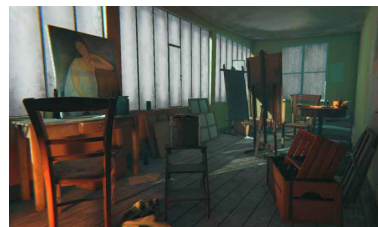


Figure 34-1. Modigliani VR

VR experience, visitors can immerse themselves in a VR recreation of his final studio. (Tate, Modigliani VR: The Ochre Atelier, 2017)

### + Strength(s):

- Recreation of environment of cultural and historical significance

### - Constraint(s):

- Limited interactivity with the content in the VR environment



Figure 34-2. Modigliani VR

## 04.03.02 VR in Other fields

### 1) Training : VR Fire Trainer

VR Fire Trainer (Figure 35) is a mobile, easy-to-use off-the-shelf programme, targeting businesses in need of readily accessible VR fire emergency training (Vobling, 2021).

### + Strength(s):

- Better learning results achieved by active learning
- Safe training environment

### - Constraint(s):

- Expensive peripherals (e.g., Oculus Rift) are required
- Moving while physically being in reality but visually being in virtuality lead to a sense of insecurity.



Figure 35. VR Fire Trainer



## 2) Gaming: Beat Saber

Beat Saber (Figure 36) is a VR rhythm game where the goal of the user is to slash the beats perfectly fit into precisely handcrafted music.

### + Strength(s):

- Fully immersive experience achieved by the combination of music and visual effects
- Strong feedback improves user motivation

### - Constraint(s):

- Expensive peripherals (e.g., Oculus Rift) are required
- Moving while physically being in reality but visually being in virtuality lead to a sense of insecurity.



Figure 36. A player is playing Beat Saber

## 3) Social VR: AltspaceVR

Microsoft's social VR platform, AltspaceVR (Figure 37), allows users to hang out, chat, and host events. Users come to the virtual world to see specific live events hosted by creators.

### + Strength(s):

- The feeling of social presence and sense of relatedness

### - Constraint(s):

- The atmosphere of the environment is hard to sense
- Expensive peripherals (e.g., Oculus rift) are required



Figure 37. Microsoft's social VR platform, AltspaceVR

## 04.03.03 Conclusion of strengths and constraints of VR

Besides the unique strength(s) and constraint(s) each product possesses, there are some common aspects of strength(s) and constraint(s):

Among all three technologies (AR, MR, and VR), VR is the most immersive one, and **interaction possibilities are abundant**.

However, these strengths of VR do not come without a price.

**Developing a VR experience is time-consuming, and equipment such as a VR headset is required.** Not only is it expensive, but also wearing the headset blocks users from reality. While physically being in reality, they are visually in the virtuality. The discrepancy results in **the sense of insecurity during a VR experience**. Therefore, considering all these aspects, VR is not an optimal technology for this graduation project.

## 04.04 The Selection of the Technology

The conclusions of the strengths and constraints of each technology provide insights on 1) whether they have the potentials to fulfill the needs of the target group. 2) the clients' consideration of the accessibility of the experience by the target group.

AR is ruled out due to the limited possible interaction it can provide. It can hardly become the playful and engaging experience itself but rather the supporting elements. VR allows a more immersive and interactive experience. However, the experience relies on a VR headset, usually very expensive, not very affordable, and accessible by many people from the target group.

Compared to the previous two, MR is a more desirable, viable, and feasible choice. Although within the MR category, there are experiences that require additional devices (e.g., Hololens), the same disadvantage as VR. Another option is MR experience enabled by large-scale display equipment (e.g., projection) with body tracking, which possesses the advantages of AR and VR - accessible yet with plenty of possibilities of designing for interaction, therefore, most plausible to be the technology for this project.

Answers of participants from a questionnaire about people's views on different forms of the technologies also serve as a reference to make the decision. One recurring answer is that experiences with installation are usually more engaging, immersive, and unforgettable, so they have a greater impact on people. However, if it is an app, they typically use it once and forget about it. For details of the questionnaire, see Appendix B.

Therefore, MR installation using **large-scale display** (e.g., projection) combined with **full body tracking** is selected for this graduation project. The advantages show below (Figure 38):

- **Diverse possibilities of interaction:** fulfill the needs of the target group of active participation
- **More accessible:** people come across the experience in the city, without additional equipments required
- **Spread easily online,** the experience with the installation can be recorded and posted online, therefore, more influential

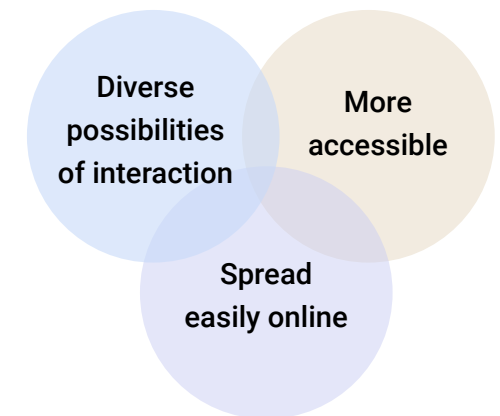


Figure 38. Advantages of MR installation

## 04.05 Conclusion of Chapter 04

The XR products, including AR, MR, and VR from both the museum context and other fields, are analyzed in this chapter.

The analysis provides a general understanding of the capacity of each technology and their possible input and output, which pave the way for the ideation phase afterward.

Based on the strengths and constraints of each technology, **MR, due to its capability of enabling diverse interactions without requiring additional devices from users**, is selected as the technology for this graduation project.



# CHAPTER 05

## Design Criteria & Design Goal

### | Method: literature review & Questionnaire

In previous chapters, insights on the target group's needs and the technologies' capacity are gained, which help **formulate design criteria and the design goal** in Chapter 05. With questionnaire results, the **design criteria are prioritized**, providing a clear focus on the ideation phase.

Finally, a group brainstorming was conducted to scope down the project. 1) **The connection among the interaction qualities in the design criteria is figured out**, suggesting the experience this project aims to achieve is an unconstrained free form playful experience. 2) **The characteristics of the installation locations** are found, which helps select the optimal installation location.

*'I know no better definition of the word Art than this, "Art is man added to nature," nature, reality, truth, but with a meaning, with an interpretation, with a character, that the artist brings out and to which he gives expression, which he sets free, which he unravels, releases, elucidates.'*

*- Vincent Van Gogh*

## 05.01 From the Needs of Target Group to Preliminary Design Criteria

In Chapter 03, young people's needs in their physical museum experience are identified, which are representations of humans' fundamental needs (Desmet & Fokkinga, 2020) in a specific context. When designing the new experience in the MR environment, the identified needs require a deeper understanding by tracing back to the fundamental needs before translating to design criteria (Figure 39). Looking at the current needs from a more abstract fundamental level expands design opportunity space, providing more possibilities to fulfill them.

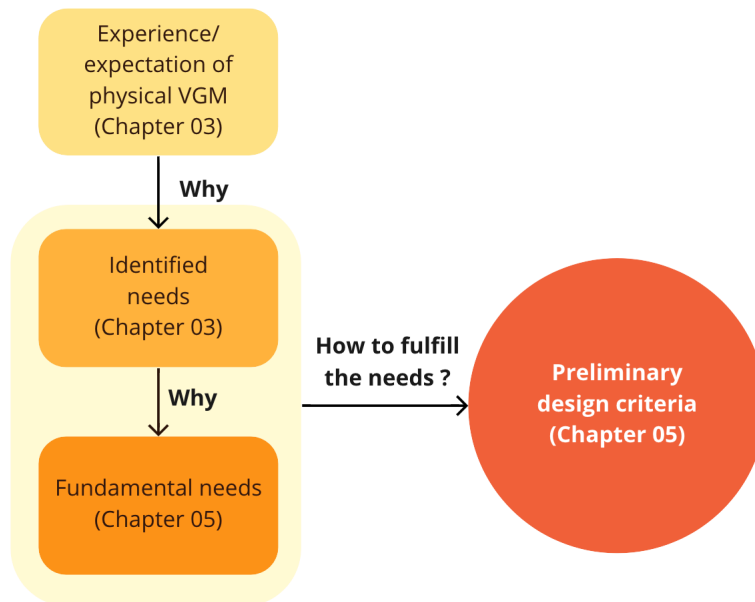


Figure 39. The process of forming preliminary design criteria

### 05.01.01 Two aspects of design implication by fundamental needs

The preliminary design criteria are formulated considering the following two aspects: 1) strengthen the current needs fulfillments and 2) reduce the needs harm. The two aspects provide a structured way of forming criteria and **make sure the new experience, while possessing the desired qualities of the physical museum experience, provides extra value through MR**; as a result, enhancing young people's engagement.

**1) Strengthen the current needs fulfillments:** The needs fulfilled in the on-site museum experience are promising to be brought and strengthened in an MR environment.

**2) Reduce the needs harm:** The needs that are harmed by the current museum experience, but the harm can be reduced by taking advantages of the new medium.

### 05.01.02 From fundamental needs to preliminary design criteria

By asking why the identified needs, a laddering process is conducted; as a result, the fundamental needs of young people are associated with the identified needs, making the connection of two levels of needs explicit.

**The optimal abstract level of needs (the level that is most inspiring) is used to form the preliminary design criteria** on the next page.

### 1) Strengthen the Current Needs fulfillments

The needs for mental stimulation, relatedness and competence are fundamental needs fulfilled in current museum experience and can be strengthened in MR environment.

- *Need for stimulation (mental)*

Young people feel satisfied with their museum experience when they discover new things and get inspired, which shows their need for mental stimulation. There exist three sub-needs: needs for interpretations of Van Gogh's personal stories, creative inspirations from Van Gogh's paintings, and reflections on their own lives based on the museum content. To generalize the three sub-needs, Criteria 1 is formed:

**Criteria 1: The design should be a source of inspiration.**

- *Needs for relatedness and competence*

Sharing understanding of artwork motivates people to process new content, identified from the literature, Contextmapping, and supported by self-determination theory (Deci & Ryan, 2012). While exchanging ideas, people demonstrate competence and feel a sense of relatedness with others, which improves their intrinsic motivation to learn.

**Criteria 2: The design should connect young people with others and allow ideas sharing.**

### 2) Reduce the Needs Harm

The needs for comfort and physical stimulation are harmed in the current physical museum experience due to limited interaction with the museum content. Taking advantages of MR can reduce the needs harm.

- *Need for comfort*

Young people usually see visiting museums as a leisure activity, in which they expect to relax and switch the mind from daily work. However, the perceived high cognitive effort in the experience is contradictory to their need for comfort. To reduce the need harm, make a relaxing experience directly is one way.

**Criteria 3: The design should help young people relax.**

Another way is to make the experience playful, which helps people focus on the process rather than the result, therefore, reduce their perceived cognitive effort in the experience (Vermeeren & Calvi, 2019).

**Criteria 4: The design should be playful.**

- *Need for stimulation (physical)*

Physical stimulation help people focus on the process and achieve a better learning outcome. Young people like the interactivity of science museums, where they are able to learn from experimenting. Although physical interactivity inside VGM is limited, it is promising to fulfill in an MR environment.

**Criteria 5: The design should involve physical interaction.**



## 05.02 Final Design Criteria

The preliminary design criteria in the last section are based on literature and the insights from qualitative research in Chapter 03. In this section, **the preliminary design criteria are validated and prioritized with more people through a questionnaire distributed via social media, where young people often visit**, such as Reddit, Facebook, etc. For more objectives of the questionnaire, see Appendix B-a.

After a few sensitizing questions related to ways of experiencing art (see Appendix B-c), a multiple choices question was followed: "Imagine a new product that tells the contents about Van Gogh you are interested in, what characteristics should it have in order to be more attractive to you?" with the five design criteria as the options of the answer.

Among five preliminary design criteria, "be a source of inspiration and involve physical interaction" are selected most by participants\* (19/26), and "be playful" (15/26) and "help me relax" (12/26) are also preferred. However, only 9/26 people selected "to connect with others & be able to share ideas," which suggests the need for this quality is relatively low for the new experience designed in the MR environment. Figure 40 shows the results.

Based on the analysis above, the five preliminary design criteria are prioritized to the final design criteria below, the MUST and SHOULD qualities have to fulfill by design. The COULD quality will be considered only when the more prioritized criteria are already fulfilled.

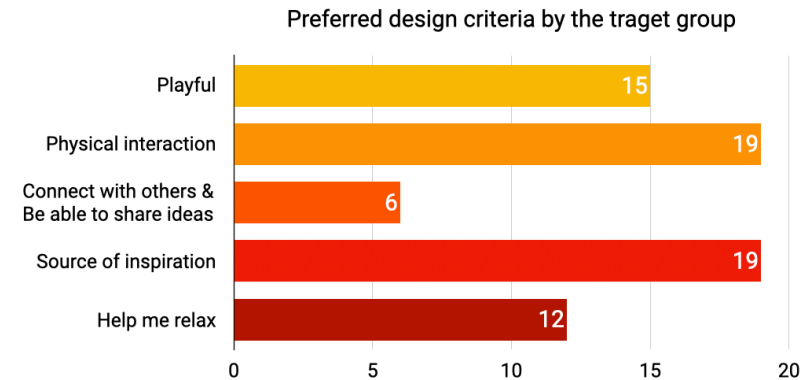


Figure 40. Preferred design criteria of the target group

### The aimed experience ...

#### MUST:

- be a source of inspiration
- involve physical interaction.

#### SHOULD:

- help young people relax
- be playful

#### COULD:

- connect people and allow idea-sharing

\* **Participants:** Among 37 participants, 26 are from the target group (age 18-30). The above information only counts the answers of the target group. However, the design is designed for public space, having insights from a broader group of people can serve as a reference. The results of 37 participants are consistent with that of the target group. (Questionnaire results from all 37 participants, see Appendix B-d).

## 05.03 Defining the Design Goal

Defining the design goal requires scoping down the design brief in Chapter 01 by answering the following two questions: **Where is the leverage point to initiate the emotional connection? What contents should be the focus of the design?** Making these aspects explicit in the design goal will give clear direction to the ideation phase afterward.

### 05.03.01 The leverage point

In the design brief, the stated objective is to design an engaging experience that facilitates the emotional connection. Based on prior research, **the leverage point of achieving the emotional connection is the discovery phase, the foundation to achieve emotional connection.** Especially for most people from the target group who feel irrelevant to Van Gogh and his art, approaching and priming them from this phase is more effective.

### 05.03.02 The focused content of the design

Among four types of content identified from literature and Contextmapping, Van Gogh's "painting styles & techniques" and "personal life" interest people the most (Figure 41). Moreover, in prior research, the participants show great interest in the connections between these two aspects, therefore, selected as the content this project focussing. For more details of the questionnaire, see Appendix B.

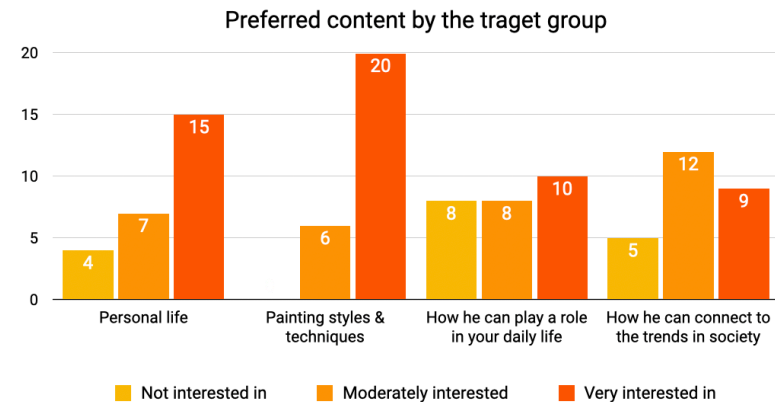


Figure 41. Preferred content by the target group

### 05.03.03 Design Goal

To design an experience that **trigger the interests** of young people about Van Gogh and his art through experiencing **the connections between his personal stories and his painting style and technique** in a mixed-reality environment.

## 05.04 The Connection of Design Criteria & Location of the Installation

### 05.04.01 Deepening understanding of design criteria from other people's perspectives

After defining the final design criteria, a group brainstorming session was conducted to **understand how other people perceive the abstract keywords in the criteria**. By asking questions below (Q1&Q2), the keywords are translated into possible tangible design elements, which creates a starting point for the individual brainstorming afterward (06.02). Besides, the characteristics of possible locations for the installation are also explored (Q3).

- Q1: How would you like to experience art with physical interaction?
- Q2: How do you get inspired in a playful way?
- Q3: Where would you like to come across the installation?

### 05.04.02 Participants of the group brainstorming

Among four participants, three are design students from the industrial design faculty at TU Delft, and one is a UX practitioner working in the technology industry.

### 05.04.03 Procedure of the group brainstorming

First, the graduation project was introduced briefly to participants, providing sufficient information for ideas generation while leaving enough space for their imagination.

Each question was presented in a sub-session (Figure 42) (see Appendix C for the screenshots of the group brainstorming), including ten minutes of brainstorming ideas and a short group discussion. The order of the questions was designed where the previous question(s)

serves as a basis for the question(s) afterward. The brainstorming was conducted via Miro, an online whiteboard for collaboration, and Zoom, a video conferencing tool.

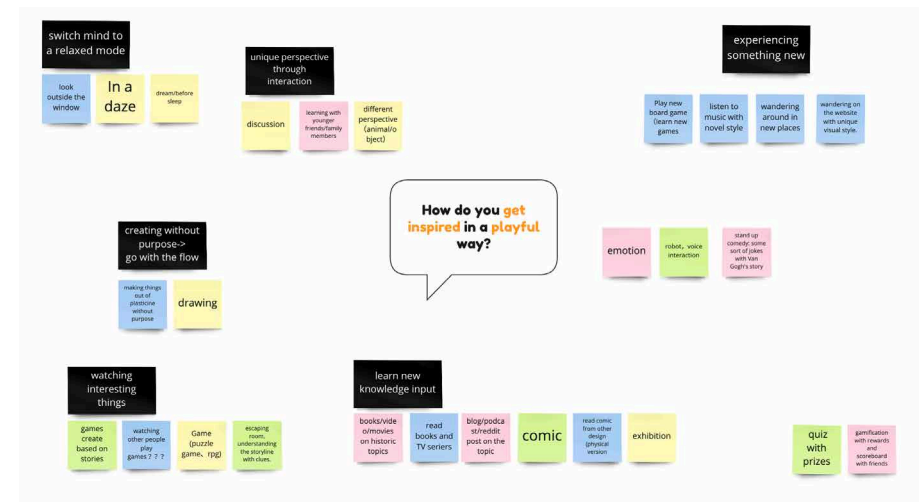


Figure 42. One of the sub-sessions in the group brainstorming

### 05.04.04 Analysis of brainstorming results

*Q1: How would you (young people) like to experience art with physical interaction?*

The ideas generated from this question were cluster into four main aspects (For more details, see Appendix C-Q1):

- Recreating artworks in various mediums and forms;
- Acting out Van Gogh's life and stories;
- Interacting with virtual Van Gogh by various input, such as voice or facial expression;

- Multi-sensory experience, such as experience enabled by XR.

Therefore, experiencing art physically to participants means the experience allows **diverse data input and output possibilities, using sensors to detect motion, voice, facial expression, etc.** A more immersive experience is achieved.

#### Q2: How do you (young people) get inspired in a playful way?

Playful can come in many different ways and forms. What kind of playfulness stimulate inspiration? Here are findings from the session (For more details, see Appendix C-Q2):

- When people are in a relaxing state of mind;
- Creating without much intention;
- Experiencing something new (e.g., reading books, talking with children, and being in new places.)

The findings suggest that **the playful yet inspiring experience is not the kind of formal, rule-driven game. Instead, the free and unconstrained experience stimulates people's inspiration more effectively.** Therefore, playfulness should help people have a relaxing state of mind while experiencing something new related to Van Gogh and his art.

Based on the results of Q1 & Q2, the connection between keywords in design criteria surfaces. Playful, relaxing, and physical interaction support each other and help people get inspired (Figure 43).

Playful experience integrated with physical interaction can better immerse people in the process and help them switch minds and relax. Once people are in a relaxing state of mind and create or experience new things, they get inspired easily.

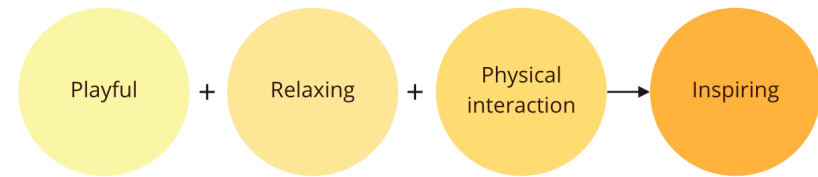


Figure 43. The connection between keywords in design criteria

#### Q3: Where would you like to come across the installation?

The locations of the installation affect interaction, concerning feasibility and social norm, and how long people would interact with it. The possible locations have the three characteristics below (For more details, see Appendix C-Q3) :

- **Artistic places**, allowing the relevance to be perceived easily (e.g., outside VGM).
- Places that **young people often go to** (e.g., train station, university campus).
- Places that young people **go with a relaxing state of mind** (e.g., shopping mall)



Possible locations of the installation

## 05.05 Conclusion of Chapter 05

In Chapter 05, **the design goal is defined** (05.03.03), **and design criteria are prioritized** (05.02) based on the insights from previous chapters and the questionnaire results.

The connection of the design criteria surfaces through the group brainstorming - **Playful, relaxing, and physical interaction work together to achieve an inspiring experience** (05.04.04). This insight provides more focus for the ideation phase in the next chapter.

**Three characteristics of the desired locations of the installation are figured out** (05.04.04) through the brainstorming session, providing the possible locations for the context observation conducted in 06.02.

# CHAPTER 06

## Ideation by Prototyping & Testing

| Method: Brainstorming , Speed dating, Wizard of Oz

The research in the previous chapter provides a basis for ideation and prototyping from both user and technological perspectives.

After scoping down the solution space in a feasible direction and formulating the design criteria and design goal, two ideation, prototyping, and testing cycles were conducted with participants and clients to gather insights on **how to balance the educational and playful elements**, so that engages people in the experience. Secondly, **the essence of the MR experience** this project aimed for was made explicit at the end of Cycle 1. Thirdly, **a design strategy was created** for designing an experience for public space at the end of Cycle 2.



## 06.01 CYCLE 1 Four Initial Ideas from Technological Perspective

### 06.01.01 Individual brainstorming from the technological perspective

In 05.04, ideas generated in the group brainstorming went wild without considering any constraints from a technological perspective. Therefore, **individual brainstorming was needed and conducted with the consideration of what interactions can be enabled by the MR technology** while fitting the design criteria and roughly aligned with the design goal.

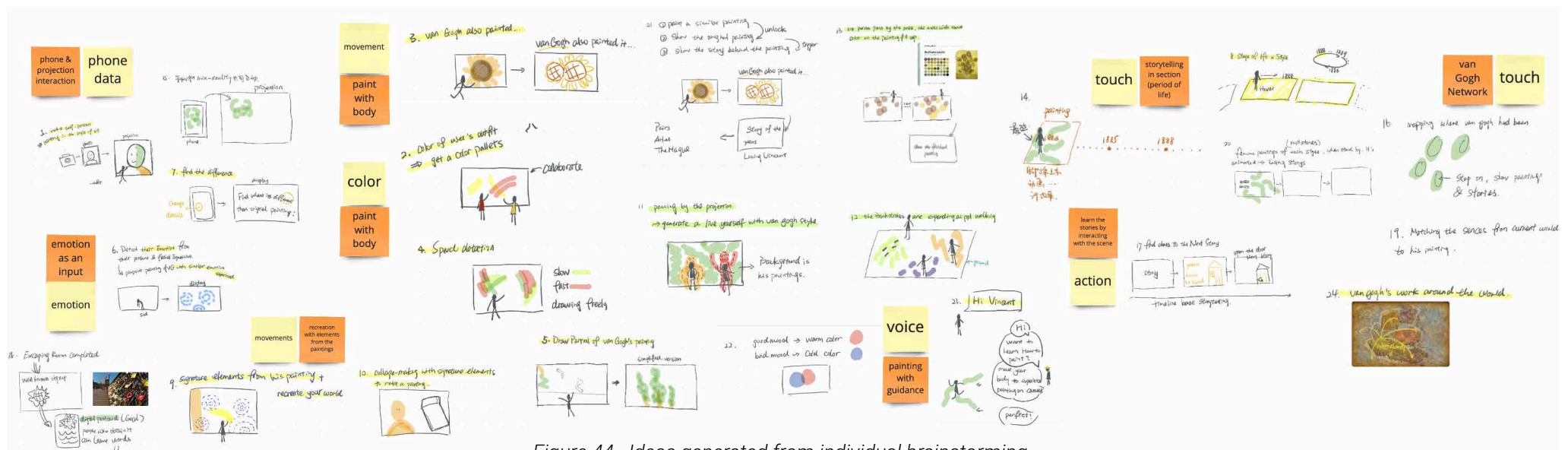
### 06.01.02 Procedure of the individual brainstorming

The results of the analysis of existing products (Chapter 04) are a reference for the possible inputs and outputs enabled by the technology, the foundation of the individual brainstorming. However, when combining the content of VGM with the available inputs and outputs,

what could be relevant interactions? To answer this question, the data from Contextmapping provides an excellent source of inspiration. The aspects of the VGM onsite experience appreciated by participants were transformed into design elements and interactions in the individual brainstorming.

### 06.01.03 Results of individual brainstorming

Around thirty ideas were created (Figure 44), **connecting the feasible inputs and outputs of the MR technology with the stories of Van Gogh and his paintings**. Yellow post-its in Figure 44 show the possible input, and orange ones are potential output.



To summarize the potential input and output from the individual brainstorming, the input includes movement, voice, touch, emotion, etc. The output is more content-oriented, including story elements of Van Gogh, such as his iconic brush strokes, Van Gogh style filtered elements and animation, etc., (Figure 45).

#### 06.01.04 Considerations of the feasibility of data input & output

Although all the listed data input and output in Figure 45 are feasible to some extent from a technological perspective, the state of the art of each specific technology varies a lot. For instance, the accessible technology within the scope of the project for emotion detection is not

accurate and sophisticated enough for serious purposes and voice recognition as well. Therefore, if emotion and voice input is finally being used, the trade-off between the aimed effects and side effect caused by the limitation of the technology should pay extra attention.

On the other hand, looking at the possible output, designing for interactive animations, or the escape room as output would result in significant amounts of work that is even beyond the scope of a graduation project. However, if appropriately designed, they are engaging ways of telling Van Gogh's stories; therefore, they can be considered using as supporting elements in this project.

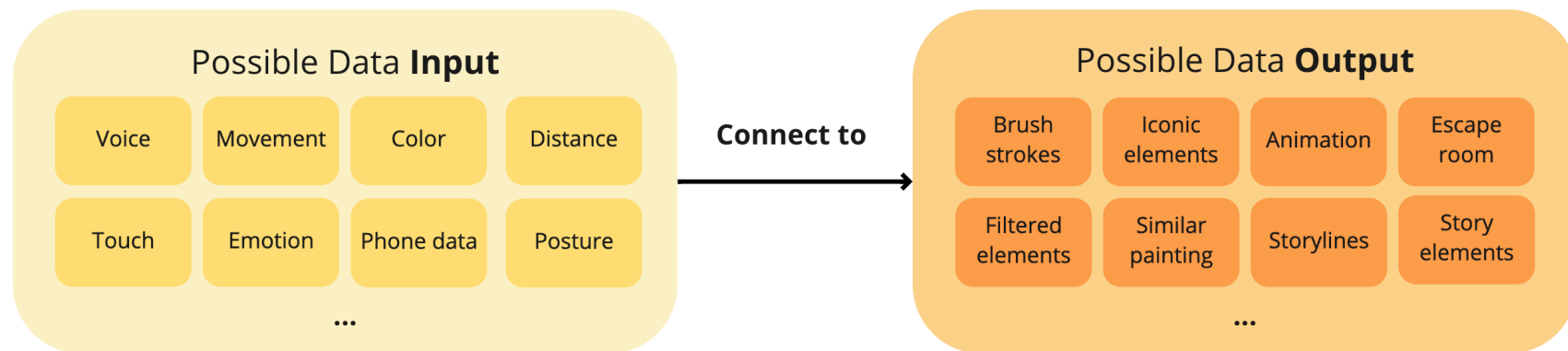


Figure 45. Connecting the possible inputs and outputs of the mixed reality technology with the content of VGM

### 06.01.05 Four initial idea from the result of individual brainstorming

The four most unique ideas were selected for divergence purposes from the individual brainstorming as the basis to build upon in the following ideation phases.

#### *Idea 1: Van Gogh Style Filter*

Van Gogh's iconic style is made to video filters (Figure 46). It **mirrors the environment in real-time on the projection**. The movements of people are also captured, filtered and projected on the wall, aiming to trigger people's interest in Van Gogh's style.



Figure 46. Filtered Body Movements

#### *Idea 2: Drawing Like Van Gogh*

Van Gogh's expressive color combinations are used as color palettes for people to **paint with their body movements** (Figure 47). When the painting is finished, machine learning will help **match a similar painting from the collection** of VGM.

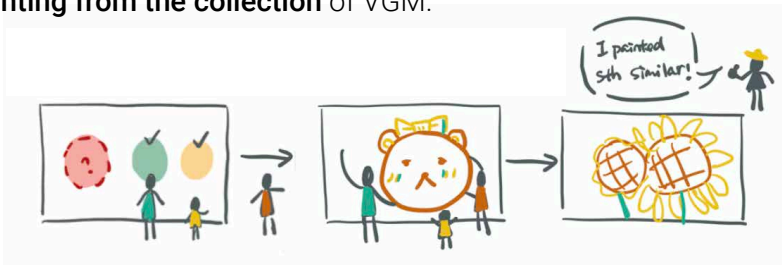


Figure 47. Drawing Like Van Gogh

#### *Idea 3: Walking through Van Gogh's Artistic Development*

Van Gogh's masterpieces are projected onto the ground in continuous years (Figure 48). **When stepping onto a year, the movements of the brush strokes are triggered.** This idea allows people to view and interact with paintings in a timeline dynamically, a preferred way of content presentation identified in chapter 03.

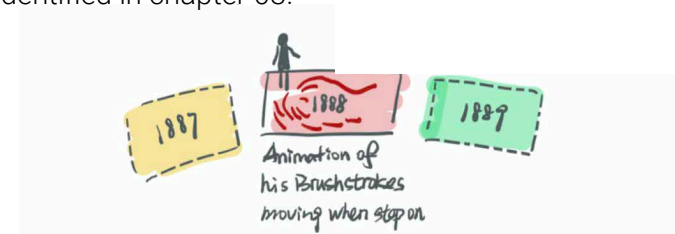


Figure 48. Walking through Van Gogh's Artistic Development

#### *Idea 4: Escape Room*

Escape Room was designed based on scenarios depicted in Van Gogh's paintings (Figure 49), connected by story elements from Van Gogh's life. **Using the movements of body, users interact with the objects in the scenarios.** This idea changes the conventional storytelling by words to an interactive experience.

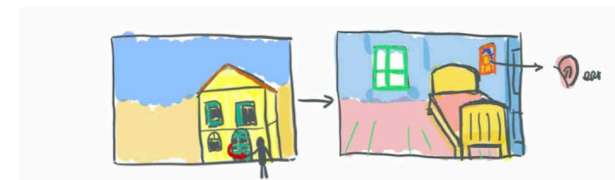


Figure 49. Escape Room

### 06.01.06 Testing the four Initial Ideas

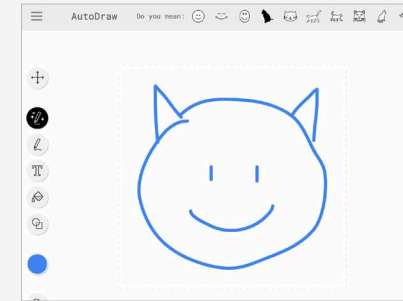
The ideas were created through an interaction-up approach, meaning that its focus is mainly on designing interactions. The content of VGM was fed into the interactions. However, for VGM, as a cultural institute, its main emphasis is still on its educational role. In other words, **the playful interactions and experiences only add value if they empower the educational purpose**. Therefore, three research questions were proposed. The aim of the questions is to **find a balance between playful and educational**:

- RQ 1: How do people feel about the integration of the contents and interactions?
- RQ 2: Would the design trigger people's interest in Van Gogh and motivate them to discover more content?
- RQ 3: How do the four ideas fit the design criteria?

The four initial ideas in 06.01.03 were tested through the speed dating method (Zimmerman & Forlizzi, 2017) with two people from the target group and clients, **where the sketches of the ideas with a description are shown** (see 06.01.05) and discussed to collect quick and qualitative feedback to answer the research questions above. After speed dating, participants knew how the four ideas work. Some **simple prototypes of the four initial ideas were provided** (Figure 50), which allows them to try out the experience and the feel directly.



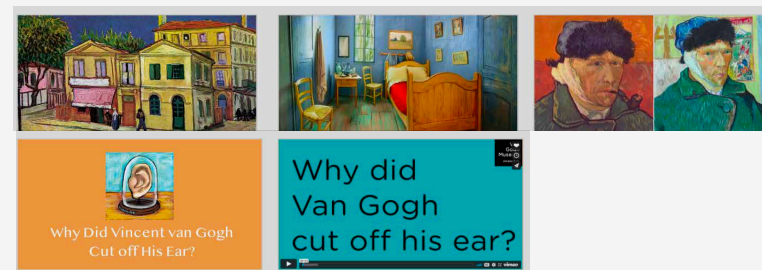
**Idea 1 Van Gogh Style Filter** by ArtShots, using existing artistic video filter to simulate Van Gogh style



**Idea 2 Drawing like Van Gogh** by AutoDraw to simulate the experience of matching similar paintings



**Idea 3 Walking through Van Gogh's Artistic Development** uses clips from the movie Loving Vincent to simulate the triggered animation



**Idea 4 Escape room**, connecting scenes by elements in the paintings using Adobe XD

Figure 50. Prototypes used for testing of the four initial ideas

### 06.01.07 Main takeaways by testing of the four Initial Ideas

The insights from testing the four initial ideas with participants and clients answer the questions raised in 06.01.06. Clients' feedback focuses on the integration of content and interactions (RQ1). The insights from the user testing center on the detailed elements of the ideas (RQ2).

*RQ 1: How do people feel about the integration of the contents and interactions?*

- The educational elements in the experience are mostly facts. However, what is interesting is the reason and meaning underlying the facts. **The preferred experience should allow users to experience the meaning behind the facts naturally through interactions.**
- **Small pieces of knowledge with deeper meaning are preferred** to broad but shallow information. Therefore, when designing the experience, pick up one or two things to focus on is more important.
- Playfulness and knowledge are now separate elements in the experience. They should be infused into each other, meaning that **the added playful interactions should be relevant to the content and contribute to the core message of Van Gogh's art and life.**

*"The ideas are mostly focusing on facts... go one step further... Instead of saying what is the color combination, allowing people to experience the difference."*

*- clients*

*"It is important to keep in mind that people are still learning things. Body mapping is fun, but what do people learn?"*

*- clients*

*"Rearrange the swirls in the painting in idea 1 might be playful, but the interaction itself is not relevant to the content."*

*- clients*

*RQ 2: Would the design trigger people's interest in Van Gogh and motivate them to discover more content?*

The following elements of the ideas are effective in motivating people to learn.

- **Questions** presented during the experience **stimulate people's curiosity and interest, which motivate them to learn more.** People like their questions being answered immediately.
- **Presenting information step-by-step** motivates people to keep learning and go through the entire experience.
- **Variations in data input and output** of the installation trigger people's interest to explore and discover further because of the unexpected.

*"I like idea 4 because it presents information step-by-step... It feels good when my questions are answered immediately."*

*- participant D*

*"I'd like to have variations in the experience. Variations in its input and output...they interest me to explore."*

*- participant J*

*RQ 3: How do the four ideas fit the design criteria?*

The four ideas can partially fit the design criteria. Participants appreciate the **diverse interactions enabled by ideas 2 and 4** and think they are **playful**. The information presented step-by-step in idea 4 is inspiring. However, participants **did not mention things related to the qualities of "physical interaction" and "relaxing,"** which might be because the prototype cannot fully represent the experience of the original design. Some qualities in the simulated experience are missing.



### 06.01.08 Reflection on essentials of MR

During testing, a question arises: Why are such experiences called mixed reality? Although existing product analysis shows using large-scale projection and full-body tracking technology is a characteristic of one type of MR experience, is it also true the other way around? Are all experiences involving large-scale projection and full-body tracking an MR? What is the essentials of MR precisely?

By examining the four ideas with literature review in the MR domain, a significant difference surfaces:

**Experience of Idea 1 and 2** (type 1 experience) **uses continuous real-time data as input and output**, meaning that the users' motion continuously influences the MR environment, even not intentionally.

Moreover, the type 1 experience is **more interactive, allowing various degrees of interaction**, a key aspect in MR (Speicher, Hall & Nebeling, 2019). However, in idea 3 or 4 (experience type 2), users' movement only serves as a trigger of displaying pre-defined data, such as animation and scenarios, which feels like simply translating on-screen interactions to a larger display (Figure 51).

Therefore, using continuous real-time data as input and output is considered the essential of MR. Such experience is usually more interactive and has more potential to fulfill the design goal and the design criteria.

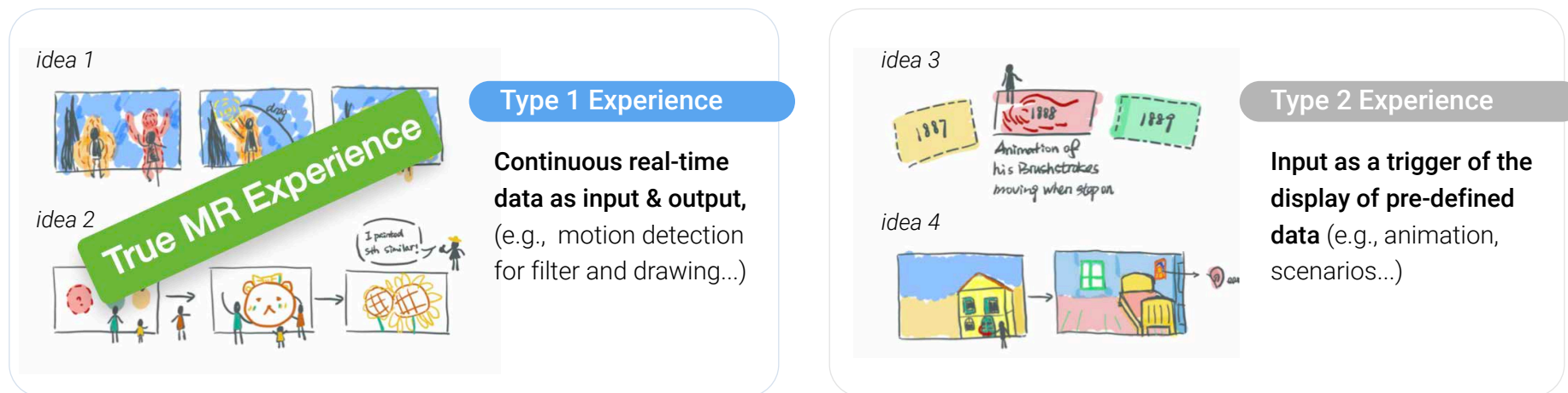


Figure 51. The difference between two types of experience among four ideas



## 06.02 CYCLE 2: Design Strategy by Behavior Pattern at Possible Locations

In cycle 1, aspects including the guideline of combining the content and interaction, the promising design elements, and the essence of the aimed MR experience are made clear. However, a design strategy is missing that helps compose the components for a user journey.

In cycle 2, by observing people's behavioral patterns at possible installation locations, the first impression was gained, which helps in building four ideas. Based on insights obtained from validating the ideas through user testing, a design strategy emerges. Figure 52 visualizes this process.

### 06.02.01 Observe of people's behavior at possible locations

As human behaviors are affected by context, **observing people's behaviors in the possible locations of the installation provides an understanding of the design focus of different phases of the experience.** Locations of the university campus, train station, and shopping mall are examined, considering the following two questions:

- Q1: What are the patterns of people's behavior in public space? (06.02.02)
- Q2: How would the behavioral patterns of people at the locations influence their interaction with the design? (06.02.03)

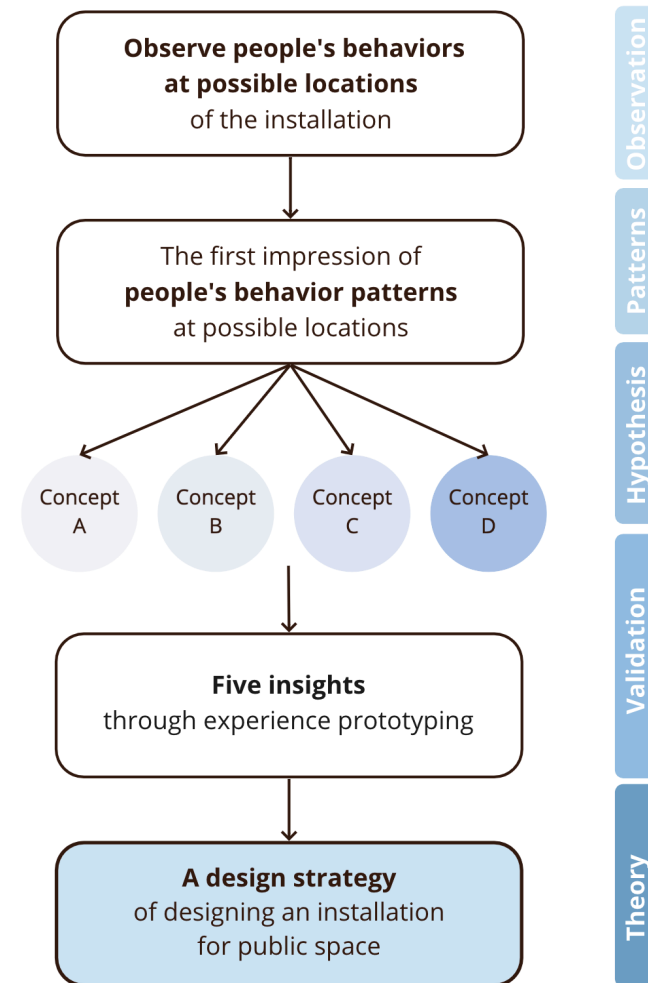


Figure 52. Process of defining the design strategy

### 06.02.02 First impression of people's behavior patterns

When introducing an installation to a public space, one needs first to consider people's existing behaviors shaped by the characteristics of the context and people's do-goal in the context. The observation at possible locations gives the first impression of people's behavior patterns (Figure 53), answering the Q1 in 06.02.01.

Q1: What is the **pattern of people's behavior** in public space?

**Pattern 1:** People in public spaces are usually preoccupied with other tasks; therefore, they **pay little attention or even be indifferent to anything else in the environment**.

**Pattern 2:** People have **limited patience and time to figure things out**, especially when the things are not relevant to what people are doing.

**Pattern 3:** People might **feel insecure when having the potential of being judged** by others when doing strange things in public.

How do these behavioral patterns influence people's interaction with the installation? Insights on how to design installation for the pattern were gain in the next section.

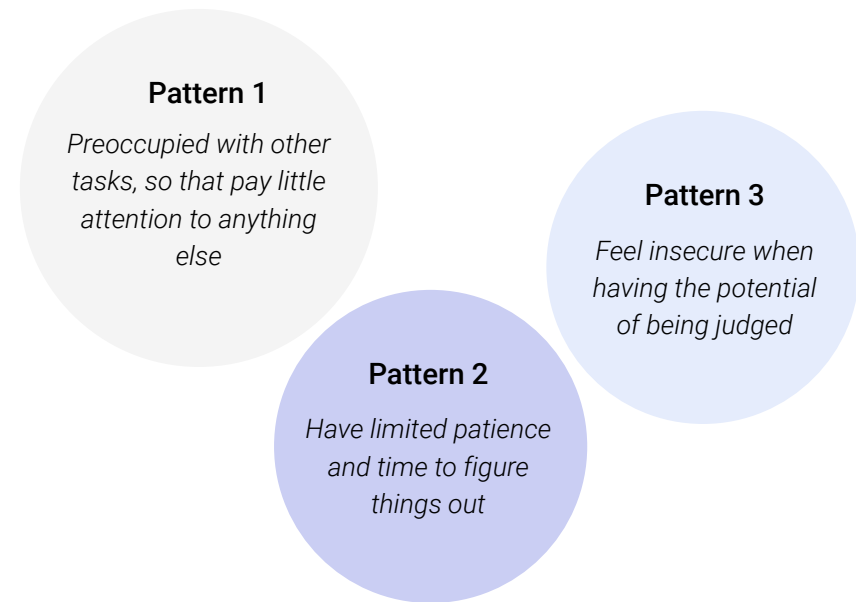


Figure 53. First impression of people's behavior patterns

### 06.02.03 Four concepts and their testing

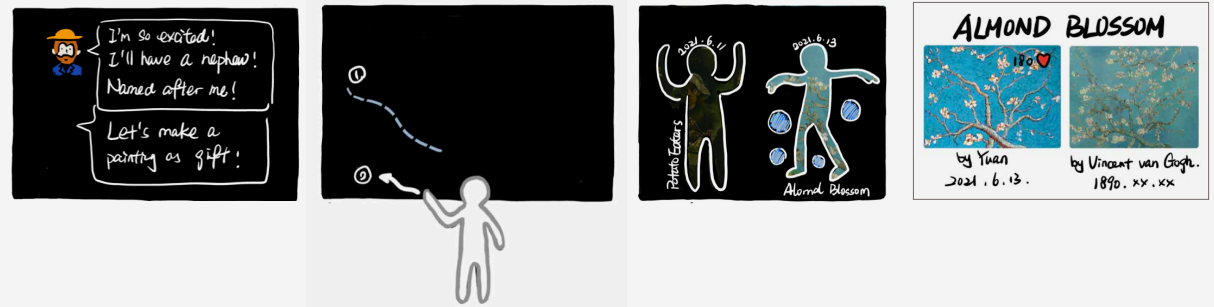
After observing people's behavioral patterns at possible installation locations, hypotheses were made on how to intervene in the existing patterns, which were translated into four tangible concepts (Figure 54) to test whether the elements in the concepts work or not. For the detailed description of each idea, see Appendix D.

The four concepts were tested using Wizard of Oz, with lo-fi paper prototypes, controlled by myself to interact with the user. See the user's direct reactions to the elements of the ideas, whether the features work or not, were clear. The speed dating method was also used to complement Wizard of Oz, where visualization and description of the four ideas are shown and help participants reflect on their experience during Wizard of Oz.

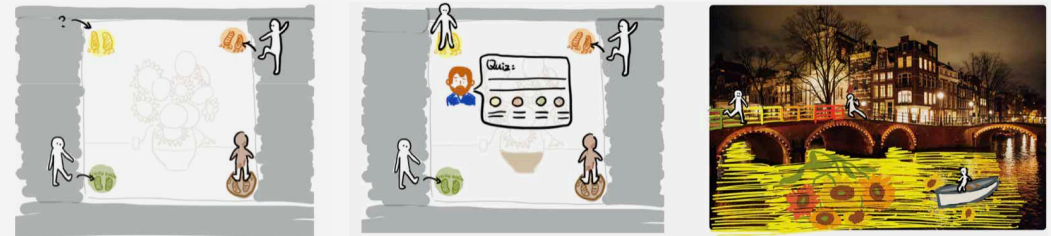
#### Concept 1. Coloring the masterpieces of Van Gogh



#### Concept 2. Recreating Van Gogh's masterpieces with backstories



#### Concept 3. Coloring masterpieces by correctly answering questions



#### Concept 4. Learning the path of Van Gogh's artistic development through his letters

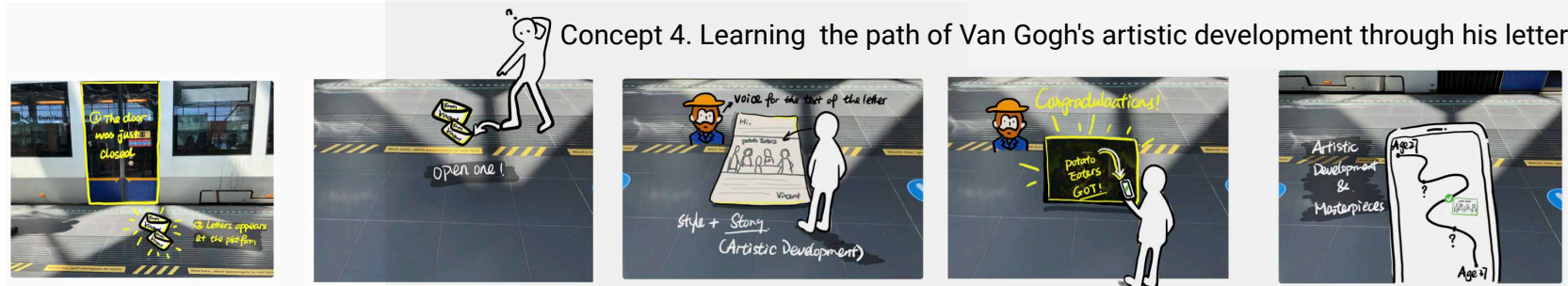


Figure 54. The storyboards of the four ideas

#### 06.02.04 Five insights from the testing

The insights 1 to 5 from prototyping and testing in the following pages answer Q2 in 06.02.01.

Q2: How would the **behavioral pattern** of people at the locations **influence their interaction** with the design?

##### Pattern 1

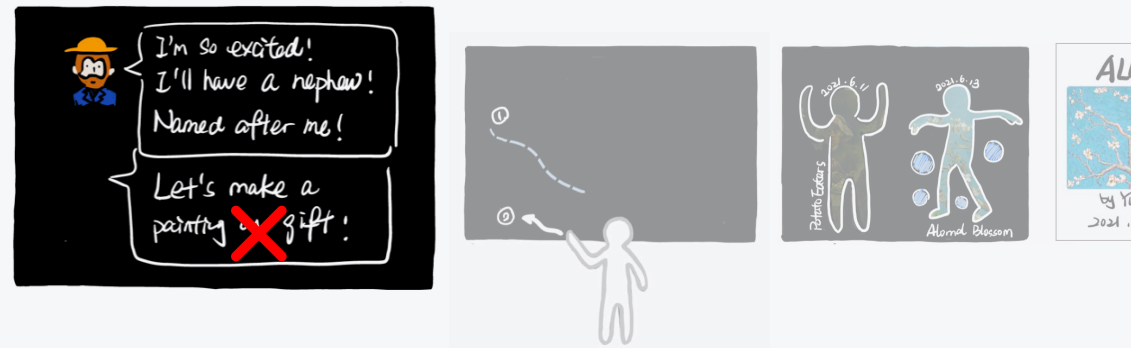
*Preoccupied with other tasks, so that pay little attention to anything else*

**Insight 1: A visually salient trigger is necessary. It draws people's attention to the interactive installation** (Figure 55), such as the colored tiles on the ground (Concept 1) and the envelope on the platform (Concept 4) as opposed to the text-based trigger in (Concept 2). Curiosity drives participants to interact with the trigger and see what will happen. Designing installation for public space, where people are not prepared for an informative experience at the beginning, a visually salient trigger draws people's attention and sets an explorative start.

#### Concept 1. Coloring the masterpieces of Van Gogh



#### Concept 2. Recreating Van Gogh's masterpieces with backstories



#### Concept 4. Learning the path of Van Gogh's artistic development through his letters

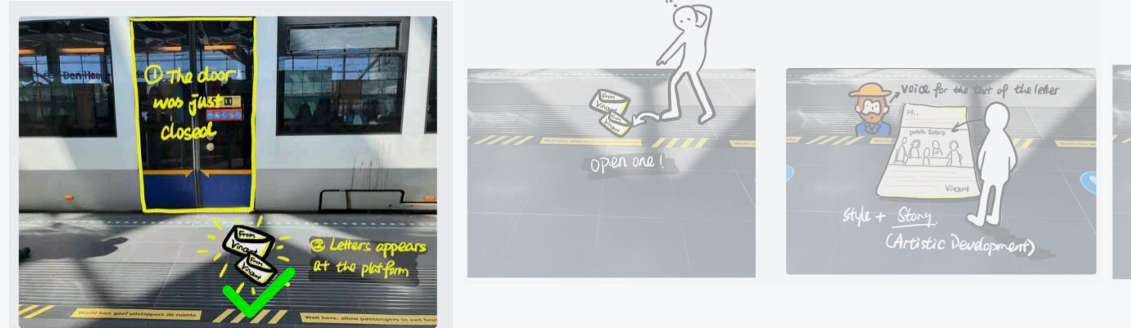


Figure 55. Attempts to catch people's attention in public space



## Pattern 2

*Have limited patience  
and time to figure  
things out*

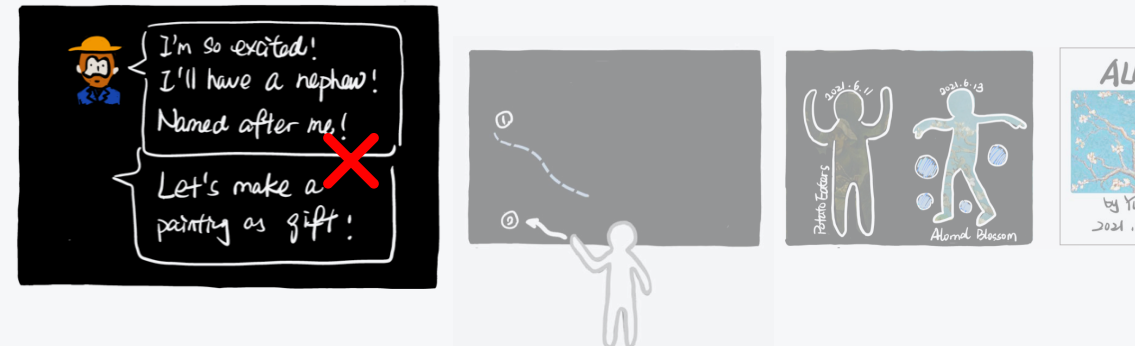
### Insight 2: Content should approach people gradually during the installation-people interaction.

A large amount of information shown together at once during the interaction with the installation would turn people's interest off quickly (Figure 56) because of the perceived high cognitive effort. Instead, if the information is discovered step-by-step through active participation, people feel motivated to learn more.

#### Concept 1. Coloring the masterpieces of Van Gogh



#### Concept 2. Recreating Van Gogh's masterpieces with backstories



#### Concept 4. Learning the path of Van Gogh's artistic development through his letters

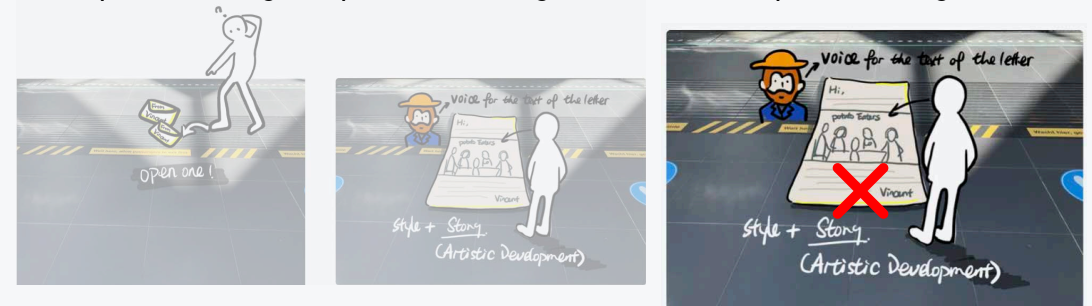


Figure 56. Attempts to engage people with the presentation of content.

### Pattern 2

*Have limited patience  
and time to figure  
things out*

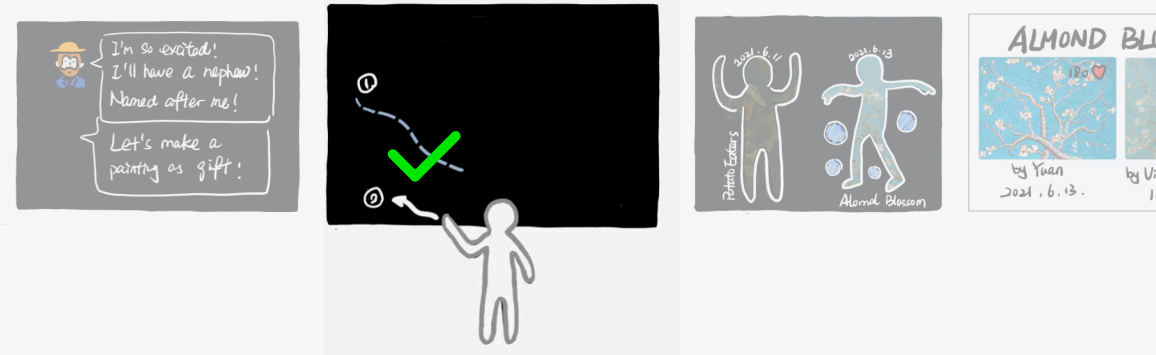
### Pattern 3

*Feel insecure when  
having the potential  
of being judged*

**Insight 3: The affordance of the installation should be clear and straightforward.**

People appreciate the clear instruction given by Van Gogh in Figure 57- Concept 2. They feel annoyed if they know they can do something but have little clue how to. For example, the way to interact with the envelopes in Figure X-Concept 4 confuses them. Instead of taking action directly, participants prefer to ask how to interact, which shows their insecurity. Especially when interacting with the installation in public, this tendency might be enhanced. Therefore, if the intended interaction is inconsistent with what people perceive, they might give up within a few seconds.

### Concept 2. Recreating Van Gogh's masterpieces with backstories



### Concept 4. Learning the path of Van Gogh's artistic development through his letters



Figure 57. Affordance of interaction



## Pattern 2

*Have limited patience  
and time to figure  
things out*

### Insight 4: Unpredictable results/variations of output engage people more with the experience.

Concept 1 coloring masterpieces and Concept 4 learning through Van Gogh's letter (Figure 58) are not very attractive to the target group due to the predictable feedback. People lose interest quickly when interacting a few times.

### Insight 5: Flexibility of participation of experience in a public environment is necessary.

It is problematic when the installation requires a certain number of people to join (Figure 59). Although collaborative experience often enhances people's motivation to participate, it also lowers the possibility of people interacting with the installation when becoming a hard rule.

## Concept 1. Coloring the masterpieces of Van Gogh



Figure 58. Lack of variations of input and output

## Concept 3. Coloring masterpieces by correctly answering question

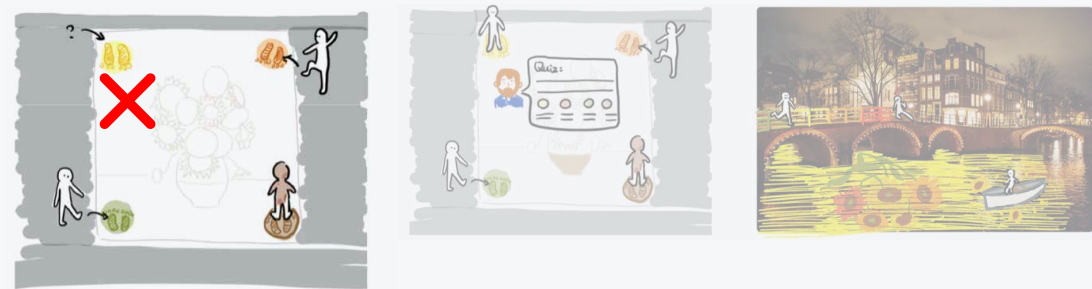


Figure 59. Lack of Flexibility of participation in a public environment

### 06.02.05 Design strategy: Four phases of interaction

Based on the insights from user testing, a design strategy for designing an installation for the public environment is proposed, containing four phases of interaction (Figure 60): 1) *Visual attention*, 2) *Awareness*, 3) *Engaging*, and 4) *Discovery*, where information should gradually build up throughout the four phases. The insights used for building the design strategy are in accordance with the findings of the literature of Audience Funnel (Michelis & Müller, 2011), where general patterns of people's reactions to interactive displays in public were discussed.

#### *Phase 1: Visual attention*

In Phase 1, **a visually outstanding while the content-relevant trigger is necessary as the first step to draw people into the experience.**

Different from experiencing art in museums, people in a public environment are often busy with their tasks; therefore, they pay little attention to something that seems irrelevant.

#### *Phase 2: Awareness*

In Phase 2, **immediate feedback of what interaction the installation affords should be explicit** after people perceive the presence of the installation. It attracts people further and encourages them to interact.

#### *Phase 3: Engage*

In Phase 3, **content should be revealed layer-by-layer through active interaction.** Because of the limited patience of people in public, **what interaction the installation affords should be clear, but what people get from interaction should be unexpected by output variations**, making them more curious and engaged.

#### *Phase 4: Discover*

At the end of the experience, **access to more educational content** should be available for people who want to discover more about Van Gogh's stories and art.

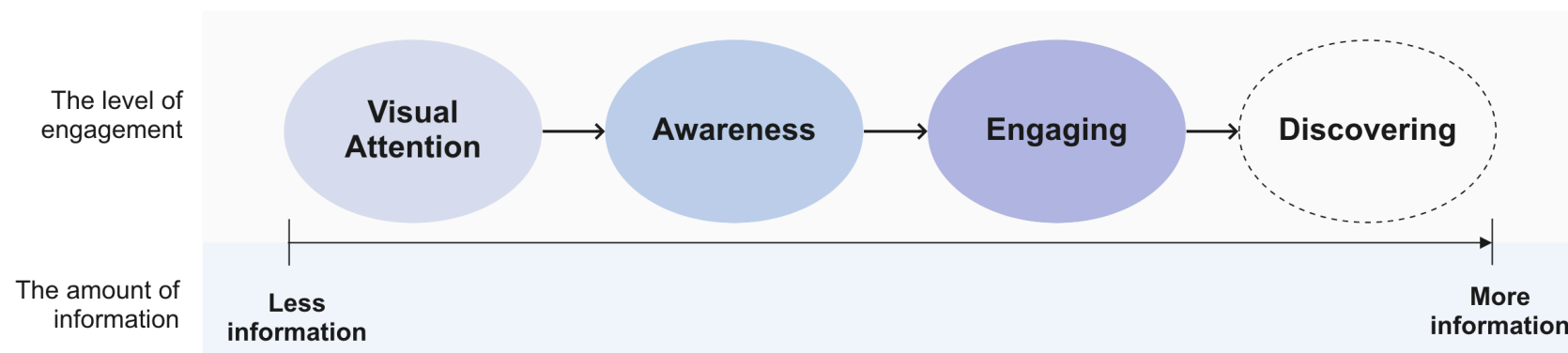


Figure 60. Design strategy: Four phases of interaction

## 06.03 Conclusion of Chapter 06

Chapter 06 consists of two cycles of ideations with different aims:

Cycle 1 investigates 1) the feasible input and output of the design from a technological perspective and 2) how to integrate interaction with the content of VGM in a balanced and engaging way. In addition, 3) by examining the similarity of four initial ideas and based on the literature, the essence of MR surfaces. As a result, MR experience with real-time continuous data input and output is the aim of the project.

Cycle 2 researches 1) behavioral patterns of people in public and 2) how they might influence people's interaction with the installation. Based on the insights from testing the four ideas, 3) a design strategy with four phases of interaction is proposed for designing installation in public space, which provides a clear structure for the converging concept in the next chapter.



# CHAPTER 07

## The Converging Concept

| Method: Brainstorming , Speed dating, Wizard of Oz

Combining the insights from testing and based on the design strategy of four phases of interaction, **a converging concept was created.**

However, with only the storyboard, it isn't easy to imagine the experience of the concept. Therefore, for effective communication, interactive prototypes were made by Java (programming language) in processing (a coding environment), which helps explain the concept and gather feedback.

Clients' feedback and user test results show the transitions between each phase of interaction confuse them. The shifts between the painting style and content make the whole experience separate apart. Therefore, **a content structure for layering information was created, providing a structured way to present the content.**



## 07.01 The Converging Concept

### 07.01.01 Converging concept description by storyboard

The converging concept is an interactive installation for public space with four phases of interaction (Figure 61). The installation uses full-body tracking sensors and projection as real-time input and output, providing an edutainment experience .

#### *Phase 1: Visual attention*

The installation shows a mirrored filtered environment in real-time with the iconic Van Gogh style. In principle, everyone who presents in the vicinity of the installation could see a silhouette of themselves appears on the projection with the same style.

#### *Phase 2: Awareness*

While people are moving in front of the installation, their silhouette on the projection follows. This implicit interaction\* makes people aware of the presence of the installation. Some people might pause in front of the projection or moving toward it.

#### *Phase 3: Engaging*

The installation initiates the interaction by presenting a visual indication for drawing a shape from one of Van Gogh's masterpieces. If they draw accurately, the installation will reveal the painting.

#### *Phase 4: Discovery*

A digital letter automatically drops on the floor, showing a question related to the painting. Within a few seconds, the answer to the question appears, including an explanation of Van Gogh's iconic painting style and backstories of the painting.

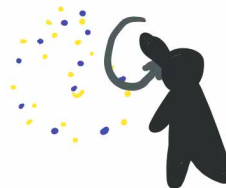
#### *Phase 1: Visual attention*



#### *Phase 2: Awareness*



#### *Phase 3: Engaging*



#### *Phase 4: Discovering*



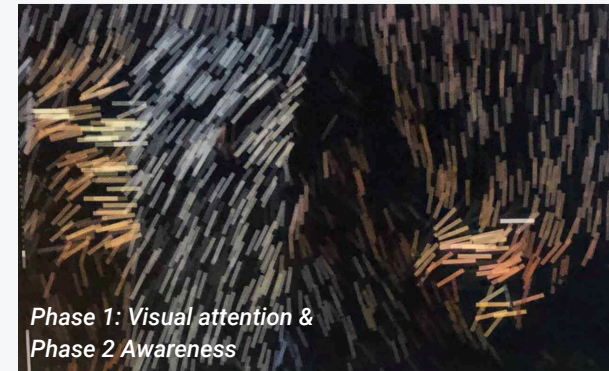
Figure 61. The storyboard of the converging concept with four phases of interaction

**Implicit interaction:** An action, performed by the user that is not primarily aimed to interact with a computerized system but which such a system understands as input. (Serim & Jacucci, 2019)

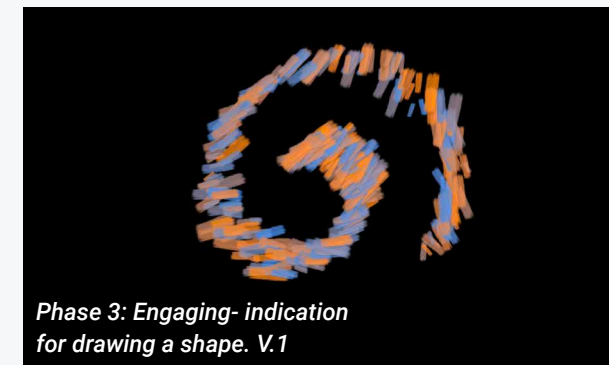
### 07.01.02 Refining the converging concept by coding

While the storyboard shows the overview of the converging concept, it is hard to imagine how the experience feels like in reality. In addition, some details of the experience are not clearly defined yet, such as the precise visual effect in Phase 1 and 2, the indication for drawing a shape, etc. These elements are most difficult to understand without making them tangible. Prototyping by coding helps refine the details. Figure 62 shows the effects of Phases 1, 2, and 3.

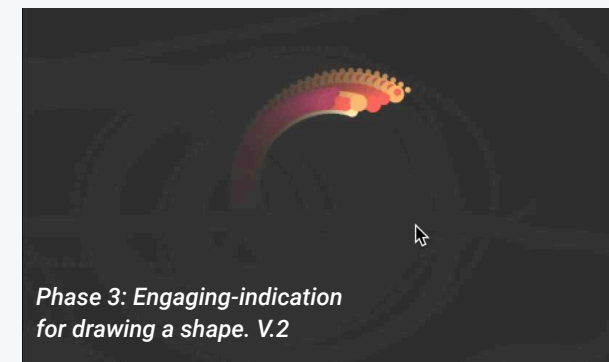
The prototypes were later used in the testing in 07.02 combined with Wizard of Oz to gather more comprehensive feedback.



Based on Tadokoro, A. (2019, July 28). Video Sketch.



Based on Farina, C. (2015, November 4). Advanced Brush design in Processing.



Based on "Mover class: Flocking" by Diana Lange (Teachings)



Figure 62. The effects of the converging concept by coding in Processing



## 07.02 User Test of the Converging Concept

### 07.02.01 Goal of the user test

The goal is to understand people's experience of the whole concept and their reactions to the elements in the four interaction phases. Questions to answer through the user testing :

- Q1: Can the Van Gogh style filter **attract participants' attention** (Phase 1)? If so, what would they do afterward (Phase 2)?
- Q2: Would people **understand the intended interaction** when seeing the indication of drawing a shape (Phase 3)?
- Q3: How do they think about the **overall experience**?

### 07.02.02 Test setup and participants

The user test was conducted using Wizard of Oz with seven participants from the target group, three students from the faculty of Industrial Design Engineering, and four people working in the tech industry.

In-person and video tests were combined. Although being aware of in-person tests is optimal, the COVID-19 pandemic when the test was conducted limits the number of physically available participants; therefore, some tests were done through video calls to gather more feedback. Figure 63 shows the environment and setup. For tests conducted by video calls, a phone was placed in front of the projection.

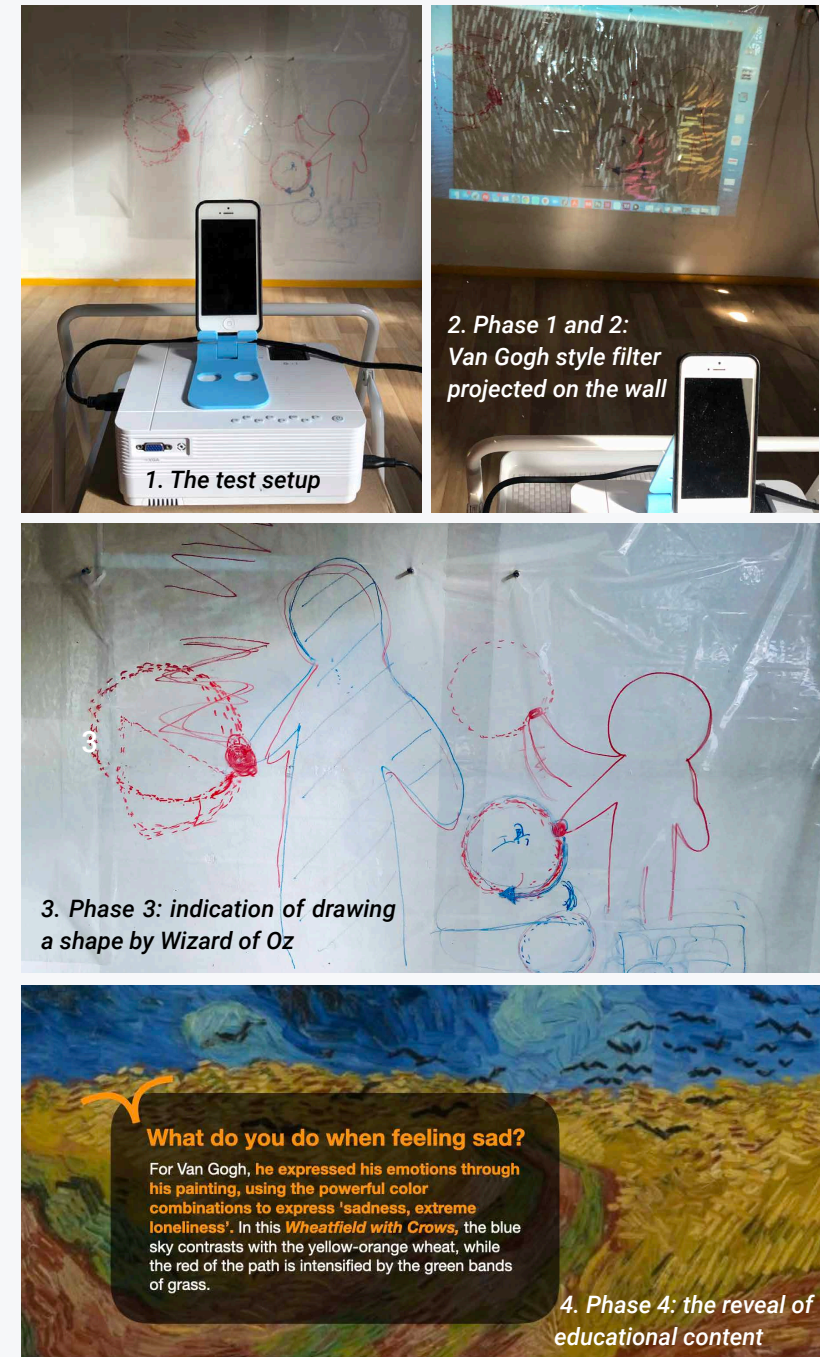


Figure 63. The testing environment and materials

### 07.02.03 Testing procedure

1. Try out the prototypes: Participants were asked to act as if they come across the installation in a train station and imagine their reaction. If they act as intended, they can enter the next phase. If they are stuck, a short discussion takes place. For Phase 3 of the experience, the interactions were simulated by drawing manually on the wall (Figure 63-3). For Phase 4, slides with educational content were shown (Figure 63-4).
2. Understand the intended interaction and experience by storyboard and reflect their experience with the prototypes.
3. Discuss the experience and questions posted above.

### 07.02.04 Insights from testing the converging concept

The insights from the user test answer the questions in 07.02.01.

Q1: Can the Van Gogh style filter **attract participants' attention** (Phase 1)? If so, how would they react (Phase 2)?

Yes, the Van Gogh style filter is salient enough to draw people's attention to the installation and make them curious. They would wave their hands or walk towards the installation. (7/7 participants)

*"If I weren't busy, I would walk toward it while waving my hand. But if I were in a hurry, I would watch how the it reacts to other people ..."*  
- Participant S.

Q2: Would people **understand the intended interaction** when seeing the indication of drawing a shape (Phase 3)?

No, the indication is **counterintuitive**. Even when showing their hand is being tracked, only 2 out of 7 people acted as intended.

*"Isn't it a tool that I can use to do something?"*  
- Participant H.

*"I think ... I should destroy the circle. You know the game Fruit Ninja?"*  
- Participant G.

Q3: How do people think about the **overall experience**?

While participants perceive the **Van Gogh style filter** positively and like the **way educational content is provided** through a digital letter with a question, there are several aspects that should be improved:

**1) Interaction and content in different phases are felt isolated.** Although elements in each phase are all related to Van Gogh and his art, participants who know little about him cannot perceive the connection between phases, which indicates that **a logical content structure is needed**. (4/7 participants)

*"I feel weird when the installation asks me to do so many things but finally shows something about Van Gogh."*  
- Participant H.

**2) Educational content appearing in the last phase is easy to be missed.** The educational information is now only provided in Phase 4; however, if people leave in the middle of the experience, the educational goal of the museum fails to achieve. (2/7 participants)

*"I wouldn't spend more than one minute on an installation in public space."*  
- Participant S.

**3) The unexpected transitions between each phase make people feel out of control.** Some people want to play around in one phase longer, but the installation automatically switches to another phase. (3/7 participants)

*"It doesn't give me enough time to take a selfie before switching to another phase."*  
- Participant W.

For a visualization of the main insights (Figure 64), see the next page.

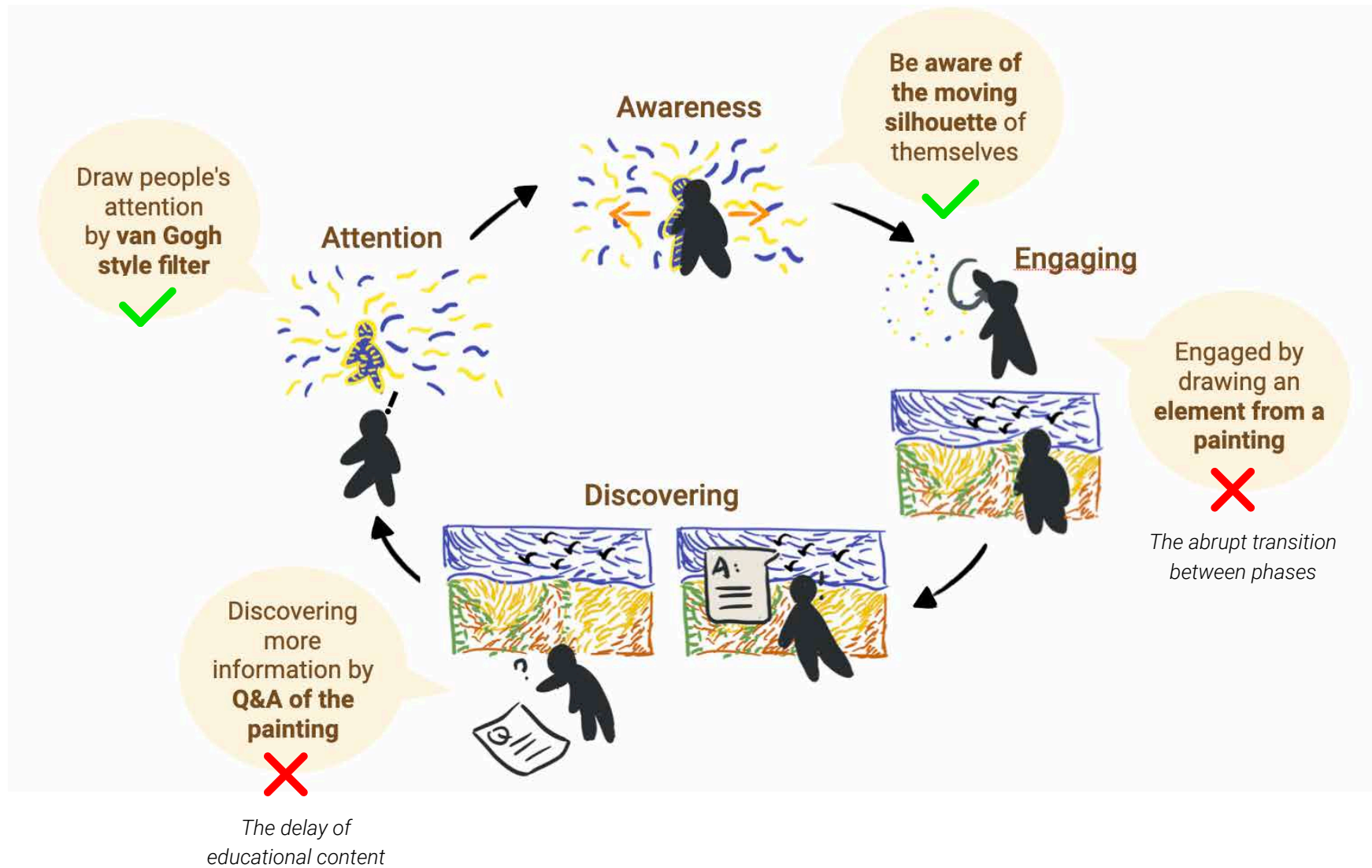


Figure 64. A visualization of the main insights from user testing

## 07.03 Clients' Feedback on the Converging Concept

While the insights from the user test center more on details of the converging concept, the client's feedback provides a holistic view.

### 07.03.01 Need for a logical interaction and information combination

**The interaction and information consisted in the experience should be one coherent and cohesive story.** The story starts from attracting people by the iconic Van Gogh brushstrokes in Phase 1 and 2; however, in phase 3 and 4, the engaging and discovering phases, the focus shifts to a specific element from a painting and the use of colors, without making the connection to his style and brushstrokes. **The lack of logical connection between style, a shape in a painting, and story and emotion makes the whole experience separated apart** (Figure 65), which uncovers the underlying reason why participants think the content and interaction in different phases are isolated.

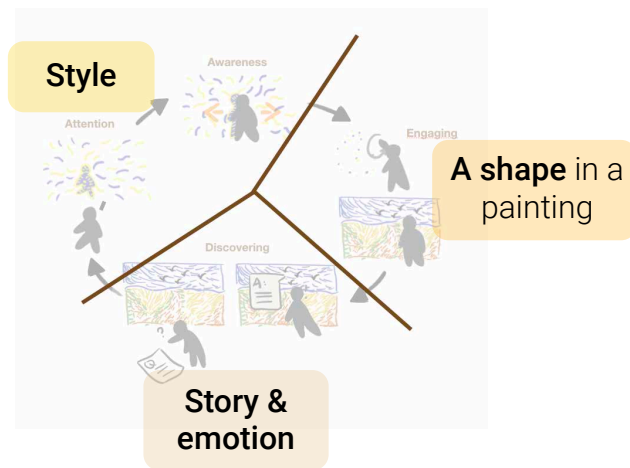


Figure 65. The focused content of each phase

### 07.03.02 System thinking for human-installation interaction

When positioning the installation in a system, more questions emerge. What would the interactions be like when more than one person interacts with the installation? How would the presence of other people affect the interaction? Would it be possible to connect the installation to the website or other channels of the Van Gogh Museum? These questions are worth considering for the development of the final concept.

The relation of the questions can be explained by the diagram in Figure 66, which shows the basic factors that play a role in the human-installation interaction (Shackel, 1984). The installation, the user and their goal, and the public environment where the interaction takes place. For the installation, it functions in networks with other products or channels of VGM. Also, other people are involved in or affected by the user's product use. The diagram provides a structured way of thinking about the answers to the questions by clients and detailing the concept.

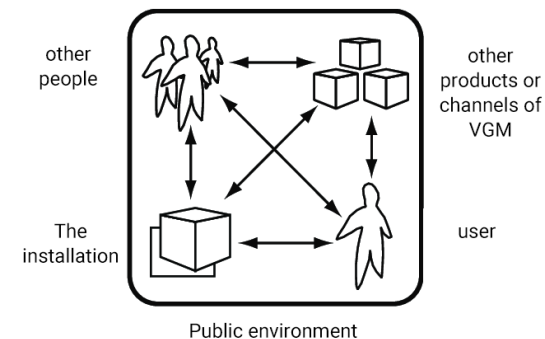


Figure 66. Human-installation interaction



## 07.04 The Content Structure for Improvements

Based on the feedback from both users and clients, the fundamental problem is uncovered - The converging concept lacks a coherent storyline connecting four phases. **There should exist at least one thing that is consistent between all four phases.** The obtrusive transitions, the unclear indication of interaction, and the delay of the presentation of educational content, etc., all these aspects are related to this fundamental problem.

Based on the insight from 06.02.04, content should be conveyed gradually in the experience. **The iconic brushstroke of Van Gogh possesses various information levels, an optimal source embedded in the story** (Figure 67), from purely visual effects, painting techniques and colors that affect the visual impact, the emotions expressed through the style, and the connected backstories. All these different information are related to the brushstrokes but gradually getting a deeper level, finally build a connection between Van Gogh's style and his stories, the goal of the graduation project set up to achieve.

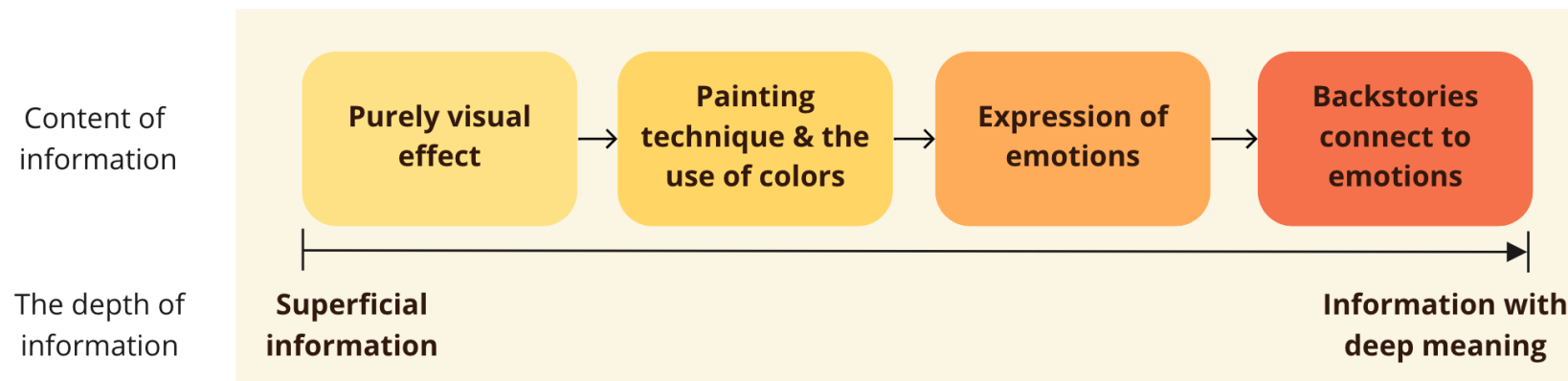


Figure 67. Storyline by Van Gogh's iconic brushstrokes

## 07.05 Conclusion of Chapter 07

In this chapter, a converging concept is created based on the insights and design strategy in Chapter 06.

The converging concept was tested with participants and discussed with clients to gather insights. After diving deeply to the core of the insights, its most critical and fundamental problem surfaces: The logical and meaningful connection of the content of each phase is missing. A storyline is needed to compose the content about Van Gogh into one coherent story.

This insight leads to the creation of a content structure, which helps in organizing the information conveyed, from purely visual to finally arrive at the deep meaning level progressively, where Van Gogh's stories are told logically and more understandably.



# CHAPTER 08

## Final Concept

**Method:** prototyping & coding, observation, questionnaire, interview, literature review

Based on the design strategy and content structure from previous chapters, the final design (Meet Van Gogh in the City) is created, described in detail, including the final concept in four phases and its overview, the interactive prototype and its development, the enabling technology, and the three examples of the content composed by content structure.



## 08.01 The Final Concept in details

The final concept is an installation designed for public space, using Van Gogh's iconic style, swirl brushstrokes mirror the environment around (Figure 68). When people actively interact with the installation, it gradually introduces content (different every time), linking the visual style, painting techniques, and color to emotions and the connected backstories. The layered content provides information step-by-step and ends up with access (QR code) to discover more about Van Gogh's life and art.

For its users, the experience is inspiring with explorative interactions. They encounter the installation unexpectedly in public space, attracted by it visually and being engaged in the process with constant feedback from the human-installation interaction that impacts them visually, cognitively, and even emotionally.

In the following sub-sections, the final concept is described phase by phase, emphasizing the input and output of the interactions.



Figure 68. Final concept

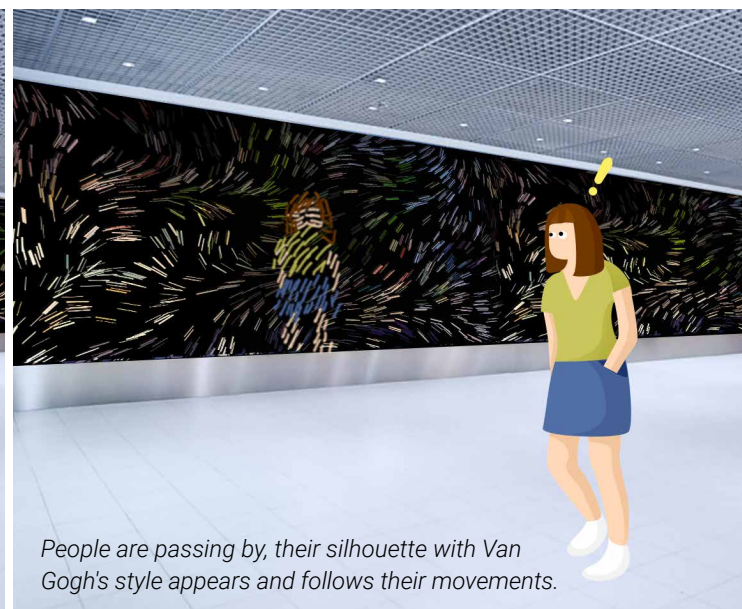
### 08.01.01 Phase 1: Visual attention

When the installation is in **standby status**<sup>1</sup> (Figure 69-1), it mirrors the environment with **thin brushstrokes that** follow swirling paths, mimicking Van Gogh's iconic style in **low saturated** colors. The **strokes are constantly moving**, which is intended to attract people's attention.

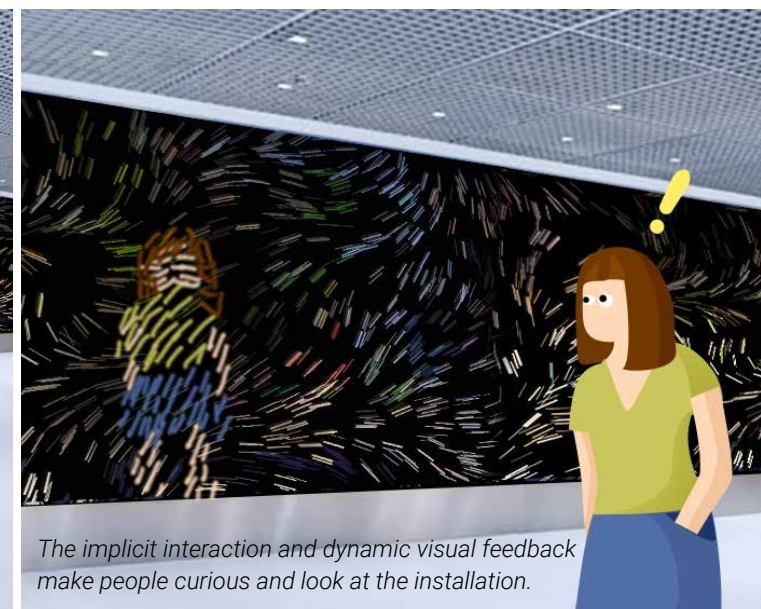
When people pass by, their **silhouette with** Van Gogh's style **appears** on the installation and follows their movements (Figure 69-2). **This implicit interaction**<sup>2</sup> and **dynamic visual feedback** make people look at and be curious about the installation (Figure 69-3).



Installation is in standby status, mirroring the environment with low saturated colors and thin swirl brushstrokes.



People are passing by, their silhouette with Van Gogh's style appears and follows their movements.



The implicit interaction and dynamic visual feedback make people curious and look at the installation.

Figure 69. Phase 1: Visual attention

**1. Standby status:** When no people within the detectable distance

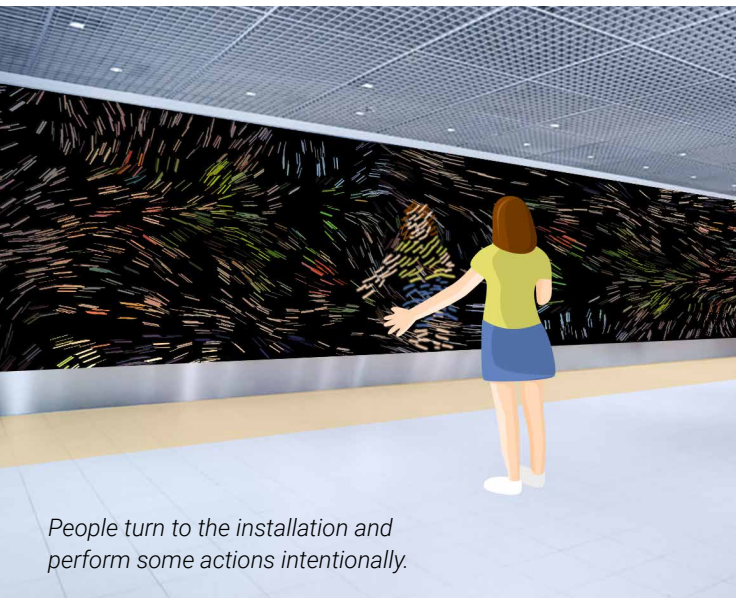
**2. Implicit interaction:** "an action performed by the user that is not aimed to interact with a computerized system but which such a system understands as input (Schmidt, 2000)."



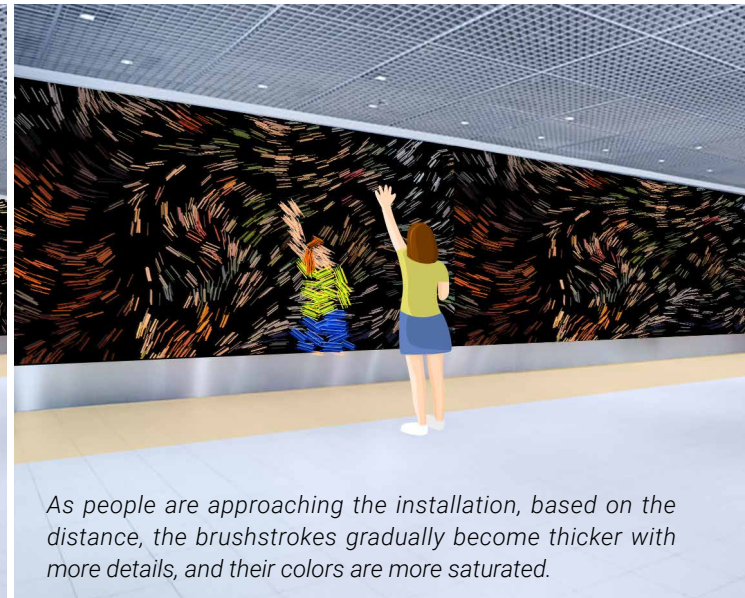
### 08.01.02 Phase 2: Awareness

After perceiving the proactive feedback from the installation, people are attracted and perform some actions intentionally, such as walking towards the installation and waving their hands (Figure 70-1).

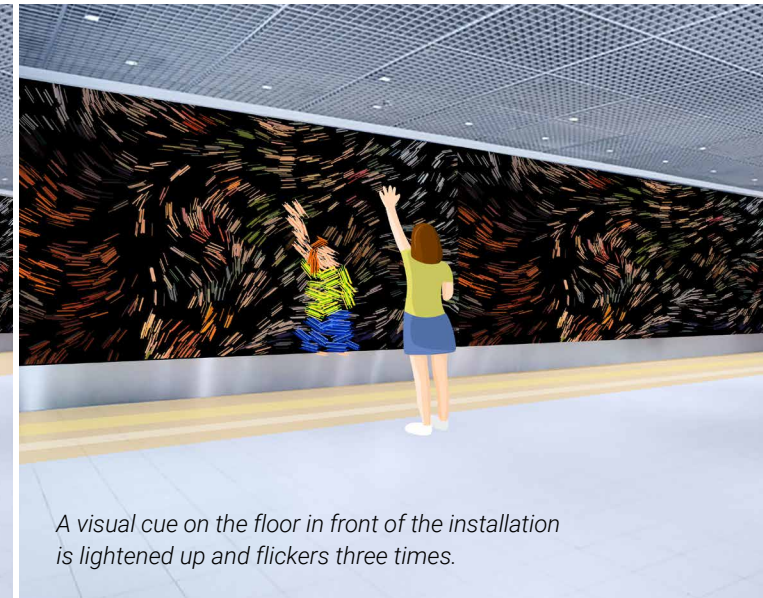
As people approach the installation, **the brushstrokes gradually become thicker and more colorful with more details, based on the distance between the people and installation** (Figure 70-2), which serves as real-time feedback to the direct interactions. **The progressively changing brushstrokes make people aware of the impact of their actions on the installation and draw their attention** to the unique visual style of the brushstrokes. It simulates the experience they have in art galleries. When being closer to a painting, more details are visible. Meanwhile, a visual cue on the floor in front of the installation is lightened up and flickers a few times (Figure 70-3), which indicates something might happen if they step into the area.



*People turn to the installation and perform some actions intentionally.*



*As people are approaching the installation, based on the distance, the brushstrokes gradually become thicker with more details, and their colors are more saturated.*



*A visual cue on the floor in front of the installation is lightened up and flickers three times.*

*Figure 70. Phase 2: Awareness*

### 08.01.03 Phase 3: Engaging (part 1)

When people step into the highlighted zone, **one of their hands is automatically being tracked** by the installation (Figure 71-1), **drawing brushstrokes with a random pair of complementary colors** (in the case of the storyboard in Figure X is yellow and blue) wherever the user's hand moves (Figure 71-2). **Along with the brushstrokes drawn freely by the user, bubbles pop up with the content about Van Gogh's painting technique, associated painting, and his story in the order of the content structure in 07.04 (Figure 71-3).**

The ongoing session will be terminated if users step out of the highlighted zone in the middle of the experience. If they step into the zone again, a new pair of colors associated with different contents will be assigned, which **provides variations of content**.

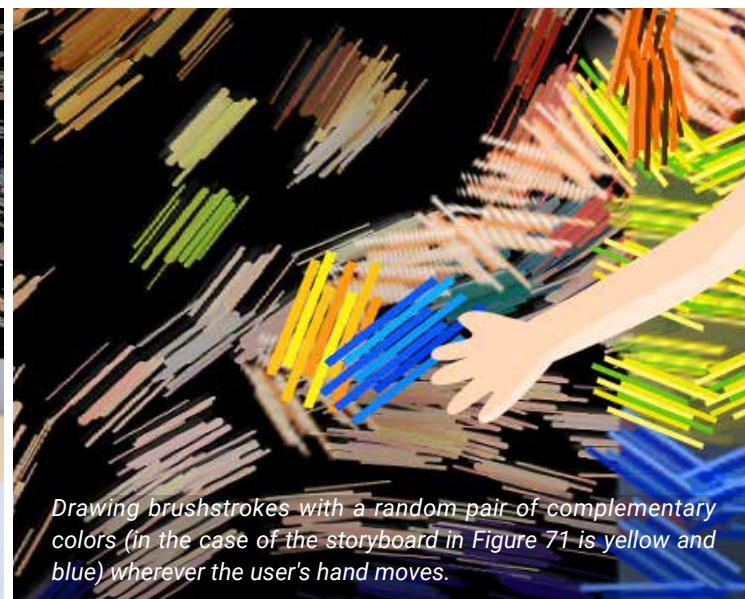


Figure 71. Phase 3: Engaging (part 1)



### 08.01.04 Phase 3: Engaging (part 2)

Each time a new bubble popping up, the user obtains a small piece of information (Figure 72-1), which lowers their cognitive effort of digesting the content and triggers their interests to discover more hidden contents by physically interacting with the installation.

After going through all the contents, a QR code pops up (Figure 72-2), allowing the user to discover more similar contents of Van Gogh's life and art on Van Gogh Museum's website or get their portrait with iconic Van Gogh style captured during their experience (Figure 72-3). The user can continue to draw whatever they would like without displaying bubbles until they detached from the highlighted zone and enter again.

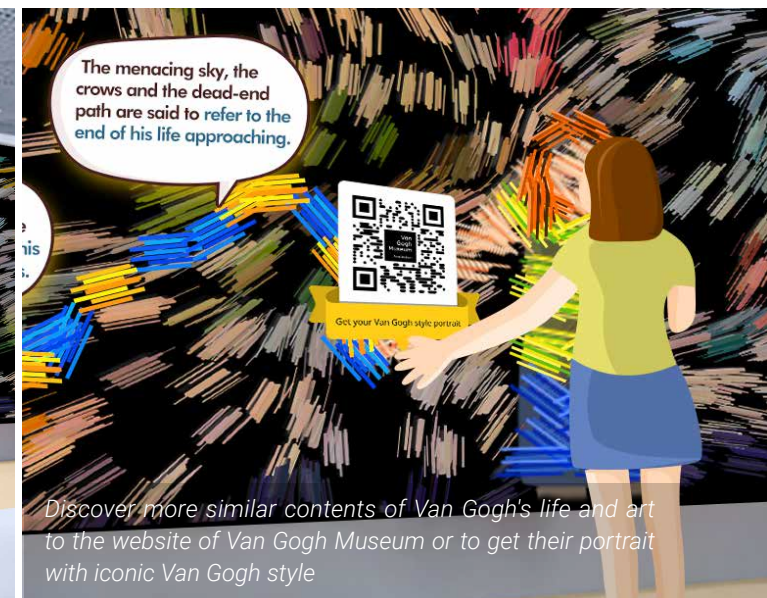
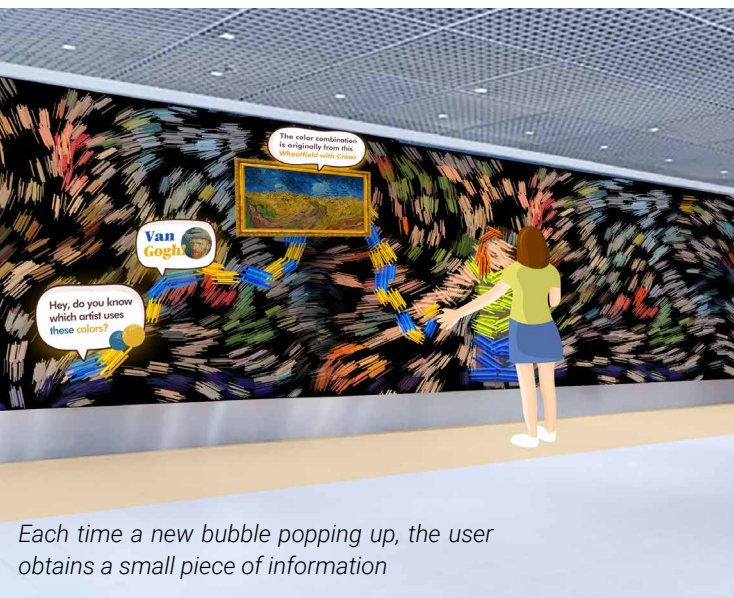


Figure 72. Phase 3: Engaging (part 2)



#### 08.01.05 Phase 4: Discovering

Figure 73 shows the last phase of the experience. The user scans the QR code and chooses whether they would like to discover more of the life and work of Vincent Van Gogh or save their portrait with iconic Van Gogh style captured during their experience.

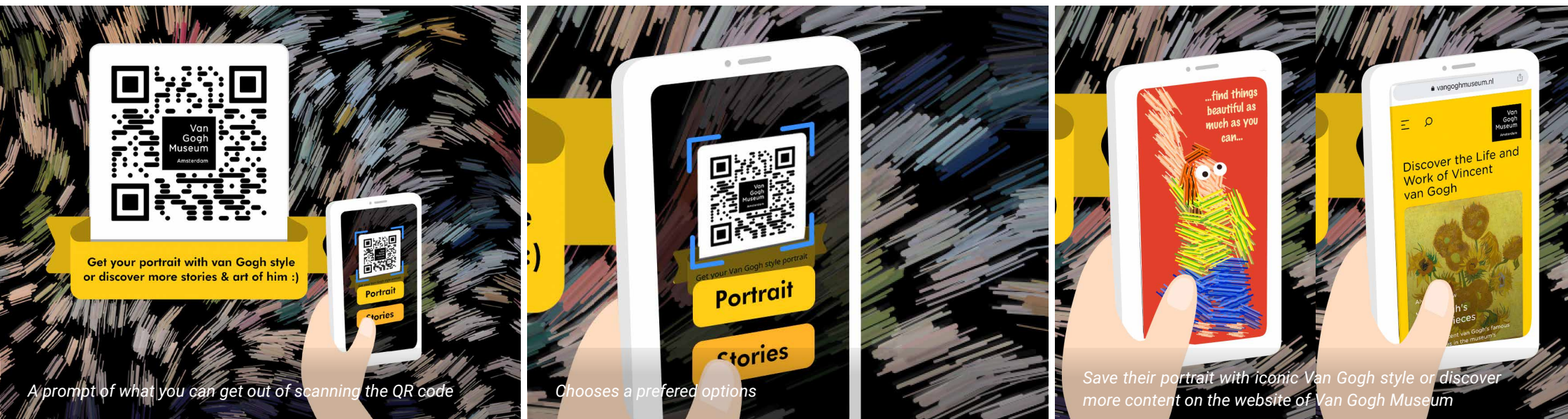
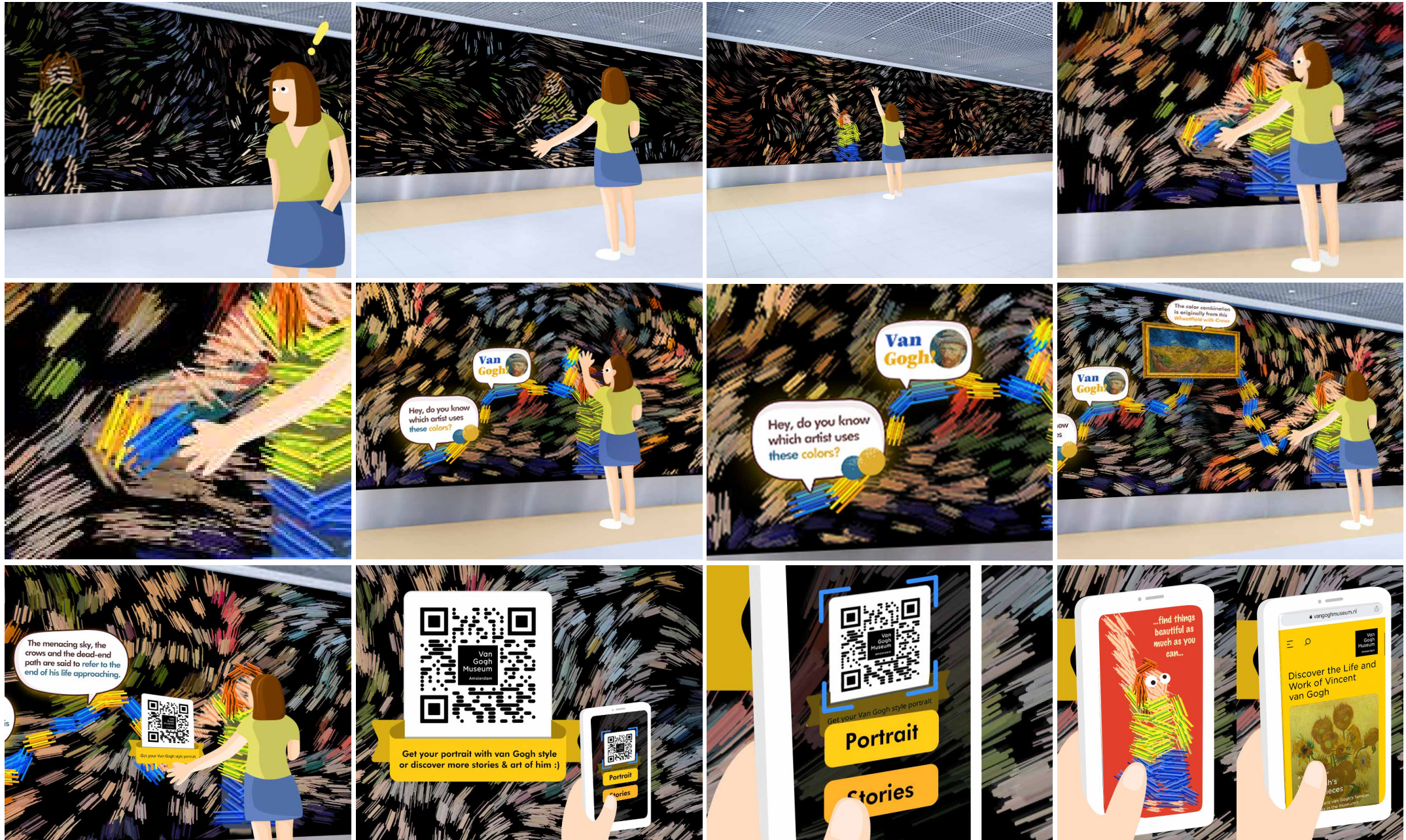


Figure 73. Phase4: Discovering



## 08.02 The Overview of the Final Concept





## 08.03 The content examples of the Installation

The content structure serves as a reference for organizing content. In execution, however, not every piece of content fits it exactly. Moreover, the content needs variations to engage people. Therefore, the **structure should be used flexibly and leave space for adaptation based on the specific content**. Two examples below show the way of using the structure. It starts with a question to trigger people's interest, and then the answer connects it to deeper levels of relevant information.

### Example 1

Q: Hey, do you know which artist uses these colors?

A: Van Gogh!

#### Technique and color:

The color combination is originally from this Wheatfield with Crows.



#### Emotion:

The blue sky contrasts with yellow-orange wheat to express his sadness and loneliness.

#### Backstory:

The menacing sky, the crows, and the dead-end path refer to the end of his life approaching.

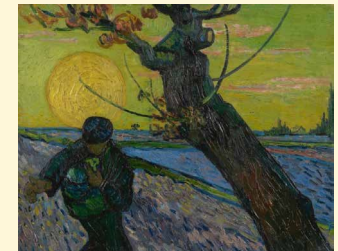
### Example 2

Q: What did you do last time you challenged yourself?

A: Vincent challenged himself by painting from imagination instead of from reality.

#### Technique and color:

In this painting, he assigned the leading roles to the greenish-yellow of the sky and the purple of the field. The bright yellow sun looks like a halo, turning the sower into a saint.



#### Emotion:

These colors were used to express emotion and passion.

#### Backstory:

Van Gogh had this attempt because, at the time, he was working together with Paul Gauguin, who believed Van Gogh should draw less on reality and more on his imagination.

## 08.04 The Underlying Technologies in the Final Concept

The detailed concept description in previous sections of this chapter shows how the human-installation interaction feels based on the input and output of the system. In this section, the underlying technical features of the concept, i.e., estimating the distance between camera and people, and tracking hand, are introduced.

### 08.04.01 For distance detection

In the final concept, the installation can sense the distance between the camera and the people in front of it (Figure 74). According to the changes in distance, it shows different visual effects to the users. This interaction is achieved by depth estimation, usually supported by a stereo camera (Szeliski, 2010), together with machine learning (ML) algorithms to sense the distance. Typical products are ZED 2 camera, Kinect and ASUS Xtion, etc. Other solutions can enable the designed interaction by a plain camera with BlazerPose, which is a lightweight

convolutional neural network architecture for human pose estimation (On-Device, Real-Time Body Pose Tracking with MediaPipe BlazePose, 2020).

### 08.04.02 For hand tracking

Another essential feature of the final concept is tracking the position of the user's hand and leaving traces whenever it moves (Figure 75). It requires the users to be in front of the installation within a certain distance, such as the highlighted zone in the concept. This feature can be realized by pose detection. For each frame of video footage captured by the camera, a machine-learning algorithm is applied to detect the pose landmarks of the body of people in the frame, such as head, hand, and other critical points. Thus, the position of the hand of people can be tracked. This feature is supported by popular products, such as the ZED 2 camera.



Figure 74. The application of depth detection in the final concept



Figure 75. The application of pose detection in the final concept



## 08.05 The Interactive Prototype

Figure 76 shows some images of the interactive prototype of the final concept. The effect was created based on the existing code of Procedural Van Gogh. (2020, January 1) to simulate the swirling brushstrokes of Van Gogh's style. ColorTracking by Shiffman, D. (2017, May 7) was also used to mimic the effect of hand-tracking by tracking the color of an object holding by a hand.

Without the stereo camera for distance detection (08.04.01), the gradually changing visual effect in Phase 2: Awareness phase (08.01.02) is simulated by manually controlling keyListener (assigned keys on the keyboard), which is considered sufficient enough for user testing.

However, the latest pose detection ML kit from MediaPipe (On-Device, Real-Time Body Pose Tracking with MediaPipe BlazePose, 2020) has not supported Java, the programming language used in the prototype. Therefore, hand tracking is achieved by tracking the object's color that the hand is holding to simulate the same interaction.

This interactive prototype is later used in both field tests and control tests in the evaluation chapter (Chapter 09).

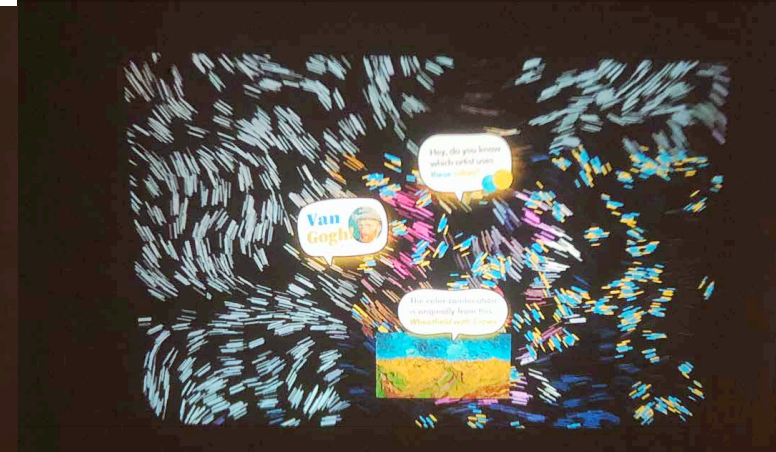
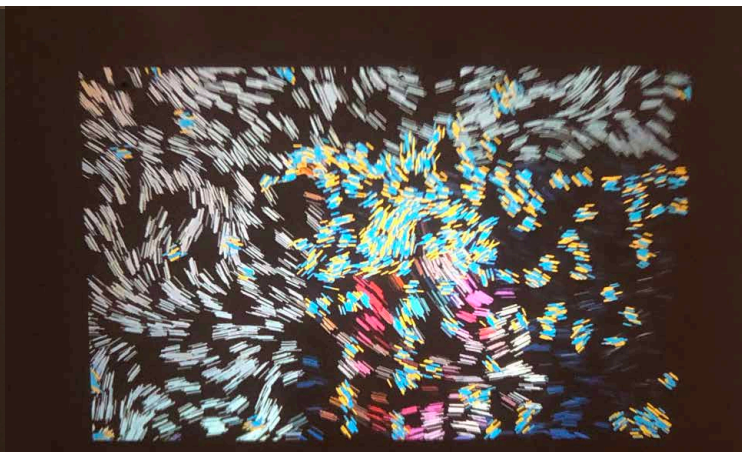
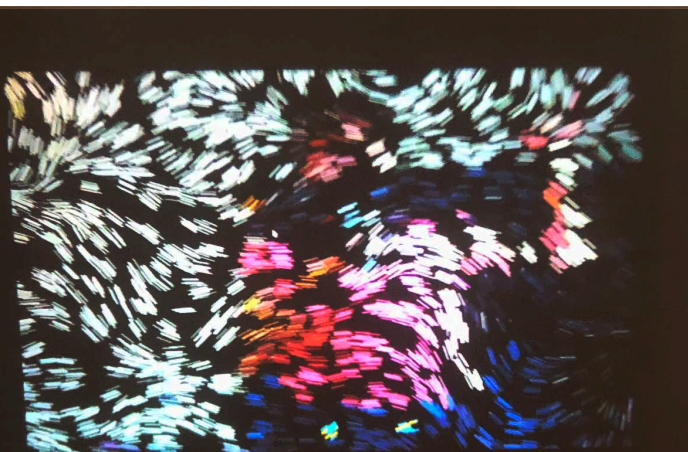
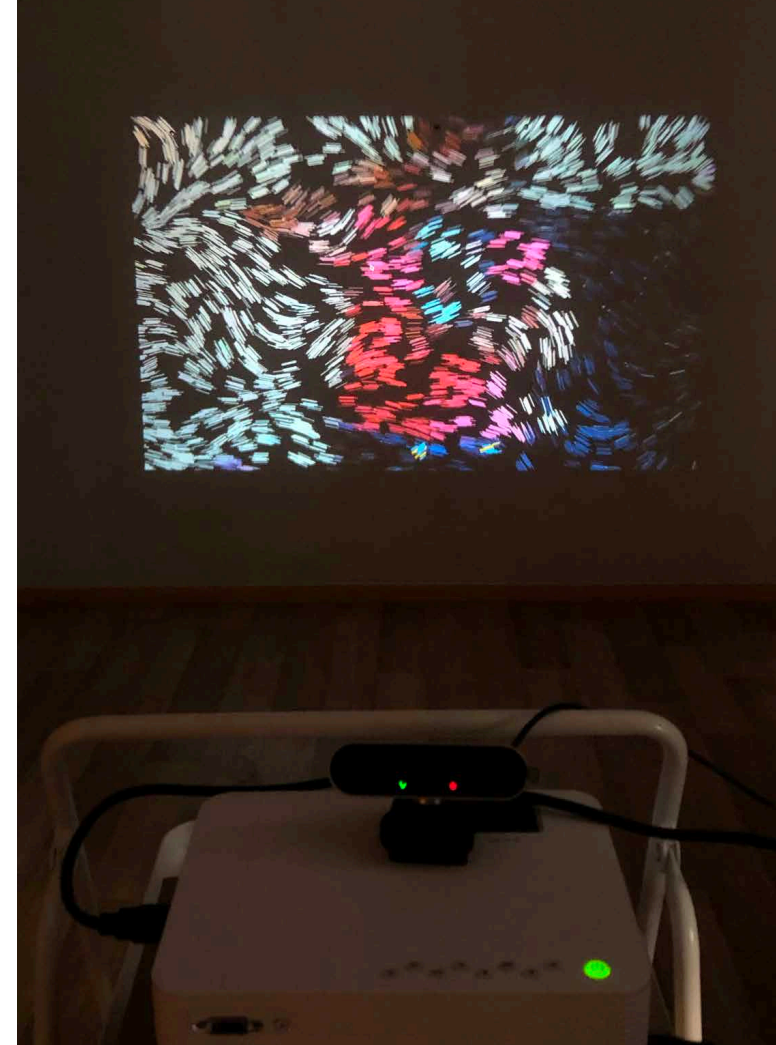
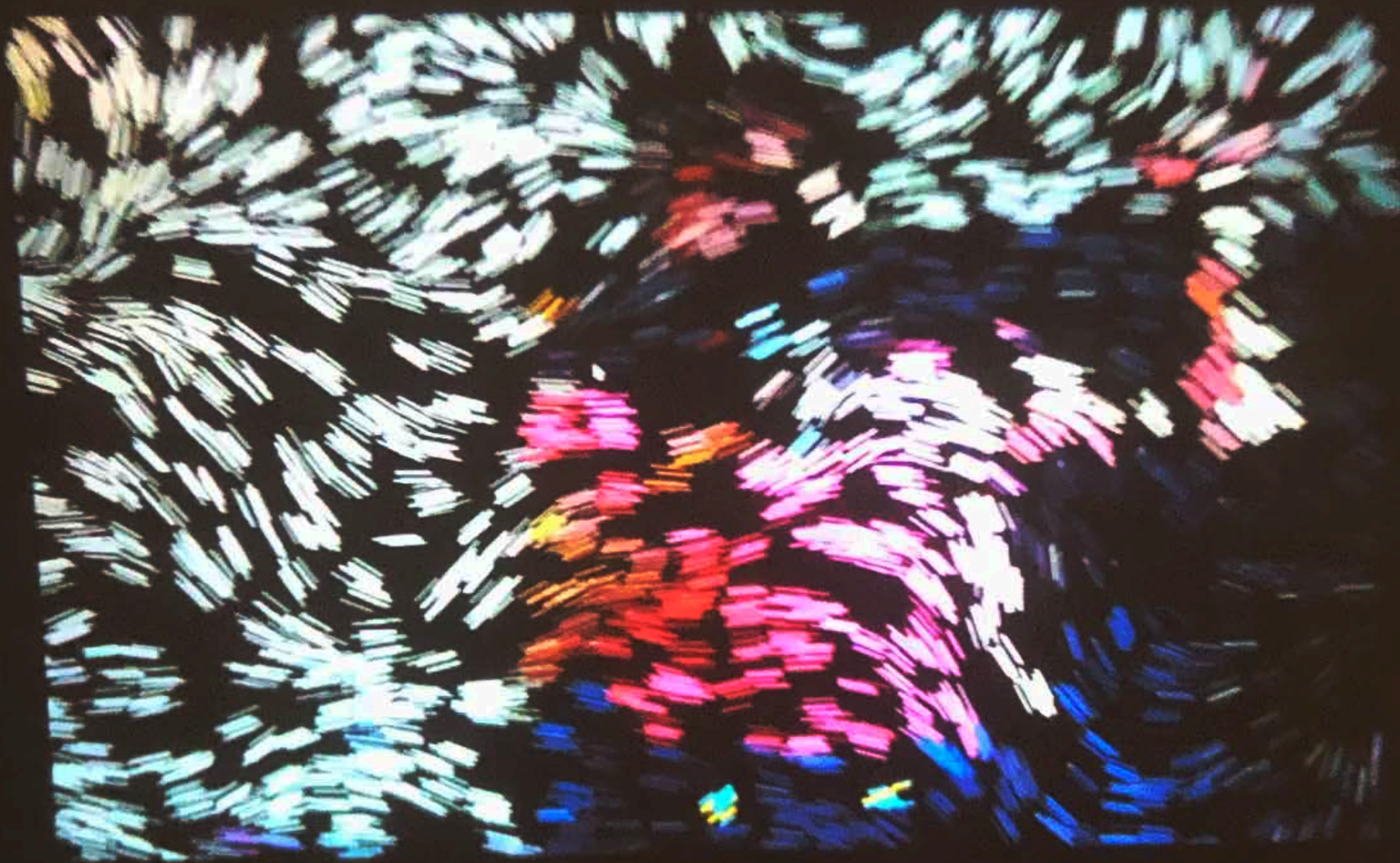


Figure 76. The Interactive prototype





*The visual effect of the final concept*



# CHAPTER 09

## Final Concept Evaluation

Control test, Field test, Interview, Questionnaire,  
Experience storyboard

In this chapter, the final concept evaluation and its results are presented and discussed.

The evaluation consists of two types - field test and control test. The field test aims to validate whether the design can catch people's attention in public environments, the prerequisite for the rest of the experience. The control test focuses on validating to what extent design achieves the design goal and the qualities in the design criteria. The conclusion is made at the end by looking at the analysis results of both tests as a whole.

This chapter concluded with a reflection on the limitations and recommendations for the final design.



## 09.01 The Field Test

### 09.01.01 The aim of the field test

The field test aims to evaluate to **what extent the effect of the interactive Van Gogh filter can draw people's attention and make people aware of the presence of the installation in public** (The first two phases of four interaction phases in Chapter 06).

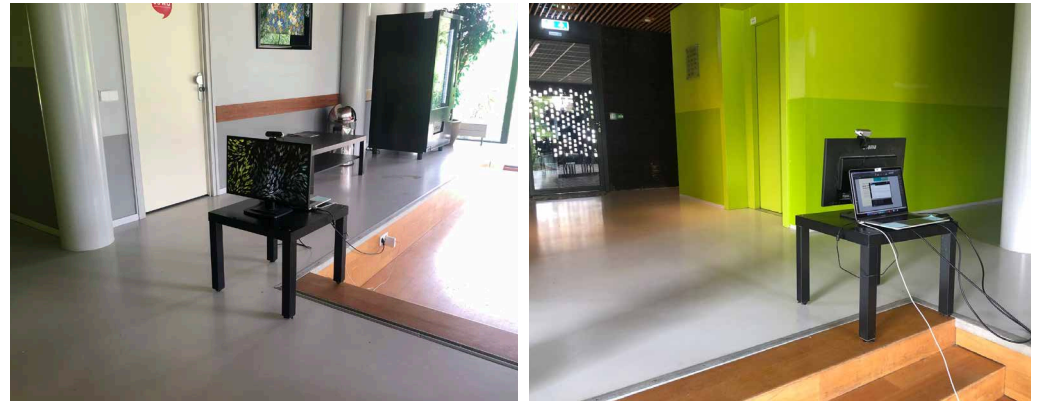
### 09.01.02 Field test setup

Two rounds of field testing were conducted in two different contexts (locations), where young people often go:

- The entrance of a student housing
- The corridor of the sports center X, TU Delft.

Figure 77 shows the two test setups at the two locations. Except for the conditions of the environment, other settings and devices are the same, including a webcam to capture the real-time environment, a 24-inch screen to display the captured surrounding with the Van Gogh filter effect, and a laptop connect to the webcam and the screen, placed behind the display for running the program.

**Conducting the field test in two different locations helps compare how people's mindsets in different contexts affect their interaction with the design.**



*location 1: The entrance of a student housing*



*location 2: The corridor of the TU Delft sports center X*

*Figure 77. Test setup at two locations*

### 09.01.03 The method of the field test

The effect of the Van Gogh style filter was altered manually to an optimal detailed and saturated level before the test (Figure 78). The test runs for approximately **60 minutes** separately at two locations.

The researcher was at a spot of the locations where is close enough for clearly observing people's subtle behaviors, meanwhile, trying to be less noticeable by pretending to do something else and not directly looking at the installation.

The numbers of people passing by the installation were counted and categorized based on their **behaviors and degree of interaction**:

1. **Ignore:** People pass by but without giving any attention.
2. **Aware:** People who watch the display without further interaction.
3. **Active interact:** People who intentionally by waving hands or moving back and forth in front of the installation.

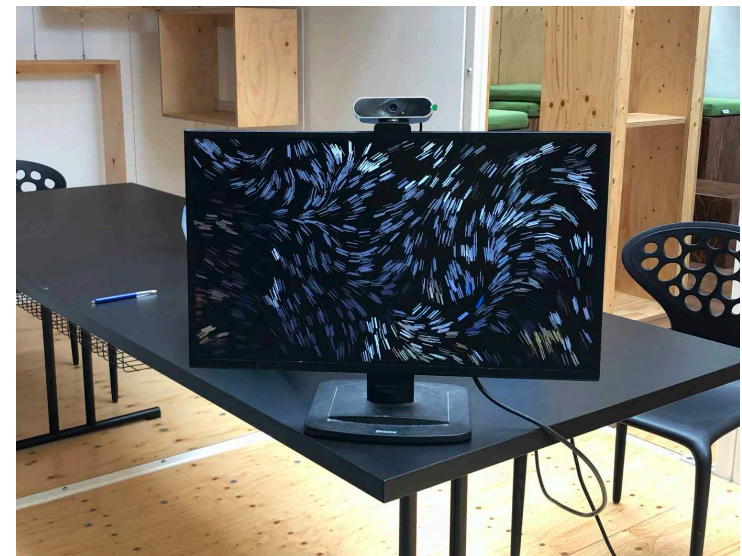
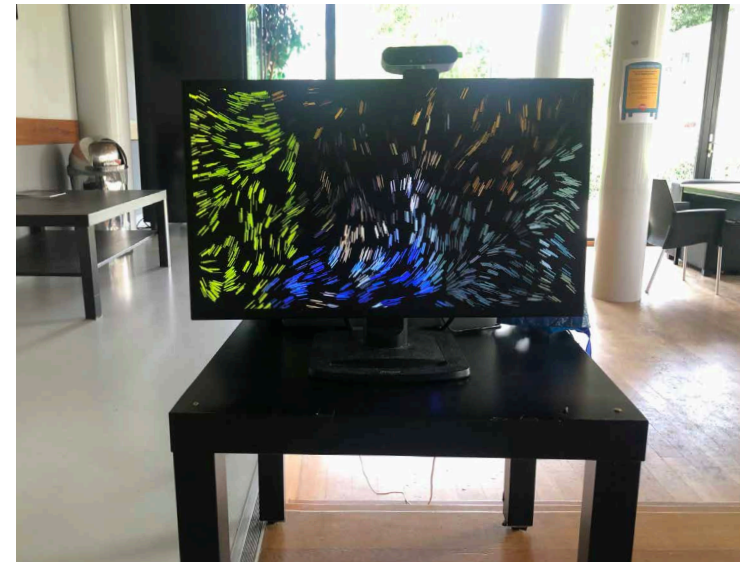


Figure 78. The effect of Van Gogh style filter shown in the test altered to an optimal detailed and saturated level

#### 09.01.04 Field test results

The test results consist of both quantitative and qualitative results.

##### *Quantitative results & its analysis*

As shown in Table 1, **the test result shows that the percentage of people's behavior at the two locations is significantly different.** For the entrance of the student housing, in an hour, among 15 people passing by the installation: 5/15 people ignored the installation. 8/15 people were aware of the presence of the installation. 2/15 people actively interacted by waving hands or moving back and forth in front of the installation. However, at the sports center X, most people (15/21) ignored the installation, only 6/21 people are aware of it, and no one actively interacts.

Behavior \ Location	The entrance of a student housing	The corridor of the TU Delft sports center X
Ignore	5 (33.3%)	15 (71.4%)
Aware	8 (53.3%)	6 (28.6%)
Actively interact	2 (13.3%)	0 (0%)
Total	15	21

Table 1. The numbers of people in three categories of behavior with the installation at two locations

**Insight 1: The visual effect is salient enough to draw people's attention in a public environment.** The conversion rates from "passing by" to "aware" in the two tests are 44% and 28.6% separately, which is a lot higher than or close to the result of a similar interactive installation (33%), Magical Mirrors in the same stage, used for generating *Audience Funnel* by Michelis & Müller (2011).

**Insight 2: The significant difference in the percentage of people's behavior at the two locations indicates the impact of their do-goal at specific locations on their interaction with the installation.** People at student housing are usually relaxing, compared to people at the sports center who might hurry to take a class. The different states of mind lead to the difference in their reaction to the installation. This insight provides a further reference for selecting locations of the installation.

##### *Qualitative results & its analysis*

Apart from the quantitative results, some behavioral results are also worth mentioning.

**Insight 3:** People who come across the installation with their friends are more likely to try it out and interact with it even if they ignored the installation in the first place; if their friends were interested in it, they would likely join. **Therefore, an even higher conversion rate can be expected when the installation is placed in an environment with more people because people's behaviors are influenced by others' reactions to the installation.** However, the test took place on campus during the summer holiday, and there were not many people around.

**Insight 4: Familiarity creates relevance.** If people come across the installation and are aware of it but have not actively interacted, they would be more likely to interact with it actively and be engaged the second time they pass by. This insight indicates that more people would actively interact if the installation is placed at the location for longer.

With insights above, a conclusion is made - the visual effect of the Van Gogh style filter is salient enough to draw people's attention.



### 09.01.06 Test limitations of the field test

#### 1. The limitation of assigned spot

Figure 76 in 09.01.02 shows the test setup, in which the visible difference in the condition of the two environments affects the test results. The test at the sports center, the spot assigned was not ideal, which is away from people's sight with a chaotic background, and the lighting was not good enough for the camera to capture colorful video. These might be reasons that lead to the difference in percentage in Table 1.

#### 2. The limitation of the test setup

- The size of the screen is significantly smaller than it is supposed to be in the final design; therefore, more easily be ignored.
- The presence of an obvious webcam makes people feel insecure; therefore, they might hesitate to interact and even try to avoid it.
- The screen was placed below the eyesight of people.
- The delay of the visual effect, which is due to the processing speed of a old laptop.

#### 3. The limitation of the prototype

Due to the lack of a stereo camera, the details and saturation of the Van Gogh filter cannot change automatically based on the distance between people and installation. However, to lower the researcher's influence on the test result, manually controlling the effect during the field test is not possible. The missing part of the visual feedback might also have a negative influence on the test results.

#### 4. The presence of the researcher in the testing environment

The research had to be present in the environment to observe people's subtle behaviors, which might affect the results, even if she tried to be less noticeable and pretended to be irrelevant to the installation.



Test location at the entrance of a student housing

## 09.02 The Control Test

### 09.02.01 The aim of the control test

The control test is used to evaluate **to what extent the final concept achieves the design criteria and goal**. In addition, **Ideas for further improvements** are obtained.

### 09.02.02 Control testing setup

The control tests took place at **two locations** (Figure 79), the faculty of industrial design (IDE) at TU Delft and the researcher's home, for the participants' convenience to recruit more people.

#### *The screen:*

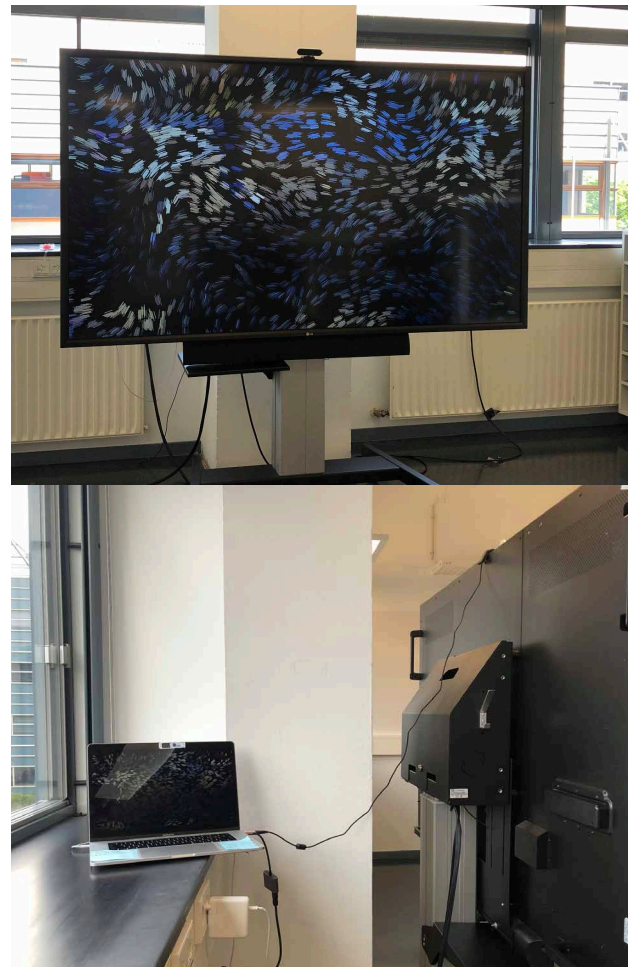
The tests at home use 1080p projection as output, whereas the tests at IDE use a large-scale screen. The size of the two displays and their quality are comparable.

#### *The placement of webcam:*

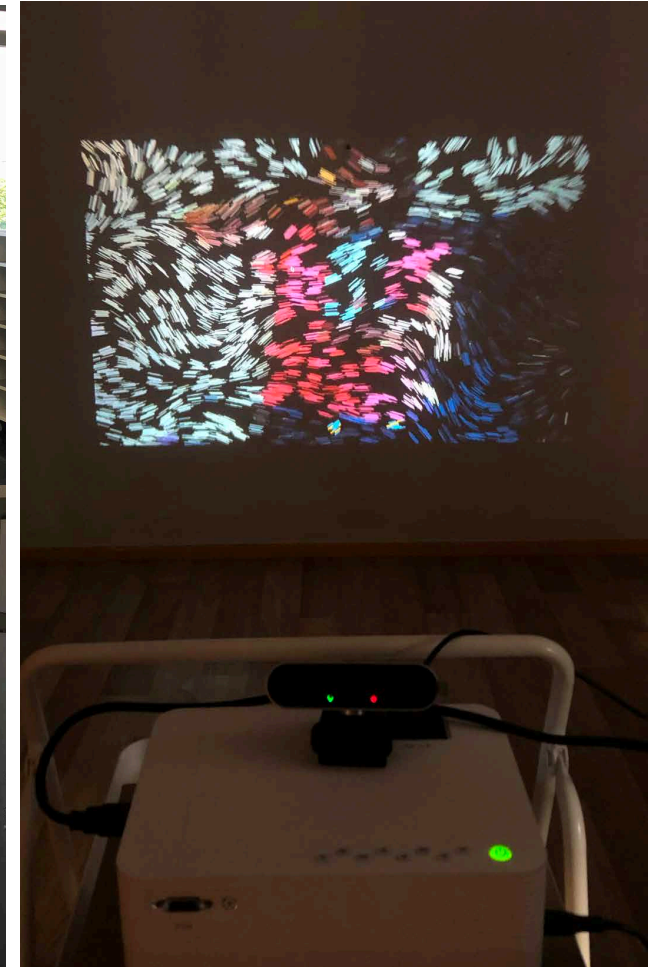
For the tests at home, the webcam, placed on top of the projector, whereas, for the tests at IDE, it is placed on top of the screen. The difference might result in slightly different output perspectives.

### 09.02.03 Participants

**10 participants** (age 18-35) were involved in the control tests— 5 people for each location. The participants are students and employees from various faculties at TU Delft, including IDE, 3ME, BK, AE, etc.



location 1: Test setup at IDE



location 2: Test setup at the researcher's home

Figure 79. The test setup at two locations



#### 09.02.04 The method and procedure of the control test

A brief background of the graduation project and the test procedure were given at the beginning of the evaluation, followed by the four test steps:

##### 1. User experience storyboard

The storyboard is shown to participants, providing a complete **overview of the experience** with the installation (see Appendix E-a). The participants were allowed to ask questions, which made sure they fully understood the purpose.

##### 2. Try out the interactive prototype

Participants **tried out the key features of installation** with the interactive prototype (Figure 80), through which they can feel the experience lively.

##### 3. Fill out the questionnaire

After trying the experience, participants filled out a questionnaire (For the questions, see Appendix E-b). **The questions aim to evaluate the visual effect, provided content, interaction, and overall experience of the final concept.** For the qualities of interaction, the questionnaire asks participants to rate pairs of words with opposing meanings. Some pairs are similar, which lowers the impact of different perceptions of the words.

##### 4. Semi-structured interview

Around five questions were asked regarding the overall experience, aspects they like or dislike, the intuitiveness of interaction, how other people's presence or change in context influences their interaction, etc and whether they would like to take further action to learn more content. These **aspects are closely connected to the aspects of the questionnaire.** Therefore, **the quantitative and qualitative results can help interpret each other, making the conclusion of evaluation more accurate and robust** (Interview questions, see Appendix E-c).



Figure 80. Experiencing the interactive prototype

### 09.02.05 The control test results & analysis

The questionnaire and interview results are analyzed separately. The overall evaluation results are concluded at the end of 09.02 (For more evaluation details, see Appendix E).

#### Questionnaire result & its analysis

Figure 81 & Figure 82 show scores of each evaluated aspect. In general, the design receives relatively positive quantitative feedback. Some initial assumptions and interpretations are made. The more concrete reasons behind the scores will be figured out by combining them with qualitative results from the interview later in this chapter.

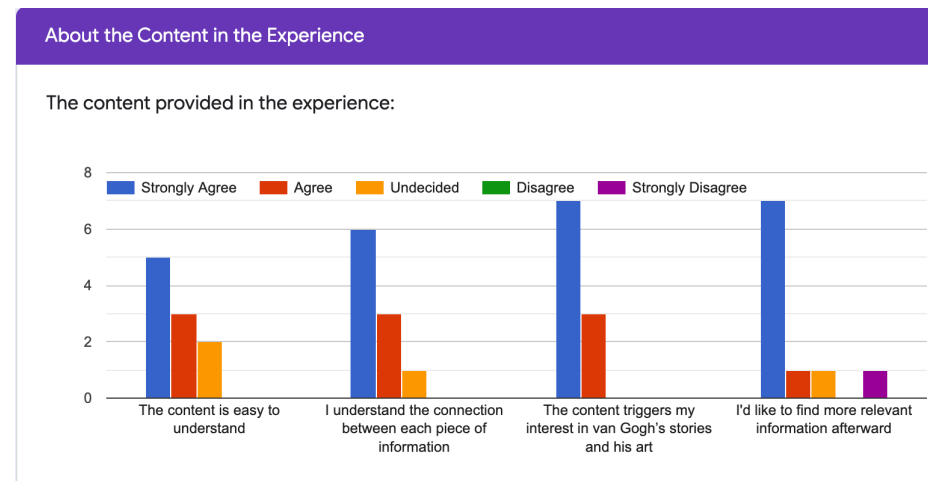


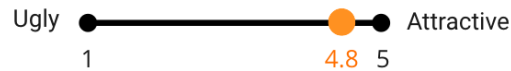
Figure 81. Questionnaire results of content provided in the experience

Q 1. The **content** in the experience:

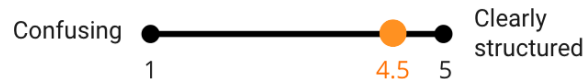
As the results show in Figure 81, people perceive the content provided in the experience positively, indicating two key aspects: the **cognitive efforts required are low**, and **the content can trigger their interest**.

- **The cognitive effort for digesting the information is acceptable.** 50% of people strongly agree & 30% of people agree that the content is easy to understand.
- **The content structure created in the previous chapter is effective and desired.** 60% of people strongly agree & 30% of people agree that they understand the connection of each piece of layered information.
- **The content in the experience triggers people's interest in Van Gogh's stories and his art** (70% of people strongly agree and 30% of people agree), which is the design goal of the project.
- **The content can stimulate people to discover more relevant content** (70% of people strongly agree and 10% agree), which is the first step to initiating the personal connection mentioned in the previous chapter.

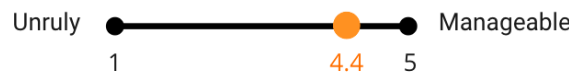
2. The **visual effect** of the installation



3. The **content** provided in the experience



4. The **interaction** with the installation



5. The **overall experience** with the installation

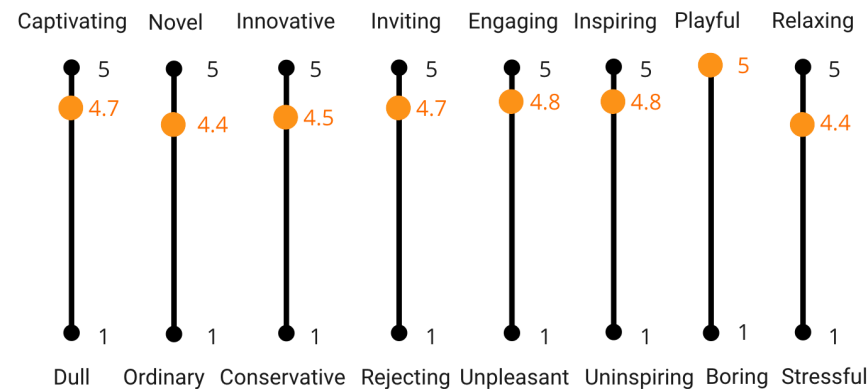


Figure 82. Questionnaire results on various aspects of the user experience

Q 2. The **visual effect** is highly appreciated (4.8/5).

Q 3. The **content** provided in the experience is clear structured (4.5/5).

Q 4. The **interaction** with the installation, compared to other aspects, receives a relatively lower score (4.4/5).

Q 5. For the **overall experience** with the installation:

Relatively **positive** aspects:

- Captivating (4.7/5) receives a high score, which might be because of the highly appreciated visual effect (Q 2).
- The qualities of engaging (4.8/5), inspiring (4.8/5), and playful (5/5), key elements of the design goal and criteria, are perceived very positively, indicating the success in achieving design goal and criteria.
- Inviting (4.7/5) has a relatively high score, which might be because the dynamic and proactive visual feedback makes people feel welcomed.

Relatively **negative** aspects:

- Novel (4.4/5) or innovative (4.5/5) are indicators of the extent to which the design can trigger people's interest or inspire them.
- Relaxing (4.4/5), this quality receives a relatively low score, which might be associated with the lo-fi prototype used in the test, resulting in higher cognitive effort when interacting with it (Q 4).

## Interview results & its analysis

The qualitative evaluation results will be first given from a holistic view, the overall experience of the final concept (Insight 1), and how specific design features contribute to the qualities of the experience (Insight 2, 3 & 4).

Secondly, insights into how other people's presence and context change influence the experience are discussed in Insight 5 as well as in Recommendations for Improvements, which helps predict how the installation might work in reality.

In addition, whether the design can successfully interest people were evaluated by asking whether they would scan the QR code for more related content (Insight 6).

Apart from the positive feedback of the above, several aspects are needed to be improved, discussed in the recommendation.

### Insight 1. The overall experience:

Participants used edutainment, playful, and surprising to describe the experience. The edutainment quality makes the experience inspiring, playful, and engaging, scoring high in the questionnaire results.

- **Edutainment (educational & playful)**

*"I like the educational part... especially for knowledge related to art, I think the general public lacks such knowledge." - Participant Y*

*"I feel like I am not simply looking at the painting... I am feeling it." -Participant P*

*"I was guided to pay attention to the details of a painting... the brushstrokes... the aspect I had never paid attention to when visiting the museum." - Participant P*

- **Playful**

*"It is such a playful experience if it is in the city. I would definitely like to interact with it!" - Participant S.*

*"It is super playful. I hope the museum can make it real someday!" -Participant S.*

*"If I come across in the city, I would take selfies. It is so interesting!" -Participant R*

- **Surprising**

*"I felt surprised when I realized it was because of my hand... I mean the brushstrokes left on the screen" - Participant P*

*"If I see this... in a metro station, some situations happening, I will be excited and curious and go close ...."-Participant M*

*"I can definitely attract my attention if it is in public. I am curious to see what will happen?" -Participant Y*



### Insight 2. The content:

Regarding the content, providing layered information with a logical connection of relevant information can effectively reduce participants' cognitive effort.

- **Lowering cognitive effort by layered information**

*"The bubbles pop up one at a time, which leaves me some time to think" - Participants DB.*

*"I like the Q&A. It progressively exposes new information and leaves me time to digest." - Participant G.*

*"The way the information provided also stimulates me to think..." - Participants D*

- **Lowering cognitive effort by connecting content logically**

*"The content is very organized, provided step by step"-  
Participants R*

*"My favorite part is the installation makes connections between the elements visually" - Participants P*

*"I like it introduces the story through the brushstrokes. I think a lot of people don't know the techniques" -Participant S.*

### Insight 3. The interaction

The instant feedback draws people's attention effectively and engages them more in the process, which explains why the quality "inviting" and "captivating" receives a high score in the questionnaire.

- **Instant feedback enhances engagement**

*"At first glance, I was attracted. I like the fact it provides instant feedback" - Participants O.*

*"I like when I get closer...it provides feedback to my movements"-  
Participant D.*

*"... When I'm far away. It's like black and white. And when I get closer, it's getting more colorful... something is happening with the screen...So I find it quite interesting."- Participants M.*

The interaction and the visual effects are inseparable as interaction emphasizes the process of connecting input and output. The visual effects focus more on the output.

#### Insight 4. The visual effect

Participants appreciated the colors and the movements of the Van Gogh style filter, but it also connects to reality and themselves, making the experience more relevant.

- **Create relevance by mirroring reality with Van Gogh style**

*"I like the visual effects. It feels like a mirror but with Van Gogh style. Everyone likes to look into mirror..." -- Participants R*

*"The color is beautiful, and I can clearly perceive the changes. It is beautiful and connects to the reality, which I really like" -- Participants O.*

*"I like the fact that the effect is associated with me, which build a more intimate connection between me and the installation" -- Participants B.*

- **The color and movements of strokes are relaxing and mesmerizing.**

*"It is beautiful. It feels like a city gallery." - Participant P*

*"I like the colors, the visual effects, especially when the speed of the stroke is slower, it is very mesmerizing..." - Participant T*

*"I really like the visual effect. It looks like a huge movie poster" - Participant S.*

#### Insight 5. The influence of the factors in human-installation interaction

Participants would engage more when playing the installation with their friends, suggesting a possible direction for future work.

Regarding the change of context, if the installation is in a public space, the feeling of unexpected enhance participants' engagement. However, more usability concerns emerge when it is in public, which is discussed in the next section, the recommendation for improvements.

- **Come across the installation in public enhance engagement**

*"Come across the installation in the city is like a serendipity" - Participant O.*

*"...if I see this, let's say in a metro station, some situations happening, I will be excited, and I will go like be curious and go close and move on." Participant M.*

- **Experiencing the installation with others enhance engagement**

*"If I'm alone, I don't think I would interact with it...when I'm with my girlfriend ... she would be like, Oh, look, I was like, Can we just like walkthrough ... then we would like together play with it. So I think it's like a thing that you would do together most?" - Participant T*

*"If I play by myself, I may move slightly, but if I am with a friend, I will be more excited." - Participant S*

**Insight 6. The experience triggers people's interest in learning more.**

Among 10 participants, 5 mentioned they would like to scan the QR code for both the contents and their portrait. 2 participants said they would only look for the contents. 3 participants said they prefer the experience itself rather than other materials. This result shows the experience effectively triggers people's interest in Van Gogh and his art.

**09.02.06 Test limitations of the control test****1. The fidelity of the interactive prototype.**

Some features need to be manually controlled. Therefore, the experience is not precisely the same as the intended experience. For example, the change of visual effect based on the distance between participants and installation was not aligned precisely with their action, which lowered the perceived quality of the experience.

A storyboard was used to introduce the entire experience before participants try out the prototype. The storyboard might potentially affect participants' perception of the interactive prototype.

**2. The participants' educational level**

Among ten participants, two are postdoc researchers, and eight are master's students, which is the higher educational level of the general public. Therefore, the participants might be more likely to be interested in an art experience.

## 09.03 Conclusion of final Evaluation

The final evaluation consists of the field test and the control test, evaluating different aspects of the experience quality.

### The Van Gogh style visual effect

From the field test, whether the visual effect of the Van Gogh style filter can effectively attract people's attention was tested. Despite the unavoidable limitations, such as the small screen and the limited number of people in the test environment, it receives relatively positive results referring to the data provided in *the Audience funnel* by Michelis & Müller (2011).

The visual effect is also validated by the controlled test with the questionnaire and interview results. Participants appreciate the visual effect a lot, the movements and color of the brushstrokes, and its ability to mirror and connect Van Gogh's style to reality, which are the qualities that help create relevance.

### The content in the experience

The **content itself and the way it is presented** are both appreciated by participants. They like the aspects of connecting elements of art and the story of Van Gogh logically and provide layer by layer, which effectively reduces people's cognitive effort and can trigger their interest in discovering more relevant stories, the design goal of this project.

### The interaction and its quality

Despite the fidelity of the interactive prototype, the intended qualities (playful, inspiring, relaxing, and physical interaction) of the experience were described spontaneously by participants.

- The most successfully achieved quality is **playful**, scored 5/5 in the questionnaire, and mentioned directly by participants during the interview.
- **Inspiring** scored 4.8/5 in the questionnaire. Although it was not mentioned directly during the interview, participants said similar words, such as unexpected, surprising, curious, and novel, to describe the experience, the prerequisites to get inspired, identified in (05.04).
- **Relaxing** is a quality that received a relatively low score in the questionnaire result(4.4/5). Interview results uncover the reason. 2 Participants mentioned they feel more relaxed or the experience is more mesmerizing when the speed of the movement of the strokes is lower. This insight contributes to the recommendation for improvements.
- **Physical** interaction was not directly evaluated in the test. Because this criterion is not an intended effect, it is a process to achieve engaging and playful qualities. Participants describe the experience as edutainment and playful in the interview and score the quality of engaging 4.8/5, which suggests the learning by doing through physical interaction is achieved.



## 09.04 Limitations & Recommendation for Improvements

In the previous section, the insights are mainly focused on the positive aspects. In this section, the limitations of the final concept are discussed, based on which the recommendation for improvement is proposed.

### **The delay of the visual effect**

In both field and control tests, the delay of the brushstrokes' movements lowers the possibility people distinguish themselves from the regular background of the installation. The delay is because rendering real-time video effects with a certain amount of detail requires a relatively good computer.

### **Difficulty in recognizing themselves from the background**

Although all participants could finally recognize themselves on the installation, some participants needed guidance before recognizing themselves, even during the control test. Their silhouette with Van Gogh style might be too abstract to distinguishable from the dynamic background. This result could also be because of the delay of the effect—the precise reason needed to be figured out by conducting new tests. The problem can also be addressed by using depth detection, making a more salient visual effect only for the body of the user.

### **Lack of affordance of moving forward**

Participants indicate the affordance of moving forward to the installation to enter the engaging and discovering phase is not clear yet. The visual cue of changing oof colors and details of the brushstrokes requires a change in distance between people

and installation. However, in reality (the public environment this installation was designed for), most likely, people would pass by and leave without being aware that something else could happen.

### **Designing for a multi-people experience**

This project results in a Minimum Viable Product, considering the possibility of one user interacts with the installation at a time. But if positioning it in a real public environment, factors such as other people passing by might disturb or interrupt the person who is interacting. Their silhouettes might be overlapped, and the bubbles with content too.

All these mentioned aspects needed to be improved through iterating and testing in detail in a public environment. This graduation project explored the possibility of bringing art experience outside the walls of the museum with novel technologies and created a starting point for further developments.

# Personal Reflection

The following reflection is based on the ambitions I set out in the project brief.

## **Ideas do not always come out of mind by thinking only**

It might sound like an irony. The graduation project I was doing is about using physical interaction to stimulate inspiration and achieve the effect of learning. However, when it came to my own project, I did a lot of ideating and reasoning in my head before starting to build. When I was suggested to "get my hands dirty," I realized that working towards something, even if it is simple and not perfect yet, helps generate new ideas while refining it along the way.

In contrast, trying to make a perfect idea in mind is dangerous and frustrating. Because the more time invested in thinking the ideas, the more fear you would have for failure and for "kill your own cat." Building also helps you enjoy the process more. It shifts the focus from the result to the process and constantly having new input and output through prototyping. I should have tried it early.

## **Some thoughts on working with technology**

My graduation project is intentionally shaped by myself that needs to involve some technologies. Exploring technologies is fascinating but also challenging or even intimidating. The difficulty comes from the limited time of the graduation project combined with the unfamiliarity with the technology.

Sometimes, I felt hesitant to build, not only because it is not the way

I used to work but also because the cognitive effort of working with technology is too high. Think about if the idea you want to build is not fully there yet; meanwhile, the technology you will use is unknown to you too. Then it feels like being in a completely dark room, and you are entirely lost.

Also, the ideas are easily limited by the examples I saw online because You cannot build something without considering the feasibility of the technology. However, at the same time, I understood that the examples I found might not be the most innovative ways of applying the technology. If those examples are used as the basis, you will most likely end up with some incremental ideas.

I found a solution for this problem at the very end of my project - Having some understanding of the underlying principles of the technology. The examples are only the surface. Even the level of technologies such as AR, MR, or VR is still in a way, looking at the technology at their surface or applications. Understanding some bits of the root and the core of the technology might enable a higher chance of creating innovative ideas that make a radical change. In this sense, the students who do their graduation project are actually a product manager.

## **Designing physical interaction**

In the past two years of my study, more than half were online education. Designing for physical interaction part was missing. So

for my graduation project, I wanted to try something new, and I was fortunate enough to work on this project. But I have to admit. It was also a challenging one. Not only did prototyping and testing the physical interaction during the COVID-19 bring me a lot of anxiety, but physical interaction itself is more abstract and complex than designing something like an app.

Physical interaction happens in 3D space, meaning that anything that sensors can detect could be potential input and output of the design. You cannot design something for physical space and expect it works the way exactly as you imagined. There are innumerable variables and usually hidden factors, needed to be addressed. The level of complexity increases exponentially.

In this regard, designing by building is indeed a good way for working with technology. You start with something small, like the 30 ideas from my individual brainstorming, then build upon them, which avoids bringing too many complexities in the beginning. It also helps you slowly get familiar with the technology and its principles and build confidence to work with something unfamiliar.

### **Reflection on time management**

I started my project relatively late. So I almost worked no-stop to complete it before the deadline I set for myself. However, it does not mean I worked efficiently. I always tend to make everything perfect at the moment to satisfy myself; as a result, I spent too much time on details that might not be important in the future. Being aware of this, I was constantly and consciously reminding myself to reflect on the goal of what I was doing when I was focusing too much on small details. I think it is a good start for behavior change.

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...

But there's no sense crying  
Over every mistake  
You just keep on trying  
Till you run out of cake  
- Jonathan Coulton

# Appendices

## Appendix A - Contextmapping

- a. The Booklets (2 versions)
- b. Participants
- c. Initial analysis of quotes from interview
- d. Link of the filled out booklets

## Appendix B - Questionnaire

- a. Objectives of the questionnaire
- b. Participants
- c. Questions of the questionnaire
- d. Questionnaire results

## Appendix C - Brainstorming Session

- a. Q1: How would you like to experience art with physical interaction?
- b. Q2: How do you get inspired in a playful way?
- c. Q3: Where would you like to come across the installation?

## Appendix D - Description of Four Concepts

- a. Coloring the masterpieces of Van Gogh
- b. Learning the path of Van Gogh's artistic development through his letters
- c. Recreating Van Gogh's masterpieces with backstories
- d. Coloring masterpieces by correctly answering question

## Appendix E - Final Evaluation

- a. Storyboard used in the control test
- b. Questionnaire and its results
- c. Interview questions



## Appendix A - Contextmapping

### a. The Booklets (2 versions)

Two versions booklets were used for different types of participants: **Booklet A** for people who have been to VGM asks about young people's VGM experience. **a.1 shows the entire Booklet A.**

**Booklet B** for people who have not been to VGM asks their expectations for their future VGM visits. **a.2 only shows the different pages of Booklet B than Booklet A.**

### b. Participants

Eight participants from the target group with various cultural backgrounds and ages were recruited for the generative research, which is considered sufficient to get rich insights within the time limit of the project.

4 participants have been to VGM (see Table 1).

4 participants have not been to VGM (See Table 2).

Having two different groups of participants provides the opportunity to compare whether there are differences between their needs in visiting VGM and if so, how the needs result in different visiting intentions and behaviors.

No.	Name	age	Cultural Background	Gender (M/F)
1	Participant P.	23	Chinese	F
2	Participant D.	23	Chinese	F
3	Participant M.	26	Turkish	F
4	Participant A.	26	Indian	M

*Table 1. Participants (No.1-4) who have been to VGM*

No.	Name	age	Cultural Background	Gender (M/F)
5	Participant J.	23	Dutch	M
6	Participant E.	26	Dutch	F
7	Participant F.	23	Dutch	F
8	Participant Z.	30	Chinese	F

*Table 2. Participants (No.5-8) who have not been to VGM*

## a.1 Booklet A for people who have been to VGM

Hi!

Many thanks for your participation! :)



This booklet aims to help me learn your experience of visiting Van Gogh Museum. What was your motivation? What content of the museum did you appreciate most? ...

A collage-making session will help you recall your memory, which is followed by a few questions. There is no right or wrong answers. I am curious to see how was your unique experience!

Let me know when you finish. I am looking forward to talking with you in the interview.

Yuan

Your name\_\_\_\_\_

Your age\_\_\_\_\_

Education level\_\_\_\_\_

## My museum experience

Place the stickers  
to your choices



How often did you go to museums  
before COVID-19? Why?

What is your motivation to go to museums?  
you can select multiple options;)



Curiosity-driven. I want to  
learn new things and get  
inspired.



Important destination. I need  
to be there and check my list.



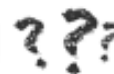
Socially motivated. I go to  
museums because other people I  
care want to go to museums.



Switch mind. I want to be away  
from my daily work and have  
a peaceful moment.



Specific learning objectives. I  
want to learn a specific  
content in the museum.



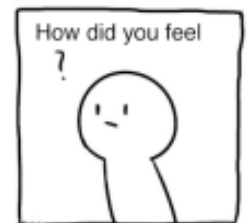
Others \_\_\_\_\_

\_\_\_\_\_

## This is how I experienced Van Gogh Museum

Why did you visit this Museum? What did you expect? What happened? What content in the museum impressed you most? Try to map on the timeline. Please feel free to explain when, with whom, what you did, how you think and feel, etc. You can use the images/words on slides 4 & 5 to help you express your thoughts and emotions in the experience.

Example:







## Is Van Gogh Museum relevant to you?



Looking back to my experience  
to Van Gogh Museum (VGM), I  
was impressed by \_\_\_\_\_

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Would you like to visit Van  
Gogh Museum again? Why or  
Why not?

---

---

---

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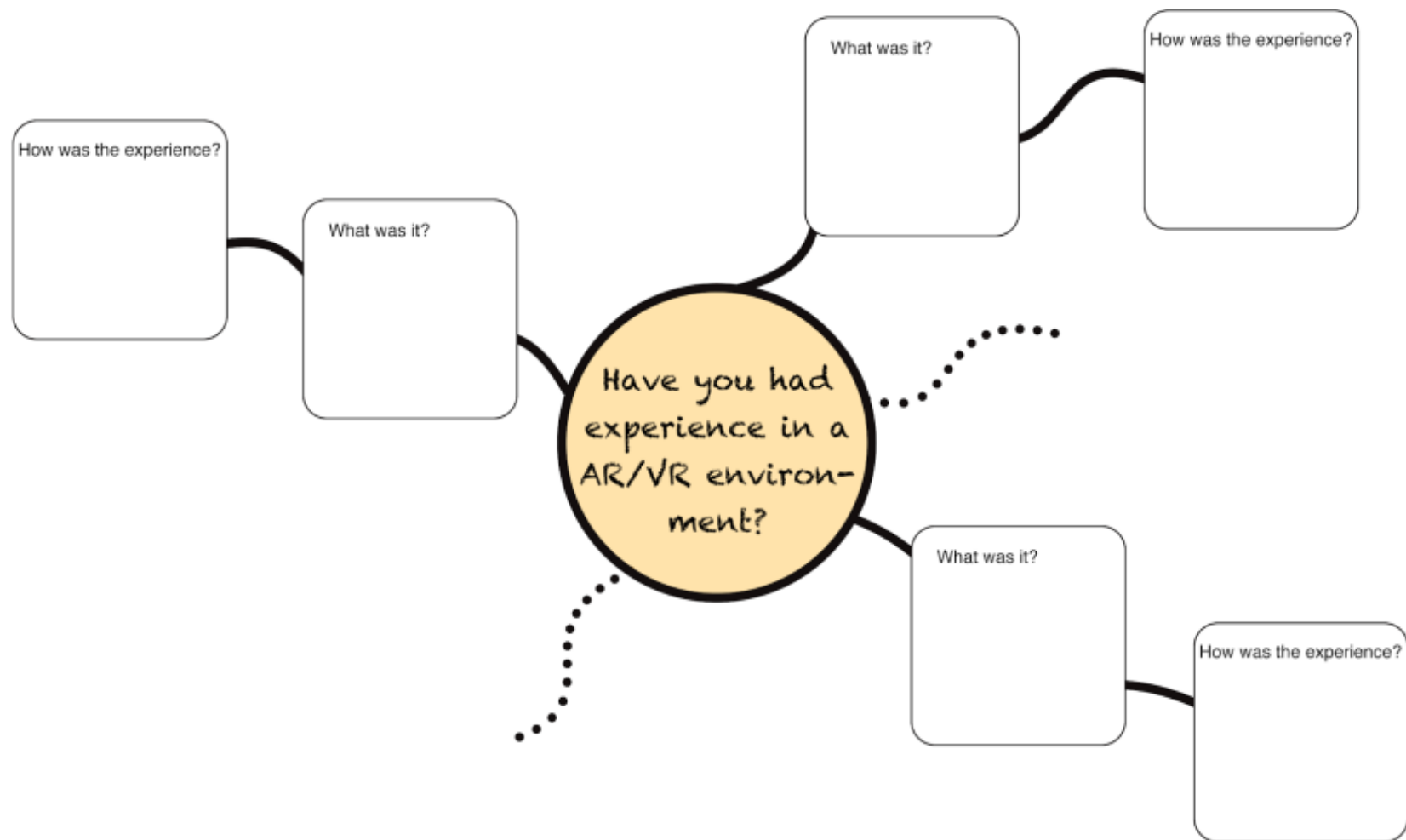


I think Van Gogh Museum is  
a place where \_\_\_\_\_

---

---

---



## a.2 Booklet B for people who have not been to VGM

The two different pages compared to Booklet A are shown below.

### Is Van Gogh Museum relevant to you?



Would you like to visit Van Gogh Museum ?

---

---

---

why or why not?

---

---

---

I think Van Gogh Museum is a place where\_\_\_\_\_

---

---

because\_\_\_\_\_

---

---

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**What is inside the museum?**

Official website of Van Gogh Museum  
<https://www.vangoghmuseum.nl/en>  
The youtube channel of the Museum  
<https://www.youtube.com/channel/UCmh8ObfC7uNs-wSSR2KoFsg>





## Create your own experience of Van Gogh Museum

If the Van Gogh Museum becomes attractive to you, could you imagine the experience of visiting the museum? What kind of experience you would like to have in relation to Van Gogh and his artworks? What characteristics should it have? How would you experience it? etc...It does not have to be realistic! Think about things interest you. You can use the images/words on slides 4 & 5 to express your desired experience.



I would like to visit Van Gogh Museum, if...

because...

I would like to visit Van Gogh Museum, if...

because...

I would like to visit Van Gogh Museum, if...

because...

I would like to visit Van Gogh Museum, if...

because...

## c. Initial analysis of quotes from interview

J.

familiarity  
creates  
connection

The optimal state of visiting a museum is I am able to discover connections between me and the exhibits. Maybe my status of life/ myself, which helps me better remember the content as well

familiarity builds  
connection

I went to the van Gogh Museum because he is really famous and I like his style. When I was in high school, the cover of the notebooks I bought were his paintings.

Evoke  
memories

especially van Gogh, I knew him early in my life, so when you look at his paintings, they bring me back to the past, when I was in high school.

from genius  
to ordinary

You might think van Gogh is far away from your life in the beginning. But when I noticed he painted many paintings in a short time. I thought it excitedly like me before DDL. He is talented but he is also hardworking.

storyline creates  
immersive  
feeling

Sometimes you see this painting, the story behind it can be connected to another painting, which creates a more immersive experience

social is part  
of the exp.

When I visit museum with friends I like to talk with them about what I saw. even if I am alone, I would take pictures and send to my friends.

curiosity

I know some of his of his famous painting and anecdotes, which makes a difference. So I was curious to see what's inside the museum.

Personal  
stories

I am interested in his stories but the painting techniques I don't have much interests.

familiarity  
creates  
connection

The optimal state of visiting a museum is I am able to discover connections between me and the exhibits. Maybe my status of life/ myself, which helps me better remember the content as well

Association of  
style & stories

I am impressed most by his experience in the different stages of life and the changes in his painting style.

Affordance  
of VGM

I'd like to go to VGM again. It's like reading a book, each time you will discover something new. But I prefer to go other museums I haven't been to.

A.

style with  
imperfection

I like his art style, because he is not one person who strives for perfection... But it still comes out very beautifully. It's also a style that resonates with me personally.

Not superficial  
but emotional  
quality

In the way he expresses most things, he tries to express the innate quality of the thing or person. So in potato eaters, also, that's what I feel like he's trying to portray what they feel internally, is even for his own self portraits, it feels like the very expressive, they're not superficial, beauty oriented paintings focused on like, the emotional quality.

Paintings in  
context

Van Gogh is also really an interesting character. it places all of his paintings in context. So like it, it tells you who Van Gogh is, and like, why he did a certain painting or what is the context of a certain painting or things like that. So that is very important to me in terms of going to a museum

Context

... audio track that you can listen to, to give you a bit more context about what all this is. ...there is a gallery like a corridor sort of place where a lot of things he has used himself is also there. Letter, he has sent to his brother. ... almost like you can get a glimpse of his life. So that is very cool.

Visual  
impact

I also think there is a nice comparison to this. So the Moco museum was like, a very strong experience, like visually, it was more about a wow factor.

Combination of multi-senses improve concentration

you're looking at the painting and listening to the audio, it requires a certain amount of concentration. But if it's purely just visual, like with the painting and something around it, I think it is not taking all my focus into it. I feel like I would be distracted by other moving things in the vicinity because it's not completely focused.

interpretation  
require guidance

The audio guide was very historical. So to me, they were a little dry, to be honest... because they were being very dry about the facts. but after that there was this place where you could see clippings of movies about Van Gogh's that had some sort of emotional quality. I think because you could see something, you were made to think about it in a more abstract sense in terms of the person his emotions and stuff like that are associated.

Similar  
experience

I relate to the eccentric story of van Gogh, like his craziness and all of that. Because it feels like his paintings were inspired by his suffering or his mental chaos. I have had experiences where I used art just for expression. I think those are my best sketches.

Source of  
inspiration

I feel like I can use this to, for my own creative process actually took photos of the color just of the paintings for color palettes as well. So it's like, oh, this is very inspiring. I can use this later, for practical reasons

I would take my sketchbook with me to take down points of inspiration.

Art as  
therapy

So I think in Van Gogh's case... He was desperately trying to make himself feel better through his art, but I don't know how much it helped him. I felt like he failed at curing himself... Also, artistic expression also has its limitations. Art therapy is great. But I feel like that also has some limitation.

Intentions behind  
the painting  
technique

...you can actually see, when the artist does certain things to the paint itself... the paint movement. It's not for me to learn that. But like, as my reflection, just seeing that is such a immersive experience to me... because this is something that happens for many years in the past, right? It's such a great cultural importance. So you feel like there is deeper meaning that you can take from this each time you go there. I think that is, that is the main motivating factor for going to art museums in general or art galleries...

unique, distinct  
language of Art

Historically, the artist was not connected to a global culture, the artist was connected to either his own small surroundings or the small locality there. So his art has a very unique, distinct language. And it's a very personality.

Interested in  
different  
perspectives

I'm also really interested to go with people who don't really know about art, because you will get a very different viewpoint ... people who don't like art or don't know about art, they take it very literally. Like these are colors these are shapes, this is that this looks good.

Combination  
with stimulation  
and knowledge

I went with my girlfriend she does not know about he knows a bit but she's not really interested. But she was what she likes experiences. Anything that is new and helps her learn a bit.

Pander to  
social culture

When I look at contemporary art... at times, it becomes really overly inspired by things that everyone is doing. It most like they are pandering to social culture and it's not very creatively evocative. it does not evoke a strong feeling, or emotion...

New definition  
of emotional  
quality

But Konings dog sculpture, if I see it in person, I think there is a lot of value, because it does evoke an emotional response. Because strong emotion, especially if it's like big and if it has scale. And if I look at it, and if I see the light bouncing off in different directions, I think that has an experiential quality.

Art should  
enable reflection

Take Andy Warhol, for instance. Right? So his art is all about consumer culture, and how consumer culture can be problematic or common to see. So do you embrace consumer culture and branding? Or do you stay away from it? He does not give you the answer. Right. So it is up to you to think about such things. I think modern art has its value.

Jia

familiarity builds connection

I went there because I'm interested in Van Gogh after reading his biography.

interpretation of his well-being

Know more about Van Gogh's wellbeing :) and the reason (personality, relationship...)

social is part of the exp.

One friend said Van Gogh use darker color when he is mentally ill, which inspires me.

interactivity in mind

When I look at a painting, subconsciously think about some questions. for example, whether the painting has somewhere look strange? Is it beautiful? etc. which stimulates me to see the explanation. Otherwise, I will just take a look of the title.

familiarity builds connection

After visiting the museum I felt closer to van Gogh. because I read books about him but I think there might be something made up. Also, his letters, people around him... all of these present the context van Gogh was in.

Impression and motivation

I can only remember something interesting facts or interpretations related to van Gogh. I think because I went there is for leisure not for learning.

Playful and intellectual stimulation

For some museums, if you only seek for playful experience, you just get around the museum but finally get nothing out of it, because they don't have interactive installations.

Serious learning

The purely educational museum experience seems like one of the reason decreases my motivation to museums.

Storytelling

The paintings are organized in a "storytelling" way. So I could guess and know the friend and family circle by looking at paintings nearby.

leisure activity

I went to VGM because my friends and I wanted to go Amsterdam. VGM is in Amsterdam.

empathy

I feel I get closer to the real image of Van Gogh. Respect this amazing life for art, and also very pity because he passed away so young :(

M

social is part of the exp.

I bought a friend of mine along with me in order to show her Van Gogh's perspective of life.

looking for interactivity

what I like about science museum is they make complicated things very easy to understand. You can just experiment that those kind of things

Context and timeline

And you could of course, learn those kinds of things from Google. But then being in the museum is more interactive, and then you see stuff, and then how they kind of...chromatically, designs everything and you learn step by step. So I quite liked it...I know some stuff about van Gogh but it was not a whole picture in my mind.

familiarity bring people in, new knowledge keep people's interests

I didn't know how the wife of the brother, she had protected all those things about one girl. And she had, she was probably visionary. And she could see her his blue and how she tried to make the whole thing, you know, from his paintings and the story. So I didn't know that part. I didn't know that she had put that much effort. So to learn, this was nice. Also, it was not I think in the movie. Movie. So it was valuable for me. And it was a complete new information.

Power of Emotion

He's so emotional, maybe it's just me, but I feel like he has a lot of emotions. And he's trying to put those emotions with his technique. And the things he is painting like floors, and the colors he used, I think gives me a feeling that he is very warm, sensitive person also. So I quite like all this feeling that he gave me.

familiarity builds connection

When I was in primary school, our teacher said everyone has to choose a painting of a painter. The painting I chose was the potato eaters. It was my favorite painting, but now it's almond blossom. When I saw the real painting (potato eater) I wanted to cry.

Similar personality

You know, it's just maybe flowers, but I feel Oh, my God, I can feel your emotions. And also, I feel like we have a similar personality as well. And it's like, if I would meet with him one day, if I would talk with him, quite understand each other.

empathy

But after reading all these letters, and then seeing the entire story, I had the feeling that he's even more sensitive, and more emotionally intelligent than what I have thought, but still is also very vulnerable... this surprised me, and also made me feel like a little bit sad for him.

Interested in different perspectives

I know a lot about van Gogh and other people don't know or they know and want to discuss. I like share knowledge with friends.

Pride to share

My friend and I had took a lot of pictures for social media. In order to let our followers about Van Gogh and his paintings. And we have visited this amazing place :) That was fun.

space for interpretation

Almost blossom, it is like representative of my emotional personality. as that gives me a feeling of hopeful person also emotional and also happy and warm. Spring is coming. And then you are still venerable and Emotional, but you are also hopeful and grow again.

Intentions behind the painting technique

what I thought he's not, like just drawing, unconsciously he has his own technique. And it's not like the technique itself. It's just like, how he you know, does it like what kind of intentions he has?

guidance of interpretation

I'm being in his own world, like, you know, you have something imagined in your mind. And nobody can understand that. But because they use this painting style. And through the entire movie about like...this is what van Gogh feels like work...



Z.

### Stereotype

When I am thinking of museums. The Stereotype I have is museums are boring

### looking for interactivity

I think science museums are interesting because there are more things I can explore. I like the way science explains things more experimental

### cognitive load

Art museums are more traditional.  
Many texts

### Socially motivated

The museums i have been to are mostly with friends and family members

### Association of style and personal stories

I know van Gogh has mental problems so if I look at his painting I would think about why he painted in this way? What did he want to express? How the style associate with changes in his life?

### Art is elusive

my impression to art museums is like paintings are hanging on the wall. But you can little when you only look at the paintings.

### iterative experience

I would like to have explorative experience in the museum, which can stimulate your creativity.

### Multisenses

I have been to an industrial museum that was interesting because the exhibits were shown in combination with sounds, lights and movies. You can not only see How the machines look like but also how it actually work and the stories behind. There was something like a quiz, which asks you to interact with the exhibits. You can touch and feel the materials.

### Museum as a lifestyle

There are paintings projected on the wall of a library. I think in this way art because part of people's everyday life.

### Exchange understanding with friends

When I go with friends I probably would have a different understanding of artworks than when I visit alone. You get to know how your friends think. The different understandings from them are interesting to me. I think we would talk about the experience from time to time which becomes part of our life.

Franca

### Static

In general I'm not a big part of museums, unless it's interactive or they are showing something I'm really curious about. I get bored easily when it's just paintings hanging on a wall.

### Cognitive load

I'm also never sure whether to read all the signs. I would like to but sometimes I start doing that and then there are just too many so halfway through the museum I stop.

### Storytelling

Would be nice if there's an actual storyline that you follow.

### Serious learning

I think I would but only because I think it is part of being Dutch. I'm not super interested in this type of art but I think it would be cool to see those famous pieces in real life.

### Personal stories

I could learn something about his personal life and values, not only his art. This add a lot to the experience because it will make the narrative behind the paintings more interesting. I would like to know how this guy became famous/funny anecdotes.

### looking for interactivity

There was some kind of event going on as well. Like a theatre play or something more interactive like a painting class maybe, that would be cool

### Storyline

There was a intriguing storyline along the museum I get bored just looking at paintings and it would be interesting to actually follow a story and through that story learn and see

### Cultural

I usually go to museum when I'm traveling and when I want to learn about that culture, like of the country that I'm in

### experience seeker

I'm in and I usually does also because the building the museum is in is really nice. Like I know, for example, that just walking around the building itself is already a nice experience. And then I'm more willing to go there.

### Context

I think talking about, like this person, Van Gogh, I think, what is interesting about him is that specific time in which he lived. Yeah, so it's not just about what he shows on the painting, but also about what was happening during that time.

### familiarity bring people in, new knowledge keep people's interests

what I remember liking about it is the fact that I was in school learning about a lot of physics and stuff. And then once I was in that Museum, I was like, Oh, I recognise this because that's blah, blah, theory and oh, I actually know things like it was more like a 'Yeah, validation of my own knowledge, which was really cool. And then also, of course, a lot of new things that I've learned



Julian

### Storytelling

Storytelling is important: I'd love to know the backstories from his paintings

### connect to society

It is amazing when museums can reflect their collection on current trends: such as loneliness now in covid times, or depression. That makes the art relevant.

### Muti-senses

Art should let you reflect on other topics as well. This is often done through multimedia, that makes art more alive for me.

### Source of inspiration

Art should make me creative. It can inspire me in a spiritual, philosophical or aesthetical way.

### Storytelling

it's very important with art that is not just beautiful art, it has to have story to it. And the story is something that's gonna inspire me, it doesn't have to be beautiful, in an aesthetic way. But as long as it has a powerful story, it's gonna inspire you.

### Interpretation

Tells the story of the artist or about the painting itself, but also gives you space to fill it in for yourself, or let us reflect on yourself...

### Van Gogh as a person

he was struggling, he was struggling with depression, he could see it in his paintings. And I think that's a very strong topic that the museum could now use as a theme, to attract people and tell their story. To Yeah, to let people relate to van gogh in a new way, not just as a as a very good painter, but also as a as, like a human. Yeah,

### Social

I like to share with friends or a family it does has multiple reasons that I like it. I think one is it makes you feel intellectual. And it sounds a little bit ugly, but it's just very nice. If you can talk about arts just completely understand. Yeah. So that's one and two. I think it's nice that you can get to know each other in that sense.

### unique interpretation forms personal relationship

I see something else that when my girlfriend looks at the painting, because she fancies dresses, so she sees all the dresses, and I fancied movement and stuff. So I see the movements in the painting. And I think that's so interesting about art, it's can, that it's the you're getting a personal relationship with the art piece when you're looking at it.

### Contract

I visited the website. And the way the paint was, the paintings were like, the way the website was designed for ready, was like, I'm triggered me already, because it's showcased the identity of fango and showcased his art in a very bold way. And I like that he set up a classical way. So showing his face on the old page of the website, for example. That's what I mean with bold. It's not it's not like a classical.

### Link to reality

If you combine it with some sort of documentary or studies on the actual night sky, and see how there's links between what he saw in his end he painted and what actually is there? Yeah, because they're really interesting links.

### dream & reflect

On the one hand, you need to dream. On the other hand, you need to be able to reflect on it and really get the information...

### Multimedia

With all the multimedia nowadays, you can share the ideas behind the art in a very emerging way. And that's, I think, a way in which art can really reach you.

### emotions in paintings

Because the way he paints already tells a story that he's not just very literally painting everything with he is in his way telling what he sees. Yeah. And I think that's the abstract level that I like that you are not seeing directly reality, but the you're seeing what the painter sees as reality.

### reflect issues in society

I think, for me, art a very important tool to translate current issues or currents, ideas, or trends or whatever, to an audience in a way that cannot be done in any other medium, like artists, telling stories in a fairy can be heard direct, can be very indirect. And that is me that is making art so interesting for me and making classical art less interesting.

### inspired by others

But I think it is nice to I do like when I'm in a museum, when I hear someone else talking about art. I just don't like to share myself with other people either like to be put on the spot, or stuff like that. But sometimes you have these museums where they have a documentary way where they just let other people talk about the art. And you can hear what they see. And it's this really inspiring...

### important destination

if you're on a holiday then I would also but I'm never planning it was on a holiday. I'm just walking through a city and like, hey, this museum here.

### Leisure

I'm not the type of guy who reserves museum. I just I'm just like, okay, it's Sunday. What are we gonna do today? Go to museum and then go to music.

E

### connect to society

he just portrays messages in a very edgy way. Yeah, about racism or war about poor people. So I guess yeah, we're looking at an artist very different.

### Serious learning

Since van Gogh was a very well-known painter, it feels like a 'must-visit' as a dutch person, and I can dream a bit about what kind of art I would like to hang in my future home.

### Personal stories

I can see a glimpse of how van Gogh's life was: was he alone, where did he live, and who he was as a person

### Intentions behind the painting technique

Through the lens of his life like previously mentioned, see how his life and background are connected to what he actually paints. I think his art can become way more interesting if you know with what thoughts and opinions he's been painting, so you can see the art a bit more through his eyes.

### unique, distinct language of Art

Then you can understand more the complexity of his paintings and the amount of effort he put in. You already know you're looking at beautiful art pieces, but as a non-painter, I don't have any reference as to why his paintings are special for his time, and how it opposes to fellow artists from that time.

### Muti-senses

I would like a more immersive experience that speaks to the imagination, instead of reading those texts besides each painting. Some short videos that go with spoken text or music that illustrate in a glimpse more about van Gogh.

### Rich experience

Also the head like art installations, like rooms with were sort of all the walls were from glass with diamonds hanging and different colors, lights. So it's really like an experience where you walk through. And it's also a popular place to make pictures. So yeah, I guess actually, like those rooms were kind of, like magical, almost. They also had this background music, which is very soothing and relaxing, and also inspiring. Yeah, and even had an app, which you could use to scan the paintings, and then would add an extra 3d effects.

### Context

I just I think it just has my interests more than just looking to paintings, because then often you also see like, the products they used or cutlery or like the tombs itself, it's more than just paintings. So I think that's where it comes from.

### need to learn

if I would be on a holiday, then sometimes I also, like, visit more museums than I would normally do. Like, I also feel like I need to see all the cultural places of a city I'm visiting.

### Want to do

maybe I like to just spend more time with friends and chew in the city itself, instead of just only going to museums,

### Lack knowledge

maybe it's also because I don't know enough about paintings are about the artists. Because I think if I was, if I would not know more about like painting techniques, that's what this last thing is about, then I would maybe understand more the, the complexity of the of the painting. And, yeah, and how it relates to other paintings and other artists.

### Context

maybe you know more about his life and his background, his interests. Maybe there were certain taboos or certain stories that were very popular back then.

#### **d. Download the filled out booklets**

[https://drive.google.com/drive/folders/1QL8qn9-CMpLHyra\\_SuUP7PSzZDR4lv6c?usp=sharing](https://drive.google.com/drive/folders/1QL8qn9-CMpLHyra_SuUP7PSzZDR4lv6c?usp=sharing)

## Appendix B - Questionnaire

### a. Objectives of the questionnaire

The objectives of the questionnaire is to narrow down the scope of the project based on the identified aspects from the generative research.

The questionnaire consist of the three main aspects below:

- To **validate and prioritize initial design criteria** with a larger number of people.
- To learn the most **preferred content of VGM** among young people
- To find out the **preferred form** (installation/app) of the design.

Other questions are related to young **people's experience with AR/MR/VR products and what novel art form interests young people in their experience and their opinions**. These answers help analyze existing products and serve as sensitizing questions for the questions afterward.

### b. Participants

Among 37 participants of the questionnaire, 26 are from the target group (young adults between 18-30 years old). The results are based on the participants from the target group; however, what is surprising is that the results of all 37 participants are consistent with that of the target group, making the argument of the results more robust.

### c. Questions of the questionnaire

This section shows how questions were asked to achieve the objectives. see details on the following pages.

### d. Questionnaire results

4.1 Qualitative results

4.2 Quantitative results

## c. Questions of the questionnaire

Questions

Responses 37



### Research on telling Van Gogh's stories with Mixed Reality

Hi everyone!

I am doing my graduation project about using Mixed-reality(MR) technology to tell the stories of the artist Vincent van Gogh in an engaging way for young adults. The goal of this survey is to understand what contents about Van Gogh resonate with you most. And how you would like to experience it!

Thank you! Have a nice day : )

What is your age group? \*

- ☐ <18
- ☐ 18-30
- ☐ >30

How do you like to experience art?

- ☐ Reading books
- ☐ Visiting art museums
- ☐ Learning by doing
- ☐ Watching videos/ movies
- ☐ Talking with other people
- ☐ Social media
- ☐ Playing games
- ☐ Other...

Have you had AR/VR/MR experience that you like? What's it? Why do you like it? \*

Long-answer text

Have you experienced art in some novel forms that are more appealing to you? What's it? Why do you like/dislike it? (e.g. art installations, app, game, VR, AR, etc). \*

Long-answer text



Imagine a new product that tells the contents about van Gogh you are interested in, what characteristics should it have in order to be more attractive to you? \*

- ☐ Be playful
- ☐ Involve physical interaction
- ☐ Connect with others and be able to share
- ☐ Source of inspiration, interpretation or reflection
- ☐ Help me relax and switch mind
- ☐ Other...

The new product can include the following aspects about van Gogh, rate them based on your interests \*

	Not interested in	Moderately interested in	Very interested in
His personal life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
His painting styles and t...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How van Gogh can play ...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How van Gogh can conn...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Would you like the product to be an installation in a public space or an (AR/VR/MR) app you can access anytime anywhere? Why? \*

Long-answer text

Anything else you want to say?

Long-answer text

## d.1 Qualitative results of the questionnaire

Time	What is your age	How do you like to experience art?	Have you had AR/VR/MR experience?	Have you experienced art in a virtual environment?	The new product can include the following aspects about van Gogh, rate them based on your interests [His personal life]	The new product can include the following aspects about van Gogh, rate them based on your interests [His painting styles and techniques]	The new product can include the following aspects about van Gogh, rate them based on your interests [How van Gogh can play a role in your daily life]	The new product can include the following aspects about van Gogh, rate them based on your interests [How van Gogh can connect to the trends in society]	Would you like the product to be an installation in a public space or an (AR/VR/MR) app you can access anytime anywhere? Why?	Anything else you want to say?
06/05/2	18-30	Visiting art museums, Learning by doing, Watching videos/ movies	AR and VR, game, I explained it in the interview	Google art website, interesting and playful	Very interested in	Moderately interested in	Very interested in	Very interested in	Both, it depends on how you design it, but my immediate choice when I saw this question is app(game)	Good luck
06/05/2	18-30	Visiting art museums, Learning by doing, Watching videos/ movies, Talking with other people	There was this VR experience at the humanity house. You would be hearing stories from refugees in refugee camps over the world. While wearing the HMD you would be sitting inside a box which also stimulated other senses giving more immersion to the experience. Heaters while being in a refugee camp around the desert. This helped understanding the conditions those people had to live in.	NXT museum in Amsterdam. I will send a video. I liked it because the mirrors really amplified the idea of space being endless. The way the art was portrayed really amplified the idea of the installation.	Not interested in	Very interested in	Very interested in	Moderately interested in	From a personal perspective it should be a public space. Since I always feel those have a better impact on me. From a marketing perspective an app would be better to lure people from further away to visit the museum	
06/05/2	18-30	Reading books, Talking with other people	Not much experience. I like the App culture and art. I like the one that I could place art work and gallery at my home using AR. Mainly because of the novelty	Animal crossing? I saw some gamers make famous paintings in the game to decorate their home. I also like the museum collaborating with Lego. It's mainly for selling things, but might be games as well.)	Very interested in	Moderately interested in	Very interested in	Very interested in	I'd like to access it anywhere, because the current situation don't allow me go out. Also, I feel more freedom and can fully engaged when I'm playing in private space instead of public space	Gong Doudou good luck. Great questions haha
06/05/2	18-30	Visiting art museums, Learning by doing, Watching videos/ movies, Talking with other people, Social media, Playing games	I've once been into a rollercoaster with an VR experience, which was super cool! I liked it cause the visuals looked good and you felt like being inside a short movie	Interactive installations can be fun if done well. Highlighting stuff in an informative story by means of lighting design can be powerful too.	Very interested in	Very interested in	Moderately interested	Moderately interested in	Installation, because that can be more immersive	With any interactive experience you design, I would still want to have the option to view Van
06/05/2	18-30	Reading books, Visiting art museums, Learning by doing, Watching videos/ movies, Talking with other people, Social media	I only experienced VR game once. It was fun but it didn't really feel real.	Art installation	Very interested in	Moderately interested in	Not interested in	Very interested in	Public space? I want to experience some tangible and if I have access at anytime, it doesn't feel special anymore.	
06/05/2	18-30	Reading books, Visiting art museums, Learning by doing, Watching videos/ movies, Talking with other people, Social media	Yes, it was in Busan movies museum. Full immersion is cool.	Yes I think that is convenient to know them	Very interested in	Very interested in	Moderately interested	Moderately interested in	Yes but I have a concern about COVID	Nee
06/05/2	18-30	Visiting art museums, Talking with other people, Social media	can't remember any	I generally like it when museums have some form of interactivity - but that does not necessarily need to be high-tech	Very interested in	Very interested in	Moderately interested	Moderately interested in	if it is done well, sure...	
06/05/2	18-30	Watching videos/ movies, Playing games	Immersive experience that it gives you and how realistic it is.	I visited Singapore science museum once and there was AR exhibition which I still remember since I liked it. It was just so much well using the space and creating new atmosphere	Not interested in	Very interested in	Moderately interested	Moderately interested in	Idk. Both would sound interesting but I prefer public space one since it's more engaging. Usually the app ones I download and not use it much.	
06/05/2	18-30	Reading books, Visiting art museums, Watching videos/ movies, Talking with other people, Social media	Havent had so much experience	No, but I think the idea is very interesting	Very interested in	Very interested in	Moderately interested	Very interested in	Public space, makes the experience more meaningful and impactful	Sounds like a really interesting topic!
06/05/2	18-30	Visiting art museums	-	-	Very interested in	Very interested in	Not interested in	Moderately interested in	Installation in a public space (preferably museum). because it adds a special touch.	

Time	What is your age?	How do you like to experience art?	Have you had AR/VR/MR experience?	Have you experienced art in a virtual environment?	The new product can include the following aspects about van Gogh, rate them based on your interests [His personal life]	The new product can include the following aspects about van Gogh, rate them based on your interests [His painting styles and techniques]	The new product can include the following aspects about van Gogh, rate them based on your interests [How van Gogh can play a role in your daily life]	The new product can include the following aspects about van Gogh, rate them based on your interests [How van Gogh can connect to the trends in society]	Would you like the product to be an installation in a public space or an (AR/VR/MR) app you can access anytime anywhere? Why?	Anything else you want to say?
06/05/2	18-30	Visiting art museums, Talking with other people	VR for playing, 3D modelling and testing some stuff	Nope	Not interested in	Very interested in	Not interested in	Moderately interested in	Not sure how this would work, but sounds cool!	
06/05/2	18-30	Visiting art museums, Watching videos/ movies, Talking with other people	I went to a filmfestival where I had a vr glasses with a diving with sharks short movie. It was nice and immersive. It looked like I was diving along with the crew	I really love the stuff by teamlab. Once went to an exhibition in Helsinki's Amos Rex with a hand full of their installations. Really like entering a different world. Very immersive	Very interested in	Very interested in	Not interested in	Not interested in	In public space, as this feels more like I could enter a different world	Difficult questions to answer like this on the spot, maybe some images or so could help me to get in the
06/05/2	18-30	Visiting art museums, Watching videos/ movies, Talking with other people, Playing games	I never really experienced any	Online moving through the art websites	Moderately interested in	Moderately interested in	Very interested in	Moderately interested in	Both could work	
07/05/2	>30	Visiting art museums	Oculus game is really fun!! Because it's a more immersive experience than looking at the screen.	laser lighting show with music is very cool	Moderately interested in	Very interested in	Moderately interested in	Very interested in	It depends. Interactions with other people in person could be fun in public places.	
07/05/2	18-30	Visiting art museums, Watching videos/ movies, Talking with other people	Not with art. Only video games.	Interactive installations can be fun. But its fun because its new and its own thing. Its equally fun as 'regular' art i would say. Just different. Same with VR, though I have not seen that as often. I do think art is most interesting if the artist has chosen the medium for a reason, and the art fits that medium. Not to just remake something that exists already in a 'novel' form.	Moderately interested in	Very interested in	Not interested in	Not interested in	Not really. I am not really a fan of van gogh, and like i said, i would rather see something new with vr that was made with that medium as the source of inspiration instead of a remake of something the artist intended to be a painting.	
07/05/2	>30	Visiting art museums, Learning by doing, Watching videos/ movies	I played VR game Beat Saber. I like it very much. It makes me feel in another space	(^_^) I don't particularly understand this question but the answer seems to be no	Moderately interested in	Very interested in	Moderately interested in	Moderately interested in	Everyone is creative and sometimes people need to be reminded of that	I look forward to seeing your work
07/05/2	18-30	Visiting art museums	yes, VR video FPS game, unforgettable experience	No	Moderately interested in	Very interested in	Not interested in	Not interested in	Hygiene is a concern when use the device in public place.	No
07/05/2	>30	Watching videos/ movies, Social media	No	No	Moderately interested in	Not interested in	Not interested in	Moderately interested in	No	No
07/05/2	18-30	Visiting art museums, Learning by doing, Watching videos/ movies, Social media	AR, very practical experience with build-in parts of a factory. Is was cool to touch it, see something in 3D to better see the size, but also be able to see inside	no	Not interested in	Very interested in	Very interested in	Moderately interested in	Public space would be nice, but how will you keep it open to everyone when it is too crowded by tourists?	
07/05/2	18-30	Visiting art museums, Learning by doing, Watching videos/ movies, Talking with other people, Social media	Yes in DDW map of Eindhoven it's fun and we do this together with friends	Installation several people could sit in the installation and it's like旋转木马那种可以转的 有人一起玩就很好玩	Very interested in	Very interested in	Very interested in	Very interested in	前者 用app可能并不会想起来去用	
07/05/2	18-30	Visiting art museums, Watching videos/ movies, Social media	never	I'd like to enjoy art by watching it in front of me	Moderately interested in	Very interested in	Not interested in	Moderately interested in	It would be nice to have an item that I can daily accessed	
07/05/2	18-30	Visiting art museums, Learning by doing, Talking with other people, Playing games	NA	Interactive installations (EX. Meow wolf)	Very interested in	Moderately interested in	Very interested in	Not interested in	Public space - following the pandemic, I want to leave the house.	

Time	What is your age	How do you like to experience art museums, Learning by doing, Watching videos/ movies, Talking with other people, Social media	Have you had AR/VR/MR experience	Have you experienced art in a museum	The new product can include the following aspects about van Gogh, rate them based on your interests [His personal interests]	The new product can include the following aspects about van Gogh, rate them based on your interests [His painting styles and techniques]	The new product can include the following aspects about van Gogh, rate them based on your interests [How van Gogh can play a role in your daily life]	The new product can include the following aspects about van Gogh, rate them based on your interests [How van Gogh can connect to the trends in society]	Would you like the product to be an installation in a public space or an (AR/VR/MR) app you can access anytime anywhere? Why?	Anything else you want to say?
07/05/2	>30	Reading books, Visiting art museums, Learning by doing, Watching videos/ movies, Talking with other people, Social media	no	There's this poster that if you 'scan' it with your phone and a special app. On top of it a 3D visualization pops up in AR. I don't remember the name but it awesome.	Very interested in	Very interested in	Moderately interested	Very interested in	both? It's always awesome to learn/do something in a specific place, but be able to access it and share with others later at any time and place.	Hope you get enough responses. Good luck!
07/05/2	>30	Reading books, Visiting art museums, Learning by doing, Watching videos/ movies, Talking with other people, Social media, Playing games	Yes, Adriaen Brouwer, Figures in paintings coming to life are great because they are an indication not only of art but also of history and culture	Extreme close up of technique	Not interested in	Very interested in	Not interested in	Not interested in	Why not both?	
07/05/2	18-30	Learning by doing, Watching videos/ movies, Talking with other people, Social media, Playing games	Yes, I played Pokémon Go. The AR function is just ordinary. I wasn't impressed by it.	I have been to a museum in Ghent where they use projected films, sound effects in a themed hall to exhibit.	Very interested in	Moderately interested in	Very interested in	Very interested in	I would appreciate it more as an app so it will be accessible 24/7.	Nothing else.
08/05/2	18-30	Reading books, Visiting art museums, Learning by doing, Watching videos/ movies, Talking with other people, Social media, Playing games	Yes, I've watched VR videos. And experienced AR game. I like how VR videos provided me with a full image of the scenes.	A game of refilling colors to Van Gogh's work. I like the process of recreating. By doing it, I learned to admire how he played with the colors.	Moderately interested in	Very interested in	Not interested in	Moderately interested in	Both are interesting to me.	
08/05/2	18-30	Visiting art museums, Talking with other people	I went to an electronic art show in Paris. The art was projected and animated inside a dark room. It was really cool!	I do like physical art installations more. It is getting too mainstream to project artwork and it gets old if everything gets projected onto the walls with everything.	Very interested in	Very interested in	Moderately interested	Not interested in	Public space. I like the thrill of going somewhere alone or with my friends.	No
08/05/2	18-30	Reading books, Visiting art museums, Learning by doing, Watching videos/ movies, Talking with other people, Social media	Yes I went to the Van Gogh Exhibit in Antwerp. I really liked it, it was a new experience and really positive.	I think so. The exhibit in Antwerp were partly projections where a story was told over them, so I think so. I really liked it.	Very interested in	Very interested in	Very interested in	Very interested in	This is really hard. I love Van Gogh. As in I'm obsessed with it. I have books, art, made school projects inspired by them. Personally I like somewhere I have to go, so I can be submerged in it. But an app you can access all the time has the potential with right marketing to connect new people.	I'm really interested in what you're going to do. If there are updates you can always contact me
08/05/2	18-30	Visiting art museums, Social media	No i haven't had that experience	I haven't experienced that	Moderately interested in	Very interested in	Very interested in	Very interested in	Both I think. It would be nice to have it in public, but since i think not many people will use it, i think an app will be better	
10/05/2	18-30	Reading books, Visiting art museums, Learning by doing, Watching videos/ movies, Talking with other people, Social media	Rythm games in VR are fun	Projection mapping on ruins. Large scale sculptures in nature	Very interested in	Very interested in	Moderately interested	Very interested in	VR App so that I don't need to worry about proper social interactions and can take as much time as I want	
10/05/2	>30	Reading books, Visiting art museums, Learning by doing, Talking with other people	Loving Vincent if it counts	Some apps are enjoyable but prefer hands on art	Very interested in	Very interested in	Moderately interested	Moderately interested in	APP. EASIER AND FASTER TO ACCESS	
10/05/2	>30	Reading books, Visiting art museums, Learning by doing, Watching videos/ movies, Talking with other people, Social media	No, but I am very interested in trying it.	I like reconstruction videos and interactive art installation	Very interested in	Very interested in	Very interested in	Very interested in	Both is fine, I would be happy with either	Great initiative. As an art teacher I Please spell or words! Do not have initials, or at least explaine initials!
10/05/2	>30	Reading books, Visiting art museums	I have no idea what you mean, initials for something do not mean anything to me :(	Puzzles, this way i can see the detail better	Very interested in	Very interested in	Very interested in	Very interested in	Have no idea what you are asking	As an older person I have
10/05/2	>30	Reading books, Visiting art museums, Learning	none	magical reality is good	Moderately interested in	Very interested in	Moderately interested	Not interested in	either	

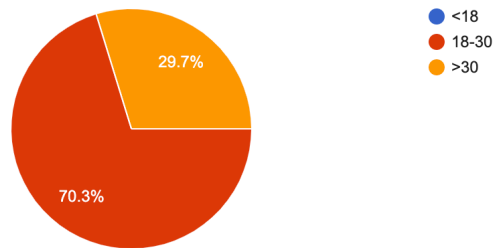


Time	What is your age	How do you like to experience art?	Have you had AR/VR/MR experiences?	Have you experienced art in a museum?	The new product can include the following aspects about van Gogh, rate them based on your interests [His personal interests]	The new product can include the following aspects about van Gogh, rate them based on your interests [His painting styles and techniques]	The new product can include the following aspects about van Gogh, rate them based on your interests [How van Gogh can play a role in your daily life]	The new product can include the following aspects about van Gogh, rate them based on your interests [How van Gogh can connect to the trends in society]	Would you like the product to be an installation in a public space or an (AR/VR/MR) app you can access anytime anywhere? Why?	Anything else you want to say?
11/05/21	>30	Learning by doing	No	No	Moderately interested in	Very interested in	Very interested in	Very interested in	VR	
11/05/21	18-30	Visiting art museums, Learning by doing, Watching videos/movies, Talking with other people, Social media, Visiting art museum with a guide who has interesting background information	Haven't had many of such experiences	I've visited an exposition by Daan Roosegaarde, where you were encouraged to touch and interact with the art. I loved that, it helps immerse you in the art instead of just being an observer. I have also visited Museum Voorlinden, where there are certain installations that you can interact with, again very cool. My visit there was also with a guide, who really helped to explain some of the more abstract pieces.	Moderately interested in	Very interested in	Moderately interested	Moderately interested in	An installation in a public space. Interacting with it will feel like more of a conscious thing then, and I think that would give me a better experience. If it's an app, I might install it, look at it for 5 minutes and then forget about it.	
11/05/21	>30	Visiting art museums, Learning by doing, Watching videos/movies, Talking with other people	Yes, it was uncomfortable	More comfortable with 2 dimensions	Moderately interested in	Very interested in	Not interested in	Moderately interested in	Hungry for public space	Best wishes

## d.2 Quantitative results of the quationnaire

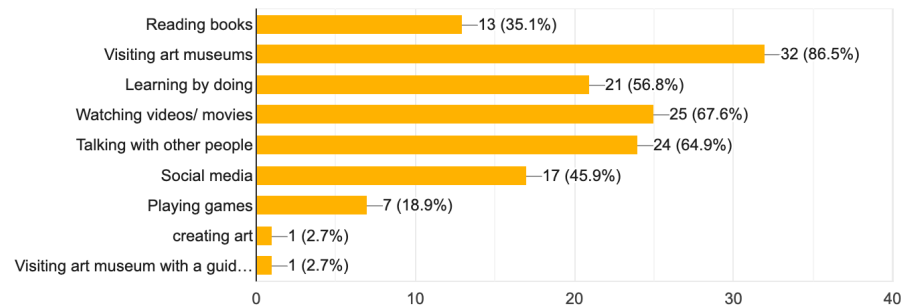
What is your age group?

37 responses



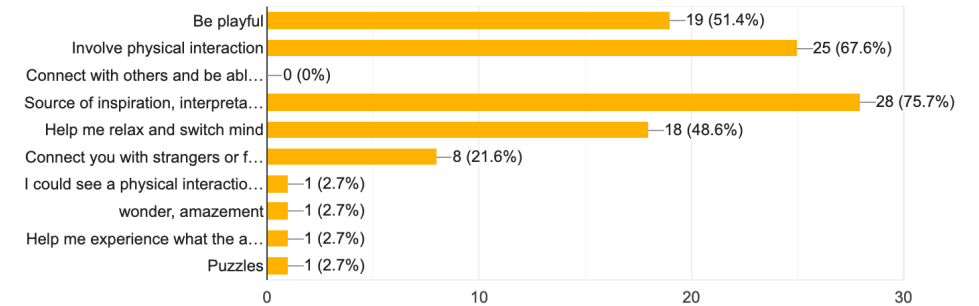
How do you like to experience art?

37 responses

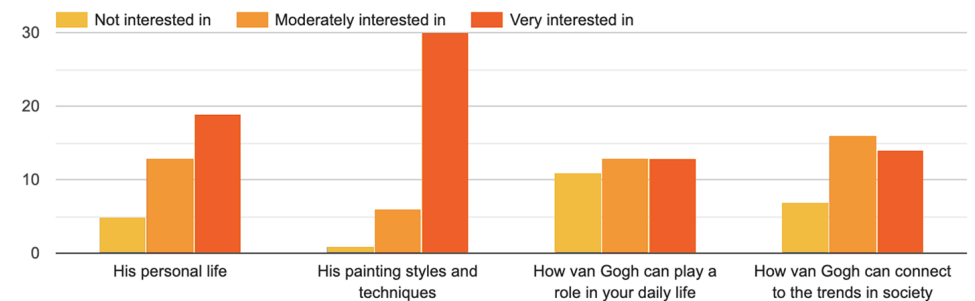


Imagine a new product that tells the contents about van Gogh you are interested in, what characteristics should it have in order to be more attractive to you?

37 responses



The new product can include the following aspects about van Gogh, rate them based on your interests

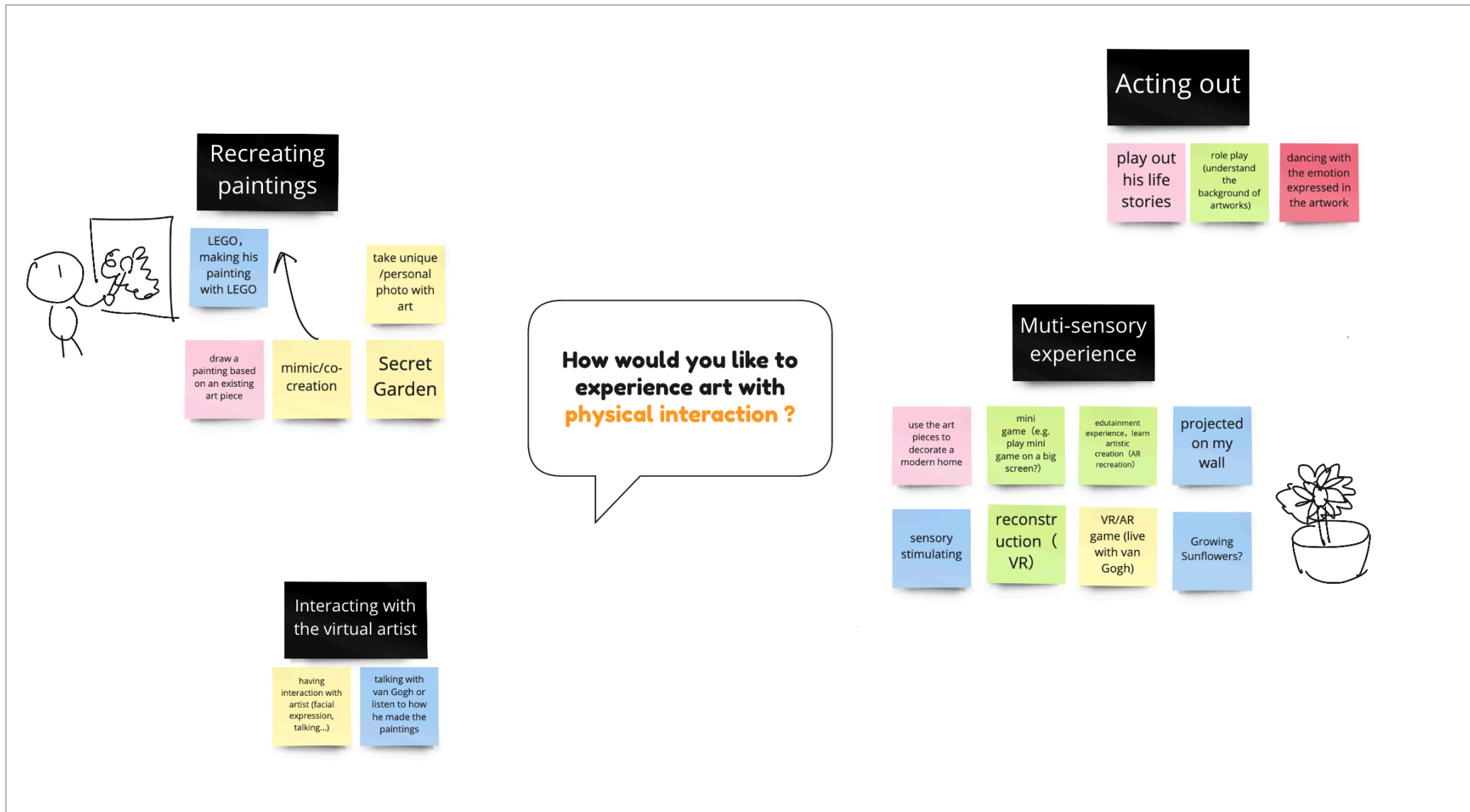


## **Appendix C - Brainstorming session**

The following pages show the clustered results of the raw data from the brainstorming session generated by four participants.

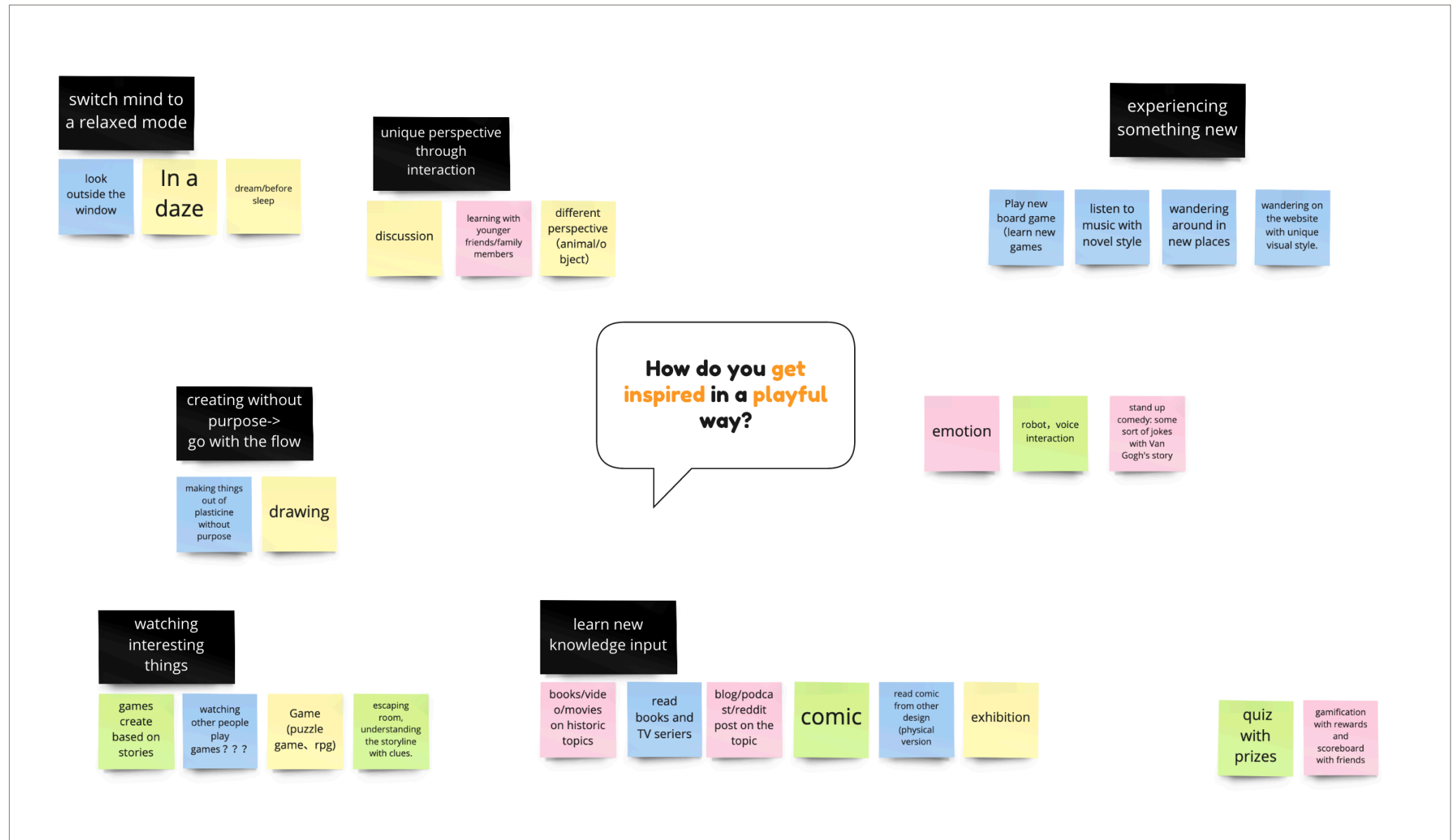
After a brief introduction of the project, participants were given 10 minutes and typed what came out of their minds for each question.

# Q1: How would you like to experience art with physical interaction?

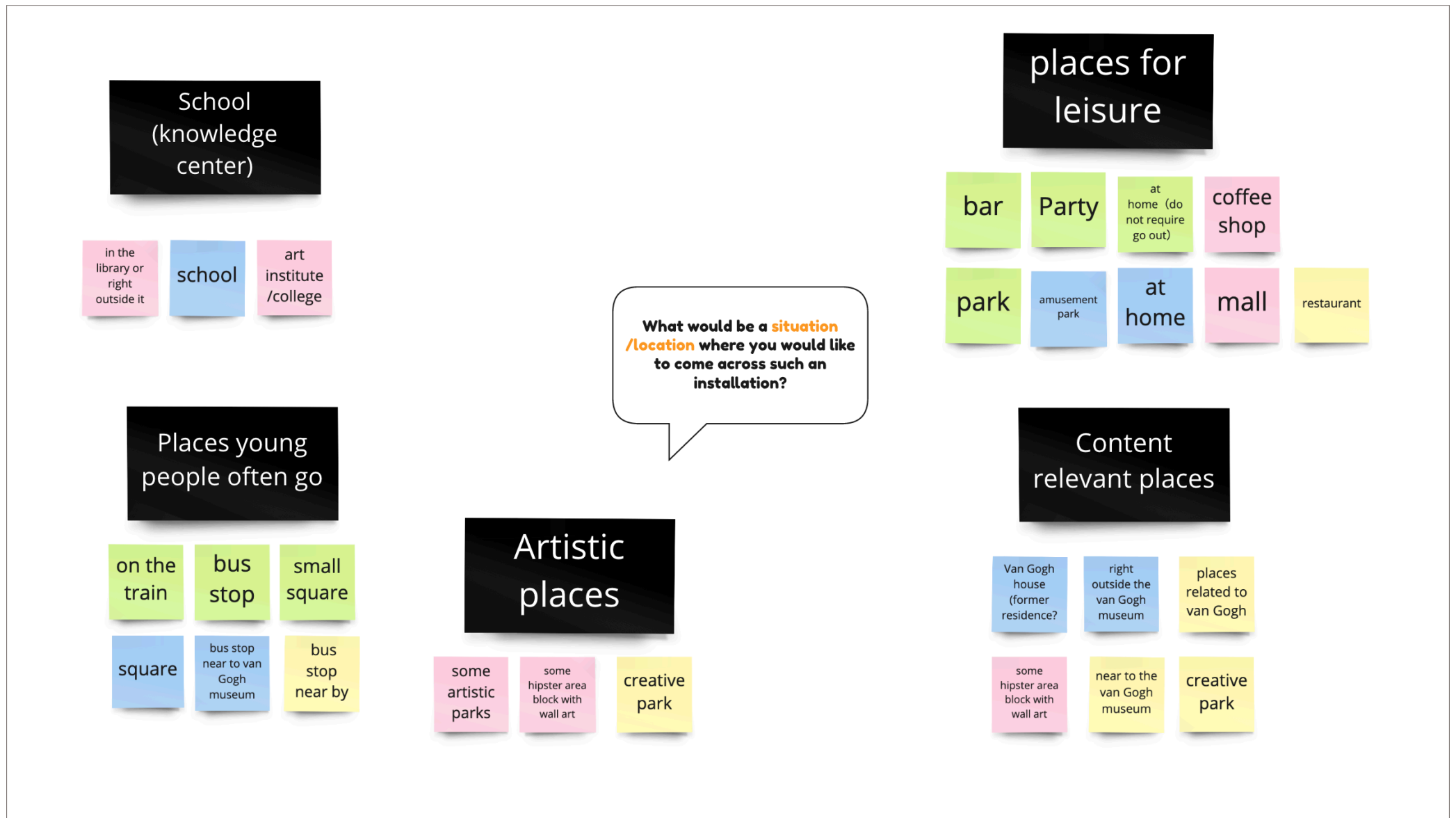




## Q2: How do you get inspired in a playful way?



### Q3: Where would you like to come across the installation?



## **Appendix D - Detailed Description of Four Ideas**

- a. Coloring the masterpieces of Van Gogh
- b. Recreating Van Gogh's masterpieces with backstories
- c. Coloring masterpieces by correctly answering question
- d. Learning the path of Van Gogh's artistic development through his letters

## a. Coloring the masterpieces of Van Gogh



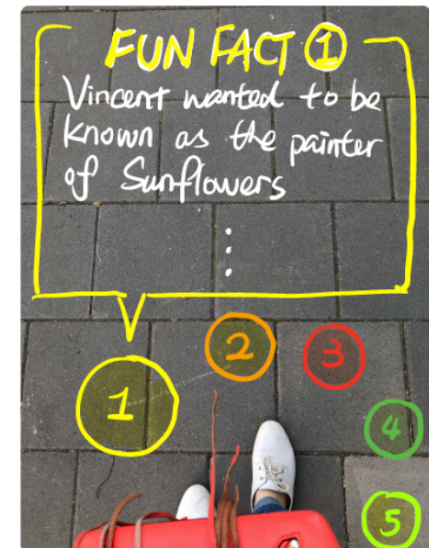
**1** When approaching the area some tiles are lightened up and ready to be interacted



**2** Step onto the highlighted tile, the color in the painting filled in. Music is playing



**3** Others are joining and finishing the coloring together.



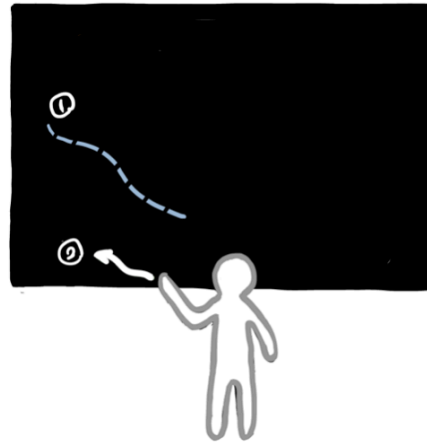
**4** Some fun facts of the painting are presented after finishing up coloring



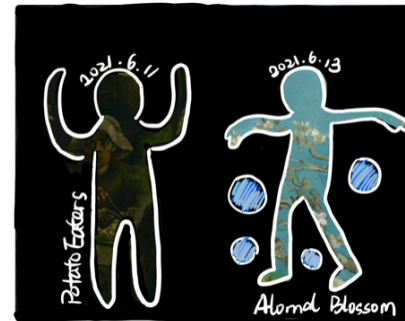
## b. Recreating Van Gogh's masterpieces with backstories



- 1** The backstory of the painting introduced first as a trigger.



- 2** Painting with body movement with instruction given by van Gogh

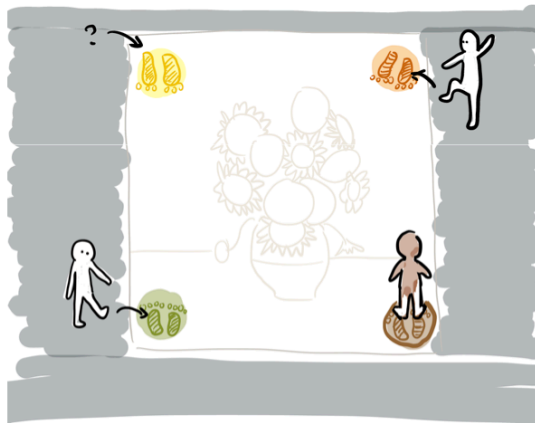


- 3** Display of recreations from people, the movement of people are captured during painting.

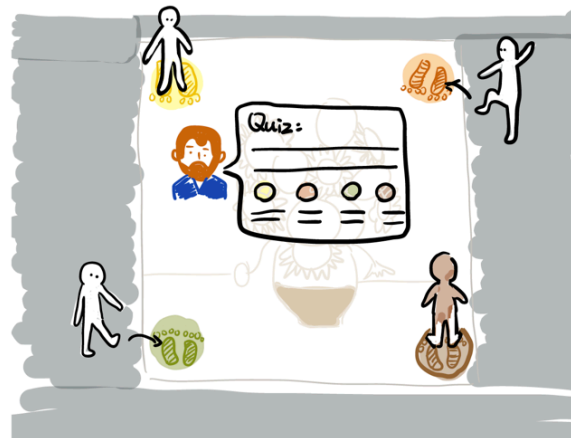


- 4** Recreations compared with the original. Vote for your favorite recreation.

### c. Coloring masterpieces by correctly answering question



**1** Multiple people join together to complete the color of a painting



**2** Answering quiz about van Gogh's art and life. The options are connected to his color pallet.

When select correct answer, the corresponding color will be filled in on the painting



**3** When more than 80% questions are correct, the colored painting will displayed on river.

#### d. Learning the path of Van Gogh's artistic development through his letters



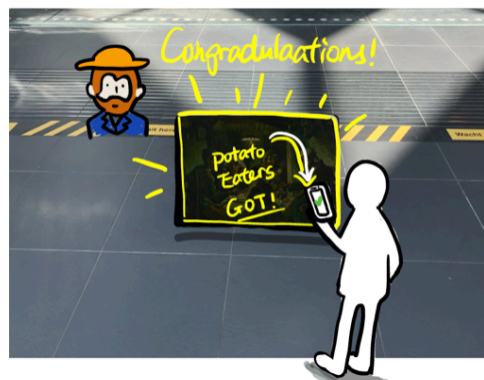
- 1** The train is leaving, and left letters on the platform



- 2** People come across the letters



- 3** The letter opened by users, van Gogh tells his stories, art and development in himself



- 4** The users receive a souvenir from van Gogh and save to their VG app (Download via QR code)



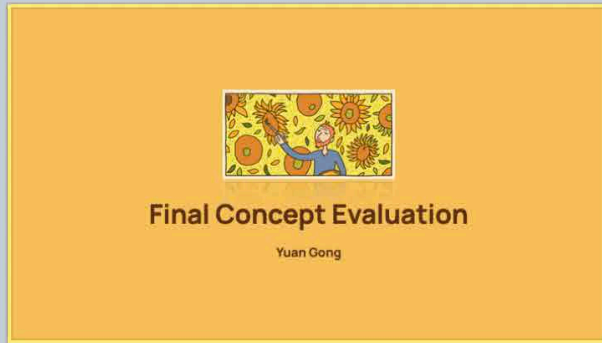
- 5** Each time come across new letters, a milestone added in van Gogh's artistic development.

## **Appendix E - Control test materials**

- a. Storyboard used in the control test
- b. Questionnaire and its results
- c. Interview questions



## a. Storyboard used in the control test



1



2



3



4



5



6



7



8

## b. Questionnaire and its results

Questions Responses 10

Section 1 of 3

### Questionnaire of the Final Concept Evaluation

Hi, thank you for participating in my final concept evaluation and being part of my graduation project! :)

This questionnaire consists of the following three aspects:

- 1) your background information;
- 2) the content provided in the experience;
- 3) your overall experience with the installation.

Your answer will be anonymous.

Many thanks to you and have a great day.

Best,  
Yuan

Age \*

☐ <18

☐ 18-30

☐ 31-35

☐ >35

Gender \*

☐ Female

☐ Male

☐ Other...

Nationality \*

Short-answer text

After section 1 Continue to next section

## About the Content of the Experience



Description (optional)

The content provided in the experience: \*

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagr...
The content is ...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understand th...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The content tri...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I'd like to find m...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

After section 2 Continue to next section



## Your Experience with the Installation

Description (optional)

The visual effect of the installation is \*

	1	2	3	4	5	
Ugly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Attractive

The content provided in the experience is \*

	1	2	3	4	5	
Confusing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Clearly structured

The Interaction with the installation is \*

	1	2	3	4	5	
Unruly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Manageable

The experience with the installation is \*

	1	2	3	4	5	
Dull	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Captivating

The experience with the installation is \*

	1	2	3	4	5	
Ordinary	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Novel

The experience with the installation is \*

	1	2	3	4	5	
Conservative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Innovative

The experience with the installation is \*

	1	2	3	4	5	
Rejecting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Inviting

The experience with the installation is \*

	1	2	3	4	5	
Unpleasant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Engaging

The experience with the installation is \*

	1	2	3	4	5	
Uninspiring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Inspiring

The experience with the installation is \*

	1	2	3	4	5	
Boring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Playful

The experience with the installation is \*

	1	2	3	4	5	
Stressful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Relaxing

10 responses



Accepting responses ☒

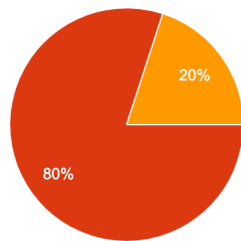
Summary

Question

Individual

Age

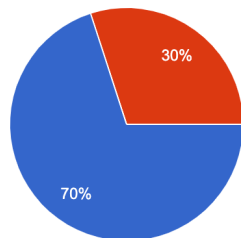
10 responses



- <18
- 18-30
- 31-35
- >35

Gender

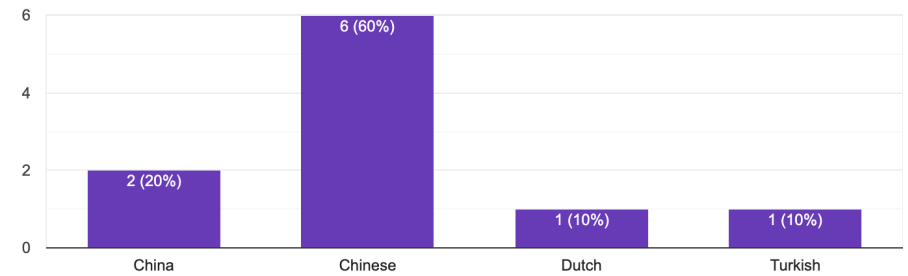
10 responses



- Female
- Male

Nationality

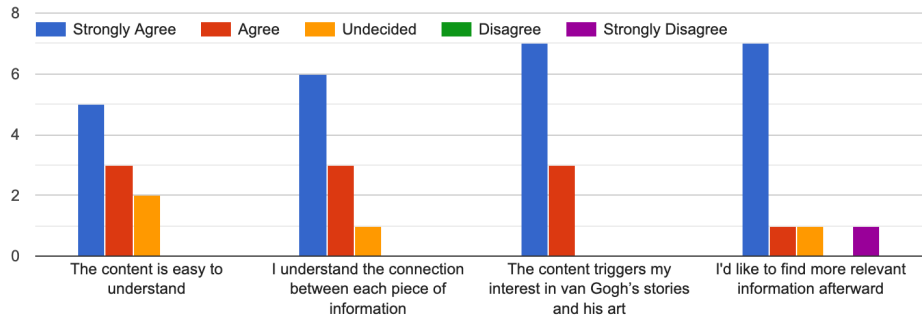
10 responses





About the Content in the Experience

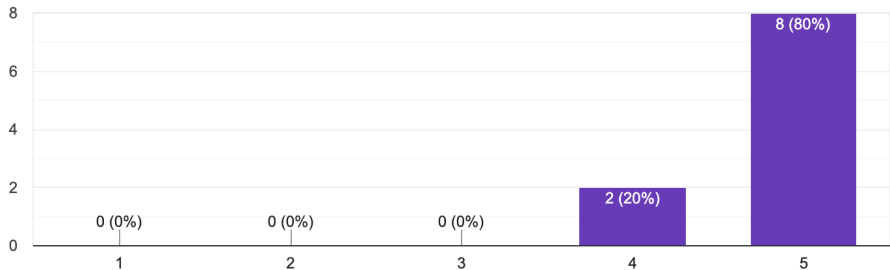
The content provided in the experience:



Your Experience with the Installation

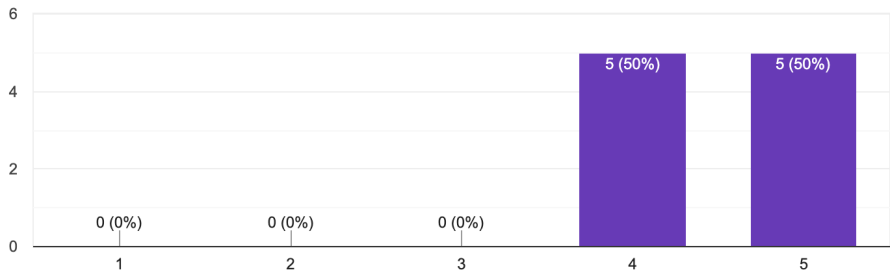
The visual effect of the installation is (Ugly-Attractive)

10 responses



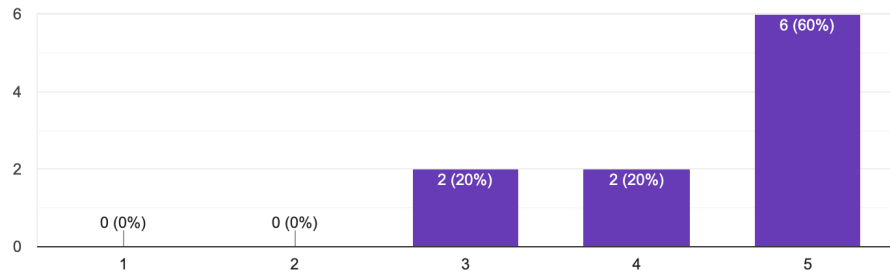
The content provided in the experience is (Confusing-Clearly structured)

10 responses



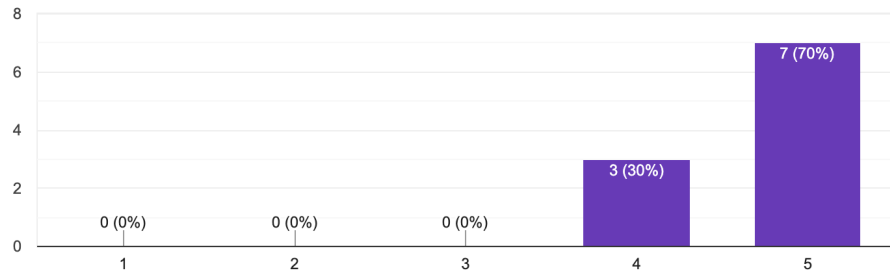
The Interaction with the installation is (Unruly-Manageable)

10 responses



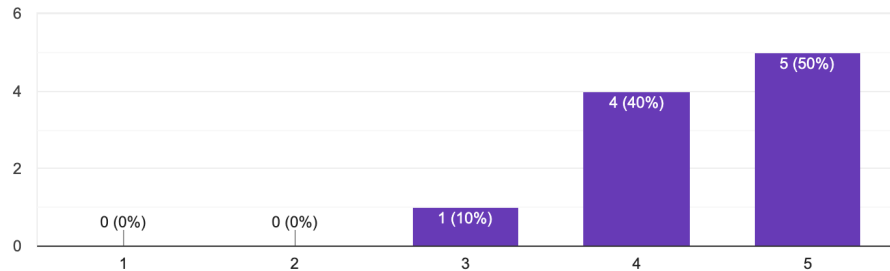
The experience with the installation is (Dull-Captivating)

10 responses



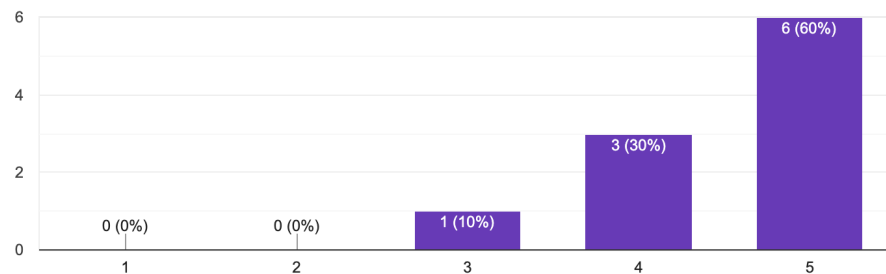
The experience with the installation is (Ordinary-Novel)

10 responses



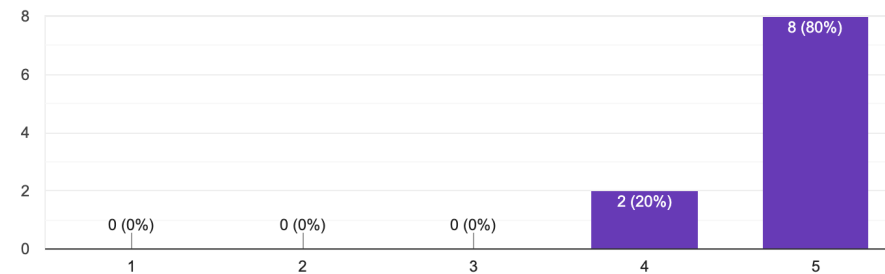
### The experience with the installation is (Conservative-Innovative)

10 responses



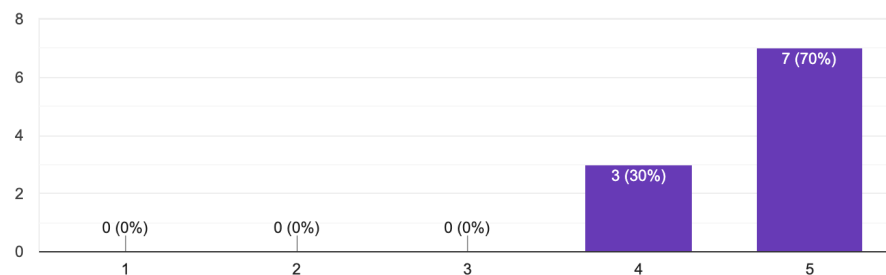
### The experience with the installation is (Uninspiring-Inspiring)

10 responses



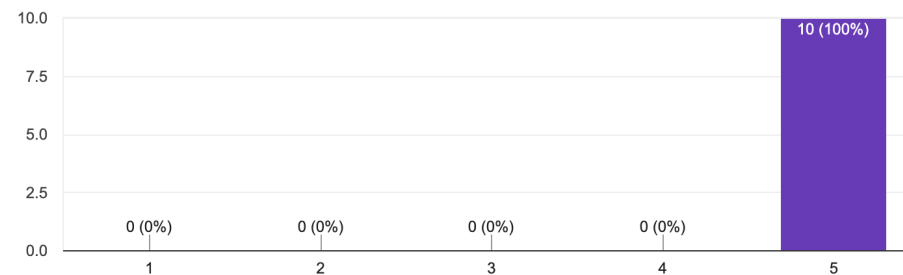
### The experience with the installation is (Rejecting-Inviting)

10 responses



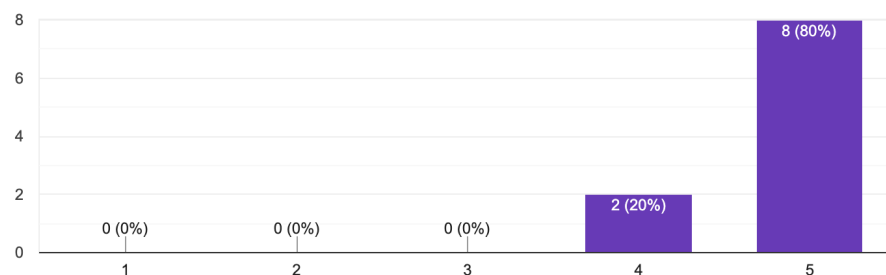
### The experience with the installation is (Boring-Playful)

10 responses



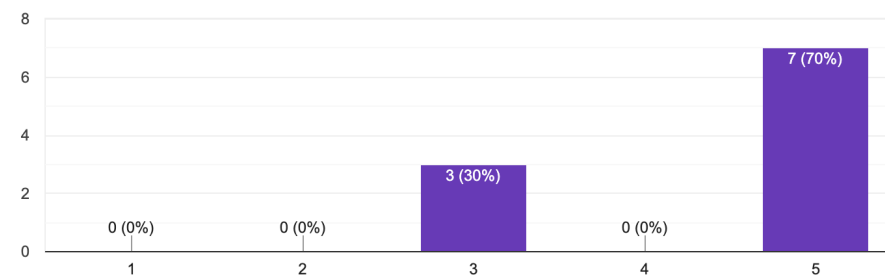
### The experience with the installation is (Unpleasant-Engaging)

10 responses



### The experience with the installation is (Stressful-Relaxing)

10 responses



## c. Interview questions

- How do you feel about the experience in general? Which part do you like? Which part do you dislike?
- Did you understand the influence of your action to the installation? (Usability)
- Can you imagine the scenario if you encounter the installation in a public space (e.g., airport/train station)? How would the difference in the environment affect your behaviors? Would you react differently than in this controlled environment?
- Could you imagine if you experience the installation with other people's presence, what would be different?
- How likely would you scan the QR code? The reason you might scan the QR code is most likely because...
  - e.g., I want to save my van Gogh-style portrait/ I want to discover more information on the Van Gogh Museum Website.