Appendix

Exploring Colour Compositions Like Van Gogh:

Designing an Interactive Learning Experience at the Van Gogh Museum

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2025 August

Move the tokens to change colours!
druk op de knop!
Press Button!
Verplaats de tokens om de kleur te veranderen!

Appendix

Appendix A: Time Planning /4

Appendix B: Pilot Study /6

Appendix C: Materials for User Research /12

Appendix D: Raw Data from Pilot Study & Formal Study /22

Appendix E: Statement Cards from User Research /26

Appendix F: Full List of Inspirations /38

Appendix G: Ideation Cards Set for Workshop /40

Appendix H: Ideas from Individual Ideation /46

Appendix I: Setup of Co-creation Workshop /48

Appendix J: Co-creation Workshop Outcomes /50

Appendix K: Raw Ideas Grouping /54

Appendix L: Concept Evaluation Process /58

Appendix M: Prototype Developing Details /60

Appendix N: Complete Programming /68

Appendix O: Prototype Cutting Plans /84

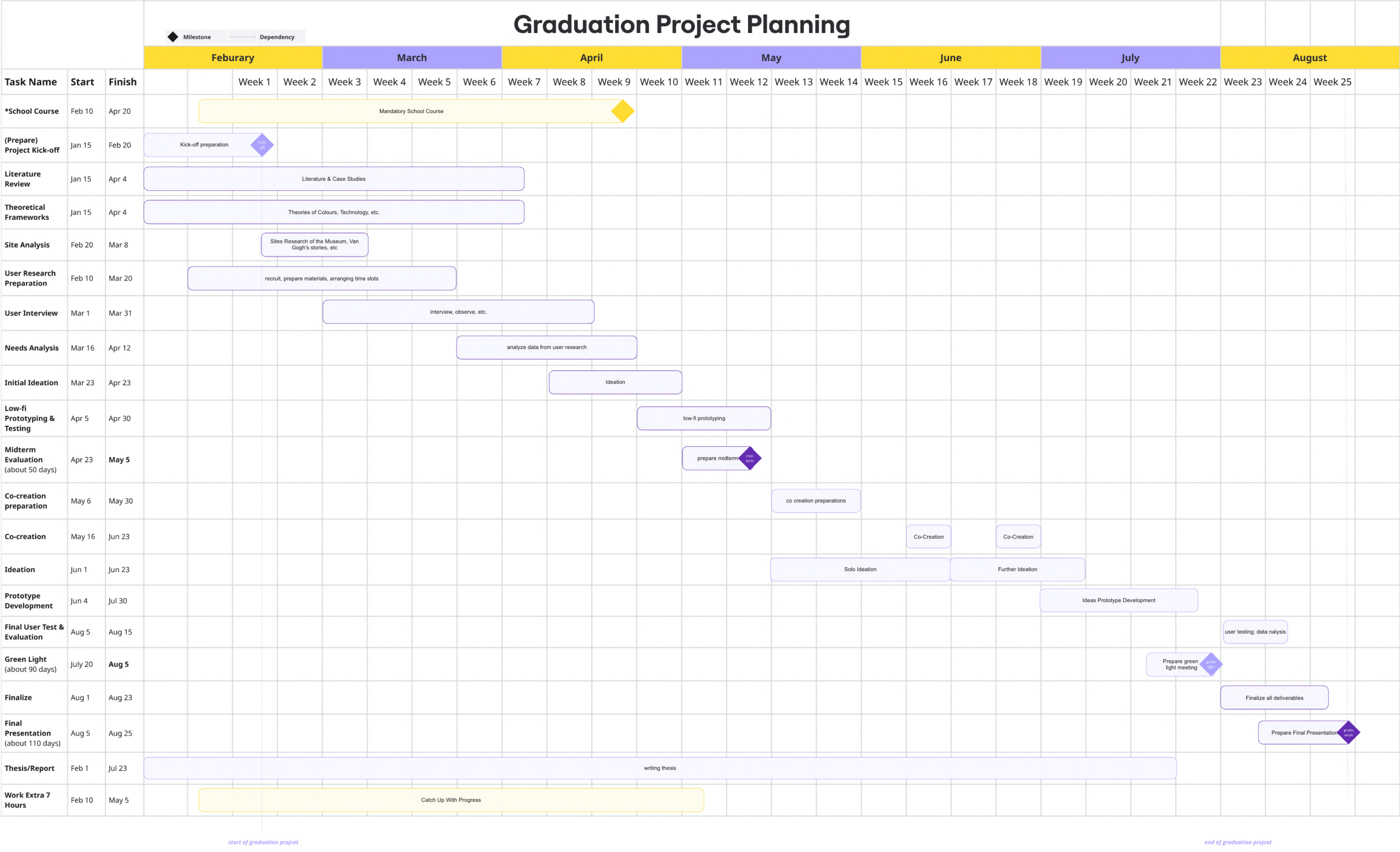
Appendix P: Final User Testing Plan /86

Appendix Q: Materials for User Testing /90

Appendix R: Statement Cards from Final User Testing /98

Appendix S: Graduation Project Brief /112

Appendix A: Time Planning



Graduation Project Planning

Task Name	Start	Finish
*School Course	Feb 10	Apr 20
(Prepare) Project Kick-off	Jan 15	Feb 20
Literature Review	Jan 15	Apr 4
Theoretical Frameworks	Jan 15	Apr 4
Site Analysis	Feb 20	Mar 8
User Research Preparation	Feb 10	Mar 20
User Interview	Mar 1	Mar 31
Needs Analysis	Mar 16	Apr 12
Initial Ideation	Mar 23	Apr 23
Low-fi Prototyping & Testing	Apr 5	Apr 30
Midterm Evaluation (about 50 days)	Apr 23	**May 5**
Co-creation preparation	May 6	May 30
Co-creation	May 16	Jun 23
Ideation	Jun 1	Jun 23
Prototype Development	Jun 4	Jul 30
Final User Test & Evaluation	Aug 5	Aug 15
Green Light (about 90 days)	July 20	**Aug 5**
Finalize	Aug 1	Aug 23
Final Presentation (about 110 days)	Aug 5	Aug 25
Thesis/Report	Feb 1	Jul 23
Work Extra 7 Hours	Feb 10	May 5

Milestone
Dependency
Feburary
March
April
May
June
July
August
Week 1
Week 2
Week 3
Week 4
Week 5
Week 6
Week 7
Week 8
Week 9
Week 10
Week 11
Week 12
Week 13
Week 14
Week 15
Week 16
Week 17
Week 18
Week 19
Week 20
Week 21
Week 22
Week 23
Week 24
Week 25
Mandatory School Course
Kick-off preparation
kick-off
Literature & Case Studies
Theories of Colours, Technology, etc.
Sites Research of the Museum, Van Gogh's stories, etc
recruit, prepare materials, arranging time slots
interview, observe, etc.
analyze data from user research
Ideation
low-fi prototyping
prepare midterm
mid-term
co creation preparations
Co-Creation
Co-Creation
Solo Ideation
Further Ideation
Ideas Prototype Development
user testing; data nalysis
Prepare green light meeting
green light
Finalize all deliverables
Prepare Final Presentation
graduation
writing thesis
Catch Up With Progress
start of graduation projcet
end of graduation projcet

Appendix B: Pilot Study

B.1 study goals

A preliminary pilot study was conducted on the campus of Delft University of Technology (TUD). The aim of this study is to:

- Test the feasibility and usability of the interactive prototypes.
- Evaluate whether the study design effectively satisfies the research goals.
- Identify potential methodological issues before launching the main study.
- Findings from this pilot were used to refine the research setting, interaction prototypes, and data collection methods.

B.2 pilot study settings

8 participants recruited from a sign-up link joined the pilot study. They all age from 24-30 years old, and 7 participants are from the Industrial Design Engineering (IDE) faculty.

All pilot sessions were conducted in an informal setting in IDE faculty building, on the TU Delft campus.

Participants were invited to explore all prototypes freely, without a predefined task. Minimal guidance was provided to allow for natural interaction. The overall procedure followed the same structure as in the formal study.

Data analysis methods are the same with those of the formal study, combining qualitative techniques (e.g., observation and reflection) with quantitative measures such as Likert-scale ratings.

B.3 materials & prototypes

The selected prototypes were designed to explore several key themes in colour interaction:

- Digital vs. tangible interaction
- Multisensory engagement vs. visual-only perception
- The relationship between colour and emotion
- The desirability of freedom and creativity in user engagement

The prototype overview is as follows:

Prototype A: Paper and Colour Pens:
Participants are given a double-sided sheet: one side is blank for free drawing, while the other contains a printed outline that can be filled with colour. This prototype is designed to explore the desirability of freedom and creativity in user engagement with colours.

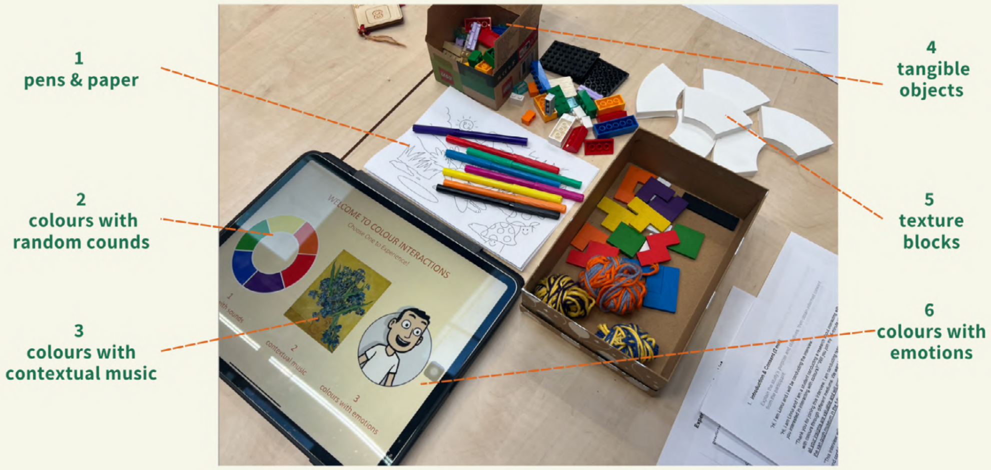
Prototype B: Digital Sound–Colour Blocks
On a digital screen, each colour block is associated with a specific musical tone—brighter colours trigger higher-pitched notes, while darker colours correspond to lower-pitched sounds. This prototype examines how multisensory engagement, specifically combining colour and sound, influences user interaction, and also contributes to the comparison between digital and tangible interaction formats.

Prototype C: Digital Painting-Based Colour–Sound Blocks
A painting is presented alongside a deconstructed musical score that reflects its colour composition. Participants can click on colour blocks to play corresponding instrument tracks, allowing them to recompose the painting as a layered sound experience. This prototype explores how colour can be interpreted through multisensory translation and contextual meaning, while also serving as a digital counterpart in the digital vs. tangible comparison.

Prototype D: Digital Emotion–Colour Association
Each colour block on the screen is linked to a specific emotion based on Plutchik's (2001) model. When clicked, a collage of expressive images appears, becoming denser with continued interaction. This prototype is designed to explore how users perceive and respond to the relationship between colour and emotion, and it also represents a digital-only mode of interaction within the study.

Prototype E: Tactile Textures
Each colour is represented by a distinct 3D-printed texture, allowing users to explore colours purely through touch. This prototype tests whether colour impressions can be meaningfully conveyed through non-visual, tactile interaction.

Prototype F: Tangible Colour Objects
Participants interact with various physical colour elements—including LEGO bricks, puzzle blocks, and wool balls—by building, arranging, and combining them. This prototype aims to explore how hands-on, playful construction supports user creativity and freedom and engagement in colour interaction.



B.4 procedure

The study aims to be conducted as a one-on-one session, lasting approximately 15-20 minutes per participant. The procedure consists of the following steps:

1. Introduction & Consent:
The session began with a brief explanation of the study’s purpose and structure. Participants were then asked to read and sign an informed consent form, in line with ethical research practices.

2. Background Questions:
Participants were asked to reflect on their previous museum experiences and share any memorable impressions. To contextualise the upcoming tasks and assess alignment with the target user profile, they were also asked to circle adjectives from a vocabulary list that best described their ideal interactive museum experience. This step helped identify initial preferences and ease participants into a reflective mindset.

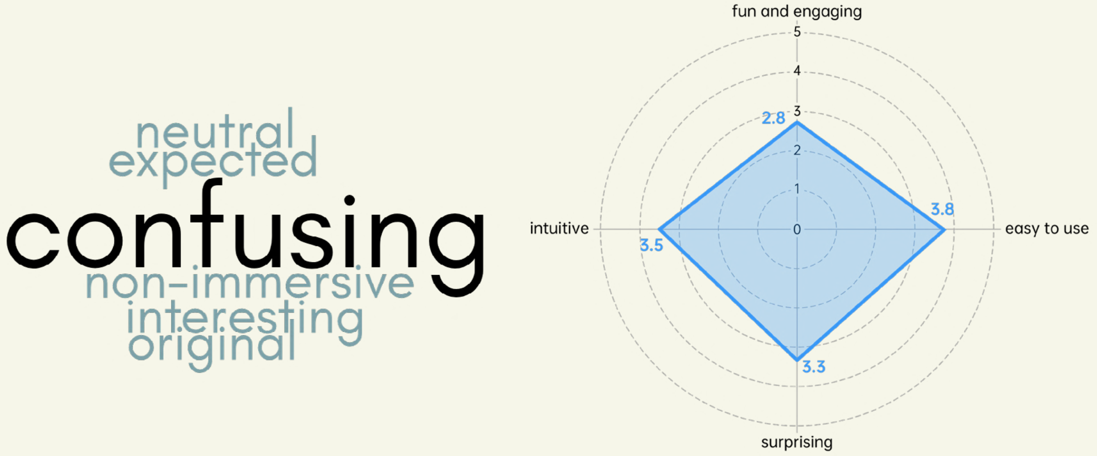
3. Test Mock-ups & Think-Aloud:
Participants interacted with all prototypes in a random order, verbalising their thoughts, feelings, and reactions in real time. The researcher provided guidance when necessary to avoid confusion while preserving natural responses. This stage aimed to sensitise participants to different interaction mock-ups and uncover deeper preferences and needs.

4. Survey & Interview:
After testing, participants revisited the same vocabulary list—this time circling adjectives for each prototype separately—to help them articulate their impressions and reflect on differences across experiences. They are then asked to complete a Likert-scale questionnaire rating each prototype across four dimensions: element of surprise, engagement, intuitiveness, and ease of use. A short semi-structured interview followed to explore reasons behind their choices, any challenges encountered, and moments they found particularly meaningful or enjoyable.

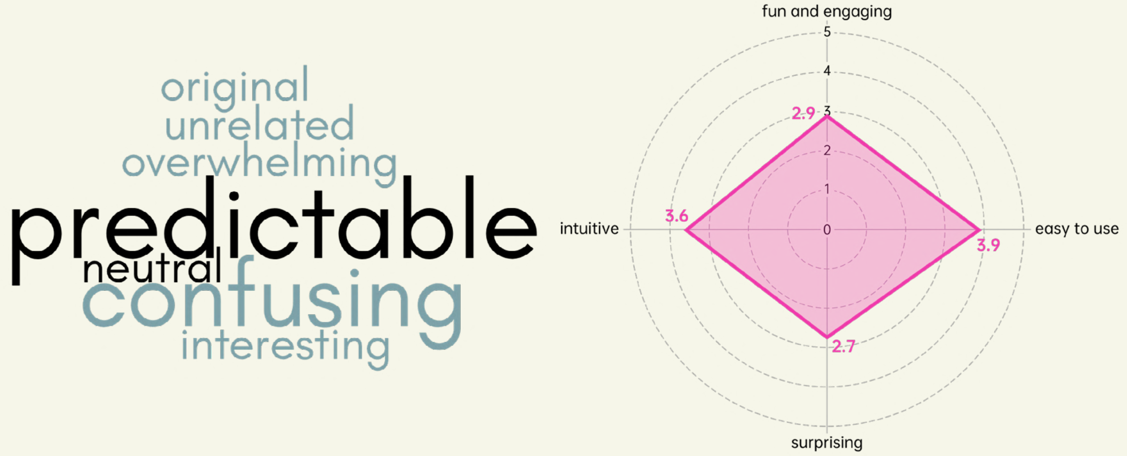
B.5 results & analysis

The pilot study involved 8 participants and generated both qualitative and quantitative data types consistent with those in the formal study. As in the main user study, qualitative data included participant-selected keywords describing each prototype, observed interaction sequences, and think-aloud interview transcripts. Quantitative data consisted of Likert-scale ratings across four evaluation dimensions: engagement, intuitiveness, ease of use, and element of surprise. Data processing followed the same methods as outlined in Section 3.2, including word cloud visualisation of descriptors, and radar chart comparisons.
This section focuses on findings for prototypes that were tested in the pilot study but not retained in the formal study.

Prototype B :



Prototype D :



·The word confusing overwhelmingly dominated feedback on Prototype B (Digital Sound–Colour Blocks), with few neutral or positive terms like original. The lack of clarity and user connection led to consistent disengagement. Due to this persistent negative feedback, Prototype B was removed from the formal study.

Prototype D (Digital Emotion–Colour Association) was described as predictable, confusing, and neutral by most participants. The absence of emotionally rich or engaging descriptors indicated weak user resonance. Given its limited impact and overlap with better-performing alternatives, it was excluded from the formal study.

Across the four evaluation dimensions, ease of use was rated highest for Prototype C (4.3), indicating strong clarity and accessibility. Surprising peaked in Prototype E (4.3) and was lowest in D (2.7), suggesting a clear engagement gap. For fun and engaging, Prototype E scored the highest (4.0) and Prototype A scored second(3.8), while B and D underperformed (<3.0), aligning with their eventual exclusion. Intuitiveness was consistent across most prototypes (3.5–3.7), with A and F slightly leading.

B.6 modifications for formal study

1. Removal of Prototype B:
Prototype B (digital sound–colour blocks) was removed due to significant conceptual overlap with Prototype C. Participants found the two prototypes confusing when tested together, and Prototype C was consistently perceived as more engaging and meaningful. As sufficient insights had already been gathered on Prototype B—highlighting its subjective interpretations and lack of alignment—it was excluded to streamline the study and avoid redundancy.

2. Removal of Prototype D:
Prototype D (emotion–colour mapping) was also excluded for the formal study. While participants acknowledged emotional associations with colours, they expressed that emotional responses to complete paintings were stronger and more relevant than those triggered by abstract colour blocks alone.

3. Addition of a Task:
An extra task was introduced in the formal study, asking participants to reinterpret or recreate one of Van Gogh's paintings using a selected prototype. This addition helped reduce uncertainty and provided clearer direction, while encouraging participants to focus more consciously on colour use and interpretation.

4. Revision of the Drawing Template (Prototype A):
The free drawing template was revised to include a sunflower-inspired outline on one side of the paper. This change aimed to strengthen the contextual link with Van Gogh's work and enhance relevance to the museum setting.

5. Improved Clarity and Support During Testing:
To ensure a smoother testing process, several adjustments were made:
– Additional hints were included in the interview script to prompt reflection
– Printed reproductions of Van Gogh's paintings were provided to inspire participants
– Researcher guidance was slightly increased where necessary to prevent confusion or hesitation. E.g. triggering people to draw on paper, asking them what colour the tactile blocks remind them of, etc.

Appendix C: Materials for User Research

C.1 Interview Script

1. Introduction & Consent (2 min):

Explain the study's purpose and objectives, then obtain informed consent from the participant.

“Hi, I am Linrui and I will be conducting the interview.”

“Hi, I am Linrui and I am a student conducting a research about interacting with colours” “Are you interested in interacting with colours?” “Will you join my 15-minute user testing session?”

the aim of the study: “sensitizing”- “This study is not just about evaluating different prototypes, but more about bringing out your thoughts, feelings, and associations with colours, making you more aware of your own experiences with colours. I'm just interested in how you perceive and engage with different interactions. This process helps us uncover deeper insights that might not come to mind immediately” I will show you some things relate to colours and tell me how you relate to them

"Thank you for joining this interview. I am conducting research to explore how people interact with colours through different mediums. We want to understand your thoughts, feelings, and all your insights are valuable and will contribute not only to my graduation project but also to the van gogh museum in the future project and exhibitions.”

"This interview will take about 20 minutes, and everything you share will be kept anonymous and confidential and used only for this project."

—— ——

"Before we start, I would like to ask for your permission to record our interview for research purposes. The recording will only be used to analyse your answers and will not be shared with anyone."

“I also want to ask you to sign the following consent form. Please take your time.”

2. Background Questions (3-5 min):

Ask participants about their past museum experiences and any memorable impressions they have had. *Ask the participants to circle the adjectives on the vocabulary list they would like to describe their ideal interactive museum experience.

“Can you briefly introduce yourself?” “Your age?” “What do you do” “What are your interests or hobbies?”

“Your background?” “Do you have a lot of knowledge about colours or art?”

—— ——

“Do you enjoy going to museums?” “Can you recall one museum experience you once had involving interactions” “What's it about?”

“Why was it so memorable?” “What did it make you think?” “What did it make you do?”

explain the vocabulary list

“With that memory in mind, Can you look at this list and circle the words you want to use to describe that experience?” “Or can you circle the words you would like an ideal museum interaction experience to have?”

“Would you like to explain some of the adjectives you selected?” “Why did you choose this word...?”

3. Prototype Interaction & Think-Aloud (5-6 min):

Participants will test all prototypes in a randomized order while verbalizing their thoughts and reactions.

“In our next session, I have prepared 4 prototypes that involve different ways of interacting with colours” “They are ....”

“Imagine you are in a museum exhibition setting”

Task: You don't have a specific task. It's an explorative testing. Please play with each prototype and Focus on what different colours in each prototype make you do or think?

You can have these as references and inspirations if you need them.”

*2nd part: first play around, pick one prototype and pick one painting- and connect them *pay attention to colours

“What's the painting's role in your experience just now?”

First, you can explore them freely: “You can explore/try to play with each of them freely/as you want.” “For example, you can try pairing the colours, see how they look when you place them next to each other....there are no specific tasks” “While experiencing, you can tell me any thoughts you have: what do you think of each prototype? What does it make you do/feel? Do you want to spend more time with it?”

"As you're working on this, please feel free to verbalize your thoughts, whether they're questions, confusions, or any reasoning behind your decisions." "If possible, try to express your thinking out loud. It will give me more insight into how you're making choices or reacting."

“Why did you choose xxx first and xx last?”

prototype a (Traditional paper and colour pens):

“Did you find … fun? because you enjoy creating?” “Do you enjoy creating with colours freely?”

“Was it too time-consuming for you?”

** help people learn about colours

prototype c (Digital screen-based colour interaction inspired by a painting-based musical composition):

“Do you find the piece of music fitting the vibe with the painting?”

“Was it noisy?” “Did it give you any insights into how different colours and sounds harmonize with each other?”

*“do you agree with the sounds of the colours?”

*“did you notice the painting beside? did it change your perception of the music?” “do you think they match?”

prototype e (Tangible tactile elements):

“Do you find touching … fun/uncommon?” “What colour would you think this piece represents?”

*“can you try matching the colours to some of the blocks?”

prototype f (Tangible colour objects):

“Did you enjoy making changes to the objects?” “Did you enjoy creating things with them?” “Are they more accessible than digital screens?” “Which is more attractive to you, digital screen or actually touching objects?”

*“what does it make you want to do?”

4. Survey & Interview (5 min):

Participants will complete a Likert scale questionnaire assessing each prototype’s element of surprise, engagement, intuitiveness, and overall interest. Open-ended questions will explore any challenges they faced and their favourite moments.

“Can you talk about your first thoughts or feelings towards these prototypes?” “What was your favourite moment or the least favourite moment you just had?” “Why?”

—— ——

prototype a (Traditional paper and colour pens):

“Why did you choose this word for it?” “what do you like/dislike about it?” “Did it remind you of some similar experience? and what did you feel back then?”

prototype c (Digital screen-based colour interaction inspired by a painting-based musical composition):

“Why did you choose this word for it?” “what do you like/dislike about it?” “Did it remind you of some similar experience? and what did you feel back then?”

prototype e (Tangible tactile elements):

“Why did you choose this word for it?” “what do you like/dislike about it?” “Did it remind you of some similar experience? and what did you feel back then?”

prototype f (Tangible colour objects):

“Why did you choose this word for it?” “what do you like/dislike about it?” “Did it remind you of some similar experience? and what did you feel back then?”

—— ——

“You can use the list again, circle one word for each prototype that you would like to describe your experience just now” + explain a bit why you chose the word

—— ——

“Can you fill in this scale survey? There are four criteria. You can score each prototype in terms of engagement, intuitiveness, ease of use, and the element of surprise from 1 to 5.”

5. Final Conclusion (1 min)

“Thank you for participating!” “Do you have any questions?”

“Do you have thoughts regarding this research itself? its form or questions? Were they clear enough to you?”

“What/Which elements would you wish or expect to see in the future museum?”

C.2 Likert-Scale Survey

To which degree do you agree with the following the statement:

1. This prototype is **fun and engaging** to interact with.
It was pleasant to use the prototype and I would like to spend more time on it.

		strongly disagree	*disagree*	*neutral*	*agree*	*strongly agree*
a		○	○	○	○	○
b		○	○	○	○	○
c		○	○	○	○	○
d		○	○	○	○	○

2. This prototype is **surprising** to interact with.
The prototype has unexpected touches and I have not seen similar designs before.

		strongly disagree	*disagree*	*neutral*	*agree*	*strongly agree*
a		○	○	○	○	○
b		○	○	○	○	○
c		○	○	○	○	○
d		○	○	○	○	○

3. This prototype is **intuitive** to interact with.
The prototype was clear from the start and I quickly knew what to do **without any extra help**.

		strongly disagree	*disagree*	*neutral*	*agree*	*strongly agree*
a		○	○	○	○	○
b		○	○	○	○	○
c		○	○	○	○	○
d		○	○	○	○	○

4. This prototype is **easy to use and easy to interact with.**
I had no trouble at all while using the prototype. I accomplished the task easily with it.

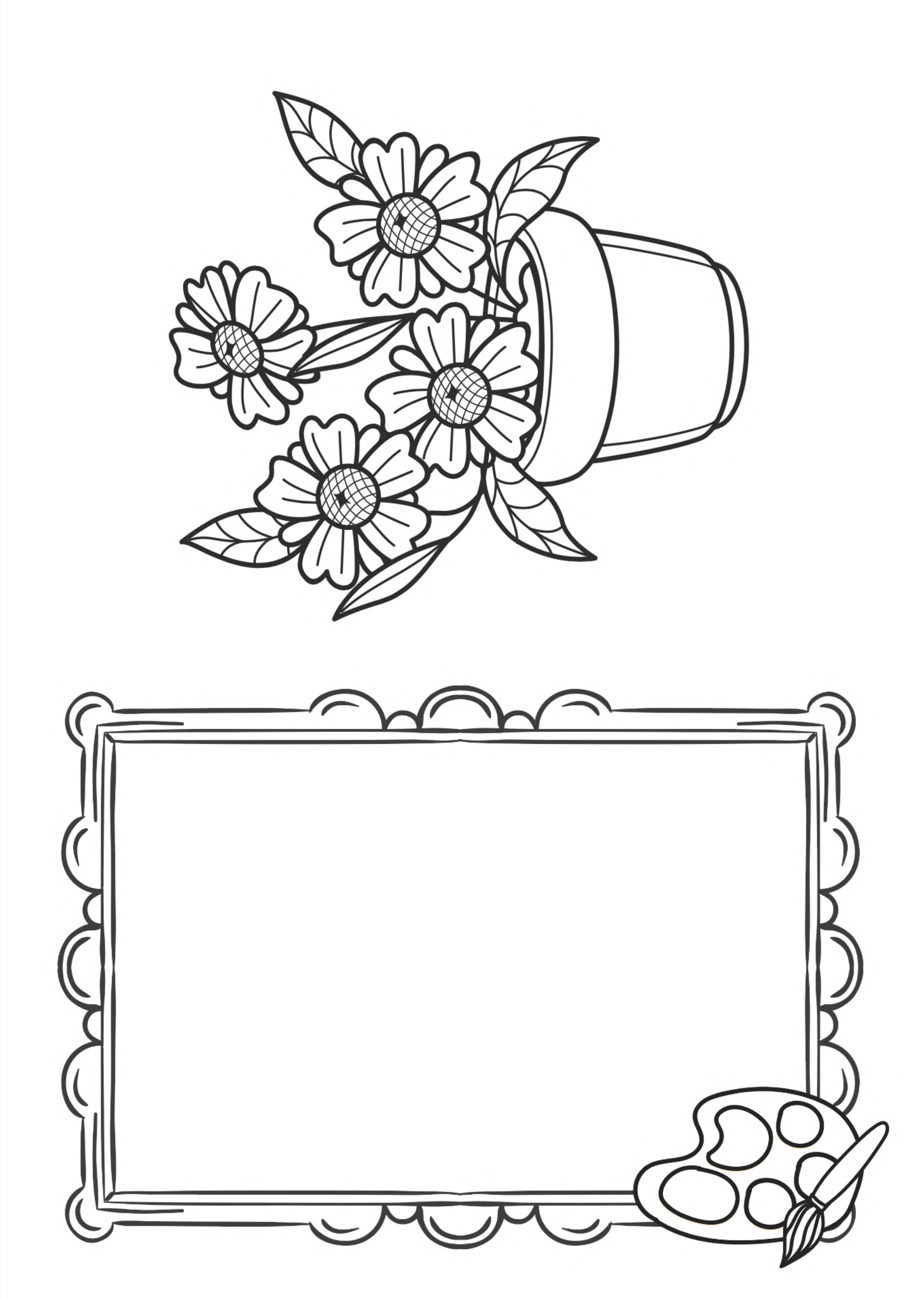
		strongly disagree	*disagree*	*neutral*	*agree*	*strongly agree*
a		○	○	○	○	○
b		○	○	○	○	○
c		○	○	○	○	○
d		○	○	○	○	○

C.3 Vocabulary List

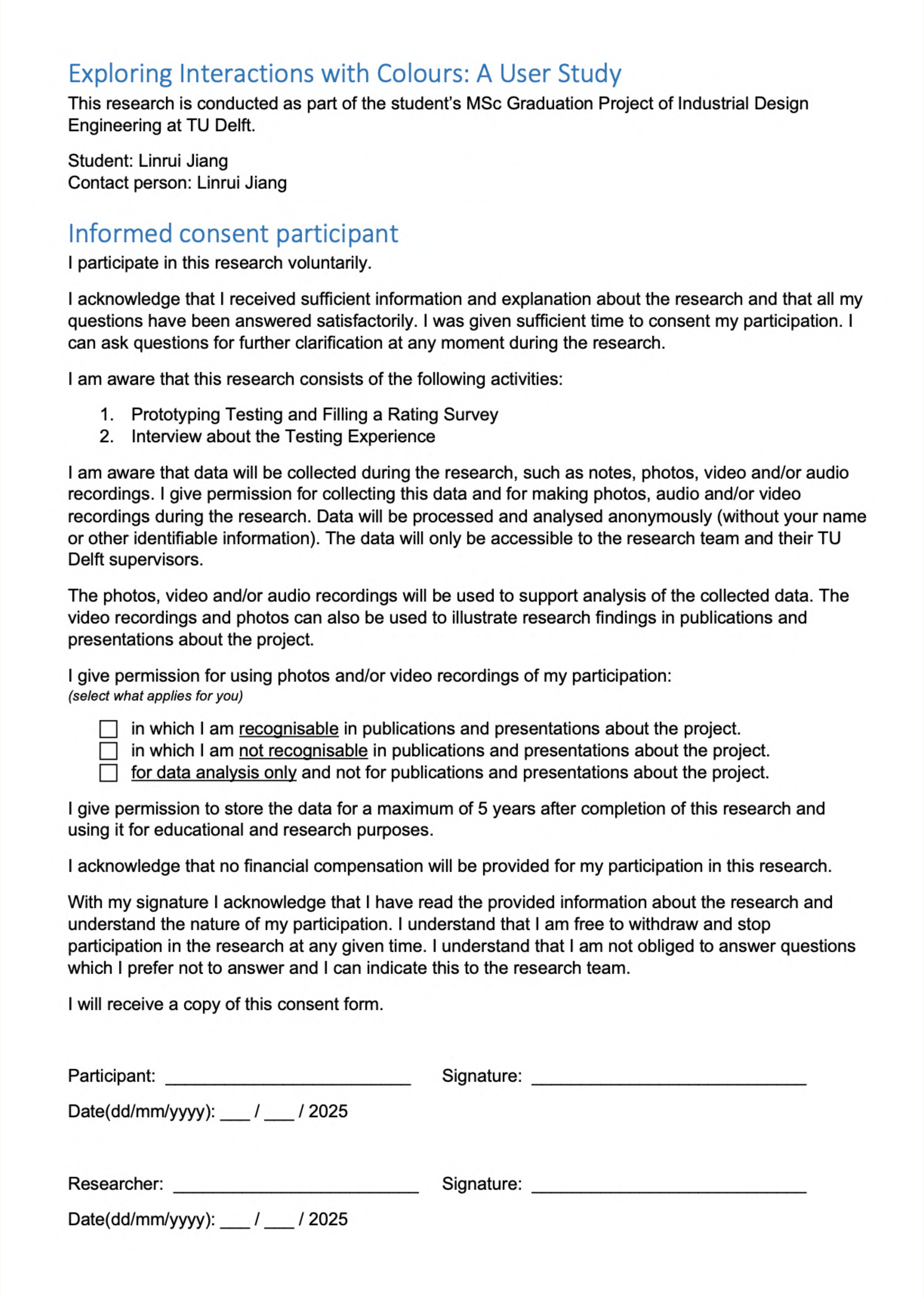
Experience Vocabulary List

interesting	predictable	boring	____________
intuitive	typical	confusing	____________
immersive	conventional	dull	____________
effortless	standard	clunky	____________
surprising	functional	time-consuming	____________
quick	moderate	slow	____________
rich	adequate	overwhelming	____________
informative	expected	cluttered	____________

C.4 Drawing Template



C.5 Informed Consent Form



Exploring Interactions with Colours: A User Study

This research is conducted as part of the student's MSc Graduation Project of Industrial Design Engineering at TU Delft.

Student: Linrui Jiang
Contact person: Linrui Jiang

Informed consent participant

I participate in this research voluntarily.

I acknowledge that I received sufficient information and explanation about the research and that all my questions have been answered satisfactorily. I was given sufficient time to consent my participation. I can ask questions for further clarification at any moment during the research.

I am aware that this research consists of the following activities:

1. Prototyping Testing and Filling a Rating Survey
2. Interview about the Testing Experience

I am aware that data will be collected during the research, such as notes, photos, video and/or audio recordings. I give permission for collecting this data and for making photos, audio and/or video recordings during the research. Data will be processed and analysed anonymously (without your name or other identifiable information). The data will only be accessible to the research team and their TU Delft supervisors.

The photos, video and/or audio recordings will be used to support analysis of the collected data. The video recordings and photos can also be used to illustrate research findings in publications and presentations about the project.

I give permission for using photos and/or video recordings of my participation:
(select what applies for you)

☐ in which I am recognisable in publications and presentations about the project.
☐ in which I am not recognisable in publications and presentations about the project.
☐ for data analysis only and not for publications and presentations about the project.

I give permission to store the data for a maximum of 5 years after completion of this research and using it for educational and research purposes.

I acknowledge that no financial compensation will be provided for my participation in this research.

With my signature I acknowledge that I have read the provided information about the research and understand the nature of my participation. I understand that I am free to withdraw and stop participation in the research at any given time. I understand that I am not obliged to answer questions which I prefer not to answer and I can indicate this to the research team.

I will receive a copy of this consent form.

Participant: ________________________ Signature: ___________________________

Date(dd/mm/yyyy): ___ / ___ / 2025

Researcher: ________________________ Signature: ___________________________

Date(dd/mm/yyyy): ___ / ___ / 2025

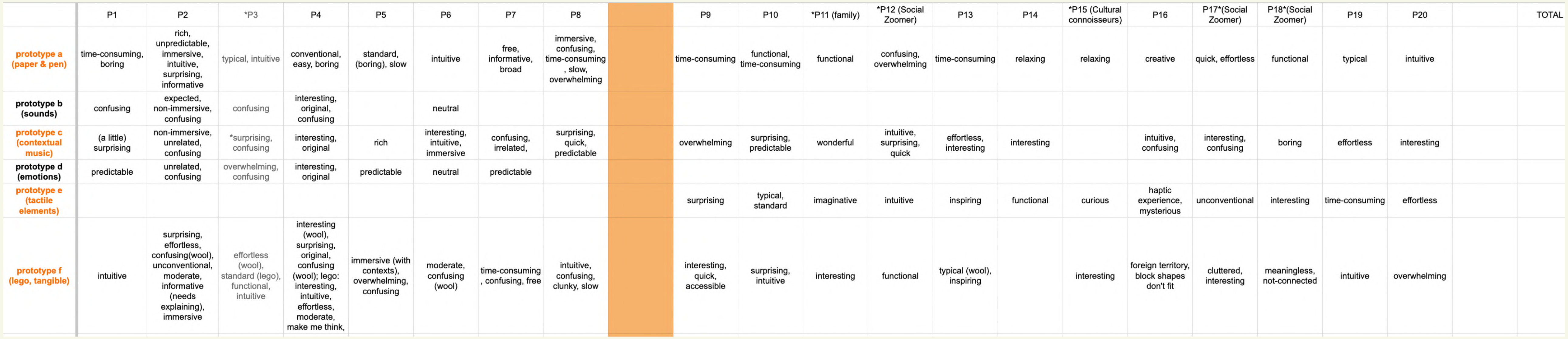
Appendix D: Raw Data From Pilot & Formal Study

Experienc Keywords & Prototype Descriptions

	P1	P2	*P3	P4	P5	P6	P7	P8		P9	P10	*P11 (family)	*P12 (Social Zoomer)	P13	P14	*P15 (Cultural connoisseurs)	P16	P17*(Social Zoomer)	P18*(Social Zoomer)	P19	P20		TOTAL
interesting	1	1	1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1			18
intuitive				1		1		1					1			1		1					6
immersive	1	1	1		1	1	1			1	1				1		1			1			11
effortless		1		1			1									1							4
surprising	1	1			1	1				1		1		1	1		1	1					10
quick				1																			1
rich			1										1						1				3
informative		1	1	1	1					1			1		1		1	1			1		10
predictable																							0
typical															1		1						2
conventional													1										1
standard													1										1
functional	1											1				1							3
moderate						1							1							1			3
adequate				1																			1
expected																							0
boring																							0
confusing																			1				1
dull																							0
clunky															1								1
time-consuming										1	1		1					1			1		5
slow																1	1						2
overwhelming										1				1									2
cluttered														1									1
enjoyable	1																						1
unconventional		1																					1
simple				1																			1
understandable				1																			1
non-predictable			1																				1
interactive			1																				1
real-time			1																				1
human-like			1																				1
original				1																			1
beautiful							1																1
personalized							1																1
ritual							1																1
fruitful							1																1
emotionally engaged								1															1
creative								1															1
participating								1															1
modern																					1		1

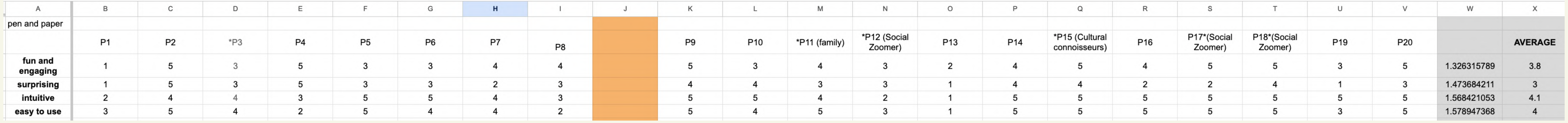
trying first:1; trying last: 6

	P1	P2	*P3	P4	P5	P6	P7	P8	TUD	P9	P10	*P11 (family)	*P12 (Social Zoomer)	P13	P14	*P15 (Cultural connoisseurs)	P16	P17*(Social Zoomer)	P18*(Social Zoomer)	P19	P20	VGM	TOTAL
prototype a (paper & pen)	5	2	5	1	1	1	3	1	2.375	4		4	4	4	3	1	3	3	1	4	1	2.909090909	2.684210526
prototype b (sounds)	2	3	1	3	3	3			2.5													X	2.5
prototype c (contextual music)	3	4	2	2	2	4	1	3	2.625	2		1	2	3	1	4	1	1	2	1	3	1.909090909	2.210526316
prototype d (emotions)	4	5	3	4	4	5	2		3.857142857													X	3.857142857
prototype e (tactile elements)									X	3	2	2	1	1	2	2	2	2	3	2	2	2	2
prototype f (lego, tangible)	1	1	4	5	5	2	4	2	3	1	2	3	3	3	4	3	4	4	4	3	4	3.166666667	3.1
											1 (3)			2(wool), 4(lego)									

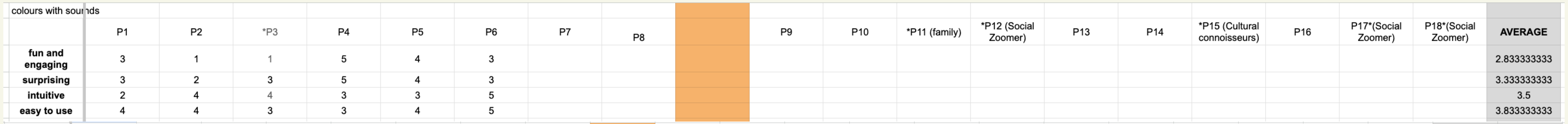


	P1	P2	*P3	P4	P5	P6	P7	P8		P9	P10	*P11 (family)	*P12 (Social Zoomer)	P13	P14	*P15 (Cultural connoisseurs)	P16	P17*(Social Zoomer)	P18*(Social Zoomer)	P19	P20		TOTAL
prototype a (paper & pen)	time-consuming, boring	rich, unpredictable, immersive, intuitive, surprising, informative	typical, intuitive	conventional, easy, boring	standard, (boring), slow	intuitive	free, informative, broad	immersive, confusing, time-consuming , slow, overwhelming		time-consuming	functional, time-consuming	functional	confusing, overwhelming	time-consuming	relaxing	relaxing	creative	quick, effortless	functional	typical	intuitive		
prototype b (sounds)	confusing	expected, non-immersive, confusing	confusing	interesting, original, confusing		neutral																	
prototype c (contextual music)	(a little) surprising	non-immersive, unrelated, confusing	*surprising, confusing	interesting, original	rich	interesting, intuitive, immersive	confusing, irrelated,	surprising, quick, predictable		overwhelming	surprising, predictable	wonderful	intuitive, surprising, quick	effortless, interesting	interesting		intuitive, confusing	interesting, confusing	boring	effortless	interesting		
prototype d (emotions)	predictable	unrelated, confusing	overwhelming, confusing	interesting, original	predictable	neutral	predictable																
prototype e (tactile elements)										surprising	typical, standard	imaginative	intuitive	inspiring	functional	curious	haptic experience, mysterious	unconventional	interesting	time-consuming	effortless		
prototype f (lego, tangible)	intuitive	surprising, effortless, confusing(wool), unconventional, moderate, informative (needs explaining), immersive	effortless (wool), standard (lego), functional, intuitive	interesting (wool), surprising, original, confusing (wool); lego: interesting, intuitive, effortless, moderate, make me think,	immersive (with contexts), overwhelming, confusing	moderate, confusing (wool)	time-consuming , confusing, free	intuitive, confusing, clunky, slow		interesting, quick, accessible	surprising, intuitive	interesting	functional	typical (wool), inspiring		interesting	foreign territory, block shapes don't fit	cluttered, interesting	meaningless, not-connected	intuitive	overwhelming		

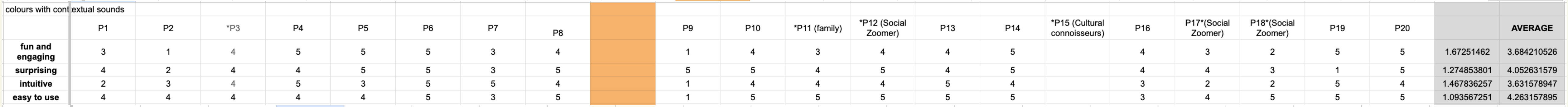
Prototype scorings



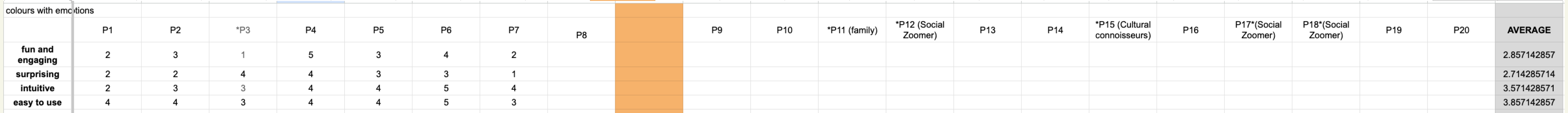
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
pen and paper																							
	P1	P2	*P3	P4	P5	P6	P7	P8		P9	P10	*P11 (family)	*P12 (Social Zoomer)	P13	P14	*P15 (Cultural connoisseurs)	P16	P17*(Social Zoomer)	P18*(Social Zoomer)	P19	P20		**AVERAGE**
fun and engaging	1	5	3	5	3	3	4	4		5	3	4	3	2	4	5	4	5	5	3	5	1.326315789	3.8
surprising	1	5	3	5	3	3	2	3		4	4	3	3	1	4	4	2	2	4	1	3	1.473684211	3
intuitive	2	4	4	3	5	5	4	3		5	5	4	2	1	5	5	5	5	5	5	5	1.568421053	4.1
easy to use	3	5	4	2	5	4	4	2		5	4	5	3	1	5	5	5	5	5	3	5	1.578947368	4



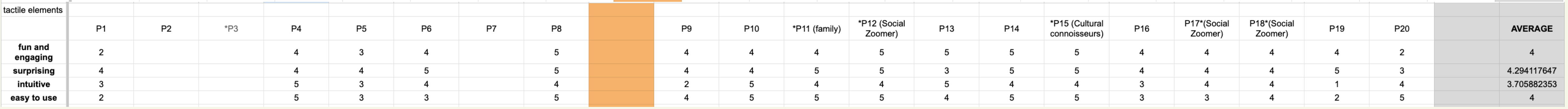
colours with sounds																			
	P1	P2	*P3	P4	P5	P6	P7	P8		P9	P10	*P11 (family)	*P12 (Social Zoomer)	P13	P14	*P15 (Cultural connoisseurs)	P16	P17*(Social Zoomer)	P18*(Social Zoomer)	**AVERAGE**
fun and engaging	3	1	1	5	4	3														2.833333333
surprising	3	2	3	5	4	3														3.333333333
intuitive	2	4	4	3	3	5														3.5
easy to use	4	4	3	3	4	5														3.833333333



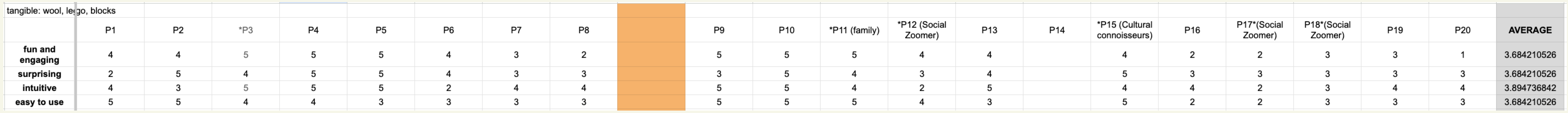
colours with contextual sounds																							
	P1	P2	*P3	P4	P5	P6	P7	P8		P9	P10	*P11 (family)	*P12 (Social Zoomer)	P13	P14	*P15 (Cultural connoisseurs)	P16	P17*(Social Zoomer)	P18*(Social Zoomer)	P19	P20		**AVERAGE**
fun and engaging	3	1	4	5	5	5	3	4		1	4	3	4	4	5		4	3	2	5	5	1.67251462	3.684210526
surprising	4	2	4	4	5	5	3	5		5	5	4	5	4	5		4	4	3	1	5	1.274853801	4.052631579
intuitive	2	3	4	5	3	5	5	4		1	4	4	4	5	4		3	2	2	5	4	1.467836257	3.631578947
easy to use	4	4	4	4	4	5	3	5		1	5	5	5	5	5		3	4	5	5	5	1.093567251	4.263157895



colours with emotions																						
	P1	P2	*P3	P4	P5	P6	P7	P8		P9	P10	*P11 (family)	*P12 (Social Zoomer)	P13	P14	*P15 (Cultural connoisseurs)	P16	P17*(Social Zoomer)	P18*(Social Zoomer)	P19	P20	**AVERAGE**
fun and engaging	2	3	1	5	3	4	2															2.857142857
surprising	2	2	4	4	3	3	1															2.714285714
intuitive	2	3	3	4	4	5	4															3.571428571
easy to use	4	4	3	4	4	5	3															3.857142857



tactile elements																							
	P1	P2	*P3	P4	P5	P6	P7	P8		P9	P10	*P11 (family)	*P12 (Social Zoomer)	P13	P14	*P15 (Cultural connoisseurs)	P16	P17*(Social Zoomer)	P18*(Social Zoomer)	P19	P20		**AVERAGE**
fun and engaging	2			4	3	4		5		4	4	4	5	5	5	5	4	4	4	4	2		4
surprising	4			4	4	5		5		4	4	5	5	3	5	5	4	4	4	5	3		4.294117647
intuitive	3			5	3	4		4		2	5	4	4	5	4	4	3	4	4	1	4		3.705882353
easy to use	2			5	3	3		5		4	5	5	5	4	5	5	3	3	4	2	5		4



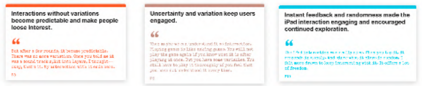
tangible: wool, lego, blocks																						
	P1	P2	*P3	P4	P5	P6	P7	P8		P9	P10	*P11 (family)	*P12 (Social Zoomer)	P13	P14	*P15 (Cultural connoisseurs)	P16	P17*(Social Zoomer)	P18*(Social Zoomer)	P19	P20	**AVERAGE**
fun and engaging	4	4	5	5	5	4	3	2		5	5	5	4	4		4	2	2	3	3	1	3.684210526
surprising	2	5	4	5	5	4	3	3		3	5	4	3	4		5	3	3	3	3	3	3.684210526
intuitive	4	3	5	5	5	2	4	4		5	5	4	2	5		4	4	2	3	4	4	3.894736842
easy to use	5	5	4	4	3	3	3	3		5	5	5	4	3		5	2	2	3	3	3	3.684210526

Appendix E: Statement Cards from User Research

interaction design features

general experience

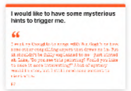
uncertainties, variations keep people engaged


Interactions without variations become predictable and make people loose interest.

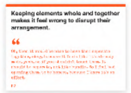
Uncertainty and variation keep users engaged.

Instant feedback and randomness made the iPad interaction engaging and encouraged continued exploration.

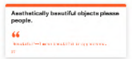
mysterious hints


I would like to have some mysterious hints to trigger me.

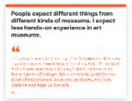
“I don’t want to disturb it”


Keeping elements whole and together makes it feel wrong to disrupt their arrangement.

Aesthetic appearances attract me.

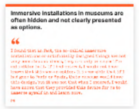

Aesthetically beautiful objects please people.

People expect less hands-on in art galleries.


People expect different things from different kinds of museums. I expect less hands-on experience in art museums.

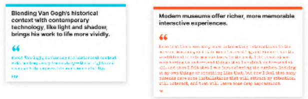
accessibility

Visitors would like to see the interactive devieces。


Immersive installations in museums are often hidden and not clearly presented as options.

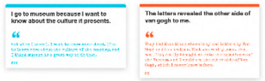
interested things in museums (VGM)

blending stories with modern technology
interactive installations leave deeper impressions.


Blending Van Gogh's historical context with contemporary technology, like light and shadow, brings his work to life more vividly.

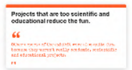
Modern museums offer richer, more memorable interactive experiences.

interested in culture & stories

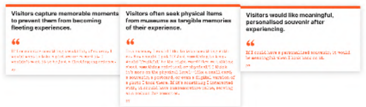

I go to museum because I want to know about the culture it presents.

The letters revealed the other side of van gogh to me.

Being too educational reduces the fun


Projects that are too scientific and educational reduce the fun.

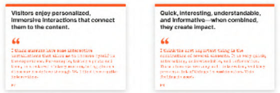
a physical “souvenir” to keep the memory


Visitors capture memorable moments to prevent them from becoming fleeting experiences.

Visitors often seek physical items from museums as tangible memories of their experience.

Visitors would like meaningful, personalised souvenir after experiencing.

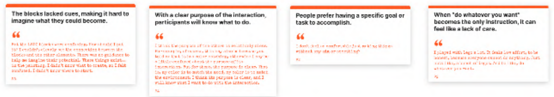
personalized, immersive and informative.


Visitors enjoy personalized, immersive interactions that connect them to the content.

Quick, interesting, understandable, and informative—when combined, they create impact.

task and meanings

People need cues and hints to know what to do with installations
People want to be assigned with a purpose before interacting.

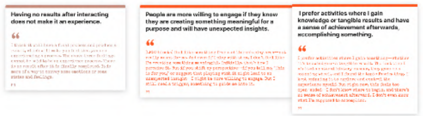

The blocks lacked cues, making it hard to imagine what they could become.

With a clear purpose of the interaction, participants will know what to do.

People prefer having a specific goal or task to accomplish.

When "do whatever you want" becomes the only instruction, it can feel like a lack of care.

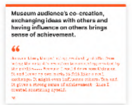
People want to see/have/achieve a result after interacting


Having no results after interacting does not make it an experience.

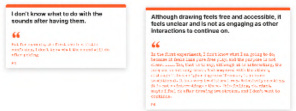
People are more willing to engage if they know they are creating something meaningful for a purpose and will have unexpected insights.

I prefer activities where I gain knowledge or tangible results and have a sense of achievement afterwards, accomplishing something.

*Influencing other visitors/exchanging with other visitors bring a sense of achievement


Museum audience's co-creation, exchanging ideas with others and having influence on others brings sense of achievement.

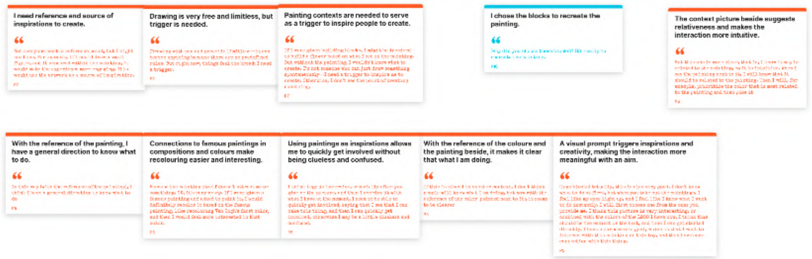
Unclear purpose makes people lost.


I don't know what to do with the sounds after having them.

Although drawing feels free and accessible, it feels unclear and is not as engaging as other interactions to continue on.

painting contexts

Paintings can serve as inspirations and hints for intuitive interacting


I need reference and source of inspirations to create.

Drawing is very free and limitless, but trigger is needed.

Painting contexts are needed to serve as a trigger to inspire people to create.

I chose the blocks to recreate the painting.

The context picture beside suggests relativeness and makes the interaction more intuitive.

With the reference of the painting, I have a general direction to know what to do.

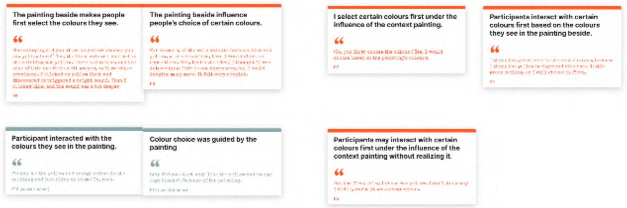
Connections to famous paintings in compositions and colours make recolouring easier and interesting.

Using paintings as inspirations allows me to quickly get involved without being clueless and confused.

With the reference of the colours and the painting beside, it makes it clear that what I am doing.

A visual prompt triggers inspirations and creativity, making the interaction more meaningful with an aim.

Paintings influence people’s selection of colours.


The painting beside makes people first select the colours they see.

The painting beside influence people's choice of certain colours.

I select certain colours first under the influence of the context painting.

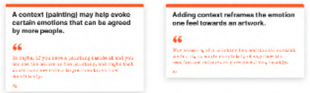
Participants interact with certain colours first based on the colours they see in the painting beside.

Participant interacted with the colours they see in the painting.

Colour choice was guided by the painting

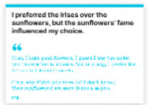
Participants may interact with certain colours first under the influence of the context painting without realizing it.

Painting may trigger similar emotions from different people.

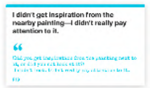

A context (painting) may help evoke certain emotions that can be agreed by more people.

Adding context reframes the emotion one feel towards an artwork.

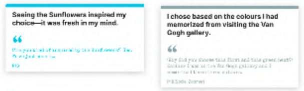
The popularity of paintings influence people’s choice


I preferred the irises over the sunflowers, but the sunflowers' fame influenced my choice.

I didn’t notice the painting


I didn't get inspiration from the nearby painting—I didn't really pay attention to it.

I remember the painting from the exhibition.


Seeing the Sunflowers inspired my choice—it was fresh in my mind.

I chose based on the colours I had memorized from visiting the Van Gogh gallery.

elements of surprise

People are attracted to/enjoy unexpected feedbacks

- People are more willing to engage if they know they are creating something meaningful for a purpose and will have unexpected insights.
- Exhibitions that offer a sense of contrast and reveal different facets from various perspectives tend to attract people.
- Common objects performing their common functions is ordinary.
- Elements of reveal and surprise elevates visitors' experience.
- The moment of expecting unknown feedbacks/interactions is most curious and exciting.
- Instant feedback and randomness made the iPad interaction engaging and encouraged continued exploration.

curiosity, novelty keep people engaged

- Things I have never seen before make me interested.

preset expectation brings curiosity

- Curiosity builds through imagination before interacting—and the moment of reveal brings both satisfaction and a sense of contrast.
- I would like to have a preset expectation with interactive installations.

attractiveness

I am attracted to specific shapes.

- I'm first drawn to elements that catch my eye—like certain shapes or lines.
- Different (uncommon) textures trigger people to try with it.

vibrant colours attract me.

- What catches my attention in paintings is the subtle variation of tones—how different shades are combined to create depth and new colours.

“interaction pressure” in the context of museums

the level of freedom

Too much creative freedom becomes overwhelming, clueless, leading o people feeling reluctant.

- Creating on blank canvas requires massive creativity even with inspiration pictures.
- Being given total freedom is overwhelming, while being given a creative context feels more meaningful.
- Having outlines gives a sense of direction, while a blank canvas feels like a freer, less guided exercise.
- Too many options and random combinations can feel overwhelming and demand more imagination.
- I don't feel the urge to create completely freely.
- Not being inspired, participant doesn't want to try with prototypes that requires more creativity.

The freedom of creating within a certain limit is enjoyable.

- The freedom of filling in colours allows all age groups to enjoy it.
- People enjoy playful experiences that are easy to grasp.
- The interaction with digital screens (clicking) limits people in a good way that limited freedom makes people feel clear.

People want to have a certain level of freedom in interacting/creating.

- I want to match colours myself instead of being told what colour that should be.
- Filling in colours is neither hands-on experience nor a creation.

in the museum context

Being in the museum makes people shy of creating.

- The presence of other visitors and the requirements of a lot of time drive people away from drawing and colouring in museums.
- Visitors only want to participate in very inviting creative sessions to not feel too shy.

time and efforts

Doing without thinking too much makes it effortless and quick.

- Scrabbling is effortless and quick to me.
- Randomly assembling pieces without too much thought is easier to execute.
- Chaos comes with minimal mental pressure and more freedom, allowing one to relax, without being obliged to create a certain shape.
- Participants naturally gravitate toward tools that feel safe and easy, allowing them to start without hesitation and too much thinking.
- Doing with hands without caring too much about outcome makes the process simple.
- I ended up with building randomly instead of thinking too much.

Unhandy tools takes more time.

- Working with wool took time and patience to handle.
- The size and shapes of lego blocks are easy to construct, being small and easy to arrange.

People select the tools they are familiar with first, saving time.

- I choose lego first because I am very familiar with it.
- Familiarity with a tool, like an iPad, makes it a natural first choice for interaction.
- Familiar methods make the creative process feel effortless and accessible without much thought.
- Unfamiliar with lego anymore, creating meaningful things takes some time.

Too much creating freedom requires much time.

- Creating with pen and paper (total freedom) requires a lot of thinking before starting.
- Creating with blocks requires more efforts and time to express my ideas.

Effortless and quick attract visitors.

- Painting is effortless and quick to me.

Visual pictures take less time than sounds to process.

- Sound takes effort to process, whereas pictures are quicker but may not always be intuitive or helpful.

I enjoy slow museum experience.

- I enjoy slower experiences—maybe also reflecting a change with age.

People leave the time-consuming(=more demanding, challenging) options last

- I tried painting last because it seemed more time-consuming.
- I chose the simpler colour task first and saved the more challenging ones for later.
- I chose the easier colour task (texture blocks) first and saved the more difficult ones for later.
- I prefer tackle interactions that require deeper thoughts later.

People select the tools are seem easier, clearer first.

- The digital screen was appealing because it's clear what we can do with it and the feedback was unexpected.
- I selected the screen first because it feels easy.
- When a task requires a lot of interaction or manipulation, people tend to choose something simple and easy to use.
- Participants naturally gravitate toward tools that feel safe and easy, allowing them to start without hesitation and too much thinking.

People would love quick and simple interactions.

- Quick, interesting, understandable, and informative—when combined, they create impact.

“making mistakes”

People refuse to participate when they have the pressure to create something wonderful

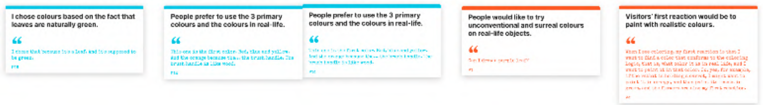
- I feel bad when I think I created something awful.
- People are afraid of making mistakes in interactive experiences.

People refuse to participate when they think they are incapable

- Drawing is fun but I can't draw well.
- Drawing is expressive but it's intimidating that it depends on personal abilities and takes time.
- I am not that creative to quickly start building with Lego like children.
- People tend to not try drawing because they don't have previous experience nor the skills.

colour impressions

I select colours based on reality.



I chose colours based on the fact that leaves are naturally green.

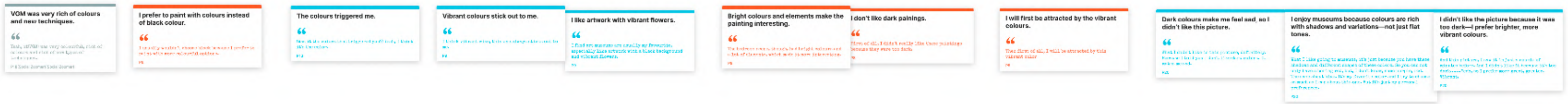
People prefer to use the 3 primary colours and the colours in real-life.

People prefer to use the 3 primary colours and the colours in real-life.

People would like to try unconventional and surreal colours on real-life objects.

Visitors' first reaction would be to paint with realistic colours.

People don't like dark colours, but vibrant ones.



VGM was very rich of colours and new techniques.

I prefer to paint with colours instead of black colour.

The colours triggered me.

Vibrant colours stick out to me.

I like artwork with vibrant flowers.

Bright colours and elements make the painting interesting.

I don't like dark painings.

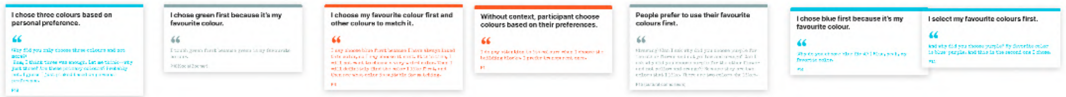
I will first be attracted by the vibrant colours.

Dark colours make me feel sad, so I didn't like this picture.

I enjoy museums because colours are rich with shadows and variations—not just flat tones.

I didn't like the picture because it was too dark—I prefer brighter, more vibrant colours.

People select their favourite colours first.



I chose three colours based on personal preference.

I chose green first because it's my favourite colour.

I choose my favourite colour first and other colours to match it.

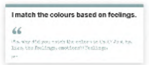
Without context, participant choose colours based on their preferences.

People prefer to use their favourite colours first.

I chose blue first because it's my favourite colour.

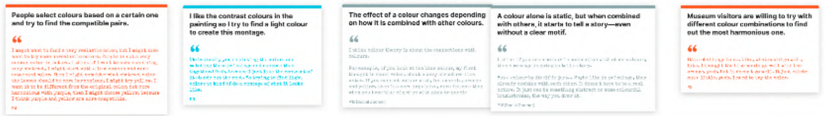
I select my favourite colours first.

It's just feelings.



I match the colours based on feelings.

People try to pair different colours.



People select colours based on a certain one and try to find the compatible pairs.

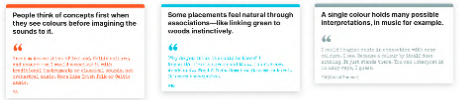
I like the contrast colours in the painting so I try to find a light colour to create this montage.

The effect of a colour changes depending on how it is combined with other colours.

A colour alone is static, but when combined with others, it starts to tell a story—even without a clear motif.

Museum visitors are willing to try with different colour combinations to find out the most harmonious one.

Colours are associative with concepts, objects.



People think of concepts first when they see colours before imagining the sounds to it.

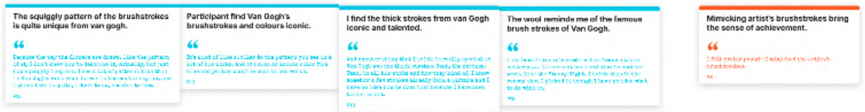
Some placements feel natural through associations—like linking green to woods instinctively.

A single colour holds many possible interpretations, in music for example.

Creating

van gogh's features

His brushstrokes are iconic.



The squiggly pattern of the brushstrokes is quite unique from van gogh.

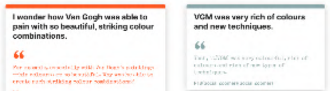
Participant find Van Gogh's brushstrokes and colours iconic.

I find the thick strokes from van Gogh iconic and talented.

The wool reminds me of the famous brush strokes of Van Gogh.

Mimicking artist's brushstrokes bring the sense of achievement.

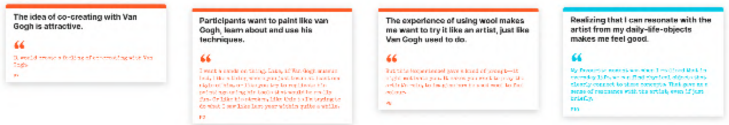
His striking colour combinitions are iconic.



I wonder how Van Gogh was able to pain with so beautiful, striking colour combinations.

VGM was very rich of colours and new techniques.

co-creating with van gogh



The idea of co-creating with Van Gogh is attractive.

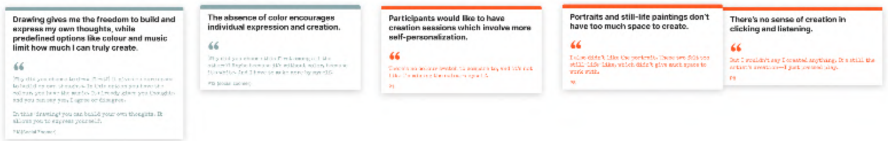
Participants want to paint like van Gogh, learn about and use his techniques.

The experience of using wool makes me want to try it like an artist, just like Van Gogh used to do.

Realizing that I can resonate with the artist from my daily-life-objects makes me feel good.

idea of creating

Creating requires more freedom than merely perceiving.



Drawing gives me the freedom to build and express my own thoughts, while predefined options like colour and music limit how much I can truly create.

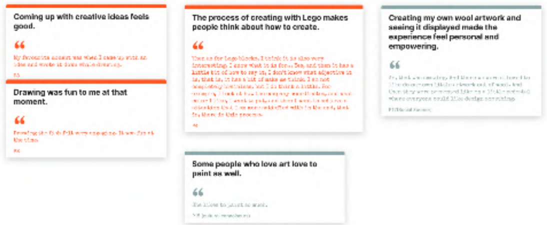
The absence of color encourages individual expression and creation.

Participants would like to have creation sessions which involve more self-personalization.

Portraits and still-life paintings don't have too much space to create.

There's no sense of creation in clicking and listening.

Creating can feel good



Coming up with creative ideas feels good.

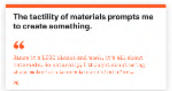
Drawing was fun to me at that moment.

The process of creating with Lego makes people think about how to create.

Some people who love art love to paint as well.

Creating my own wool artwork and seeing it displayed made the experience feel personal and empowering.

Tactile materials prompt people to create things naturally.

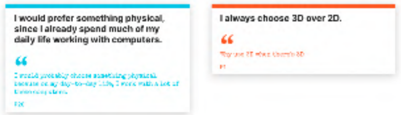


The tactility of materials prompts me to create something.

prototype mediums

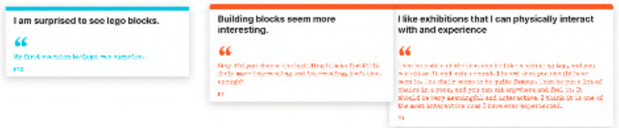
physical interations

I prefer 3D objects over 2D interactions.


I would prefer something physical, since I already spend much of my daily life working with computers.

I always choose 3D over 2D.

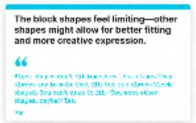
physical blocks are surprising, interesting


I am surprised to see lego blocks.

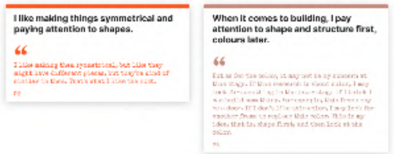
Building blocks seem more interesting.

I like exhibitions that I can physically interact with and experience

The shapes are limiting.

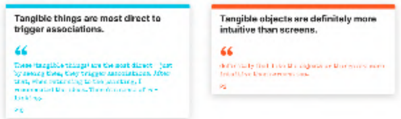

The block shapes feel limiting—other shapes might allow for better fitting and more creative expression.

I pay attention to shapes and structures over colours


I like making things symmetrical and paying attention to shapes.

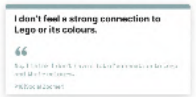
When it comes to building, I pay attention to shape and structure first, colours later.

tangible objects are intuitive to trigger associations


Tangible things are most direct to trigger associations.

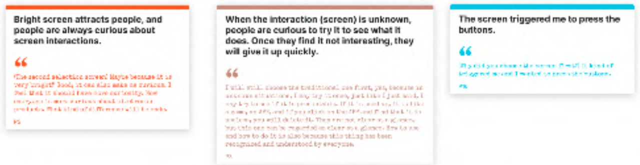
Tangible objects are definitely more intuitive than screens.

I don't like tangible objects.


I don't feel a strong connection to Lego or its colours.

digital screen

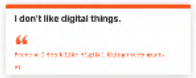
digital screen triggers curiosity and interactions.


Bright screen attracts people, and people are always curious about screen interactions.

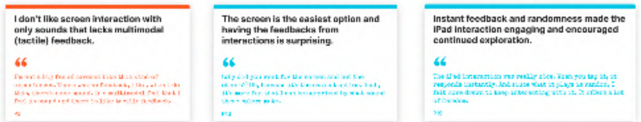
When the interaction (screen) is unknown, people are curious to try it to see what it does. Once they find it not interesting, they will give it up quickly.

The screen triggered me to press the buttons.

I don't like digital things.


I don't like digital things.

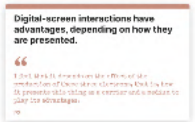
People expect instant, more interesting feedback.


I don't like screen interaction with only sounds that lacks multimodal (tactile) feedback.

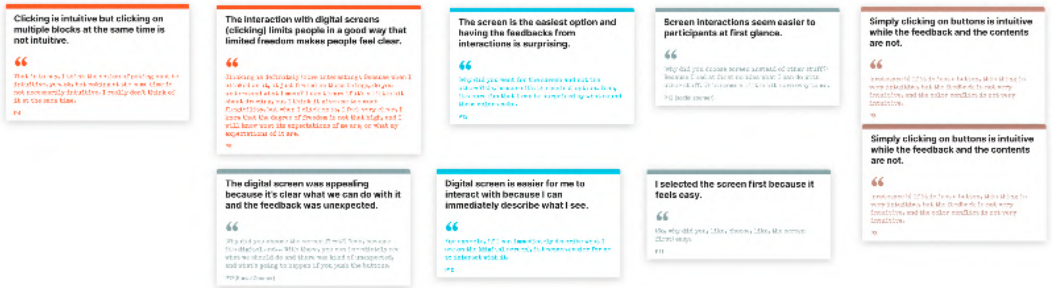
The screen is the easiest option and having the feedbacks from interactions is surprising.

Instant feedback and randomness made the iPad interaction engaging and encouraged continued exploration.

Digital screen has advantages


Digital-screen interactions have advantages, depending on how they are presented.

Clicking is intuitive and effortless, it's clear what people can do with it.


Clicking is intuitive but clicking on multiple blocks at the same time is not intuitive.

The interaction with digital screens (clicking) limits people in a good way that limited freedom makes people feel clear.

The screen is the easiest option and having the feedbacks from interactions is surprising.

Screen interactions seem easier to participants at first glance.

Simply clicking on buttons is intuitive while the feedback and the contents are not.

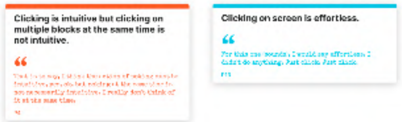
The digital screen was appealing because it's clear what we can do with it and the feedback was unexpected.

Digital screen is easier for me to interact with because I can immediately describe what I see.

I selected the screen first because it feels easy.

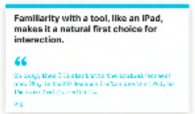
Simply clicking on buttons is intuitive while the feedback and the contents are not.

Clicking on multiple blocks simultaneously is not intuitive.


Clicking is intuitive but clicking on multiple blocks at the same time is not intuitive.

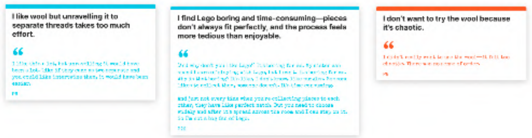
Clicking on screen is effortless.

People are familiar with screens.


Familiarity with a tool, like an iPad, makes it a natural first choice for interaction.

Prototype F: tangible objects

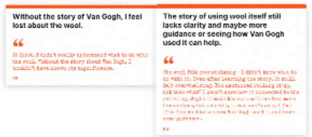
Unravelling takes much time.


I like wool but unravelling it to separate threads takes too much effort.

I find Lego boring and time-consuming—pieces don't always fit perfectly, and the process feels more tedious than enjoyable.

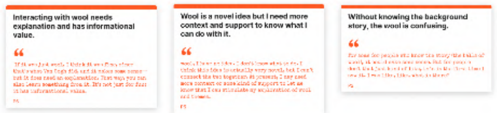
I don't want to try the wool because it's chaotic.

It is confusing without the story, which serves as a guidance.


Without the story of Van Gogh, I feel lost about the wool.

The story of using wool itself still lacks clarity and maybe more guidance or seeing how Van Gogh used it can help.

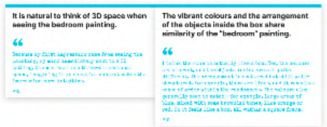
The wool is informative, but explanation is needed.


Interacting with wool needs explanation and has informational value.

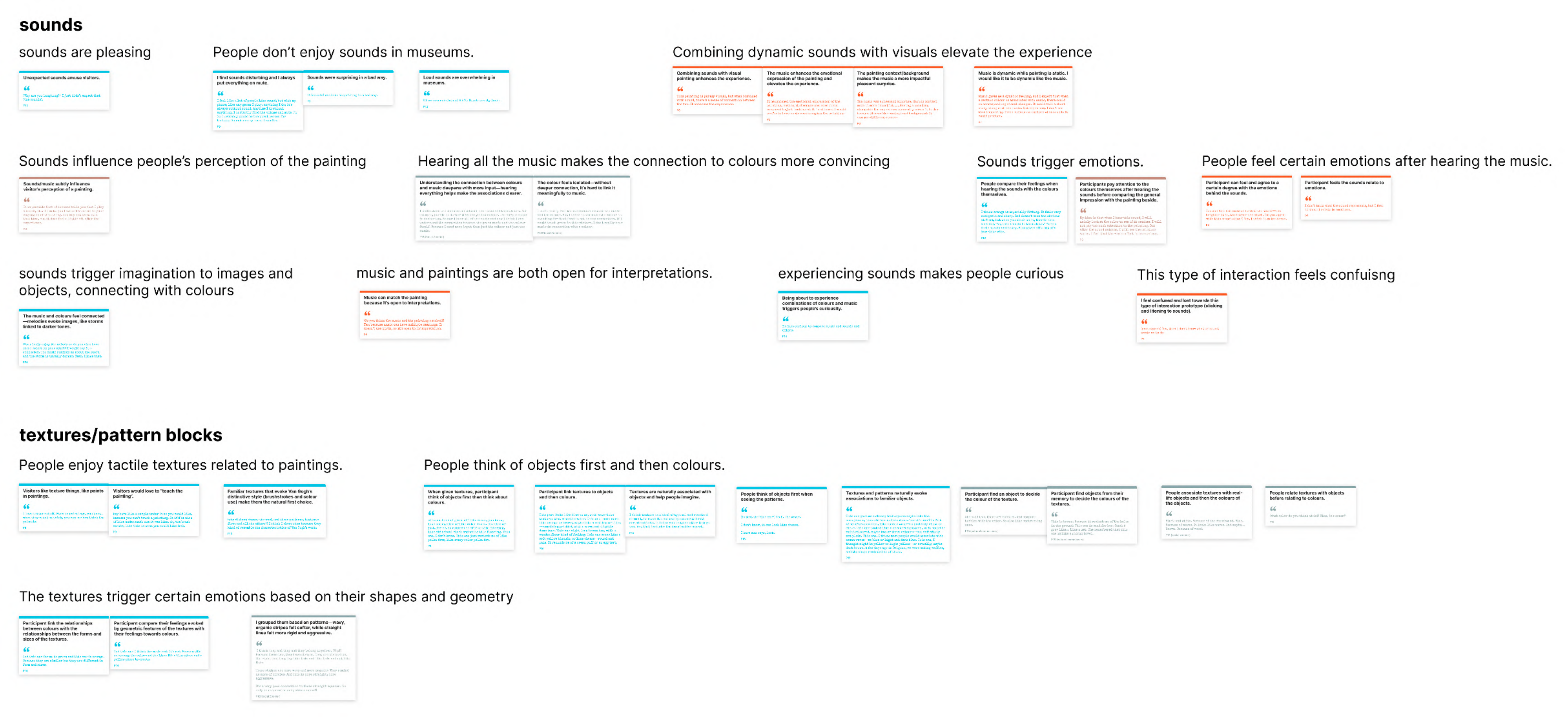
Wool is a novel idea but I need more context and support to know what I can do with it.

Without knowing the background story, the wool is confusing.

'Bedroom' is easily linked with 3D space and objects.


It is natural to think of 3D space when seeing the bedroom painting.

The vibrant colours and the arrangement of the objects inside the box share similarity of the "bedroom" painting.



sounds

sounds are pleasing

Unexpected sounds amuse visitors.

People don't enjoy sounds in museums.

I find sounds disturbing and I always put everything on mute.

Sounds were surprising in a bad way.

Loud sounds are overwhelming in museums.

Combining dynamic sounds with visuals elevate the experience

Combining sounds with visual painting enhances the experience.

The music enhances the emotional expression of the painting and elevates the experience.

The painting context/background makes the music a more impactful pleasant surprise.

Music is dynamic while painting is static. I would like it to be dynamic like the music.

Sounds influence people's perception of the painting

Sounds/music subtly influence visitor's perception of a painting.

Hearing all the music makes the connection to colours more convincing

Understanding the connection between colours and music deepens with more input—hearing everything helps make the associations clearer.

The colour feels isolated—without deeper connection, it's hard to link it meaningfully to music.

Sounds trigger emotions.

People compare their feelings when hearing the sounds with the colours themselves.

Participants pay attention to the colours themselves after hearing the sounds before comparing the general impression with the painting beside.

People feel certain emotions after hearing the music.

Participant can feel and agree to a certain degree with the emotions behind the sounds.

Participant feels the sounds relate to emotions.

sounds trigger imagination to images and objects, connecting with colours

The music and colours feel connected—melodies evoke images, like storms linked to darker tones.

music and paintings are both open for interpretations.

Music can match the painting because it's open to interpretations.

experiencing sounds makes people curious

Being about to experience combinations of colours and music triggers people's curiousity.

This type of interaction feels confuisng

I feel confused and lost towards this type of interaction prototype (clicking and litening to sounds).

textures/pattern blocks

People enjoy tactile textures related to paintings.

Visitors like texture things, like paints in paintings.

Visitors would love to "touch the painting".

Familiar textures that evoke Van Gogh's distinctive style (brushstrokes and colour use) make them the natural first choice.

People think of objects first and then colours.

When given textures, participant think of objects first then think about colours.

Participant link textures to objects and then colours.

Textures are naturally associated with objects and help people imagine.

People think of objects first when seeing the patterns.

Textures and patterns naturally evoke associations to familiar objects.

Participant find an object to decide the colour of the texture.

Participant find objects from their memory to decide the colours of the textures.

People associate textures with real-life objects and then the colours of the objects.

People relate textures with objects before relating to colours.

The textures trigger certain emotions based on their shapes and geometry

Participant link the relationships between colours with the relationships between the forms and sizes of the textures.

Participant compare their feelings evoked by geometric features of the textures with their feelings towards colours.

I grouped them based on patterns—wavy, organic stripes felt softer, while straight lines felt more rigid and aggressive.

prototype opinions

Prototype A: paper and pen

Drawing is childish, troublesome.

- Filling in colours felt childish and compulsory.
- Filling in colours/drawing is troublesome.

Painting is effortless and quick.

- Having a place where people can draw is not too much seen and surprising.
- Painting is effortless and quick to me.

It requires creativity.

- Drawing requires creativity.

Prototype B: random sounds

It makes people feel confused.

- I don't know what to do with the sounds after having them.
- I feel confused and lost towards this type of interaction prototype (clicking and litening to sounds).
- Simply clicking on buttons is intuitive while the feedback and the contents are not.

The sounds and the colours don't match in my understanding

- I don't have the feeling that these sounds and colours match.
- I don't think the colour match the sounds.
- I imagine different sounds to colours from this prototype.
- The sounds don't match my perception of the colours.
- The sounds is a bit inconsistent and conflicting.
- Participant has their own ideas about matching sound to colours.
- People have their understanding towards colours from subjective meaning defined by humans (emotions, objects). Some sounds in this prototype don't match this understanding.
- I imagine different sounds to colours from this prototype.

Prototype C: contextual music

Linking music to colours is new and interesting, triggering curiosity.

- Participant find the idea of linking contextual music to colours new to them and interesting.
- Contextual music interaction is interesting but can feel confusing without clear direction.
- When both the colours and their corresponding sounds complement each other, the interaction feels unexpected.
- Participant is curious about what sounds are linked to each colour and enjoys the process.

Music, colours and the painting are irrelevant.

- The music, colour wheel and the painting are irrelevant.
- Certain music doesn't match the certain colour.

It is confusing.

- Contextual music interaction is interesting but can feel confusing without clear direction.

The painting does not play a role in the process.

- Participant interact with the colours without noticing the painting beside at all.

People imagined a music to a colours beforehand.

- People imagine a type of music to a colour.
- Participant compare the sounds they hear with their pre-imagination based on the colours they see ---- some do, and some don't.
- The music of each colour matches the impression of the corresponding colours.
- I imagine different sounds to colours from this prototype.

Merging tracks is surprising.

- Merging tracks together is surprising while the music itself already makes people think.

Merging tracks is not intuitive.

- Clicking is intuitive but clicking on multiple blocks at the same time is not intuitive.

The sounds do match the colours.

- It brings surprise when the sounds match well with the picture to the participant.
- Participant (who has music experience) link not just individual colours to sounds, but also map relationships between colours to relationships between sounds.

Seeing pictures altogether triggers people to think about the connections.

- Showing picture and music altogether triggers people to be engaged and spend time thinking about the connection.

Prototype D: emotion pictures

People don't agree with the connection between the colours and the emotions.

- Some emotions in the prototype and my opinions have subtle differences.
- I don't agree that purple is boring.
- I don't agree with all the connections between emotions and colours in this prototype.
- I don't relate with the ideas behind the sounds nor the emotions.
- I don't recognize all emotions.

People agree to the connections given.

- The connections between colours and emotions are quite close to my perceptions.

Colours remind me of scenes and emotions.

- Green reminds me of sitting in landscapes and represents another emotion.

It's predefining and forced upon.

- The idea of predefining emotions based on colours feels like pre-assumptions and sterotypes. I don't like that.
- Simply showing pictures of emotions feels meaningless and lacks useful information. It feels like being forced upon.

The connection is predictable and not surprising.

- The current connection between colours and emotions are too predictable.
- The current connection between colours and emotions are too conventional and not surprising.
- The link between emotions and colours is predictable to me.

Prototype E: texture blocks

It is new to describe the colour of colourless.

- Describing a piece with a colour is new.
- White colourless blocks allow people to project their own thoughts onto them.
- The blocks invite imagination, letting you assign any colour you want.

They are surprising.

- The pattern blocks felt surprising—something I wouldn't expect in a typical museum setting.

The shapes matter.

- The shapes of the texture blocks remind me of the colour circle.

The patterns matter.

- It's interesting to see how connections naturally form between shapes.

New applications:

- I would use them as stamps to stamp flowers to make the design more interesting.

Subjectivity & Author's stories

People have their own understanding of certain paintings.

- The music doesn't match the participant's understanding of the painting.
- The interpretation of emotions and colours is more subjective than music.
- People have their feelings towards the paintings.

People pay attention to the "original" meaning of the painting by the artist

- The sounds match my first impression of the surface of the painting quite well, but paintings may express something different with background stories.
- I want to recall the background emotions of the painting.
- It was sometimes confusing when I couldn't understand the picture's message or recognise its motif.

Stories of both the artist and the audience play a vital role.

- The story of Van Gogh makes the wool interesting.
- Past experience and stories make interactions more personally engaging.

Emotions

People have preassumptions about emotions and colours, so it's easy to understand.

- Prior assumptions about colour and emotion shaped my expectations—blue felt calm, red felt aggressive, and green felt gentle.
- The connection between colours and emotions is easy to understand.

Museum experience are shaped by one's emotions.

- Museum experiences are filtered through personal emotions—what I feel shapes what I see.

The emotions of colours are not definite.

- To visitors who want to appreciate the artworks, emotion should be personally interpreted—not prescribed.
- I don't think the relationship between colour and emotion is absolute.

Appendix F: Full List of Inspirations

1. Colour Impressions & Preferences:

(High Priority) People don't like dark colours. They prefer vibrant colours, which can attract attention and emotional engagement.
(High Priority) People tend to select their favourite colours first.
(High Priority) People select colours based on reality.
(High Priority) People do try pairing different colours.
(High Priority) Colours are associative with concepts and objects—reminding users of scenes and emotions.
(Low Priority) People have preassumptions about connections between emotions and colours, making such links easier to understand.

2. Interacting with Different Mediums:

(High Priority) Clicking is intuitive and effortless—it immediately tells users what they can do with it.
(High Priority) Textures and patterns evoke object associations. People think of things before thinking of colours.
(High Priority) Linking music to colours is new and surprising, and sparks curiosity.
(High Priority) Specific shapes attract attention. People notice structures or patterns before colours.
(High Priority) Sounds or music can trigger emotional responses and associations.
(High Priority) Digital screens spark curiosity and promote exploratory action.
(Low Priority) People imagine sound or music before colour—an inverse connection.
(Low Priority) Describing a colourless object is a novel challenge.
(Low Priority) Physical blocks are surprising and engaging in museum settings.
(Low Priority) Tangible objects easily trigger associations through intuition.
(Low Priority) Clicking multiple blocks simultaneously surprises but doesn't always feel intuitive.
(Low Priority) Overwhelming sounds in museums may reduce enjoyment.
(Low Priority) Combining dynamic sounds with visuals can elevate an experience.
(Low Priority) People enjoy tactile textures, especially when linked to paintings.
(Low Priority) Shapes and geometries in textures can trigger specific emotional responses.
(Low Priority) Visitors feel more comfortable with screens due to familiarity.

3. Interaction Behaviour in Museum Contexts:

(High Priority) People tend to choose familiar tools first to save time.
(High Priority) People go for easier tools or those with clearer tasks first.
(Low Priority) Visual pictures require less time and effort to understand.

4. Paintings and Contextual Cues:

(High Priority) Context paintings influence people's colour choices.
(High Priority) Paintings provide inspiration and intuitive entry points for interaction.
(Low Priority) Visitors remember the painting better after engaging with it.

5. Creating with Van Gogh:

(High Priority) The idea of co-creating with Van Gogh is intriguing.
(High Priority) The process and result of creating feels emotionally satisfying.
(Low Priority) Van Gogh's brushstrokes are iconic.
(Low Priority) Van Gogh's colour combinations are iconic.
(Low Priority) Tactile materials may prompt a natural desire to create.

6. Understanding Paintings & Stories:

(Low Priority) People have their own interpretations of paintings.
(Low Priority) Visitors pay attention to the original meaning behind an artwork.
(Low Priority) Paintings may trigger similar emotions in different viewers.
(Low Priority) The artist's story and the viewer's response both matter—they shape personal experiences.

Appendix G: Ideation Cards Set for Workshop

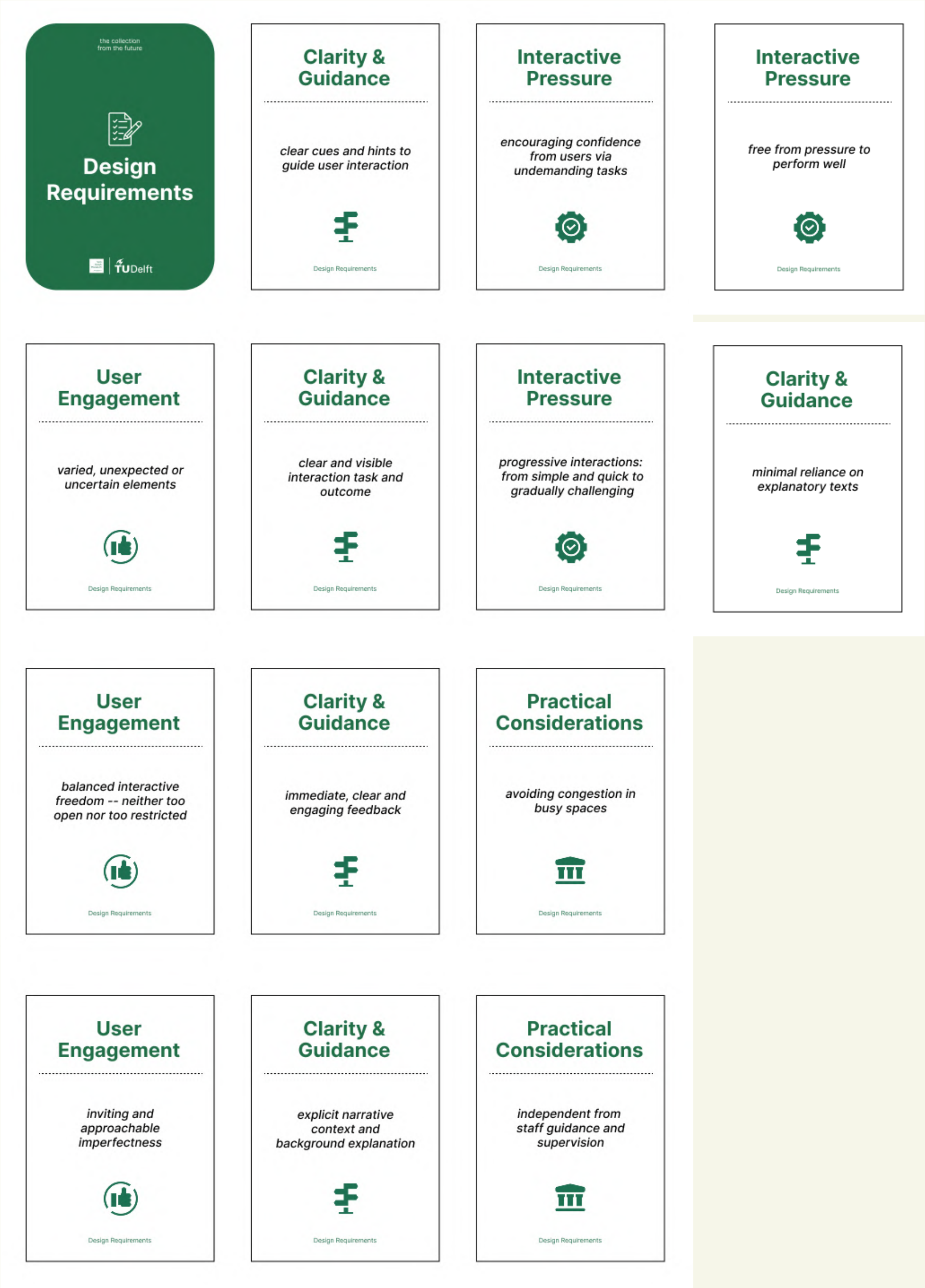
Assistive Ideation Cards, divided into three categories:
Requirement Cards: Derived from previously identified design requirements. These were reformulated into short constraint statements to guide ideation. e.g., “Interaction should be free from pressure to perform well.”

Core Sparks Cards: Based on high-priority inspirational themes, frequently mentioned in the research phase. e.g.,”People tend to choose tools that feel easier or come with clearer instructions first.”

Edge Sparks Cards: Drawn from lower-priority inspirations, representing less common yet potentially novel directions. e.g.,”Touch-based elements evoke intuitive and immediate associations.”

All card statements were reworded from original research insights to facilitate broader conceptual thinking. Please see appendix X for complete card set.

Core Sparks
Interactive Formats
Linking music to colours is new and surprising, sparking curiosity.
Edge Sparks
User Behaviour in Museums
Visual elements require less time and effort to understand.
Design Requirements
User Engagement
inviting and approachable imperfectness


the collection from the future
Design Requirements
TU Delft

Clarity & Guidance
clear cues and hints to guide user interaction
Design Requirements

Interactive Pressure
encouraging confidence from users via undemanding tasks
Design Requirements

Interactive Pressure
free from pressure to perform well
Design Requirements

User Engagement
varied, unexpected or uncertain elements
Design Requirements

Clarity & Guidance
clear and visible interaction task and outcome
Design Requirements

Interactive Pressure
progressive interactions: from simple and quick to gradually challenging
Design Requirements

Clarity & Guidance
minimal reliance on explanatory texts
Design Requirements

User Engagement
balanced interactive freedom -- neither too open nor too restricted
Design Requirements

Clarity & Guidance
immediate, clear and engaging feedback
Design Requirements

Practical Considerations
avoiding congestion in busy spaces
Design Requirements

User Engagement
inviting and approachable imperfectness
Design Requirements

Clarity & Guidance
explicit narrative context and background explanation
Design Requirements

Practical Considerations
independent from staff guidance and supervision
Design Requirements

Vincent van Gogh
Colour Storytelling

Core Sparks

TU Delft

Colour Preferences

Visitors prefer vibrant colours over dark colours.

Core Sparks

Interactive Formats

Sounds or music can trigger emotional responses and associations.

Core Sparks

Paintings & Contexts

Paintings provide inspirations and intuitive entry points for interactions.

Core Sparks

Interactive Formats

People tend to notice shapes, structures, or patterns before they pay attention to colours.

Core Sparks

Interactive Formats

Clicking on screens is intuitive and effortless.

Core Sparks

Colour Preferences

Visitors tend to select their favourite colours first.

Core Sparks

Interactive Formats

Digital screens spark curiosity and encourage exploratory actions.

Core Sparks

Co-Creating with Van Gogh

The process and result of creating feels emotionally satisfying.

Core Sparks

Paintings & Contexts

Paintings influence people's colour choices.

Core Sparks

Colour Preferences

Concepts are naturally associated with real-life concepts and objects.

Core Sparks

Interactive Formats

Textures and patterns lead people to think of objects first—colour comes after.

Core Sparks

Colour Preferences

Visitors often base their colour choices on the colours of objects in reality.

Core Sparks

User Behaviour in Museums

People tend to choose familiar tools first to save time and efforts.

Core Sparks

Interactive Formats

Linking music to colours is new and surprising, sparking curiosity.

Core Sparks

Colour Preferences

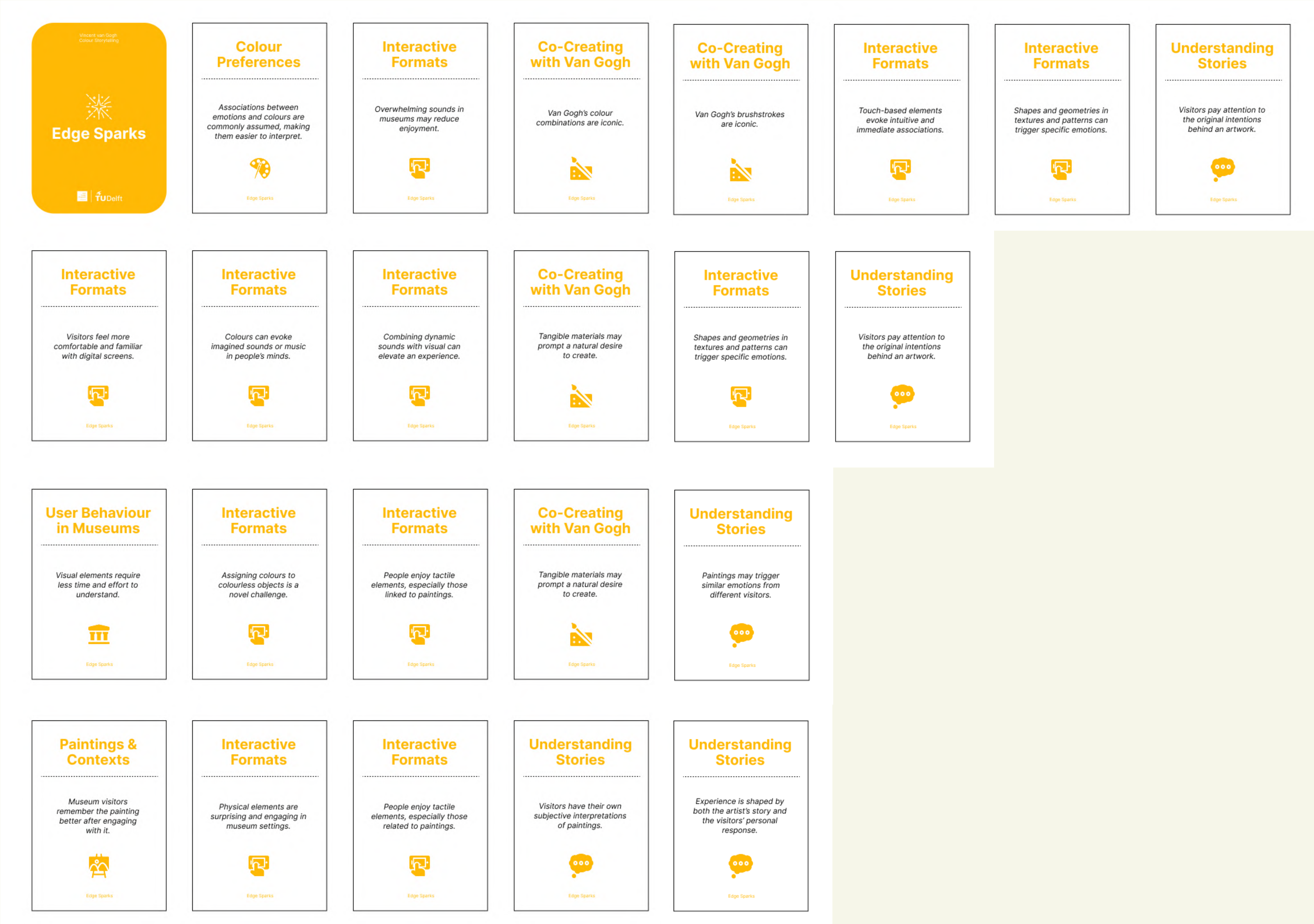
Visitors are willing to explore different colour combinations.

Core Sparks

User Behaviour in Museums

People tend to choose tools that feel easier or come with clearer instructions first.

Core Sparks



Vincent van Gogh
Colour Storytelling

Edge Sparks

TUDelft

Colour Preferences

Associations between emotions and colours are commonly assumed, making them easier to interpret.

Edge Sparks

Interactive Formats

Overwhelming sounds in museums may reduce enjoyment.

Edge Sparks

Co-Creating with Van Gogh

Van Gogh's colour combinations are iconic.

Edge Sparks

Co-Creating with Van Gogh

Van Gogh's brushstrokes are iconic.

Edge Sparks

Interactive Formats

Touch-based elements evoke intuitive and immediate associations.

Edge Sparks

Interactive Formats

Shapes and geometries in textures and patterns can trigger specific emotions.

Edge Sparks

Understanding Stories

Visitors pay attention to the original intentions behind an artwork.

Edge Sparks

Interactive Formats

Visitors feel more comfortable and familiar with digital screens.

Edge Sparks

Interactive Formats

Colours can evoke imagined sounds or music in people's minds.

Edge Sparks

Interactive Formats

Combining dynamic sounds with visual can elevate an experience.

Edge Sparks

Co-Creating with Van Gogh

Tangible materials may prompt a natural desire to create.

Edge Sparks

Interactive Formats

Shapes and geometries in textures and patterns can trigger specific emotions.

Edge Sparks

Understanding Stories

Visitors pay attention to the original intentions behind an artwork.

Edge Sparks

User Behaviour in Museums

Visual elements require less time and effort to understand.

Edge Sparks

Interactive Formats

Assigning colours to colourless objects is a novel challenge.

Edge Sparks

Interactive Formats

People enjoy tactile elements, especially those linked to paintings.

Edge Sparks

Co-Creating with Van Gogh

Tangible materials may prompt a natural desire to create.

Edge Sparks

Understanding Stories

Paintings may trigger similar emotions from different visitors.

Edge Sparks

Paintings & Contexts

Museum visitors remember the painting better after engaging with it.

Edge Sparks

Interactive Formats

Physical elements are surprising and engaging in museum settings.

Edge Sparks

Interactive Formats

People enjoy tactile elements, especially those related to paintings.

Edge Sparks

Understanding Stories

Visitors have their own subjective interpretations of paintings.

Edge Sparks

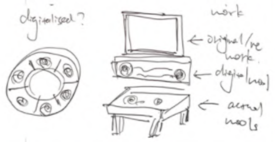
Understanding Stories

Experience is shaped by both the artist's story and the visitors' personal response.

Edge Sparks

Appendix H: Ideas from Individual Ideation

	user actions	feedback	user feelings /meaning	notes
1	select colours from palette->decide how to use colours (mixing, not mixing) like in real world	see the results directly, comparing with similar Van Gogh works	understand mixing contrast colours make muddy tones v.s. vibrant colourful ones	digital (screen); tangible (brush with screen)
2	select one's moods/emotions first ->draw without seeing colours	reveal final work, comparing with similar Van Gogh works	understand how colours convey emotions	digital (screen); tangible (brush with screen)
3	select from a range of VG's existing colour palettes of works	change colours of a painting		
4	select from a range of colour blocks to "rebuild" the painting	change the colours of corresponding elements in a painting	freely explore different colour combinitions in a paintings	tangible element blocks?
5	AI vincent: users performing simple colour tasks	AI vincent: "I would do this" or change the users' choice directly	the idea of communicate with VG	digital screen?
6	freely, intuitively move hands/arms like a painting brush	see the results of different actions (mixing v.s. not mixing)	understand the colour use of VG	motion recognition
7	select certain colour from painting palette -> decide the percentage in the painting -> repeat	reveal: this is how your choice looks like, comparing with original Van Gogh works		
8	add objects/elements of certain colours in a VG's painting	see the direct results	a sense of cocreating and understand colours combiitions	digital tangible
9	answer a series of (random) questions: what's your favourite colour, what's your mood, what's on your mind,....	reveal: this is how your choices look like ->explanation	funny	

	user actions	feedback	user feelings /meaning	notes
1	provided with pieces in different colours, user "rebuild" the painting in 3D	see a different, personalized version of the painting	understand different colour combinitions	tangible + screen
2	use colourless blocks which have different patterns (in shapes, etc) to rebuild the painting	reveal: this is what your choice looks like	understand why colours contrast with each other/close to each other?	tangible + screen
3	select colour blocks from a colour wheel and apply to a painting to change colours	directly see/understand different positions of each colour and see the difference	undersand how colours contrast with/close to each other (in position)	tangible + screen
4	see the original wool used in a painting ->change the colours of the wool	see the wool of new colours intertwining, see the new painting	understand how vangogh chose colours, different colour combinitions	**wool** fun digital (to avoid mess) and tangible (to feel the material)
5				 digitalised? work original/re work digital wool actual wools

	user actions	feedback	user feelings /meaning	notes
1	walk into an immersive area of a replica of a painting (e.g. bedroom, sunflower field) -> touch and change the colours of certain objects	see the difference in colours they make		fun
2	decide on a colour palette first -> walk through an immersive area of replica painting	reveal: a customized realistic painting with different colours		

Appendix I: Setup of Co-creation Workshop

To overcome the limitations of individual ideation and expand the design solution space, a group co-creation workshop was organised. The aim was to generate diverse interpretations and unconventional ideas for communicating Van Gogh's colour strategies through design.

participants

The session involved 5 design students from the Faculty of Industrial Design Engineering at TU Delft: 4 from the Design for Interaction (DfI) track and 1 from the Integrated Product Design (IPD) track.

purpose

- Explore effective ways to tell colour strategies through design
- Expand the solution space and avoid personal fixation, expecting diverse interpretations and fresh ideas for concept development

materials

- Van Gogh's Colour Strategies Sheet: A summary based on Section 2.3 Desk Research: Vincent's Colours, outlining four key colour strategies used by Van Gogh with supporting explanations.
- Ideation Materials: Large paper sheets, pens, markers, and sticky notes for collaborative sketching and writing.
- Assistive Ideation Cards, divided into three categories:

Requirement Cards: Derived from previously identified design requirements. These were reformulated into short constraint statements to guide ideation. e.g., "Interaction should be free from pressure to perform well."

Core Sparks Cards: Based on high-priority inspirational themes, frequently mentioned in the research phase. e.g.,"People tend to choose tools that feel easier or come with clearer instructions first."

Edge Sparks Cards: Drawn from lower-priority inspirations, representing less common yet potentially novel directions. e.g.,"Touch-based elements evoke intuitive and immediate associations."

All card statements were reworded from original research insights to facilitate broader conceptual thinking. Please see appendix X for complete card set.

procedure

The workshop lasted approximately 80 minutes and consisted of two structured ideation rounds:

1. Introduction (5 minutes)

Participants were introduced to the project context and the four key colour strategies of Van Gogh.

2. Round 1: Open Ideation with Rotational Sketching (25 minutes ideation + 10 minutes discussion)

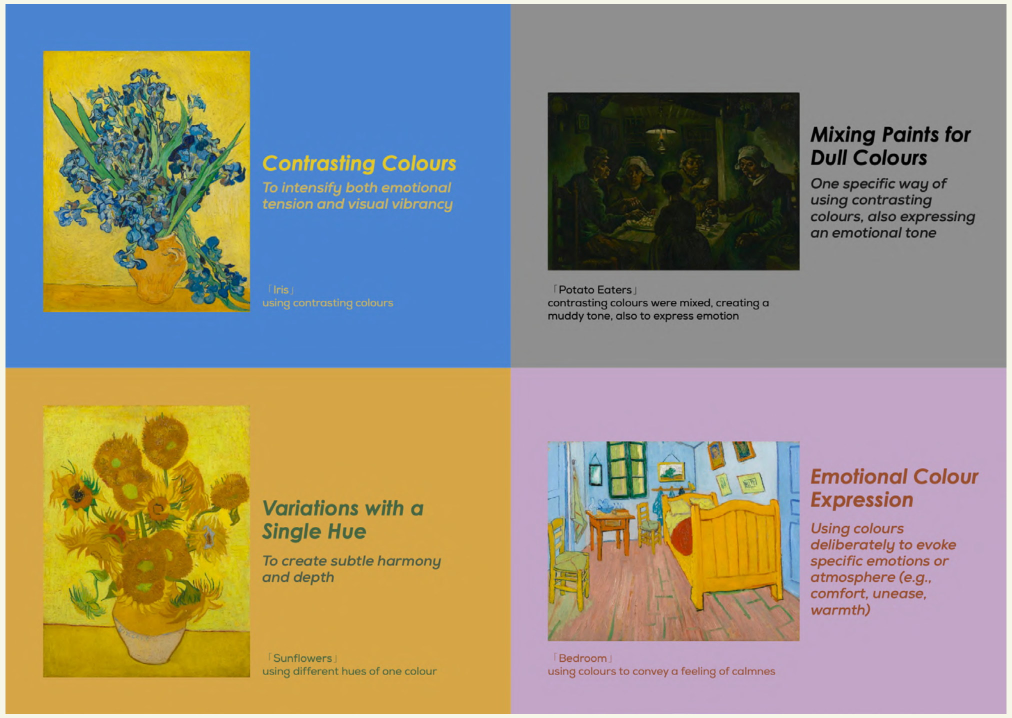
Participants were asked to ideate on the prompt: "How might we communicate Van Gogh's colour strategies through design?" Each person sketched or wrote their ideas on a sheet of paper, which was passed to the next participant every 5 minutes. This rotation continued until all participants had contributed to every sheet and received their original back. "Core Sparks" and "Edge Sparks" cards were available and could be drawn at any point for inspiration.

The round concluded with a 10-minute group discussion on initial impressions and preferences.

3. Round 2: Constraint-Based Ideation (25 minutes ideation + 10 minutes discussion)

Each participant randomly selected one "Requirement Card" and used it to refine a previous idea or generate a new one, again using rotational sketching. The process mirrored Round 1 but was now guided by an added constraint per participant. This approach allowed each concept to potentially incorporate five different design requirements by the end of the round.

Another 10-minute discussion followed, focused on the relevance of the requirements and the final preferences.



Contrasting Colours

To intensify both emotional tension and visual vibrancy

「Iris」
using contrasting colours

Mixing Paints for Dull Colours

One specific way of using contrasting colours, also expressing an emotional tone

「Potato Eaters」
contrasting colours were mixed, creating a muddy tone, also to express emotion

Variations with a Single Hue

To create subtle harmony and depth

「Sunflowers」
using different hues of one colour

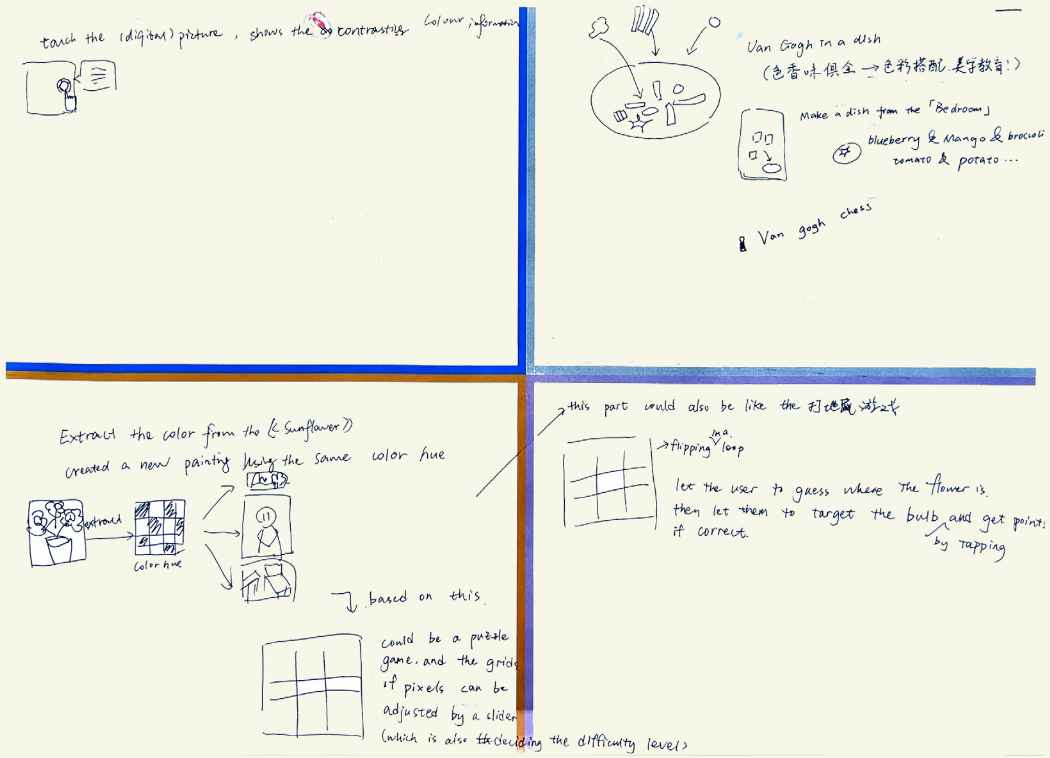
Emotional Colour Expression

Using colours deliberately to evoke specific emotions or atmosphere (e.g., comfort, unease, warmth)

「Bedroom」
using colours to convey a feeling of calmnes

Figure I.1: Colour Strategies Sheet

Appendix J: Co-creation Workshop Outcomes


touch the (digital) picture, shows the contrasting Colour information

Van Gogh in a dish
(色香味俱全 → 色彩搭配. 美学教育!)

Make a dish from the「Bedroom」
blueberry & Mango & broccoli
tomato & potato …

Van gogh chess

Extract the color from the《Sunflower》
created a new painting using the same color hue

extract
Color hue

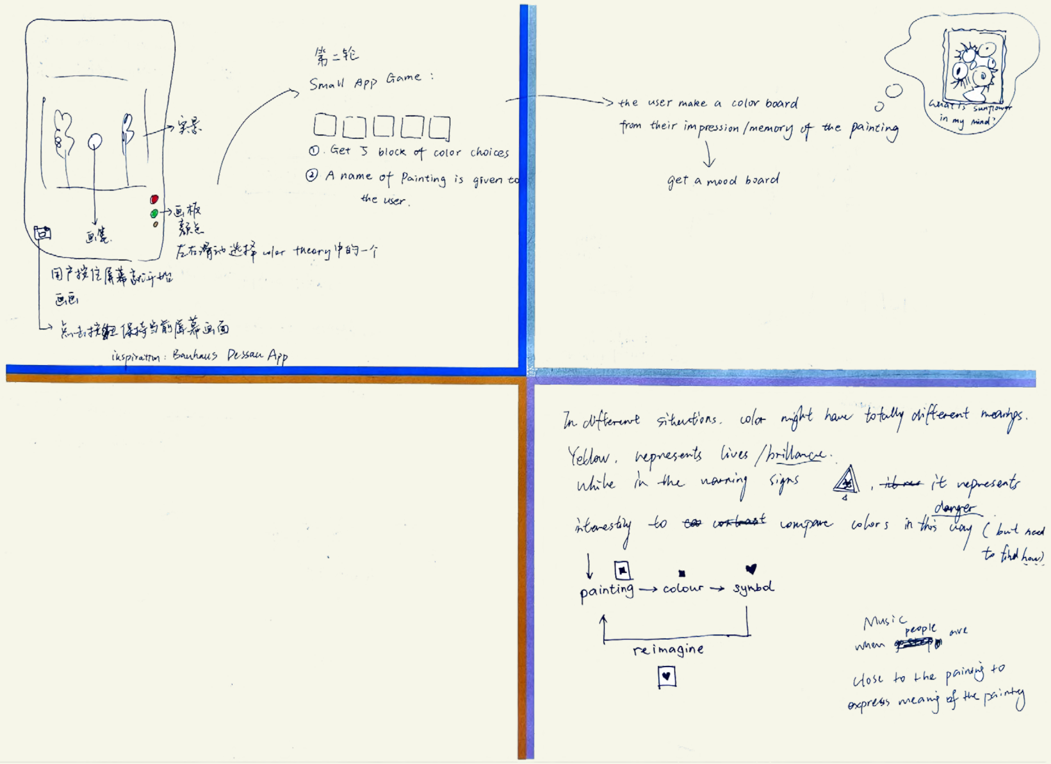
based on this.

could be a puzzle game, and the grids of pixels can be adjusted by a slider (which is also ~~the~~ deciding the difficulty level)

this part could also be like the 打地鼠游戏

→ flipping in a loop

let the user to guess where the flower is. then let them to target the bulb by tapping and get points if correct.


实景
画板
颜色
画笔

左右滑动选择 color theory 中的一个

用户按住屏幕就开始画画

点击按钮 保持当前屏幕画面

inspiration: Bauhaus Dessau App

第二轮
Small App Game:

① Get 5 block of color choices
② A name of Painting is given to the user.

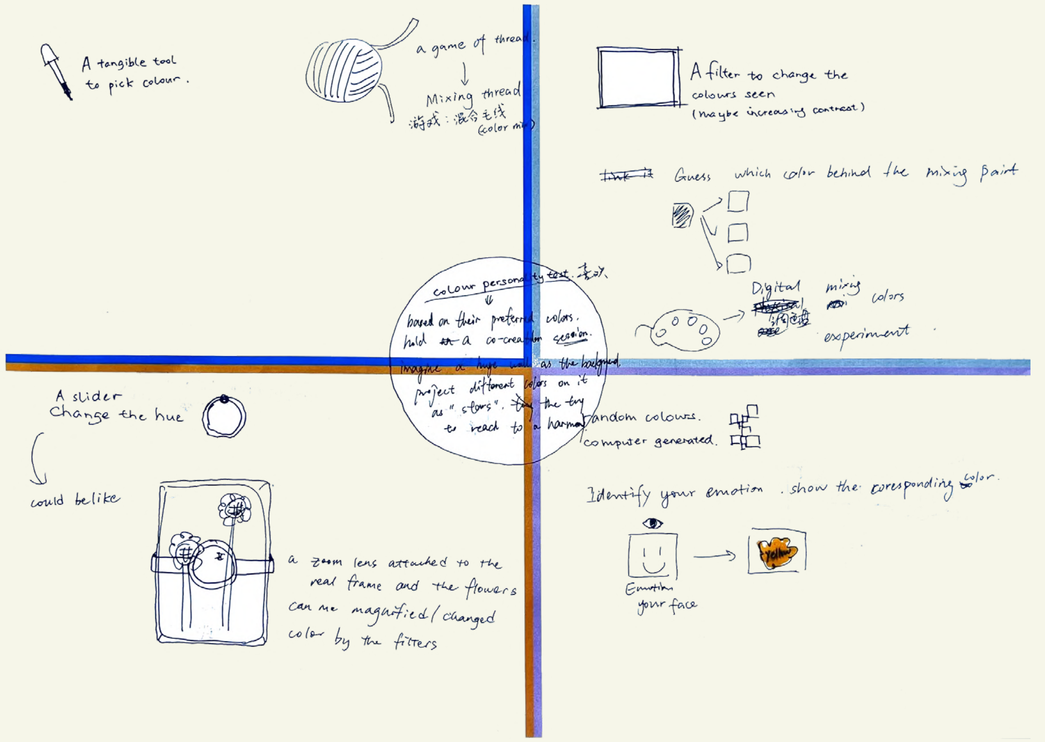
the user make a color board from their impression/memory of the painting
get a mood board

what is sunflower in my mind?

In different situations, color might have totally different meanings.
Yellow, represents lives/brillance.
while in the warning signs, ~~there~~ it represents danger
interesting to ~~too contrast~~ compare colors in this way (but need to find how)

painting → colour → symbol
reimagine

Music
when people are close to the painting to express meaning of the painting


A tangible tool to pick colour.

a game of thread.
Mixing thread
游戏：混合毛线 (color mix)

A filter to change the colours seen (maybe increasing contrast)

~~think it~~ Guess which color behind the mixing paint

Digital mixing colors experiment

colour personality test. 喜欢.
based on their preferred colors.
hold ~~an~~ a co-creation session.
imagine a huge wall as the background.
project different colors on it as "stars". ~~try~~ the try to reach to a harmony

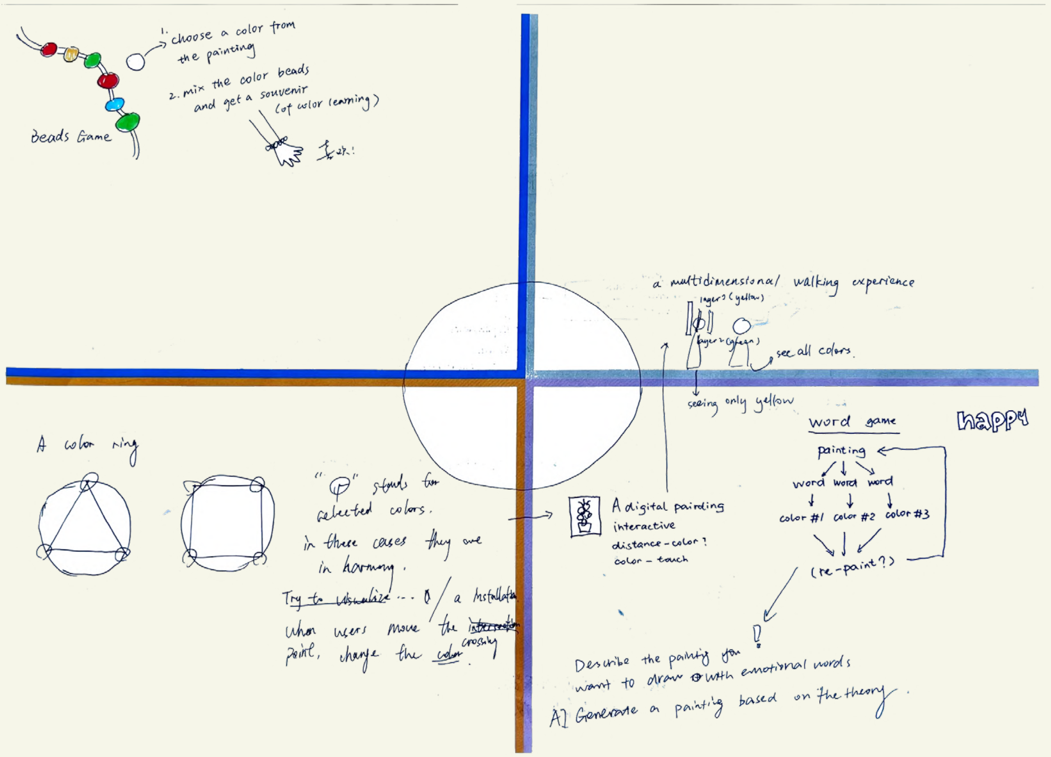
A slider
Change the hue
could be like

a zoom lens attached to the real frame and the flowers can me magnified/changed color by the filters

random colours.
computer generated.

Identify your emotion. show the corresponding color.

Emotion your face
Yellow


1. choose a color from the painting
2. mix the color beads and get a souvenir (of color learning)

Beads Game
喜欢!

a multidimensional walking experience

layer 1 (yellow)
layer 2 (green)
see all colors.
seeing only yellow

A color ring

"φ" stands for selected colors.
in these cases they are in harmony.
Try to visualize … / a Installation
when users move the ~~intersection~~ crossing point, change the color.

A digital painting
interactive
distance - color?
color - touch

word game
happy
painting
word word word
color #1 color #2 color #3
(re-paint?)

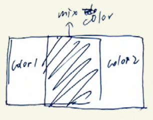
Describe the painting you want to draw with emotional words
AI Generate a painting based on the theory.

For ~~Both~~ All of them.

① Link them to some ~~represent the~~ Masters (their emotional expression / color style), ~~it's a~~ a way to help users learn how to use them.

② A basic canvas, users can paint them by their preferences. Then we introduce Van Gogh's Pallette / filter a bit for 4 modes

colour palette generation.

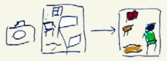

mix ~~the~~ color
color 1
color 2

overlapping with two pictures with single color.

user describes painting, AI painter paints.

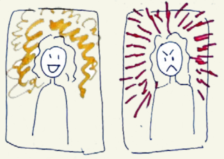
privacy!!!

take photo of your ~~bedro~~ bedroom.

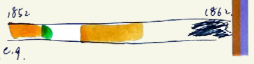


base on your emotion, create a filter/paintings.

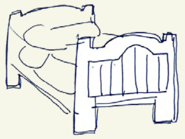
Emotional → An interactive mirror for knowing your ~~ele~~ color & emotion



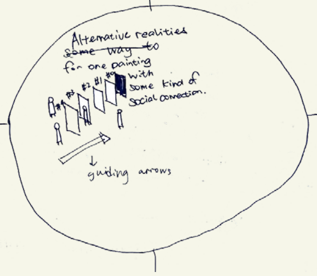
let the user to draw their personal life journey with colors first and then provide a color panel to the users showing how. Van Gogh used different color theories in different periods in his life.


1852
1862
e.g.

DIY 小球 & 扭蛋机器
同意
好!

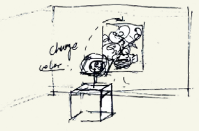


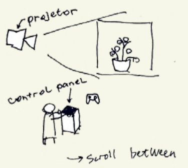
我记得二楼有个booth.
可以再搞个booth做小球&.


Alternative realities
~~Some way to~~
for one painting
with some kind of social connection.
#1
#2
#3
#4
guiding arrows

这个也可在同 DIY 小球&
是啊. +1 +2

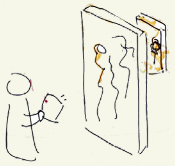
take away?
闭眼 → 回想 sunflower.
↓
What is it like?


change color


projetor
control panel

→ scroll between different color theory on same painting

或者有一个很大胆的想法, 拿盆水泼画 看这些画的颜色融合效果
but 水盆可以是传感器. 画布可以是显示屏
视觉效果类似 涂鸦



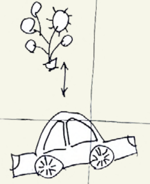
点击画面, 有一些 音乐 / 触感 / 视觉效果 表达不同的情绪

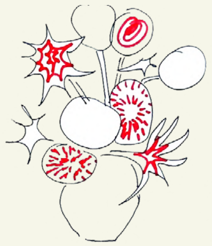
→ 也可以一些提示手势

~~踏进~~ 远看 ←→ 近看

Some ~~instruments~~ color blocks, they can put together to see the effect.

衍纸
巨大版
迷宫.





大型沙画装置

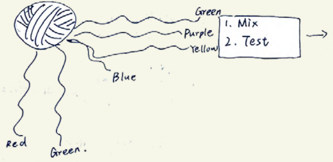
Paint Your Own Sunflower.
填色游戏!
(Base on 4 ~~theories~~ strategies of color)
Same Painting → Different Vibe!!!

公共装置

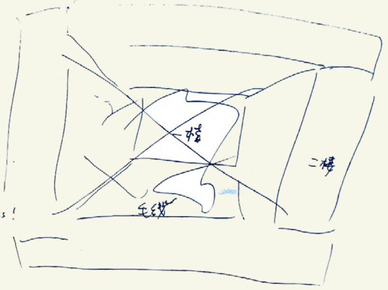
if user need to Create → there might be some pressure!!!

Free from pressure to perform well

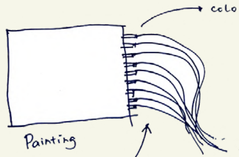
+1


Green
Purple
Yellow
Blue
Red
Green.
1. Mix
2. Test

→ Just test!
↓
No Requirements
No Results.
Only Experiment Process!

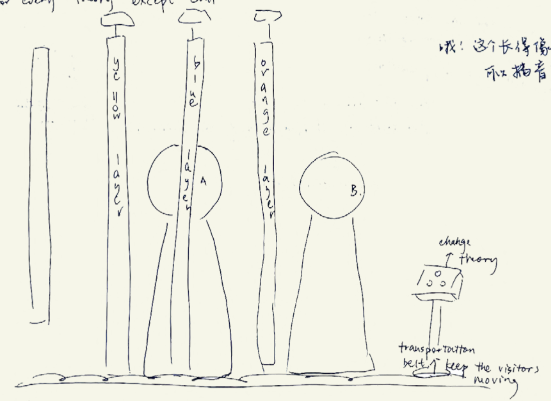


+1


Painting
plug it in.

color / palette / color strategies / mood / ...

for every theory except dull


yellow layer
blue layer
orange layer
A
B.
change theory
transportation belt
keep the visitors moving

← the way to the painting

哦! 这个长得像 合成器.
可以搞音乐表演

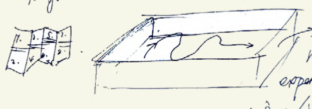
treasure hunt

小册子, 有一个

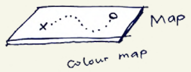
Can you find which painting include these colors (反面是答案)

Contrasting colors.
↓
What if change the color?

A guidance brochure.

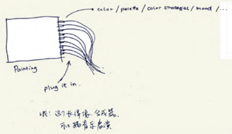


→ guide the route to experience different views / installations.

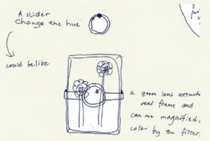

Map
colour map

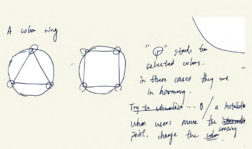
Appendix K: Raw Ideas Grouping

change (certain) colours of an existing painting

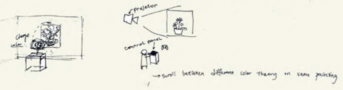

color / palette / color strategies / mood / ...
Painting
plug it in.
哦！这个长得像. 合成器.
和插着音乐感觉

5	AI vincent: users performing simple colour tasks	AI vincent: "I would do this" or change the users' choice directly	the idea of communicate with VG	digital screen?


A slider
Change the hue
could be like
a zoom lens attach
real frame and
can be magnified,
color by the filter.


A color ring
"⌽" stands for selected colors.
in these cases they are in harmony.
~~Try to visualize~~ ... 0 / a installation
when users move the ~~intersection~~ crossing point, change the color.

2	decide on a colour palette first -> walk through an immersive area of replica painting	reveal: a customized realistic painting with different colours


change color
projector
control panel
→ scroll between different color theory on same painting

	select colours from palette->decide how to use colours (mixing, not mixing) like in real world	see the results directly, comparing with similar Van Gogh works	understand mixing contrast colours make muddy tones v.s. vibrant colourful ones	digital (screen); tangible (brush with screen)

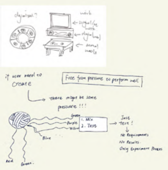
3	select from a range of VG's existing colour palettes of works	change colours of a painting

7	select certain colour from painting palette -> decide the percentage in the painting -> repeat	reveal: this is how your choice looks like, comparing with original Van Gogh works

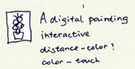
1	walk into an immersive area of a replica of a painting (e.g. bedroom, sunflower field) -> touch and change the colours of certain objects	see the difference in colours they make

1	provided with pieces in different colours, user "rebuild" the painting in 3D	see a different, personalized version of the painting	understand different colour combinitions	tangible + screen
2	use colourless blocks which have different patterns (in shapes, etc) to rebuild the painting	reveal: this is what your choice looks like	understand why colours contrast with each other/close to each other?	tangible + screen
3	select colour blocks from a colour wheel and apply to a painting to change colours	directly see/understand different positions of each colour and see the difference	undersand how colours contrast with/close to each other (in position)	tangible + screen
4	select from a range of colour blocks to "rebuild" the painting	change the colours of corresponding elements in a painting	freely explore different colour combinitions in a paintings	tangible element blocks?

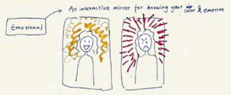
4	see the original wool used in a painting ->change the colours of the wool	see the wool of new colours intertwining, see the new painting	understand how vangogh chose colours, different colour combinitions	**wool** fun digital (to avoid mess) and tangible (to feel the material)


original?
wool
original
digital
actual wool
if user need to create
Free from pressure to perform well
there might be some pressure !!!
Green
Purple
Yellow
Blue
Red
Green
1. Mix
2. Test
Just test !
No Requirements
No Results
Only Experiment Process

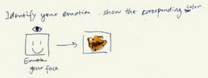
8	add objects/elements of certain colours in a VG's painting	see the direct results	a sense of cocreating and understand colours combiitions	digital tangible

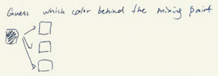

A digital painting
interactive
distance - color ?
color - touch

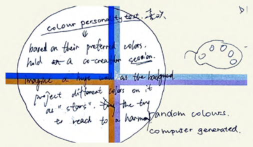
quiz/task & reveal (indirect educating)


Emotional
An interactive mirror for knowing your color & emotion

9	answer a series of (random) questions: what's your favourite colout, what's your mood, what's on your mind,....	reveal: this is how your choices look like ->explanation	funny	

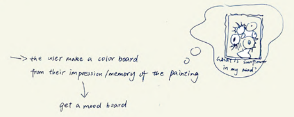

Identify your emotion . show the corresponding color
Emotion your face
Yellow


Guess which color behind the mixing paint


colour personality ~~test~~. 素人.
based on their preferred colors, hold ~~a~~ a co-creation session.
Imagine a huge wall as the background
project different colors on it as "stars". ~~Try~~ the try to reach to a harmony
random colours.
computer generated.

Describe the painting you want to draw with emotional words

AI Generate a painting based on the theory.


→ the user make a color board from their impression/memory of the painting
get a mood board
What's sunflower in my mind?

Take away?

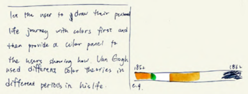
闭眼 → 回想. sunflower.

↓

What is it like?

create/draw a work

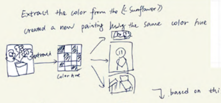
user describes painting,
AI painter paints.
more red
AI

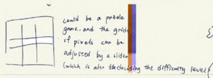

let the user to draw their personal life journey with colors first and then provide a color panel to the users showing how Van Gogh used different color theories in different periods in his life.
e.g.
1862
1862

5	AI vincent: users performing simple colour tasks	AI vincent: "I would do this" or change the users' choice directly	the idea of communicate with VG	digital screen?

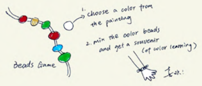
7	select certain colour from painting palette -> decide the percentage in the painting -> repeat	reveal: this is how your choice looks like, comparing with original Van Gogh works

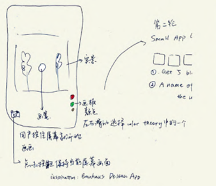
select one's moods/emotions first ->draw without seeing colours	reveal final work, comparing with similar Van Gogh works	understand how colours convey emotions	digital (screen); tangible (brush with screen)

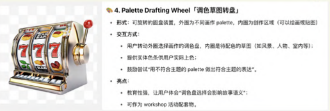

Extract the color from the《Sunflower》
created a new painting using the same color hue
extract
Color hue
based on this.


could be a puzzle game, and the grids of pixels can be adjusted by a slider (which is also the deciding the difficulty level)

Van Gogh in a dish
(色香味俱全 → 色彩搭配. 美学教育!)
Make a dish from the「Bedroom」
blueberry & Mango & brocco
tomato & potato ...

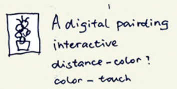

1. choose a color from the painting
2. mix the color beads and get a souvenir (of color learning)
Beads Game
手环!


实景
画板
颜色
画笔
左右滑动选择 color theory 中的一个
用户按住屏幕可以涂画
画面
点击按钮保持当前屏幕画面
inspiration: Bauhaus Dessau App
第二轮
Small App
①. Get 3 bl
② A name of the u


4. Palette Drafting Wheel「调色草图转盘」

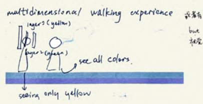
- 形式：可旋转的圆盘装置，外圈为不同画作 palette，内圈为创作区域（可以绘画或贴图）
- 交互方式：
  - 用户转动外圈选择画作的调色盘，内圈是待配色的草图（如风景、人物、室内等）；
  - 提供实体色条供用户实际上色；
  - 鼓励尝试"用不符合主题的 palette 做出符合主题的表达"。
- 亮点：
  - 教育性强，让用户体会"调色盘选择会影响故事语义"；
  - 可作为 workshop 活动配套物。

1	provided with pieces in different colours, user "rebuild" the painting in 3D	see a different, personalized version of the painting	understand different colour combinitions	tangible + screen
2	use colourless blocks which have different patterns (in shapes, etc) to rebuild the painting	reveal: this is what your choice looks like	understand why colours contrast with each other/close to each other?	tangible + screen
3	select colour blocks from a colour wheel and apply to a painting to change colours	directly see/understand different positions of each colour and see the difference	undersand how colours contrast with/close to each other (in position)	tangible + screen
4	select from a range of colour blocks to "rebuild" the painting	change the colours of corresponding elements in a painting	freely explore different colour combinitions in a paintings	tangible element blocks?


A digital painting
interactive
distance - color ?
color - touch

physical body interactions with digital paints

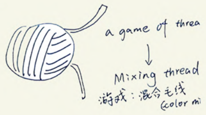
6	freely, intuitively move hands/arms like a painting brush	see the results of different actions (mixing v.s. not mixing)	understand the colour use of VG	motion recognition


multidimensional walking experience
layer 1 (yellow)
layer 2 (green)
see all colors.
seeing only yellow

或者有一个很大胆的想法. 合金小液画. 看这些画的颜色游戏效果
but 不会可以是传感器. 画布可以是显示屏
视觉效果类似 添扇

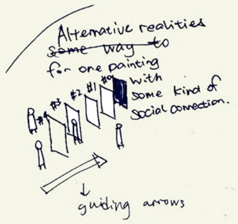
play with paints/colours

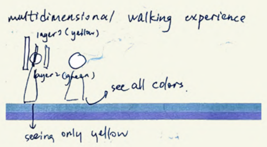
或者有一个很大胆的想法. 合金小液画. 看这些画的颜色游戏效果
but 不会可以是传感器. 画布可以是显示屏
视觉效果类似 添扇

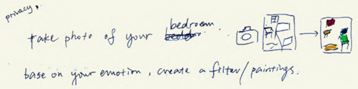

a game of threa
Mixing thread
游戏：混合毛线
(color mi

Digital
~~Physical~~
调色盘
mixing
colors
experiment

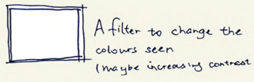
multiple ways of observing a painting/real-life photography/objects

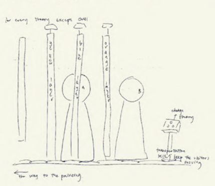

Alternative realities
~~Some way to~~
for one painting with some kind of social connection.
#4
#3
#2
#1
#0
guiding arrows

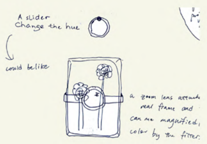

multidimensional walking experience
layer 1 (yellow)
layer 2 (green)
see all colors.
seeing only yellow

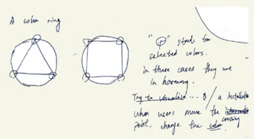

privacy,
take photo of your ~~bedro~~ bedroom.
base on your emotion, create a filter/paintings.

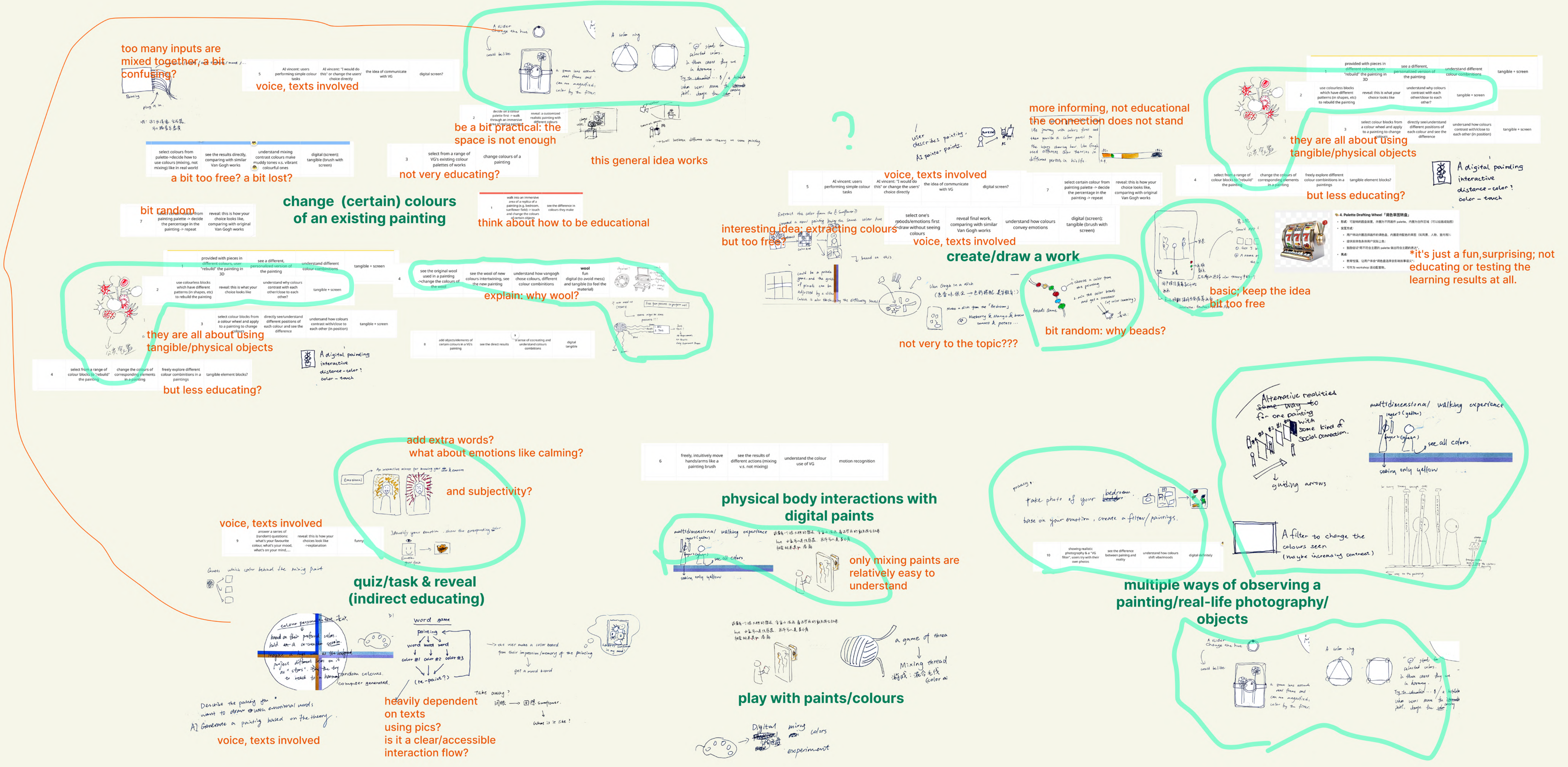
10	showing realistic photography & a "VG filter", users try with their own photos	see the difference between paining and reality	understand how colours shift vibe/moods	digital definitely


A filter to change the colours seen
(maybe increasing contrast)


change theory
the way to the painting


A slider
Change the hue
could be like
a zoom lens attach
real frame and
can be magnified,
color by the filter.


A color ring
"⌽" stands for selected colors.
in these cases they are in harmony.
~~Try to visualize~~ ... 0 / a installation
when users move the ~~intersection~~ crossing point, change the color.



too many inputs are mixed together, a bit confusing?

voice, texts involved

be a bit practical: the space is not enough

this general idea works

not very educational?

a bit too free? a bit lost?

bit random

change (certain) colours of an existing painting

think about how to be educational

explain: why wool?

they are all about using tangible/physical objects

but less educating?

add extra words? what about emotions like calming?

and subjectivity?

voice, texts involved

quiz/task & reveal (indirect educating)

heavily dependent on texts
using pics?
is it a clear/accessible interaction flow?

voice, texts involved

?

more informing, not educational
~~the connection~~ does not stand

they are all about using tangible/physical objects

but less educating?

voice, texts involved

interesting idea: extracting colours but too free?

voice, texts involved

create/draw a work

basic; keep the idea bit too free

*it's just a fun,surprising; not educating or testing the learning results at all.

bit random: why beads?

not very to the topic???

physical body interactions with digital paints

only mixing paints are relatively easy to understand

play with paints/colours

multiple ways of observing a painting/real-life photography/ objects

Appendix L: Concept Evaluation Process

participants

Five staff members from the Van Gogh Museum participated in individual evaluation sessions. Their professional roles included: Marketing & Branding; Digital Products & UX Design; Project Coordination; Content Curation; Licensing Support.

purpose

- To assess each concept from different disciplinary perspectives (e.g., communication, feasibility, visitor experience).
- To evaluate whether Van Gogh's four colour strategies are effectively expressed in each concept.
- To identify concerns, strengths, and possible improvements for further development.

materials

Vincent's Colour Strategies sheet (as developed in Section 2.3 and used during co-creation workshops).
Visualisations and descriptions of the three developed concepts (as presented in Section 4.3.3).

procedures

Each session was conducted one-on-one and held online, lasting approximately 30 minutes. The process followed a semi-structured interview format:

1. Introduction to the project background and Van Gogh's four colour strategies.

2. Presentation of each concept, one at a time. For each concept, the following questions were asked:

"What is your first impression or immediate question?"
"From your professional experience, do you see any potential concerns?"
"Can you describe this concept in one or two words?"

3. At the end of the session, participants were asked to place the three concepts on a 2×2 matrix with two axes. (Horizontal: "Fitting the Van Gogh Museum" v.s. "Not fitting";Vertical: "New and special" v.s. "Not new or special")

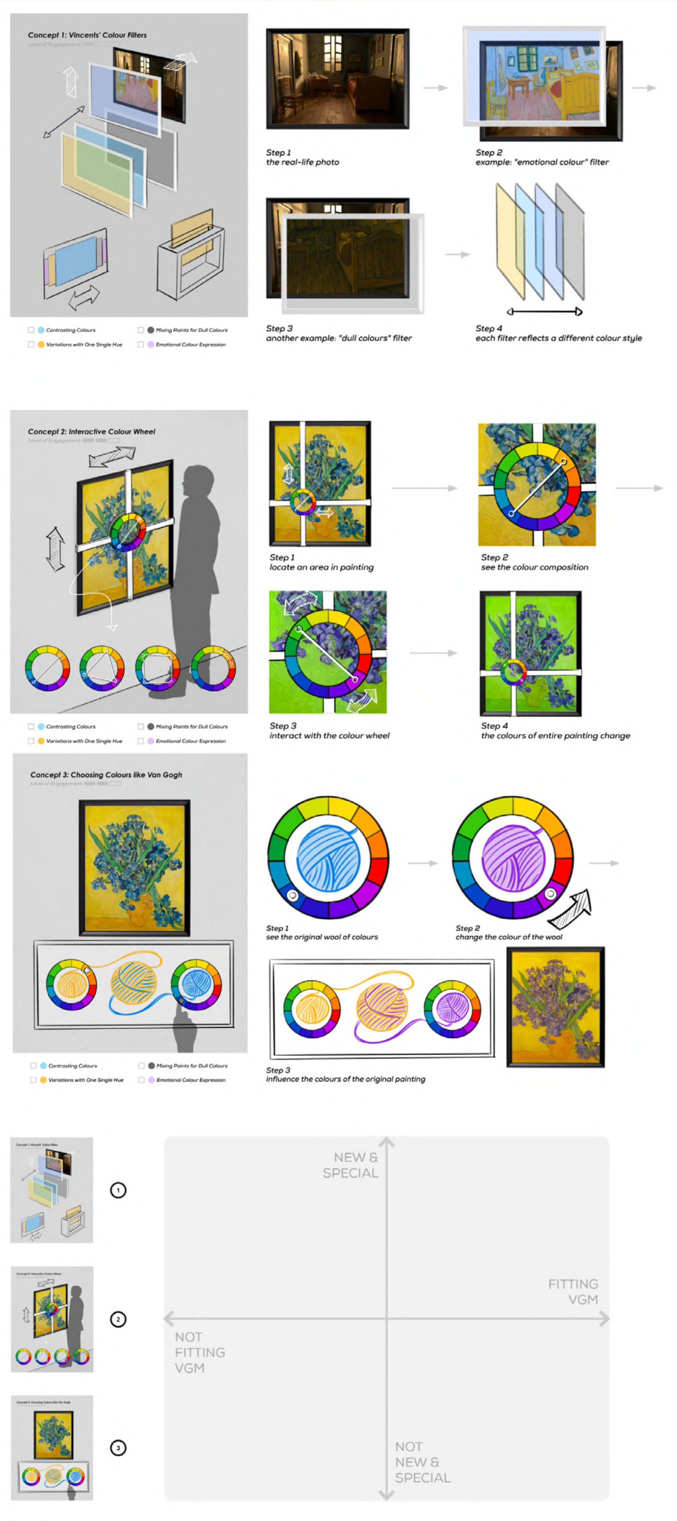

Concept 1: Vincents' Colour Filters
Level of Engagement:
Step 1
the real-life photo
Step 2
example: "emotional colour" filter
Step 3
another example: "dull colours" filter
Step 4
each filter reflects a different colour style
☐ Contrasting Colours
☐ Mixing Paints for Dull Colours
☐ Variations with One Single Hue
☐ Emotional Colour Expression
Concept 2: Interactive Colour Wheel
Level of Engagement:
Step 1
locate an area in painting
Step 2
see the colour composition
Step 3
interact with the colour wheel
Step 4
the colours of entire painting change
☐ Contrasting Colours
☐ Mixing Paints for Dull Colours
☐ Variations with One Single Hue
☐ Emotional Colour Expression
Concept 3: Choosing Colours like Van Gogh
Level of Engagement:
Step 1
see the original wool of colours
Step 2
change the colour of the wool
Step 3
influence the colours of the original painting
☐ Contrasting Colours
☐ Mixing Paints for Dull Colours
☐ Variations with One Single Hue
☐ Emotional Colour Expression
①
②
③
NEW & SPECIAL
FITTING VGM
NOT FITTING VGM
NOT NEW & SPECIAL

Figure L.1 (right): Concepts presentation materials used during the evaluation session

Appendix M: Prototype Developing Details

M.1 Prototype Development

The final prototype consists of 2 components: programming and physical buildings.

M.1.1 programming

- platforms and tools

The programme was developed using Processing on a laptop, later integrated with Arduino as the physical input module. Input is received via the serial port from the Arduino board.

Other software options were briefly considered—such as using Blender or Unity to create animated, controllable models of the wool ball. However, after initial exploration, these solutions proved to be too time-consuming and technically complex for the available timeline. As a result, the wool ball and paintings were ultimately handled as static images within the Processing environment.

- colour change logic

The core programming logic is straightforward: detect user input, identify relevant areas in the painting and wool pictures, and apply colour transformations accordingly.

During development, a key challenge emerged: accurately identifying which parts of the painting should change colour. For the programme to function effectively, it must first distinguish separate areas in the image and then apply colour changes only to the targeted regions.

Case: Irises (with contrasting colours)
No additional processing was needed for Irises. The programme successfully detected blue, yellow, and green regions using their distinct hue values. This was likely due to the high contrast between colour zones in the painting.

Case: Sunflowers (with similar colours)
In Sunflowers, hue-based detection failed due to the colours being too visually similar. As a result, the programme could not differentiate between petals, leaves, and background.

To solve this, custom masks were introduced:
Initially, black–white–grey masks were used, but border blending caused errors (e.g., white edges on black background are misinterpreted as grey areas).

Eventually, masks were restructured using RGB-coloured regions—each area (e.g., petals, leaves, background) filled with a distinct RGB value, resulting in much cleaner segmentation.

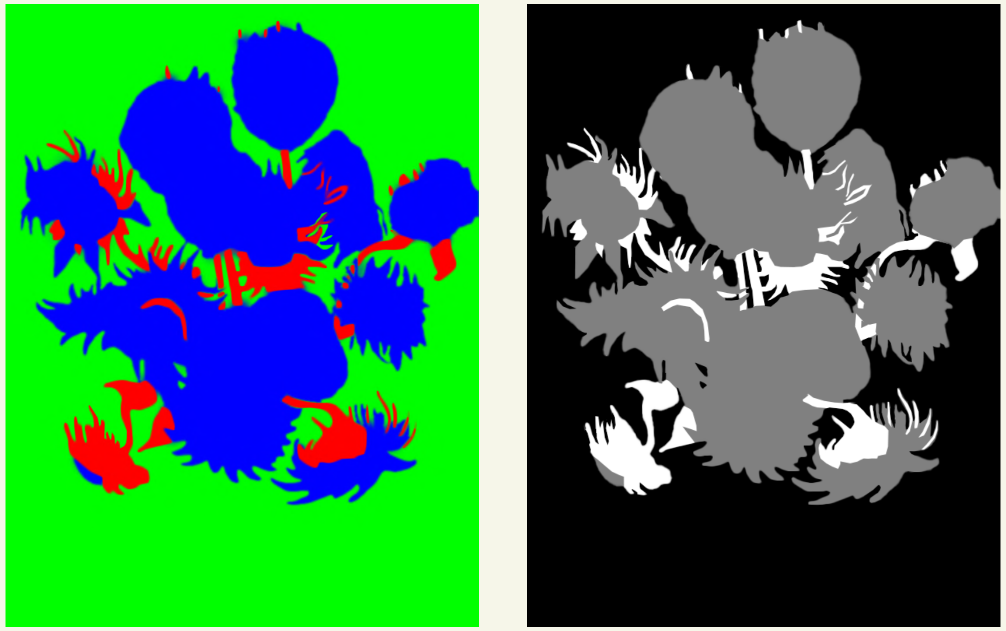


Figure M.1: Black-white-grey mask (right) and RGB mask (left)

This mask-based method proves extensible: it can be applied to any painting that features distinguishable dominant colour zones. The painting need not be visually simple, as long as key colour regions can be manually masked. For example, with the mask method, Wheatfield with Crows can also be the subject of this interactive installation.

The early demos already demonstrated successful functionality. In this phase, colour changes were triggered via mouse input (e.g., clicking colour blocks). The next step was integrating physical interaction using Arduino modules.

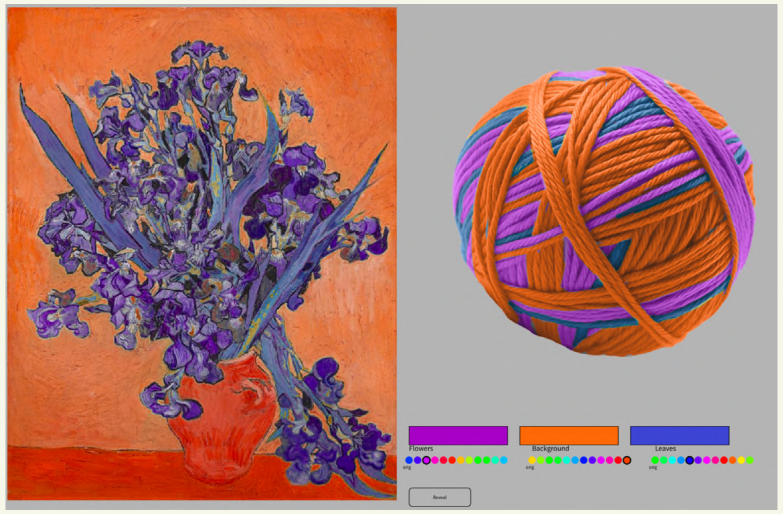


Figure M.2: Screenshot of an early demo

- integrating with Arduinos

While Processing continues to run the visual engine, Arduino is introduced to capture real-world input. When a physical sensor is triggered, the Arduino sends a signal via the serial port, and Processing interprets the signal to initiate corresponding changes on-screen.

There are two types of input required:

1. Reveal Button Input
This is a simple digital input, implemented using a push-button connected to the Arduino.

2. Token Position Recognition on the Colour Wheel
This is the core challenge—identifying which token is placed at which colour block. Three approaches were explored:

Option 1: RFID reader & RFID stickers
This approach involves placing an RFID reader beneath each colour block, with corresponding RFID tags attached to the physical tokens.
Advantages: Offers high accuracy and reliable identity recognition.
Limitations: Requires one RFID reader per block (12 in total), which demands significant space beneath the colour wheel. In addition, the complexity of wiring and integration would substantially increase.

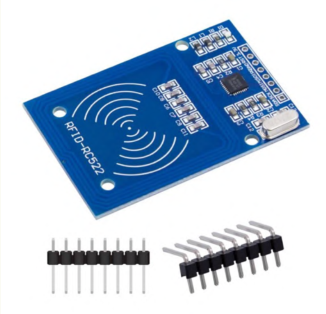


Figure M.3: Picture of an RFID reader (n.d., Shenzhen Kuongshun Electronic Business Co., Ltd. website)

Option 2: linear hall sensors
In this solution, 12 SS49E linear Hall sensors will be installed beneath the colour wheel—one sensor per colour segment. Each token will be embedded with a distinct magnet configuration to ensure identity differentiation:
Token A: Two south-pole magnets
Token B: Two north-pole magnets
Token C: One single magnet placed further from the sensor, producing a weaker field

These distinct magnetic field patterns allow the programme to determine both the position and identity of each token by interpreting the sensor outputs.
Advantages: Compact hardware footprint, cost-efficient, and relatively simple wiring
Limitations: An Arduino Uno board has only six analog input pins, which is insufficient for handling 12 sensors. Therefore, an Arduino Mega board needs to be used to meet the input requirements.

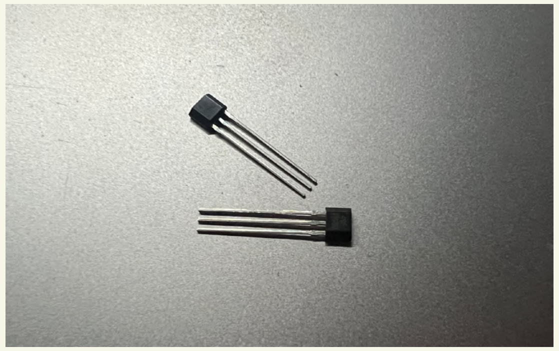


Figure M.4: Picture of SS49E linear hall sensors

Option 3: Rotary Encoders
An alternative involved embedding rotary encoders inside the tokens to read angular positions on the wheel.
Advantages: Provides precise position data
Limitations: Requires internal mechanical installation within each token, which is incompatible with the available space in the current design.

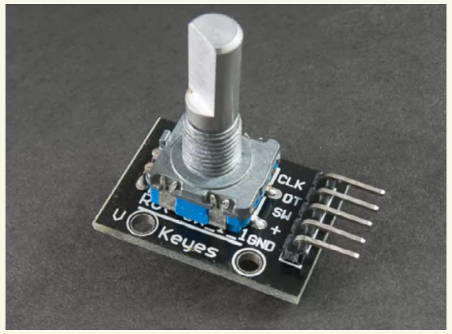


Figure M.5: Picture of SS49E linear hall sensors

After careful evaluation, the use of linear Hall sensors was selected as the most feasible and efficient solution. This decision was based on their compactness, ease of integration, and cost-effectiveness. Moreover, the designer's previous experience working with Hall sensors significantly facilitated implementation.

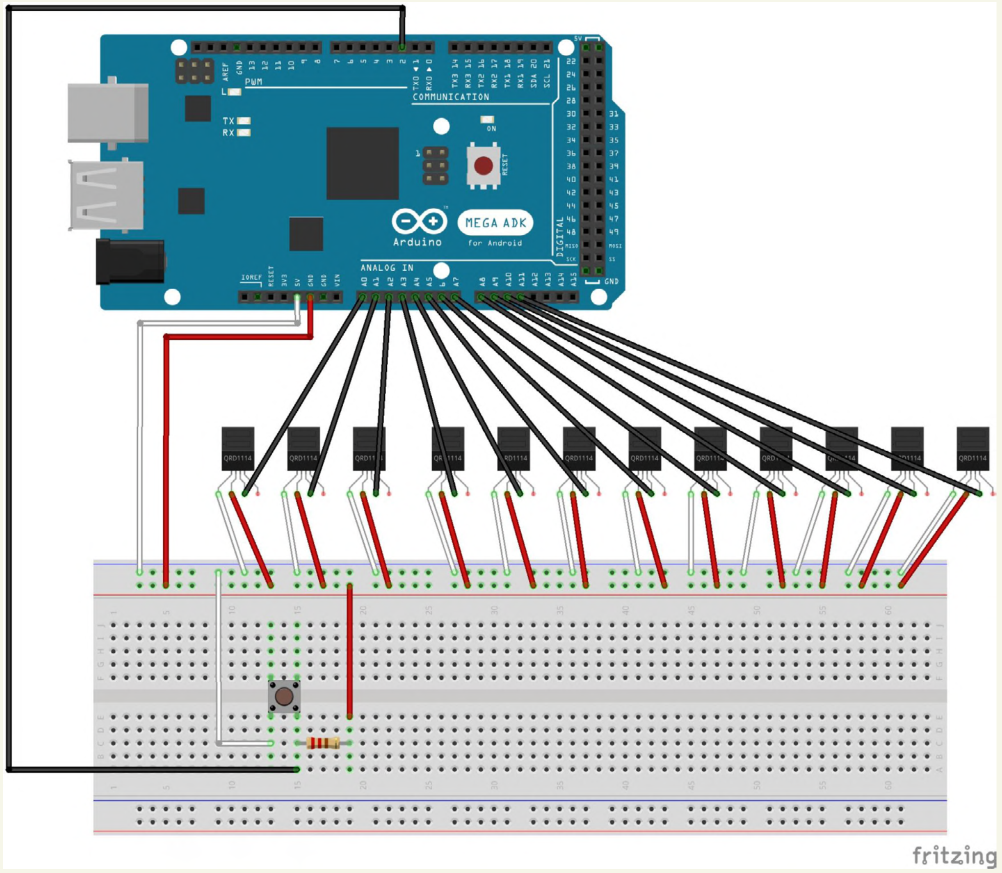
Initial tests were conducted using an Arduino Uno board with six sensors. Results showed that the system could accurately detect all three tokens and trigger the corresponding colour changes in the digital interface. The sensor readings were as follows:

- Neutral: Around 520 (no tokens or magnets nearby)
- Background token: Approximately 870-880 (strong field from two N-pole magnets)
- Flower token: Approximately 160–170 (strong field from two S-pole magnets)
- Leaf token: Approximately 200-240 or 750-780 (weaker field due to a single magnet with spacing)

Subsequently, the system was expanded to incorporate all 12 sensors using an Arduino Mega. Full-scale testing confirmed that the recognition logic remained stable and reliable across all colour blocks.

The Arduino Mega receives analog input from the twelve SS49E linear Hall sensors connected to pins A0–A11. Each sensor corresponds to one colour block on the physical colour wheel. When a token passes over a sensor, the Arduino reads the analog value and identifies the token based on the intensity of the magnetic field. It then sends a simplified signal—such as "F2" (flower on segment 2) or "B10" (background on segment 10)—via serial communication to the Processing sketch. Processing parses this input, updates the token's position and associated hue, and prepares the digital artwork for transition. This connection ensures a seamless link between physical movement and digital visualisation. The complete programming in Arduino IDE can be found in Appendix N.

Figure M.6: Illustration of the routing on Arduino



- iterations & finalization

After implementing the core logic and interaction functions, several refinements were made to enhance clarity and user experience. A functional colour wheel was added around the digital wool to reflect real-time selections, replacing the previous testing colour blocks and on-screen reveal button, which were removed for a cleaner interface.

Illustrations of the tokens were incorporated to indicate their live positions, and smooth transition animations were introduced to enrich the visual feedback and strengthen the sense of interaction.

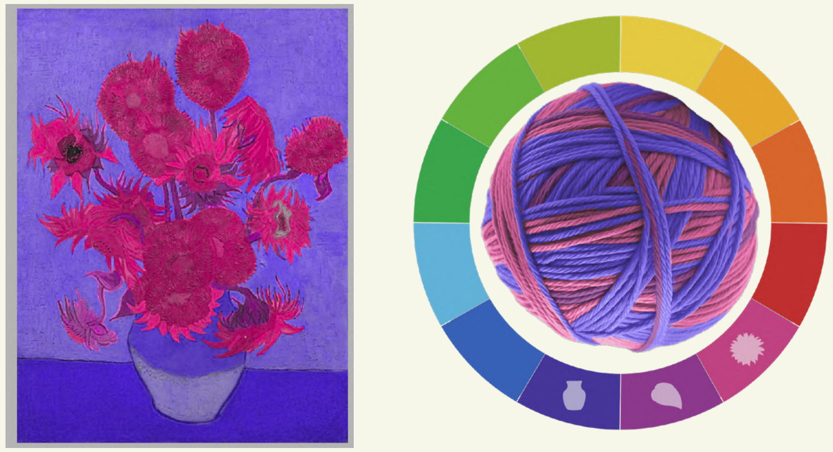


Figure M.7: Screenshot of the final programme interface

M.1.2 physical prototyping

- building blueprints (see Figure 85)

To streamline the building process and maximise material efficiency, the prototype was constructed layer by layer. A simple sliding rail mechanism was created by utilising three layers of plywood with varying diameters.

Layer 3 is magnetically attached to Layer 2, allowing for quick removal and easy token replacement. All other components are permanently fixed using wood glue.

The tokens were fabricated using the same layer-based method as the colour wheel, ensuring consistency in design and dimensions.

The final prototype measured 250 mm × 300 mm × 100 mm.

- preparing components

Material used:
4 × plywood sheets (3 mm thickness, 420 mm × 300 mm)
44 × neodymium magnets (8 mm diameter, 3 mm thickness)
1 × acrylic sheet (3 mm thickness, 200 mm × 150 mm)
Wood glue, super glue, electronic tape

Processing methods:
Laser cutting for both plywood and acrylic components
3D printing for the extended push-button component connected to the Arduino module

- assembly

The compact size of the Hall sensors and relatively simple wiring made sensor integration straightforward. Components were fixed in place using electronic tape for flexibility and adjustability.

Remaining structural components were assembled using glue, following the layer blueprint described above.

The final assembly presents a fully functional physical prototype, ready for testing and demonstration.

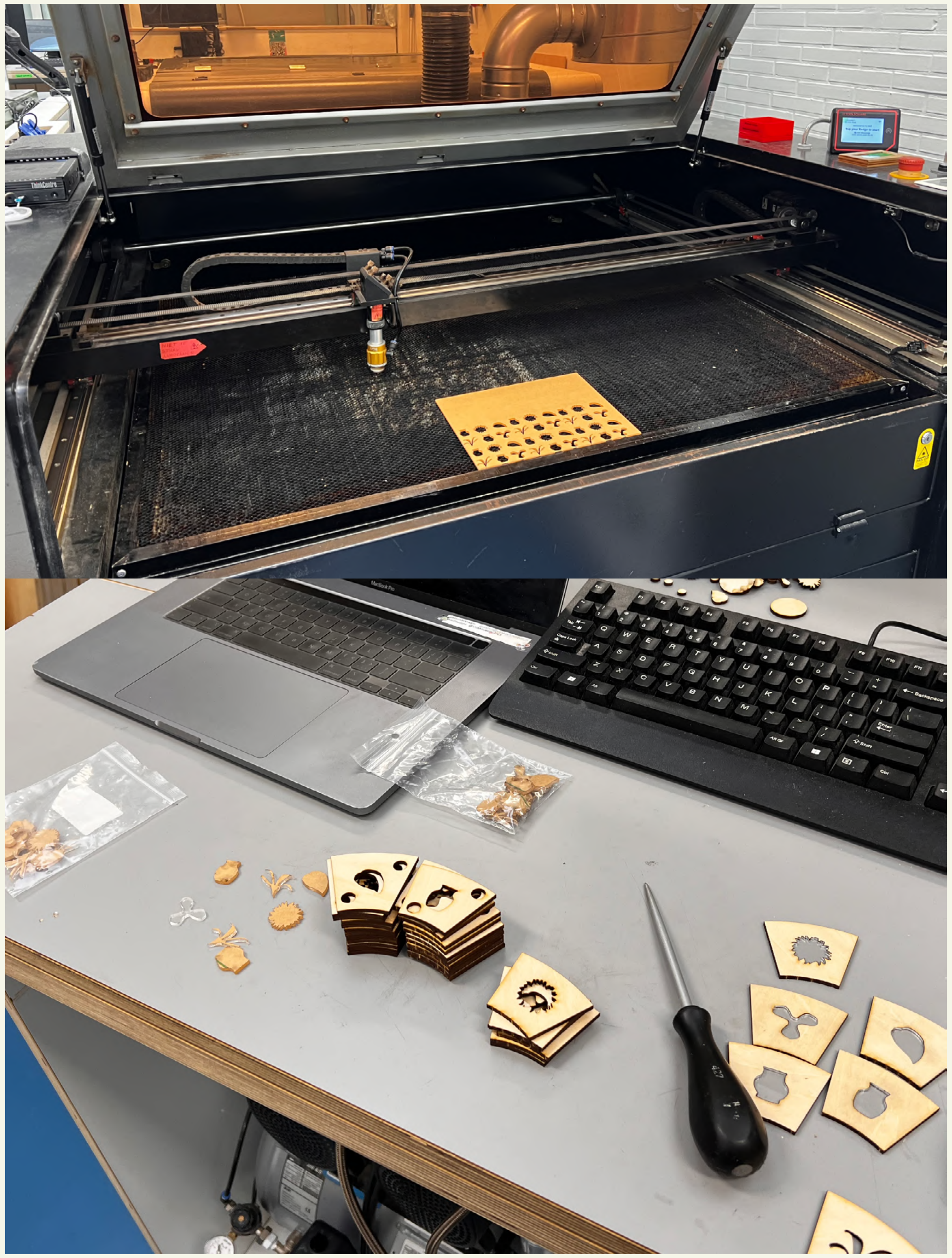


Figure M.8: Photos of lasercutting process

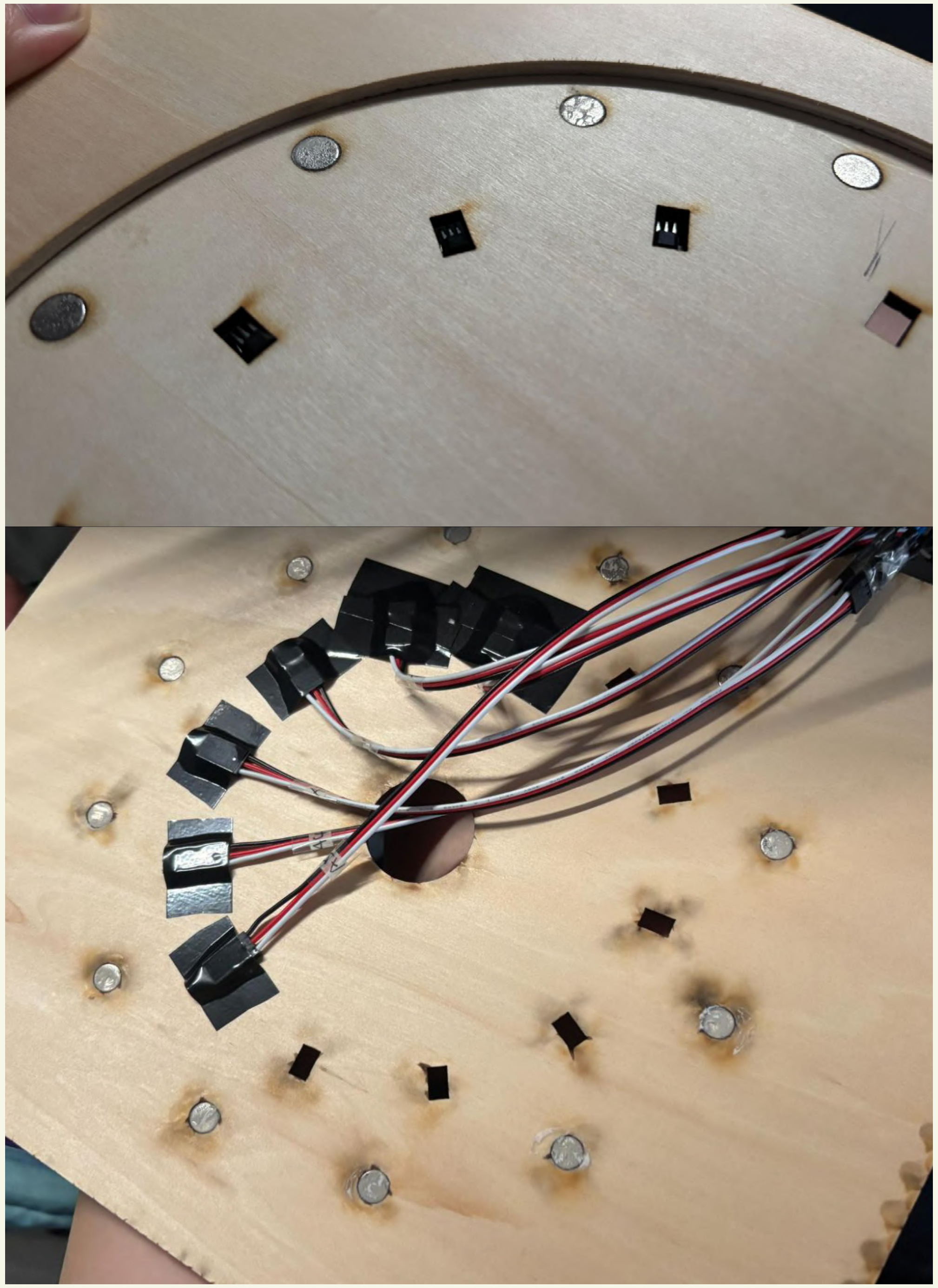


Figure M.9: Photos of integrating hall sensors in the base during assembly

Appendix N: Complete Programming

N.1 Iris (Processing)

```
import processing.serial.*;
Serial myPort;

PImage woolImg, baseWoolImg, woolCurrentImg, woolTargetImg, woolPrevImg;
PImage irisImg, irisCurrentImg, irisRevealedImg, irisNextTargetImg;
PImage tokenFlower, tokenBackground, tokenLeaf;

float angle = 0;
float transitionProgress = 1.0;
float transitionSpeed = 0.7;

int blueIndex = -1, yellowIndex = -1, greenIndex = -1;
int blueOriginHue = 225, yellowOriginHue = 50, greenOriginHue = 115;
color blueTargetColor, yellowTargetColor, greenTargetColor;

int canvasW, canvasH;
int woolX, woolY, irisX, irisY;
boolean revealAnimating = false;
int revealTimer = 0;
int maxRevealFrames = 6;
ArrayList<Particle> particles = new ArrayList<Particle>();
int woolTransitionStartMillis = 0;
int woolTransitionDuration = 500;  // 0.5 秒 = 500 毫秒
boolean woolTransitioning = false;

int[] sensorHueMap =    {60, 45, 20, 0, 330, 300, 250, 220, 200, 130, 100, 70};
int[] sensorSatMap =    {72, 80, 80, 75, 65, 60, 65, 70, 55, 65, 65, 73};
int[] sensorBrightMap = {90, 90, 85, 75, 75, 55, 60, 72, 85, 65, 70, 72};

// □□ □增固□半□
float innerR, outerR;

// token 动□状态
float[] currentAngles = {-90, -90, -90};
float[] targetAngles = {-90, -90, -90};
float markerLerpSpeed = 0.45;
boolean tokenJustInitialized = true;

void settings() {
  woolImg = loadImage("iriswool.png");
  irisImg = loadImage("test-iris.jpg");
  tokenFlower = loadImage("irisflower.png");
  tokenBackground = loadImage("irisbackground.png");
  tokenLeaf = loadImage("irisleave.png");
  canvasW = irisImg.width + woolImg.width + 300;
  canvasH = max(irisImg.height + 80, woolImg.height + 100);
  size(canvasW, canvasH);
}

void setup() {
  println(Serial.list());
  String[] ports = Serial.list();
  String portName = null;
  for (String port : ports) {
    if (port.indexOf("usbmodem") != -1) {
      portName = port;
      break;
    }
  }
  if (portName == null) {
    println("□ Arduino port not found!");
    exit();
  } else {
    println("□ Found port: " + portName);
    myPort = new Serial(this, portName, 9600);
    myPort.bufferUntil('\n');
  }

  woolX = irisImg.width + 180;
  woolY = 100;
  irisX = 80;
  irisY = 20;

  baseWoolImg = woolImg.copy();
  woolCurrentImg = baseWoolImg.copy();
  woolTargetImg = baseWoolImg.copy();
  woolPrevImg = baseWoolImg.copy();
  irisRevealedImg = irisImg.copy();
  irisCurrentImg = irisRevealedImg.copy();

  // 设置 token 初□位置
  yellowIndex = 1; // A1
  blueIndex = 7;   // A7
  greenIndex = 9;  // A9
  updateBlockColors();
  updateTargetAngles();

  // token □开□□□定□□□
  currentAngles[0] = targetAngles[0];
  currentAngles[1] = targetAngles[1];
  currentAngles[2] = targetAngles[2];
  // □□ □□ wheel 半径
  innerR = woolImg.width / 2 - 50;
  outerR = innerR + 100;
}

void draw() {
  background(200);
 if (woolTransitioning) {
  int elapsed = millis() - woolTransitionStartMillis;
  transitionProgress = constrain(elapsed / float(woolTransitionDuration), 0, 1);
  if (transitionProgress >= 1.0) {
    woolTransitioning = false;
  }
}
  updateWoolLerp();
  drawColourWheel(woolX + woolImg.width/2, woolY + woolImg.height/2, innerR,
outerR);

  // 绘□毛线□
  pushMatrix();
  translate(woolX + woolImg.width/2, woolY + woolImg.height/2);
  rotate(radians(angle));
  scale(1.02 + 0.02 * sin(radians(angle * 2)));
  imageMode(CENTER);
  image(woolCurrentImg, 0, 0);
  imageMode(CORNER);
  popMatrix();
  angle += 0.2;

  drawTokenMarkers();

  if (revealAnimating) {
    drawParticleAnimation();
  } else {
    image(irisCurrentImg, irisX, irisY);
  }

}

void drawColourWheel(float cx, float cy, float innerR, float outerR) {
  int segmentCount = 12;
  float angleStep = TWO_PI / segmentCount;
  for (int i = 0; i < segmentCount; i++) {
    float angleStart = -HALF_PI + i * angleStep;
    float angleEnd = angleStart + angleStep;
    colorMode(HSB, 360, 100, 100);
    fill(sensorHueMap[i], sensorSatMap[i], sensorBrightMap[i]);
    noStroke();
    beginShape();
    for (float a = angleStart; a <= angleEnd; a += 0.02) {
      float x1 = cx + cos(a) * innerR;
      float y1 = cy + sin(a) * innerR;
      vertex(x1, y1);
    }
    for (float a = angleEnd; a >= angleStart; a -= 0.02) {
      float x2 = cx + cos(a) * outerR;
      float y2 = cy + sin(a) * outerR;
      vertex(x2, y2);
    }
    endShape(CLOSE);
    colorMode(RGB);
  }
}

void drawTokenMarkers() {
  float cx = woolX + woolImg.width / 2;
  float cy = woolY + woolImg.height / 2;
  float r = (innerR + outerR) / 2;

  for (int i = 0; i < 3; i++) {
    if (!tokenJustInitialized) {
      currentAngles[i] = lerpAngle(currentAngles[i], targetAngles[i],
markerLerpSpeed);
    }
  }

  drawMarkerAt(cx, cy, r, currentAngles[0], tokenFlower);
  drawMarkerAt(cx, cy, r, currentAngles[1], tokenBackground);
  drawMarkerAt(cx, cy, r, currentAngles[2], tokenLeaf);
}

float lerpAngle(float a1, float a2, float amt) {
  float diff = ((a2 - a1 + 540) % 360) - 180;
  return a1 + diff * amt;
}

void updateTargetAngles() {
 float offset = +30;
  targetAngles[0] = -105 + 30 * blueIndex + offset;
  targetAngles[1] = -105 + 30 * yellowIndex + offset;
  targetAngles[2] = -105 + 30 * greenIndex + offset;
}

void drawMarkerAt(float cx, float cy, float r, float angleDeg, PImage tokenImg) {
  float angleRad = radians(angleDeg);
  float x = cx + r * cos(angleRad) - tokenImg.width/2;
  float y = cy + r * sin(angleRad) - tokenImg.height/2;
  image(tokenImg, x, y);
}

void serialEvent(Serial p) {
  String inString = p.readStringUntil('\n');
  if (inString != null) {
    inString = trim(inString);
    println("Arduino: " + inString);
    if (inString.equals("R")) {
      triggerRevealWithAnimation();
    } else if (inString.startsWith("B:")) {
      yellowIndex = parseInt(inString.substring(2));
    } else if (inString.startsWith("F:")) {
      blueIndex = parseInt(inString.substring(2));
    } else if (inString.startsWith("L:")) {
      greenIndex = parseInt(inString.substring(2));
    }
    updateBlockColors();
    updateTargetAngles();
    triggerNewTarget();
    tokenJustInitialized = false;
  }
}

void triggerNewTarget() {
  woolPrevImg = woolCurrentImg.copy();
  woolTargetImg = applySensorHueMapping(baseWoolImg);
  woolTransitionStartMillis = millis();   // □ □录起□时□
  woolTransitioning = true;
}

void triggerRevealWithAnimation() {
  irisNextTargetImg = applySensorHueMapping(irisImg);
  particles.clear();
  revealTimer = 0;
  revealAnimating = true;
  for (int y = 0; y < irisCurrentImg.height; y += 4) {
    for (int x = 0; x < irisCurrentImg.width; x += 4) {
      color c1 = irisCurrentImg.get(x, y);
      color c2 = irisNextTargetImg.get(x, y);
      particles.add(new Particle(x + irisX, y + irisY, c1, c2));
    }
  }
}

void drawParticleAnimation() {
  revealTimer++;
  float t = constrain(revealTimer / float(maxRevealFrames), 0, 1);
  for (Particle p : particles) {
    p.update(t);
    p.display();
  }
  if (revealTimer >= maxRevealFrames) {
    revealAnimating = false;
    irisRevealedImg = irisNextTargetImg.copy();
    irisCurrentImg = irisRevealedImg.copy();
  }
}

PImage applySensorHueMapping(PImage source) {
  PImage result = createImage(source.width, source.height, ARGB);
```

```
  source.loadPixels(); result.loadPixels();
  colorMode(HSB, 360, 100, 100);
  for (int i = 0; i < source.pixels.length; i++) {
    color c = source.pixels[i]; float a = alpha(c);
    if (a == 0) { result.pixels[i] = color(0, 0); continue; }
    float h = hue(c), s = saturation(c), b = brightness(c);
    float dBlue = hueDistance(h, blueOriginHue);
    float dYellow = hueDistance(h, yellowOriginHue);
    float dGreen = hueDistance(h, greenOriginHue);
    int index = -1;
    if (blueIndex >= 0 && min(dBlue, dYellow, dGreen) == dBlue) index = blueIndex;
    else if (yellowIndex >= 0 && min(dBlue, dYellow, dGreen) == dYellow) index =
yellowIndex;
    else if (greenIndex >= 0 && min(dBlue, dYellow, dGreen) == dGreen) index =
greenIndex;
    if (index >= 0) {
      result.pixels[i] = color(sensorHueMap[index], s, b, a);
    } else {
      result.pixels[i] = color(h, s, b, a);
    }
  }
  result.updatePixels();
  colorMode(RGB);
  return result;
}

float hueDistance(float h1, float h2) {
  float d = abs(h1 - h2);
  return d > 180 ? 360 - d : d;
}

void updateWoolLerp() {
  woolCurrentImg.loadPixels();
  woolPrevImg.loadPixels();
  woolTargetImg.loadPixels();
  for (int i = 0; i < woolCurrentImg.pixels.length; i++) {
    color fromC = woolPrevImg.pixels[i];
    color toC = woolTargetImg.pixels[i];
    if (alpha(fromC) == 0) {
      woolCurrentImg.pixels[i] = color(0, 0);
    } else {
      woolCurrentImg.pixels[i] = lerpColor(fromC, toC, transitionProgress);
    }
  }
  woolCurrentImg.updatePixels();
}

void updateBlockColors() {
  colorMode(HSB, 360, 100, 100);
  blueTargetColor = color(sensorHueMap[blueIndex], sensorSatMap[blueIndex],
sensorBrightMap[blueIndex]);
  yellowTargetColor = color(sensorHueMap[yellowIndex],
sensorSatMap[yellowIndex], sensorBrightMap[yellowIndex]);
```

```
  greenTargetColor = color(sensorHueMap[greenIndex],
sensorSatMap[greenIndex], sensorBrightMap[greenIndex]);
  colorMode(RGB);
}



class Particle {
  float homeX, homeY, x, y, dx, dy;
  color cStart, cEnd;
  Particle(float x_, float y_, color fromColor, color toColor) {
    homeX = x_; homeY = y_;
    dx = random(-24, 24); dy = random(-24, 24);
    x = homeX + dx; y = homeY + dy;
    cStart = fromColor; cEnd = toColor;
  }
  void update(float t) {
    float p = t < 0.5 ? map(t, 0, 0.5, 0, 1) : map(t, 0.5, 1.0, 0, 1);
    x = homeX + dx * (t < 0.5 ? 1 - p : p);
    y = homeY + dy * (t < 0.5 ? 1 - p : p);
  }
  void display() {
    float t = revealTimer / float(maxRevealFrames);
    color c = t < 0.5 ? cStart : cEnd;
    float alpha = t < 0.5 ? map(t, 0, 0.5, 255, 0) : map(t, 0.5, 1.0, 0, 255);
    fill(c, alpha); noStroke(); rect(x, y, 4, 4);
  }
}
```

N.2 Sunflowers (Processing)

```
import processing.serial.*;
Serial myPort;

PImage woolImg, baseWoolImg, woolCurrentImg, woolTargetImg, woolPrevImg,
woolMaskImg;
PImage sunImg, sunCurrentImg, sunRevealedImg, sunNextTargetImg, maskImage;
PImage tokenFlower, tokenBackground, tokenLeaf;

float angle = 0;
float transitionProgress = 1.0;
int woolTransitionStartMillis = 0;
int woolTransitionDuration = 500;
boolean woolTransitioning = false;

int flowerIndex = 1; // A1
int leafIndex = 11;  // A11
int bgIndex = 0;     // A0
int flowerOriginHue = 40, leafOriginHue = 115, bgOriginHue = 50;

color flowerTargetColor, leafTargetColor, bgTargetColor;

int canvasW, canvasH;
int woolX, woolY, sunX, sunY;
boolean revealAnimating = false;
int revealTimer = 0;
int maxRevealFrames = 6;
ArrayList<Particle> particles = new ArrayList<Particle>();

int[] sensorHueMap =    {50, 40, 20, 0, 330, 300, 250, 220, 200, 130, 100, 70};
int[] sensorSatMap =    {72, 80, 80, 75, 65, 60, 65, 70, 55, 65, 65, 73};
int[] sensorBrightMap = {90, 90, 85, 75, 75, 55, 60, 72, 85, 65, 70, 72};

float innerR, outerR;
float[] currentAngles = {-90, -90, -90};
float[] targetAngles = {-90, -90, -90};
float markerLerpSpeed = 0.45;
boolean tokenJustInitialized = true;

void settings() {
  woolImg = loadImage("wool_sunflowers.png");
  woolMaskImg = loadImage("sunflowerwool_mask.png");
  sunImg = loadImage("Sunflowers_test.jpg");
  maskImage = loadImage("Sunflowers_maskRGB.png");
  tokenFlower = loadImage("sunflower_flower.png");
  tokenBackground = loadImage("sunflower_background.png");
  tokenLeaf = loadImage("sunflower_leaf.png");

  canvasW = sunImg.width + woolImg.width + 300;
  canvasH = max(sunImg.height + 80, woolImg.height + 100);
  size(canvasW, canvasH);
}
```

```
void setup() {
  println(Serial.list());
  String portName = null;
  for (String port : Serial.list()) {
    if (port.indexOf("usbmodem") != -1) {
      portName = port;
      break;
    }
  }
  if (portName == null) {
    println("   Arduino port not found!");
    exit();
  } else {
    println("   Found port: " + portName);
    myPort = new Serial(this, portName, 9600);
    myPort.bufferUntil('\n');
  }

  woolX = sunImg.width + 180;
  woolY = 100;
  sunX = 80;
  sunY = 20;

  baseWoolImg = woolImg.copy();
  woolCurrentImg = baseWoolImg.copy();
  woolTargetImg = baseWoolImg.copy();
  woolPrevImg = baseWoolImg.copy();
  sunRevealedImg = sunImg.copy();
  sunCurrentImg = sunRevealedImg.copy();

  updateBlockColors();
  updateTargetAngles();
  currentAngles[0] = targetAngles[0];
  currentAngles[1] = targetAngles[1];
  currentAngles[2] = targetAngles[2];

  innerR = woolImg.width / 2 - 50;
  outerR = innerR + 100;
}

void draw() {
  background(255);

  if (woolTransitioning) {
    int elapsed = millis() - woolTransitionStartMillis;
    transitionProgress = constrain(elapsed / float(woolTransitionDuration), 0, 1);
    if (transitionProgress >= 1.0) {
      woolTransitioning = false;
    }
  }

  updateWoolLerp();
  drawColourWheel(woolX + woolImg.width / 2, woolY + woolImg.height / 2,
```

```
innerR, outerR);

  pushMatrix();
  translate(woolX + woolImg.width / 2, woolY + woolImg.height / 2);
  rotate(radians(angle));
  scale(1.02 + 0.02 * sin(radians(angle * 2)));
  imageMode(CENTER);
  image(woolCurrentImg, 0, 0);
  imageMode(CORNER);
  popMatrix();
  angle += 0.2;

  drawTokenMarkers();

  if (revealAnimating) {
    drawParticleAnimation();
  } else {
    image(sunCurrentImg, sunX, sunY);
  }
}

void serialEvent(Serial p) {
  String inString = p.readStringUntil('\n');
  if (inString != null) {
    inString = trim(inString);
    println("Arduino: " + inString);
    if (inString.equals("R")) {
      triggerRevealWithAnimation();
    } else if (inString.startsWith("F:")) {
      flowerIndex = parseInt(inString.substring(2));
    } else if (inString.startsWith("B:")) {
      bgIndex = parseInt(inString.substring(2));
    } else if (inString.startsWith("L:")) {
      leafIndex = parseInt(inString.substring(2));
    }
    updateBlockColors();
    updateTargetAngles();
    triggerNewTarget();
    tokenJustInitialized = false;
  }
}

void triggerNewTarget() {
  woolPrevImg = woolCurrentImg.copy();
  woolTargetImg = applyHueShiftsWithMask(baseWoolImg, woolMaskImg);
  woolTransitionStartMillis = millis();
  woolTransitioning = true;
}

void triggerRevealWithAnimation() {
  sunNextTargetImg = applyHueShiftsWithMask(sunImg, maskImage);
  particles.clear();
  revealTimer = 0;
  revealAnimating = true;
  for (int y = 0; y < sunCurrentImg.height; y += 4) {
    for (int x = 0; x < sunCurrentImg.width; x += 4) {
      color c1 = sunCurrentImg.get(x, y);
      color c2 = sunNextTargetImg.get(x, y);
      particles.add(new Particle(x + sunX, y + sunY, c1, c2));
    }
  }
}

void drawParticleAnimation() {
  revealTimer++;
  float t = constrain(revealTimer / float(maxRevealFrames), 0, 1);
  for (Particle p : particles) {
    p.update(t);
    p.display();
  }
  if (revealTimer >= maxRevealFrames) {
    revealAnimating = false;
    sunRevealedImg = sunNextTargetImg.copy();
    sunCurrentImg = sunRevealedImg.copy();
  }
}

void updateWoolLerp() {
  woolCurrentImg.loadPixels();
  woolPrevImg.loadPixels();
  woolTargetImg.loadPixels();
  for (int i = 0; i < woolCurrentImg.pixels.length; i++) {
    color fromC = woolPrevImg.pixels[i];
    color toC = woolTargetImg.pixels[i];
    woolCurrentImg.pixels[i] = alpha(fromC) == 0 ? color(0, 0) : lerpColor(fromC,
toC, transitionProgress);
  }
  woolCurrentImg.updatePixels();
}

void updateBlockColors() {
  colorMode(HSB, 360, 100, 100);
  flowerTargetColor = color(sensorHueMap[flowerIndex],
sensorSatMap[flowerIndex] * 0.8, sensorBrightMap[flowerIndex]);
  bgTargetColor = color(sensorHueMap[bgIndex], sensorSatMap[bgIndex] * 0.8,
sensorBrightMap[bgIndex]);
  leafTargetColor = color(sensorHueMap[leafIndex], sensorSatMap[leafIndex] * 0.8,
sensorBrightMap[leafIndex]);
  colorMode(RGB);
}

PImage applyHueShiftsWithMask(PImage source, PImage mask) {
  PImage result = createImage(source.width, source.height, ARGB);
  source.loadPixels(); result.loadPixels(); mask.loadPixels();
  colorMode(HSB, 360, 100, 100);
```

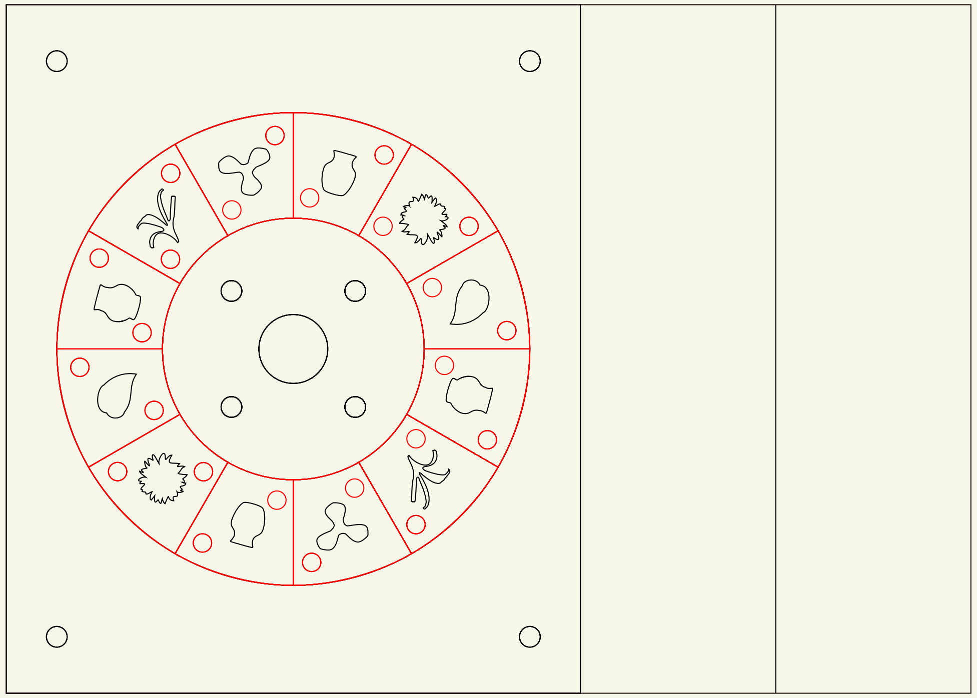
```
  for (int i = 0; i < source.pixels.length; i++) {
    color orig = source.pixels[i]; float a = alpha(orig);
    if (a == 0) { result.pixels[i] = color(0, 0); continue; }
    float h = hue(orig), s = saturation(orig), b = brightness(orig);
    color m = mask.pixels[i];
    int r = int(red(m)), g = int(green(m)), bl = int(blue(m));
    float sAdj = s * 0.8;  //                75%
    if (r > g && r > bl) result.pixels[i] = color(sensorHueMap[leafIndex], sAdj, b, a);
    else if (g > r && g > bl) result.pixels[i] = color(sensorHueMap[bgIndex], sAdj, b, a);
    else if (bl > r && bl > g) result.pixels[i] = color(sensorHueMap[flowerIndex], sAdj,
b, a);
    else result.pixels[i] = orig;
  }
  result.updatePixels();
  colorMode(RGB);
  return result;
}

void drawColourWheel(float cx, float cy, float innerR, float outerR) {
  int segmentCount = 12;
  float angleStep = TWO_PI / segmentCount;
  for (int i = 0; i < segmentCount; i++) {
    float angleStart = -HALF_PI + i * angleStep;
    float angleEnd = angleStart + angleStep;
    colorMode(HSB, 360, 100, 100);
    fill(sensorHueMap[i], sensorSatMap[i], sensorBrightMap[i]);
    noStroke();
    beginShape();
    for (float a = angleStart; a <= angleEnd; a += 0.02) {
      vertex(cx + cos(a) * innerR, cy + sin(a) * innerR);
    }
    for (float a = angleEnd; a >= angleStart; a -= 0.02) {
      vertex(cx + cos(a) * outerR, cy + sin(a) * outerR);
    }
    endShape(CLOSE);
    colorMode(RGB);
  }
}

void drawTokenMarkers() {
  float cx = woolX + woolImg.width / 2;
  float cy = woolY + woolImg.height / 2;
  float r = (innerR + outerR) / 2;
  for (int i = 0; i < 3; i++) {
    if (!tokenJustInitialized) currentAngles[i] = lerpAngle(currentAngles[i],
targetAngles[i], markerLerpSpeed);
  }
  drawMarkerAt(cx, cy, r, currentAngles[0], tokenFlower);
  drawMarkerAt(cx, cy, r, currentAngles[1], tokenBackground);
  drawMarkerAt(cx, cy, r, currentAngles[2], tokenLeaf);
}

float lerpAngle(float a1, float a2, float amt) {
  float diff = ((a2 - a1 + 540) % 360) - 180;
  return a1 + diff * amt;
}

void updateTargetAngles() {
  float offset = +30;
  targetAngles[0] = -105 + 30 * flowerIndex + offset;
  targetAngles[1] = -105 + 30 * bgIndex + offset;
  targetAngles[2] = -105 + 30 * leafIndex + offset;
}

void drawMarkerAt(float cx, float cy, float r, float angleDeg, PImage tokenImg) {
  float angleRad = radians(angleDeg);
  float x = cx + r * cos(angleRad) - tokenImg.width / 2;
  float y = cy + r * sin(angleRad) - tokenImg.height / 2;
  image(tokenImg, x, y);
}

class Particle {
  float homeX, homeY, x, y, dx, dy;
  color cStart, cEnd;
  Particle(float x_, float y_, color fromColor, color toColor) {
    homeX = x_; homeY = y_;
    dx = random(-24, 24); dy = random(-24, 24);
    x = homeX + dx; y = homeY + dy;
    cStart = fromColor; cEnd = toColor;
  }
  void update(float t) {
    float p = t < 0.5 ? map(t, 0, 0.5, 0, 1) : map(t, 0.5, 1.0, 0, 1);
    x = homeX + dx * (t < 0.5 ? 1 - p : p);
    y = homeY + dy * (t < 0.5 ? 1 - p : p);
  }
  void display() {
    float t = revealTimer / float(maxRevealFrames);
    color c = t < 0.5 ? cStart : cEnd;
    float alpha = t < 0.5 ? map(t, 0, 0.5, 255, 0) : map(t, 0.5, 1.0, 0, 255);
    fill(c, alpha); noStroke(); rect(x, y, 4, 4);
  }
}
```

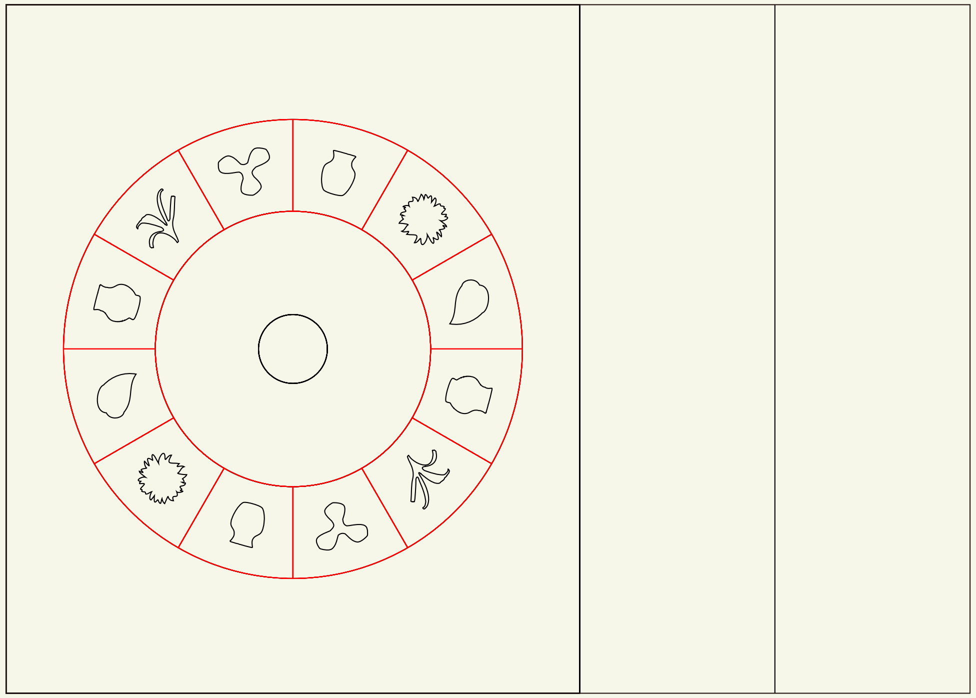
N.3 Complete Programming (Arduino)

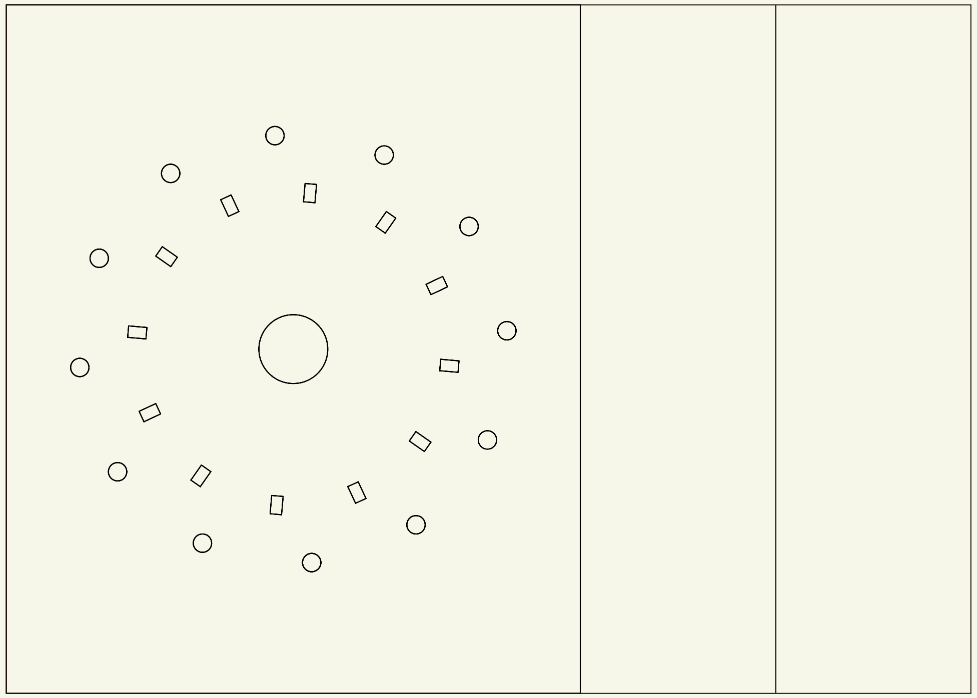
```
// ------------------------
// ⬇ □有□□定□□在□□□
const int buttonPin = 2;
bool buttonPressed = false;


const int sensorPins[12] = {A0, A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11};


enum TokenType { NONE, BACKGROUND, FLOWER, LEAF };
TokenType lastType[12];
TokenType currentType[12];
unsigned long enterTime[12];
const int holdDuration = 600;


bool lastButtonState = HIGH;
unsigned long bootTime = 0;


// ------------------------
// ⬇ setup() 写在□间
void setup() {
 pinMode(buttonPin, INPUT_PULLUP);
 Serial.begin(9600);
 bootTime = millis();


 for (int i = 0; i < 12; i++) {
   lastType[i] = NONE;
   currentType[i] = NONE;
   enterTime[i] = 0;
 }
}


// ------------------------
// ⬇ loop() □在□量□□
void loop() {
 bool buttonState = digitalRead(buttonPin);
 if (millis() - bootTime > 500) {
   if (buttonState == LOW && lastButtonState == HIGH) {
     Serial.println("R");
   }
 }
 lastButtonState = buttonState;


 for (int i = 0; i < 12; i++) {
   int val = analogRead(sensorPins[i]);
   TokenType type = detectTokenType(val);
   if (type != currentType[i]) {
     currentType[i] = type;
     enterTime[i] = millis();
   }


   if (type == NONE && lastType[i] != NONE) {
     lastType[i] = NONE;
   }


   if (type != NONE && type != lastType[i] && millis() - enterTime[i] > holdDuration) {
     lastType[i] = type;
     switch (type) {
       case BACKGROUND:
         Serial.print(">> 背景Token识别: Sensor A");
         Serial.println(i);
         Serial.print("B:"); Serial.println(i);
         break;
       case FLOWER:
         Serial.print(">> 花瓣Token识别: Sensor A");
         Serial.println(i);
         Serial.print("F:"); Serial.println(i);
         break;
       case LEAF:
         Serial.print(">> 叶子Token识别: Sensor A");
         Serial.println(i);
         Serial.print("L:"); Serial.println(i);
         break;
       default:
         break;
     }
   }
 }


 delay(30);
}
// ------------------------
// ⬇◌辅助函数 detectTokenType()
TokenType detectTokenType(int val) {
 if (val > 850) return BACKGROUND;
 else if (val > 140 && val < 190) return FLOWER;
 else if (val < 480 || val > 560) return LEAF;
 else return NONE;
}
```

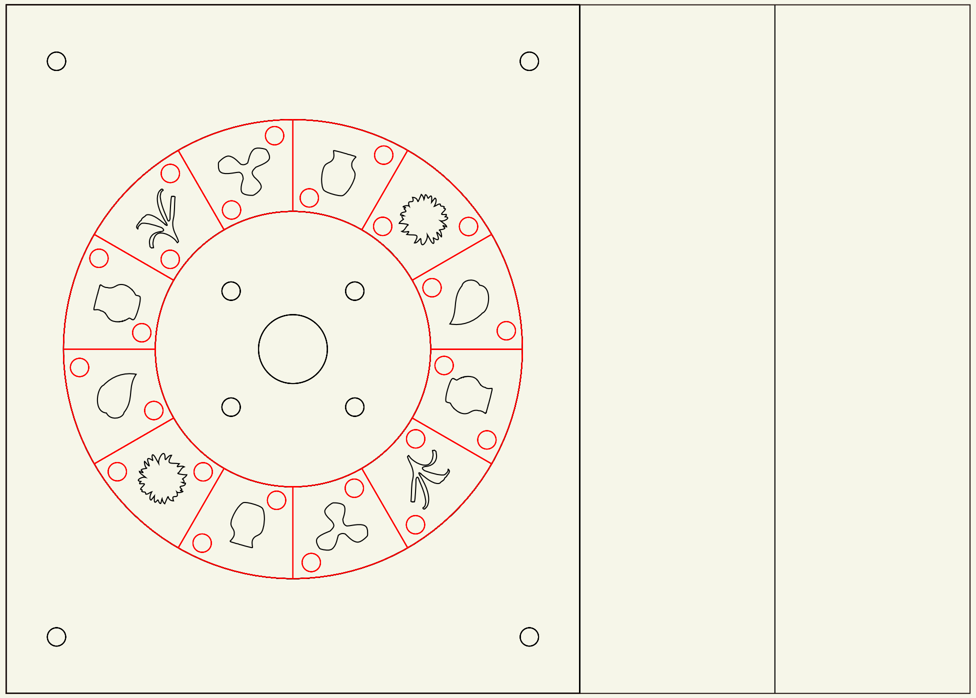
Appendix O: Prototype Cutting Plans

Cutting Plans for Wood
measurement: 420mm x 300mm









Appendix P: Final User Testing Plan

P.1 Testing Goals

Test the usability of the final design: Is the interface intuitive and easy to interact with (including texts, icons, etc.)?
Test if users actively explore and complete the interaction as intended.
Test the takeaways from a user: Does the experience successfully communicate Van Gogh's method of colour experimentation?

*how to make people go to stage 4?
*map them on the persona matrix/service journey&level of engagement

P.2 Materials

Context Poster: informing the user sufficiently of the wool story (& the current existing introduction to colour theories in the exhibition?)
Concept Poster: explaining the concept design of the space & showcasing the original colours of Van Gogh's painting and wool
The interactive prototype
Evaluation Tools (Likert Scale Survey)
Phone: For recording audio and taking photos/videos.

P.3 Location & Participants

Location:
The user tests will be conducted at the cafe area in the Van Gogh Museum.
Recruitment:
Museum visitors recruited randomly at the Van Gogh Museum, aging from 25 to 44. Approximately 10 participants will be recruited, ensuring diversity in age, gender, and professional backgrounds to capture a broad range of user perspectives. As a token of appreciation, each participant will receive a small gift from the VGM at the end of testing.
Ideally, only participants who have either finished the tour or are halfway through it will be recruited.
Ethical Considerations:
All participants will be provided with informed consent before the study begins.
All data collected will be anonymized and used solely for research purpose.

P.4 Procedure

The study will be conducted ideally as a one-on-one session, lasting approximately 15 minutes per participant. The procedure consists of the following steps:

1. Introduction & Consent:
Explain the study's purpose and objectives, then obtain informed consent from the participant.

2. Informing the Context:
Ask participants about their tour in VGM so far and if they remember the introduction to colour theories and the wool story. Make sure to explain the wool story sufficiently by showing pictures of the wool box and explaining verbally.

3. Prototype Interaction & Think-Aloud:
Present the participants with the Concept Poster and ask them to imagine themselves in the concept space. Invite them to select either Sunflowers or Irises for interaction. Show them the chosen original painting with the corresponding wool picture while they engage with the prototype. Encourage participants to verbalise their thoughts and reactions throughout the interaction. Observe whether participants actively explore the experience or only try it once.

4. Survey & Interview:
After the interaction, participants will complete a Likert-scale questionnaire assessing the prototype's perceived surprise, engagement, intuitiveness, informativeness and thought-provoking level. Let them fill it out quickly, and then go through them one by one to ask why they gave that score. While participants provide their ratings, follow-up questions will be asked to clarify the reasons behind each choice.

5. Semi-structured Interview Script:
-Step 1:
"Thank you for joining my project testing. This study is part of my graduation project in collaboration with the Van Gogh Museum. The purpose is to explore how this interactive prototype helps visitors experience Van Gogh's use of colour.
This session will take about 15 minutes and will involve a short interaction followed by a short interview. All feedback will remain anonymous and is only used for research purposes. Can you look at this consent form and sign it if you agree to the terms?"

-Step 2:
"Before we start, I'd like to know a bit about your visit today"
"How is your tour in the museum so far? What do you think of it?"
"How far are you in your museum tour—have you finished, or are you midway?"
"Do you remember seeing anything about Van Gogh's colour use or the story of his coloured wool threads?"
"If not, here's a short explanation:
Van Gogh used to experiment with coloured wool to test how colours worked together. Here is a photo of his wool box. Please keep this in mind while interacting with the prototype."

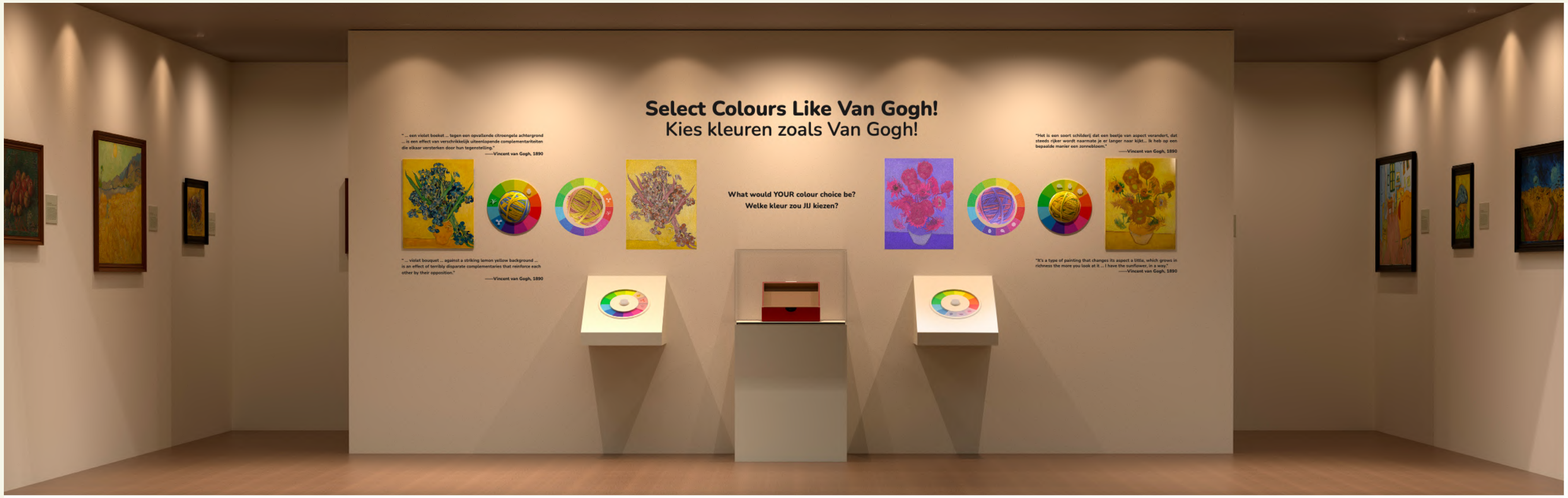
-Step 3:
"Now, please imagine you are in the concept space shown on this poster:"
"We have two options. Would you like to choose Sunflowers or Irises to interact with?"
"Feel free to play with it as you want. At the same time, I'd like to ask you to think

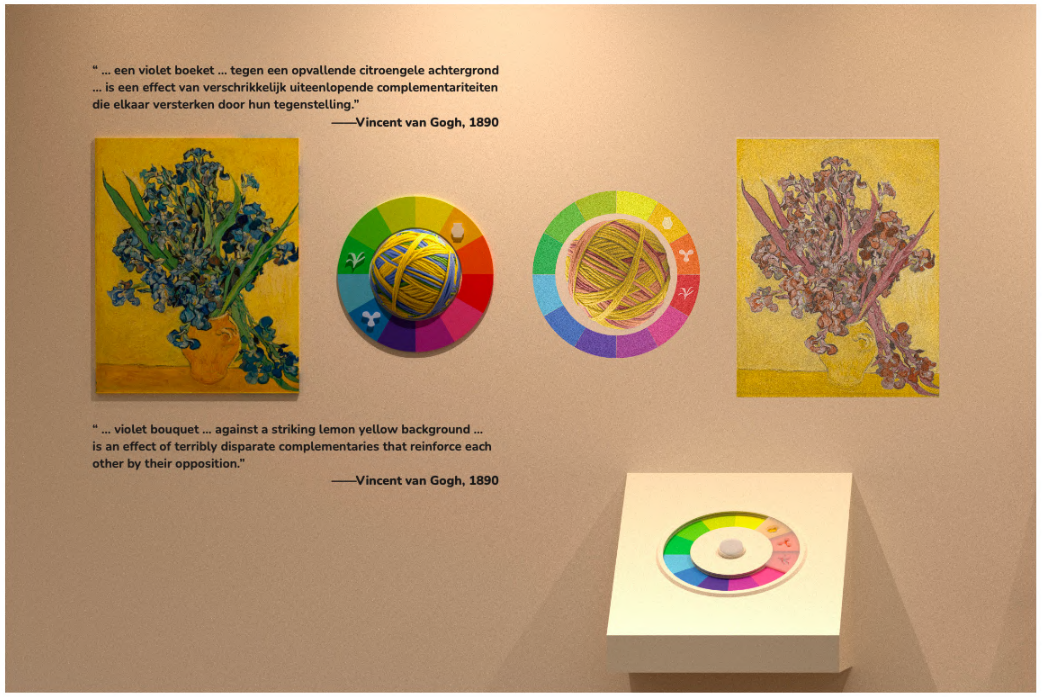
aloud while interacting—tell me what you notice, what you find interesting or confusing, and what you think about the colours. I will quietly observe.”

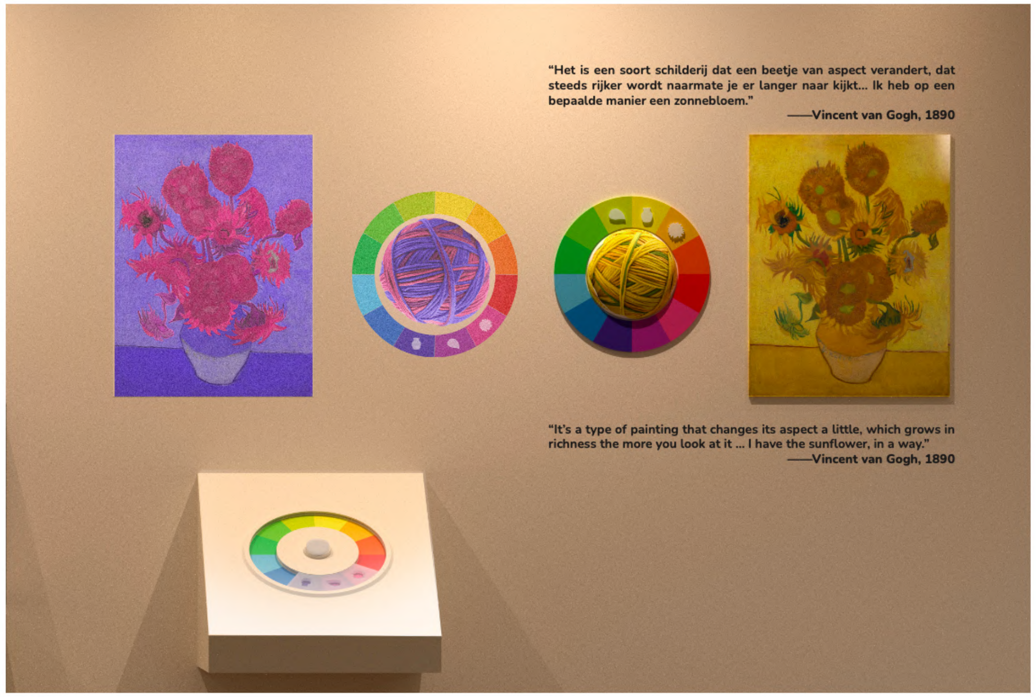
-Step 4:
“Now I will ask you to complete a short questionnaire. It will ask you to rate the experience on surprise, engagement, intuitiveness, informative level and how thought-provoking it was. While you rate each point, I will also ask some questions:”
“Why did you give this score?”
“What does this prototype make you think during and after the interaction?”
“Did you learn anything about Van Goghs use of colour with this prototype?” (“like contrasting or similar colours?”)
“Did the wool story or the interaction help you understand his colour experiments better?”
“What did you like most about the interaction?”
“What do you think of the entire concept set-up?”
“Was there anything confusing or challenging during the experience?” “Are the meaning of the icons clear to you?”
“What do you think of the texts? Are they clear enough? Do they attract you? encourage you to interact?”
……

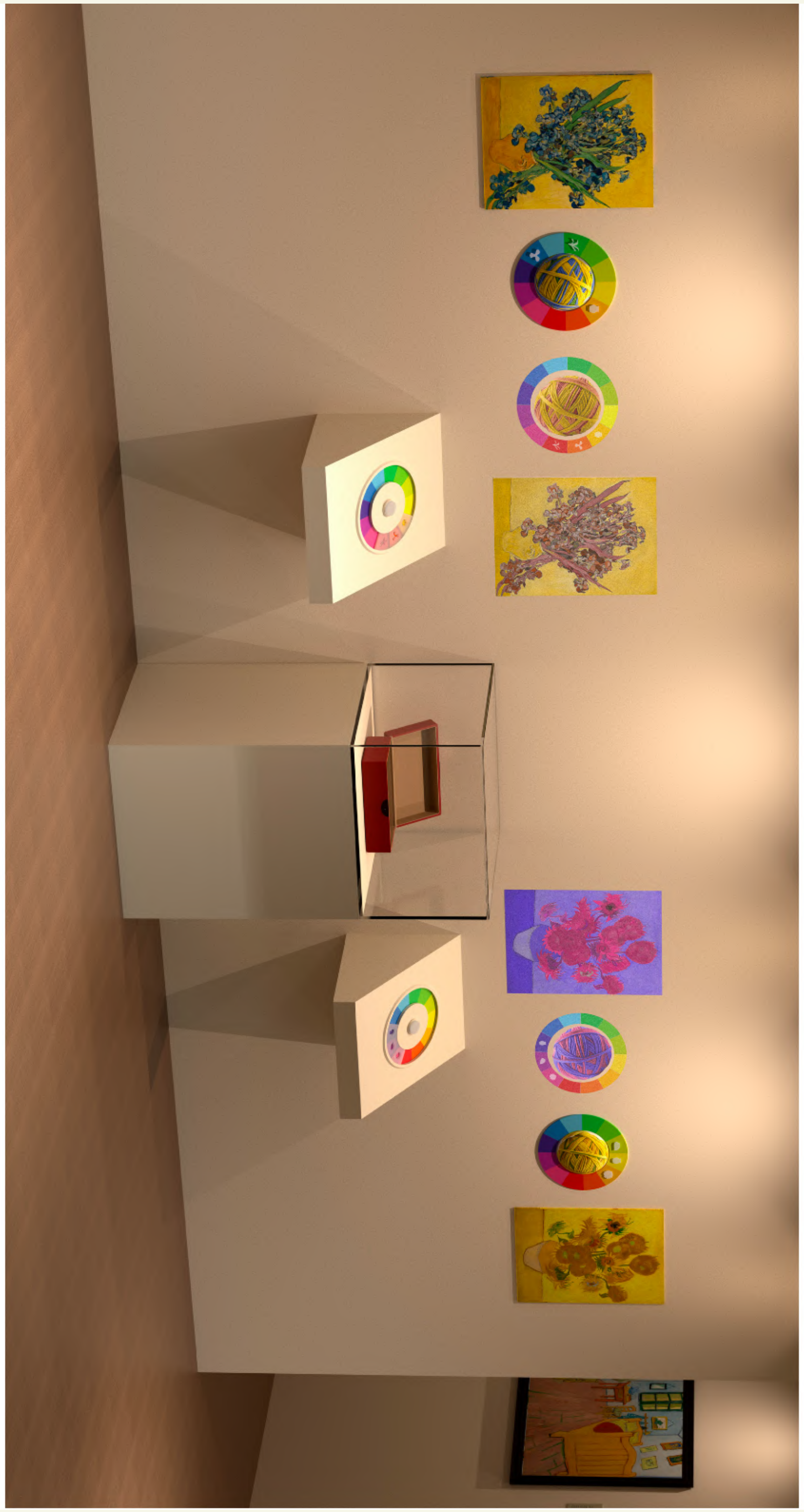
Appendix Q: Materials for User Testing

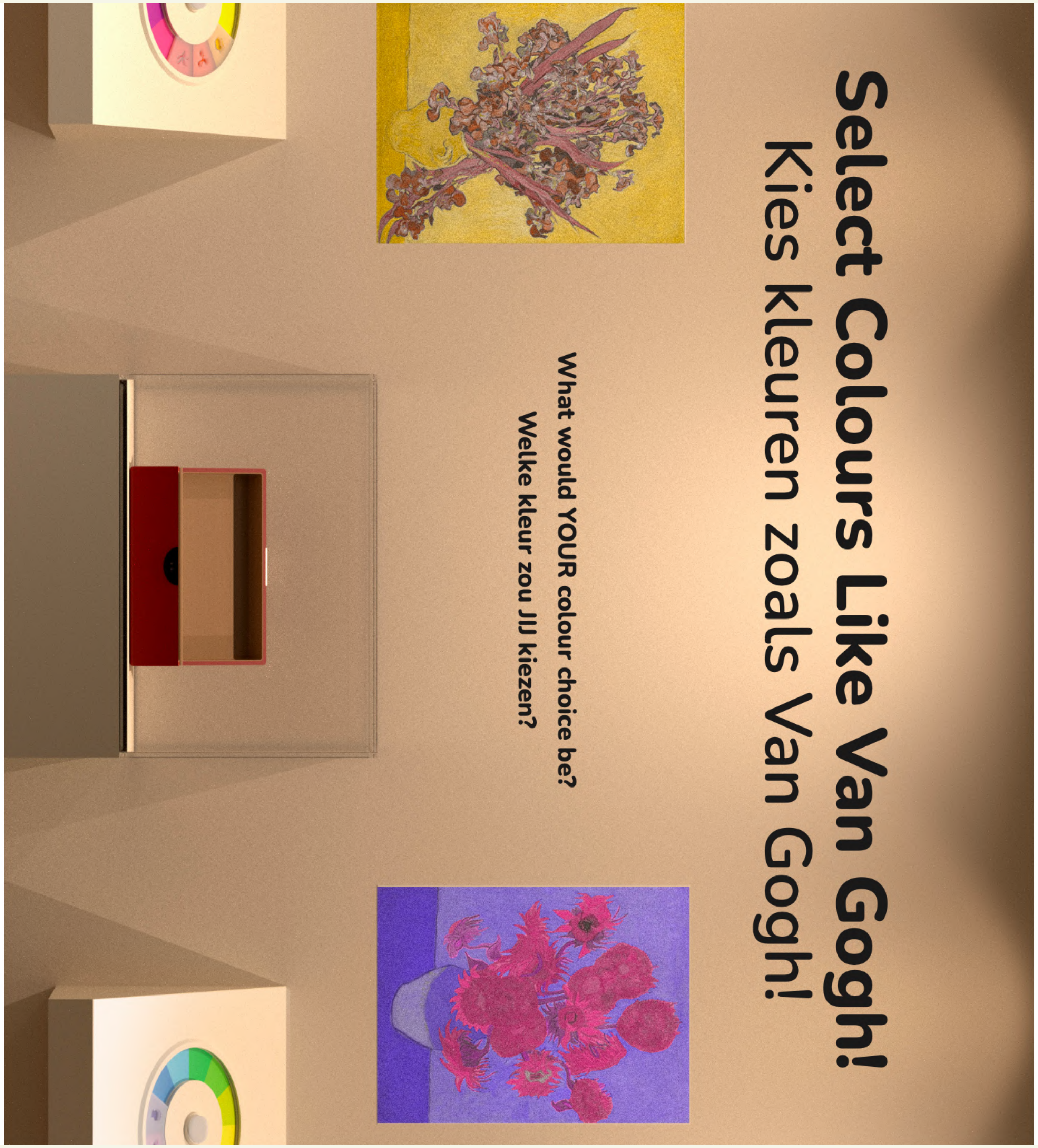
Q.1 Concept Sheets


Select Colours Like Van Gogh!
Kies kleuren zoals Van Gogh!
What would YOUR colour choice be?
Welke kleur zou JIJ kiezen?

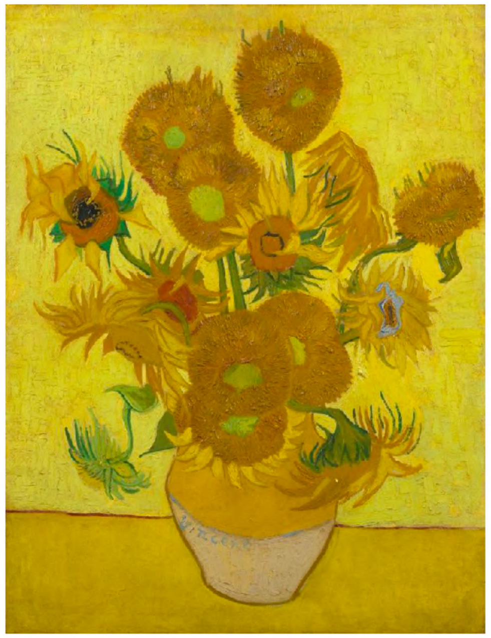

" ... een violet boeket ... tegen een opvallende citroengele achtergrond ... is een effect van verschrikkelijk uiteenlopende complementariteiten die elkaar versterken door hun tegenstelling."
——Vincent van Gogh, 1890
" ... violet bouquet ... against a striking lemon yellow background ... is an effect of terribly disparate complementaries that reinforce each other by their opposition."
——Vincent van Gogh, 1890

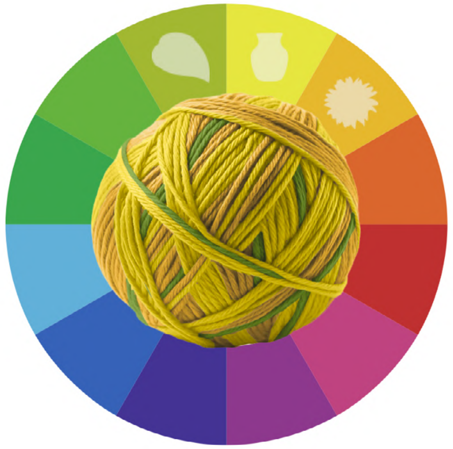

"Het is een soort schilderij dat een beetje van aspect verandert, dat steeds rijker wordt naarmate je er langer naar kijkt... Ik heb op een bepaalde manier een zonnebloem."
——Vincent van Gogh, 1890
"It's a type of painting that changes its aspect a little, which grows in richness the more you look at it ... I have the sunflower, in a way."
——Vincent van Gogh, 1890




Select Colours Like Van Gogh!
Kies kleuren zoals Van Gogh!
What would YOUR colour choice be?
Welke kleur zou JIJ kiezen?

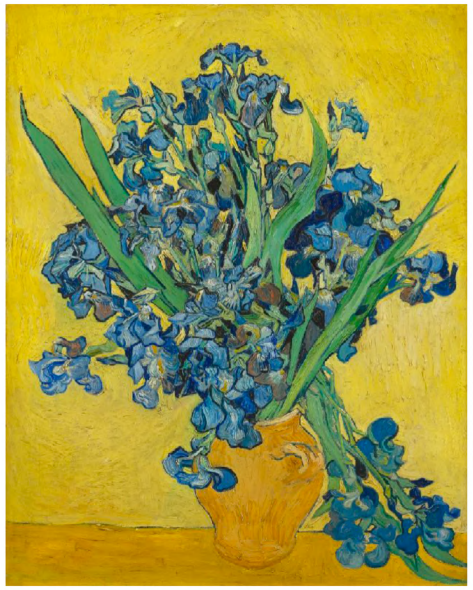
"Het is een soort schilderij dat een beetje van aspect verandert, dat steeds rijker wordt naarmate je er langer naar kijkt... Ik heb op een bepaalde manier een zonnebloem."
——*Vincent van Gogh, 1890*

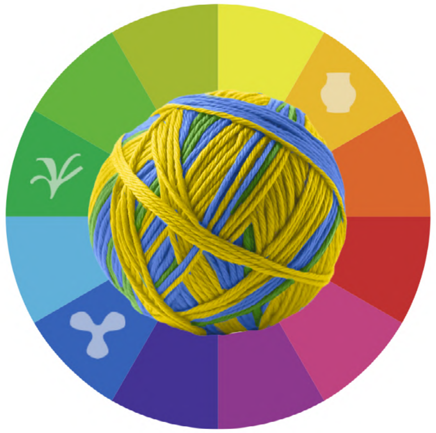




"It's a type of painting that changes its aspect a little, which grows in richness the more you look at it ... I have the sunflower, in a way."
——*Vincent van Gogh, 1890*

" ... een violet boeket ... tegen een opvallende citroengele achtergrond ... is een effect van verschrikkelijk uiteenlopende complementariteiten die elkaar versterken door hun tegenstelling."
——*Vincent van Gogh, 1890*

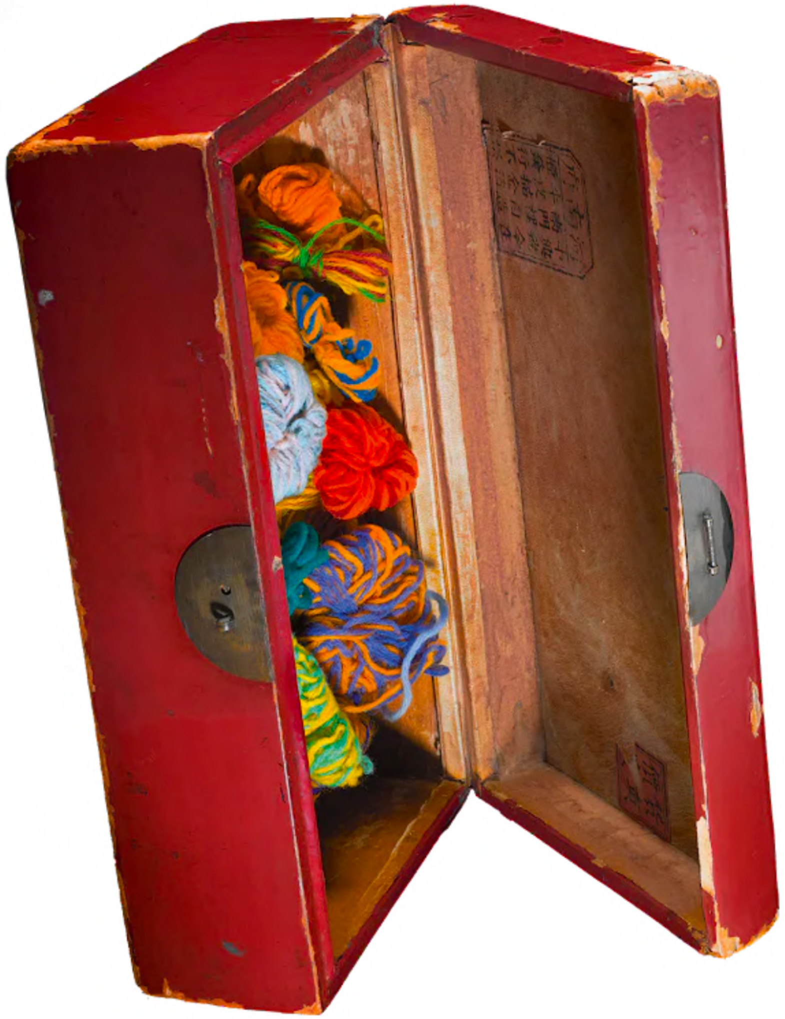




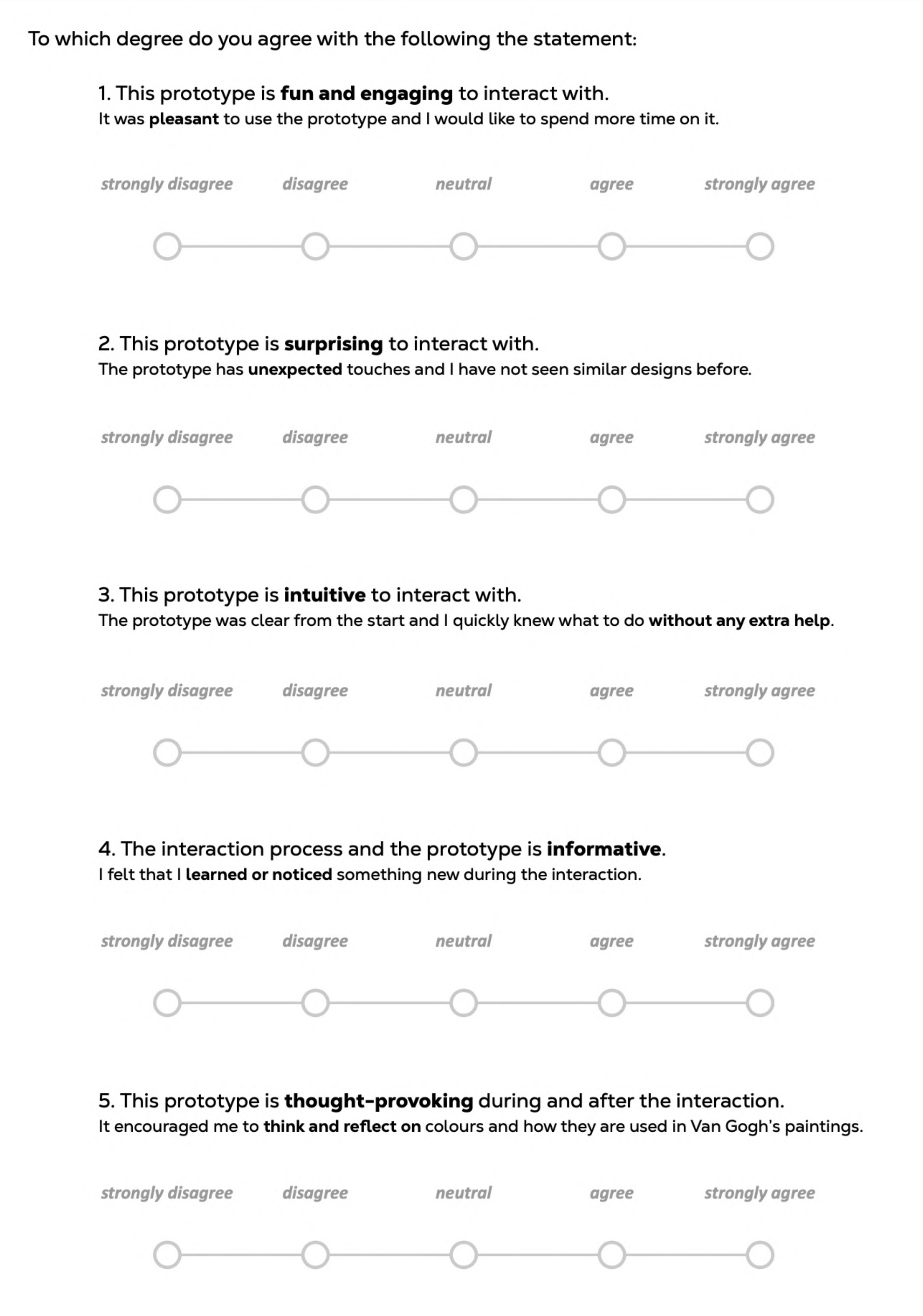
" ... violet bouquet ... against a striking lemon yellow background ... is an effect of terribly disparate complementaries that reinforce each other by their opposition."
——*Vincent van Gogh, 1890*

Van Gogh's Box of Wool

Vincent van Gogh experimented with colour combinations using coloured threads before applying the costly paint. He kept his balls of wool in this chest below:



Q.2 Likert-Scale Survey



To which degree do you agree with the following the statement:

1. This prototype is **fun and engaging** to interact with.
It was **pleasant** to use the prototype and I would like to spend more time on it.

strongly disagree	*disagree*	*neutral*	*agree*	*strongly agree*
○	○	○	○	○

2. This prototype is **surprising** to interact with.
The prototype has **unexpected** touches and I have not seen similar designs before.

strongly disagree	*disagree*	*neutral*	*agree*	*strongly agree*
○	○	○	○	○

3. This prototype is **intuitive** to interact with.
The prototype was clear from the start and I quickly knew what to do **without any extra help**.

strongly disagree	*disagree*	*neutral*	*agree*	*strongly agree*
○	○	○	○	○

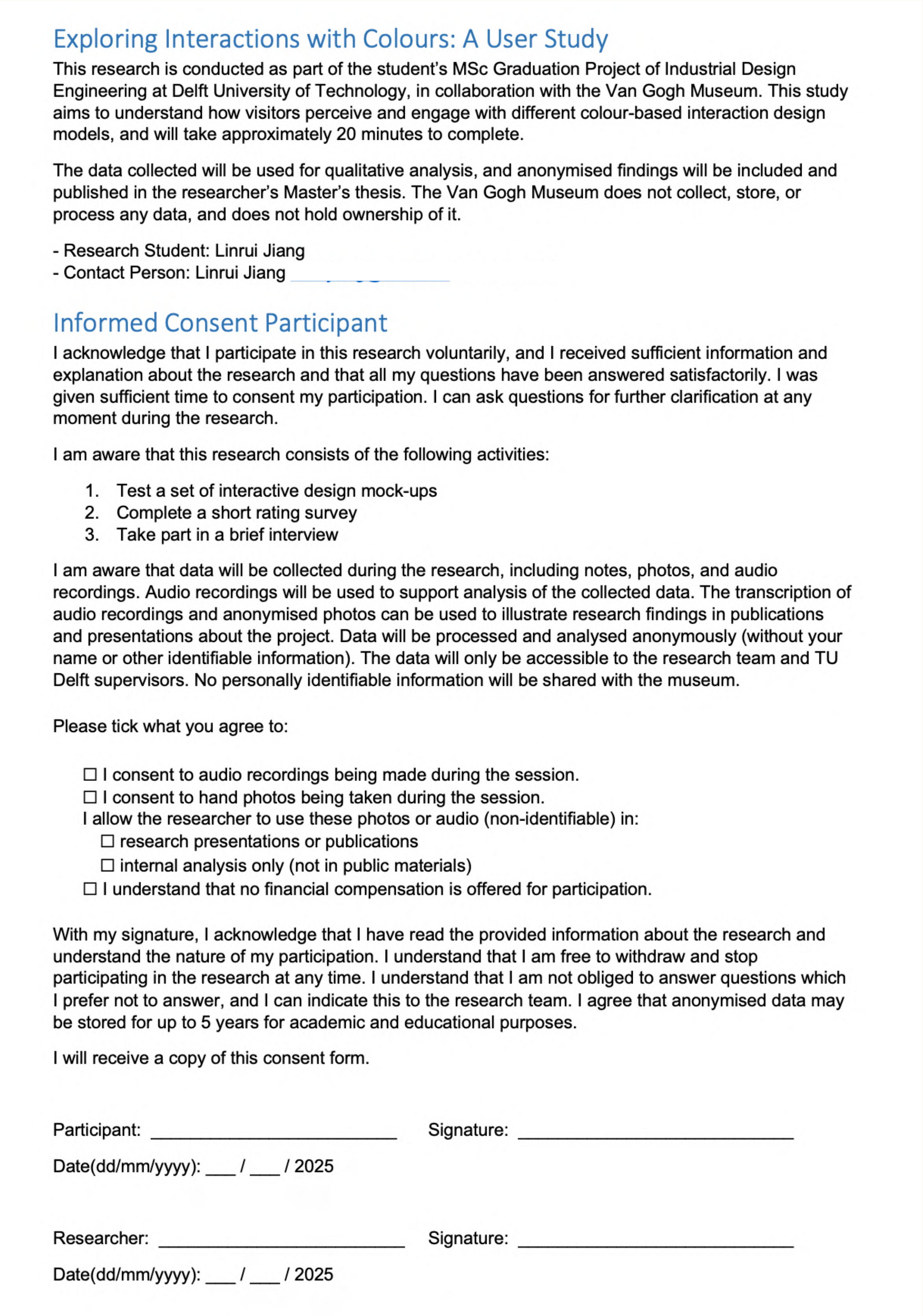
4. The interaction process and the prototype is **informative**.
I felt that I **learned or noticed** something new during the interaction.

strongly disagree	*disagree*	*neutral*	*agree*	*strongly agree*
○	○	○	○	○

5. This prototype is **thought-provoking** during and after the interaction.
It encouraged me to **think and reflect on** colours and how they are used in Van Gogh's paintings.

strongly disagree	*disagree*	*neutral*	*agree*	*strongly agree*
○	○	○	○	○

Q.3 Informed Consent Form



Exploring Interactions with Colours: A User Study

This research is conducted as part of the student's MSc Graduation Project of Industrial Design Engineering at Delft University of Technology, in collaboration with the Van Gogh Museum. This study aims to understand how visitors perceive and engage with different colour-based interaction design models, and will take approximately 20 minutes to complete.

The data collected will be used for qualitative analysis, and anonymised findings will be included and published in the researcher's Master's thesis. The Van Gogh Museum does not collect, store, or process any data, and does not hold ownership of it.

- Research Student: Linrui Jiang
- Contact Person: Linrui Jiang [redacted]

Informed Consent Participant

I acknowledge that I participate in this research voluntarily, and I received sufficient information and explanation about the research and that all my questions have been answered satisfactorily. I was given sufficient time to consent my participation. I can ask questions for further clarification at any moment during the research.

I am aware that this research consists of the following activities:

1. Test a set of interactive design mock-ups
2. Complete a short rating survey
3. Take part in a brief interview

I am aware that data will be collected during the research, including notes, photos, and audio recordings. Audio recordings will be used to support analysis of the collected data. The transcription of audio recordings and anonymised photos can be used to illustrate research findings in publications and presentations about the project. Data will be processed and analysed anonymously (without your name or other identifiable information). The data will only be accessible to the research team and TU Delft supervisors. No personally identifiable information will be shared with the museum.

Please tick what you agree to:

☐ I consent to audio recordings being made during the session.
☐ I consent to hand photos being taken during the session.
I allow the researcher to use these photos or audio (non-identifiable) in:
  ☐ research presentations or publications
  ☐ internal analysis only (not in public materials)
☐ I understand that no financial compensation is offered for participation.

With my signature, I acknowledge that I have read the provided information about the research and understand the nature of my participation. I understand that I am free to withdraw and stop participating in the research at any time. I understand that I am not obliged to answer questions which I prefer not to answer, and I can indicate this to the research team. I agree that anonymised data may be stored for up to 5 years for academic and educational purposes.

I will receive a copy of this consent form.

Participant: ________________________ Signature: ___________________________

Date(dd/mm/yyyy): ___ / ___ / 2025

Researcher: ________________________ Signature: ___________________________

Date(dd/mm/yyyy): ___ / ___ / 2025

Appendix R: Statement Cards from User Testing

fun&engaging

xxxx

“

I had fun. It's interesting.

P1

xxxx

“

That's kind of cool actually.

P1

xxx

“

I can do what I want — I can make them blue, I can make this purple.

P7

xxxx

“

(Q: Fun and engaging?) Yes. I really like it.

P10

activeness

xxx

“

It all looks like it's from a fantasy. It looks like you're really in a psychosis right now, or like you're on something."
"This one I like. That looks nice. I also like the red background."
"I think it's more expressive... that's my favorite."

P4

xxx

“

(Q: What do you think while interacting with the prototype?) I think it's a very funny thing to do, and I could stand here the whole day and make it.

P7

xxxx

“

I want to see what it's like if you put all three near to each other.

P11

xxx

“

(Q: Reaction while interacting) Interesting to make all the different combinations.

P9

xxxx

“

I would be stuck on this one. I would play around a lot if this station would be here, because I love... this design. It's very great.

P11

favourite elements

xxxx

“

(Which part of the interaction do you like best?) Just the fact that you can change your colors to yourself, like to your own imagination.

P1

xxxxx

“

It's fun to like see the different colors.

P2

xxxxx

“

I'm kind of liking, I like moving it around.

P2

I like to move the pieces and then like click the button and see the colors.

P2

xxxxx

“

I liked creating new color combos. I thought that was fun.

P2

xxx

“

I like the tactileness of it — you can physically move it and press a button versus if it was a screen or something. That's not usual.

P5

xxxx

“

(Q: Which part do you like best?) The image of the wool besides.

P10

Being able to create on one's own makes the process fun.

“

it's a little funny because it's personal.

P3

xxx

“

I like this one, and that it's connecting with the... I can do something, and it will change in the real picture... so the connection, like, the physical parts aligning with the digital ones. (Q: "Which element did you like most?")

P3

xxx

“

That I can decide here what I can adjust and stuff, and then I have the surprise... what I made here, I can see on the screen... just like working on your own and having the corresponding results." (Q: "Which element did you like most?")

P4

It is fun to see the wool changing colours.

“

(Q: What was your favorite moment when you were part of it?) For me, it's just fun to see the... I thought the wool was very fun. Just to see the combinations.

P5

xxx

“

Very nice animation. Like a cool animation and a cool idea behind it.

P5

xxx

“

(Q: Which part do you like the best — the story behind it, the connection with Van Gogh, or just the parts where you can change colors?) For me, I just like the colors most. It's fun to be your own painter for a second.

P5

xxxx

“

It's fun. It's like I am painting, too.

P10

xxx

“

(Is it fun and engaging to you?) He thinks it's very funny, like being a child, choosing color freely. Expresses himself like an artist — art freedom.

P6

xxx

“

(Q: Is it fun and engaging?) Strongly agree — what I like most is that I can change the colors and see what it could look like. That's the most fun.

P7

xxx

“

(Q: Is it fun and engaging?) Yes, I thought it was fun. It's very tactile — you're touching something and seeing it change visually.

P8

Tactile interaction is fun.

“

(Q: Fun and engaging?) Yes — tactile interaction and ability to try as you want were appealing.

P9

It is fun to try as I want.

“

(Q: Fun and engaging?) Yes — tactile interaction and ability to try as you want were appealing.

P9

xxxx

“

But also, it gives me the idea that I can paint too. it's like a painting book. A sketchbook or something.

P10

xxxx

“

(Q: Which part do you like best?) The comparison of the original and the different one. Changing, yes.

P10

xxxx

“

(Favourite part?) Definitely the painting that changes colors. That's the best part.

P11

xxxx

“

Oh, that is really fancy. I like the... animation.

P11

xxxx

“

I think it's definitely that you can see the different colors in the painting. And... you can do any... design that you want and try it out and see how the colors look. I especially like it when they're really, really different.

P11

intuitive

xxxx

> I didn't know (how to use) at first. I mean, I saw like the buttons, but I didn't understand at first.

P1

xxxxx

> I thought it was intuitive. Like I knew I could move the pieces around.

P2

xxxxx

> I didn't realize that the yarn was also changing right away at the same, because I maybe was a little focused on the button. So that's why I put neutral. As opposed to agree or strongly agree.

P2

I didn't understand how to interact right away. It took a bit of time.

> Maybe it's just me... I was a little late in my head... how do I do it, and oh, press the button... so I think it was nice, but I just had to learn it.

P3

xxx

> The first moment... I think it's a language problem... but I think it's very intuitive to interact with. The text here is good." (Q: "Is it intuitive to interact with?")

P4

xxx

> (Q: Do you have any confusing moments where you're lost or was everything clear?) No. I think it's pretty straightforward.

P5

xxx

> (Q: Is it intuitive to use without extra instructions?) Yeah, super straightforward. Simple to understand.

P5

xxx

> (Q: Is it intuitive?) Quite simple and intuitive. I understood how to use it after reading how to do it.

P8

xxxx

> The instructions are clear.

P10

xxxx

> (Q: Intuitive?) Just for the part of the movement of the pieces, but everything else was really clear.

P10

xxxx

> (Q: Intuitive?) My first confusion... after I looked at it for maybe 10 seconds, I understood everything.

P11

instruction texts, tokens, etc.

xxxx

> (Do you think like the text there have given you some help?) Oh yeah, for sure. It's clear.

P1

The instructions are very helpful.

> (Q: Did the text help?) Yeah, I read it. It's super helpful. Especially because it's like two different things you have to do, so one is the tokens and one is the button.

P5

xxx

> (Q: Is it intuitive to use?) Yes, intuitive. Even without text, I would have done the same.

P6

xxx

> (Q: Were instructions/text clear?) Yes, the text and colour coding made it intuitive, except the button was too hidden and should be highlighted more. Colours (blocks on the wheel) were very attractive, which drew attention away from the button.

P9

xxxx

> (Q: Clear instructions?) I was a little bit confused in the beginning... because I didn't realize that you have to press the button. But... it's pretty clear.
> I knew from the beginning what it was about... I was a little confused with the button, but I understood...
> The only thing that I didn't notice was... the button in the middle. But the rest was very good.

P11

xxx

> (Q: Is it intuitive to use without extra instructions?) I just said agree because I didn't read well before I started. So then I saw you touch the tokens and I thought, what are you doing? Because I only thought you had to press the button, but I just didn't read it correctly. But it is quite clear if you read it.

P5

xxx

> (Q: Were the instructions clear?) Yes, I looked at the text and instructions. They were helpful and clear enough.

P7

xxx

> (Q: Were instructions clear?) Yes, the symbols really help.

P8

xxxx

> (Q: Intuitive?) Yes — colour-coded, simple to understand once tried, except forgetting to press the button initially.

P9

*limitations

xxxxx

> But I almost, one thing, the fact that it is three going in a circle, like I almost want to take this one and put it like on the other side. You know what I mean? But they have to stay in this order.

P2

xxxx

> I can't have both in the same color, right? (No, no, that's the limitation.)
> My only question is they have to be consecutive. Because if I'd like to be this here and the flowers here, I cannot switch them. That's the only thing.

P10

informative

xxxxx

> I feel like I understand the interaction between the colors more and like how it works together to pick the colors.

P2

xxxxx

> And like the story you told me before about not wasting paint and like seeing how they interacted together before. So yeah, I feel like I learned from it.

P2

xxxxx

> (learned anything from the positions?) Not like right away. And then I was like, oh, maybe I should try to recreate the original colors.

P2

By comparison, I learned something about Van Gogh's colour choices and his reasons.

> I think that Van Gogh has a good reason why his painting is like that, because this one [mine] is not so good as the original... so I think I learned something. (Q: "Do you feel like you have learned something?")

P3

It's a cool method to help kids understand the colour usage.

> It's also very intuitive... I think it's also for kids... I think this is a cool method that children can better imagine what they've done... easier for them to also understand the process.

P4

xxx

> (Q: Is it informative? Did you learn anything from it during this interaction?) You see in real time what colors work well together, how it makes you feel, how it changes the feeling that the painting evokes afterward. Something like this is a lot more... I guess the yellow is a bit more heavier versus this one. It's a bit more like, I don't know, almost the opposite? I don't want to say unsettling, but it's just not as good. Maybe, I don't know. That's not the right word, but kind of like that. Not as bright.

P5

xxx

> I feel like it was rather a fun way to put myself in the shoes of Van Gogh... I did not learn something directly, but maybe if you also write a text on the wall about how he experimented with colors... it might be an interesting fact for many people." (Q: "Do you feel like you learned something?")

P4

xxx

> (Q: Is it informative? Did you learn anything from it during this interaction?) Yeah, I think so. I think it also just shows he (van gogh) was a master of color. The choices he made were well thought.

P5

xxx

> (Q: Is it informative? Did you learn anything from it during this interaction?) Well, it was fun to see just which colors go together or not, maybe. Or that if you use all colors that are in the same kind of spectrum, that are close together, that that is kind of the similar thing to what Van Gogh does. Just to play with it. You learn how to play with color.

P5

xxx

> (Q: Is it informative?) Different combinations give different feelings — cold vs hot feelings. I like hot, sweet colors.

P6

xxx

> (Q: Is it informative?) No, because in the exhibition there were many explanations about colors. This didn't add anything. It reminds me of Van Gogh's mixing colors to create paintings.

P6

xxx

> (Q: Is it thought-provoking?) Yes — talking about the rule, why he did that, and how it works was informative for me.

P7

xxx

> (Q: Is it informative?) Yes — I now know more about how this works. I saw the box before but didn't know how it could work; now I understand that the wool changing color shows how he did it.

P7

xxx

> I learned more about how he painted and used colors in different ways, but I wouldn't necessarily follow these rules myself. like if the flowers were pink or purple changed the whole picture.

P7

xxx

> Not sure if it taught me much about the colors themselves — more about the history of the wool.

P8

xxx

> Learned a bit about how colors work in combination.

P8

I learned about the wool story.

> (Q: Informative?) Yes — learned about the wool box and Van Gogh's method of choosing colours.

P9

I learned about the effects of different positions (of colours).

> (Q: Informative?) Realized how different positions can create high contrast or close colour schemes.

P9

I learn more about the painting details during the colour-changing process.

> Now I understand more that he had similar colors, but in the real painting it... In the painting, it shows, like, the texture or the difference. And here, it's more... I notice it more because of the change of the color. To learn more about the painting and how he paints that.

P10

xxxx

> (Q: Informative?) Yes, because in the museum I pass it by, the box. And now it's more relevant to the creative process of Van Gogh. Now it has more focus to it, not just passing by the box.
> Because I have that question, he had a lot of money, but that's a lot of pain too. And how does he allow himself to... Test and error. Fail? How much does he limit himself to fail? But with this, he had the choice of exploring first in different materials and then go for it.

P10

The interaction process makes me remember the story longer.

> (Q: Informative?) Yes, of course. If you have this little wool box... some people will read it... but if you have... the thing that you can do something by your own, more people will stop there... and you will remember it longer.

P11

xxxx

> You will understand it better... even if you don't know anything about color theory... this is the best example...

P11

thought-provoking

xxxxx

“

(Does it make you think?) It triggers you to try something else, just try other colors. Like instead of like something original, just try something that's like standing out.

P1

xxxxx

“

(Did it make you think something like reflect on your choices?) Yeah. I thought it was interesting because I feel like I'm more drawn to colors that are farther apart from each other on the wheel. So it was interesting to see how like some of the paintings had colors that were closer together and then the other one didn't.

P2

xxx

“

I didn't know the thing with the wool... so that's very funny also to try... I think it will stay in my mind. (Q: "Would this stay in your mind for a while after you leave?")

P3

xxx

“

About Van Gogh, that he was a very good painter, artist. (Q: "Was it thought-provoking?")

P3

xxx

“

I always let the effect of the painting affect me without thinking too much... maybe thinking about how this version of the painting makes me feel... colors represent emotions... you can figure out your reaction to this version." (Q: "Was it thought-provoking?")

P4

xxx

“

I think it is nice because... usually in museum exhibitions you read a lot and look a lot at paintings, and it would be nice to do something or be creative yourself in a way." (Q: "Was it thought-provoking?")

P4

xxxx

“

(Q: Thought-provoking?) I didn't really think about what Van Gogh thought while he was doing it... but afterwards... it's way more understandable what he was thinking.

P11

xxx

“

(Q: Is it a thought-provoking prototype for you?) It gives you a different feeling from what the original gives you. It just lets you play with it, lets you figure out which colors are nice, what you would do maybe as an artist. How the concept of color in the ball is different from the... it is still different in the reality of the painting, even though you see it in the ball.

P5

xxx

“

(Q: Is it a thought-provoking prototype for you?) It's a fun experience. It's a fun... you see it in the ball and you're like, hmm, what's it gonna look like? You can make a mental picture and then you can see it, so it's playful.

P5

xxx

“

Mine is best. There are lots of blue and green in Van Gogh's paintings. I think it's because he's a man. I'm a woman. Female and man don't like the same colors. I prefer pink, violet, orange — sunny colors, colors of the sun, shining. I like things that make you happy. Maybe Van Gogh was a kind of sad man because of his mental illness.

P6

(Q: What do you think while interacting with the prototype?) I really like pink color. I don't think that Van Gogh loves pink color because there is no pink in his painting. He should have put more pink color. I prefer my painting than Van Gogh's. I could earn lots of money with this one.

P6

xxx

“

I'm connected to myself and to what I like. I think that art comes from us. First I look at what colors I like most, and then I try to change Van Gogh's painting.

P6

xxx

“

(Q: Is it thought-provoking?) Yes — talking about the rule, why he did that, and how it works was informative for me.

P7

xxxx

“

(Q: Thought-provoking?) Yes, like I mentioned to you before, this approaches me more to the elections of the painter, the original painter. And how wise he was to choose that. And because of his choices, this is an iconic painting.

P10

xxx

“

(Q: Thought-provoking?) Made me think that everything in artwork is intentional and there's a science behind it.

P8

xxx

“

(Q: Thought-provoking?) Yes — made me reflect on how artists choose colors and how their palette changes how it's viewed.

P8

xxx

“

(Q: Did you think about color positions?) Yeah — different places to put the tokens. Thought about how to make it look nice or fun. Yes — spreading them out in a triangle makes them very contrasted.

P8

xxx

“

Just selected colors on purpose — now it's a triangle shape instead of the original.

P8

xxxx

“

(Q: Thought-provoking?) Yes — made me think about colour choices in art and other contexts, such as clothing.

P9

xxxx

“

Interesting to think about using similar tools for future purposes such as decorating houses or painting.

P9

xxxx

“

(Q: Thought-provoking?) Maybe the other painting is important... if you just have... the machine changing colors... you forget about the original painting... I learned from the comparisons.

P11

xxxx

“

I try to be consecutive and... And contrast. And contrast, yes. And they have different results as well.

P10

the entire setting

xxxxx

“ (Did it attract your attention?) Yeah, I think so. I guess from far away, I don't fully know what the wheel does, like how you would select colors.

P2

The colour changing display attracts people.

“ (Q: "Does this entire setting attract you?") "It's (the colour-changing display) really standing out in terms of colors."

P3

xxx

“ (Q: Would this entire setting attract you if it's in the real world?) Yeah, for me it does. It's playful. It's a fun interactive activity. You get to be the artist.

P5

xxx

“ (Q: Would this entire setting attract you if it's in the real world?) This one attracts me more than this one, because the colors are different, more flashy. This is the kind of paint that I like most.

P6

xxx

“ (Q: First thought when seeing the concept design — attractive?) Yeah, that sounds like fun. It's cool to see the different tones — same values, but different here.

P8

xxx

“ (Q: First impression — attractive?) Yes, willing to try.

P9

The space design looks rich in experience.

“ (First impression of the concept?) I think I would go to this station before I would go to any other painting because it looks like you can just... experience more.

P11

xxxx

“ (Q: First impressions of the concept) I think that this side is, like, more interesting. I personally think that because I like that it's so complementary. It's very complementary, these two pictures. I agree with that. You have more difference between the two pictures.

P11

xxxx

“ (Q: Do you feel attracted by the entire setting or willing to try it?) Yes, I feel attracted to it, because now I feel more immersive to the experience.

P10

surprising

xxxx

“ I've never been to anything like a exhibition or something like from art.

P1

I'm not used to anything like this. This is new for me.

P1

xxxxx

“ I don't know if I've seen a design before where I'm spinning something in a circle, but I feel like I've seen things before where you press a button and there's something on a screen. Something like that.

P2

xxx

“ It's totally new. I haven't seen something like that.

P3

xxx

“ I haven't seen anything like that before.

P4

We've never seen this before.

“ We've never seen this before... the way it changed was really a wow effect every time... especially for the first time." (Q: "Was it surprising?")

P4

xxx

“ (Q: Is it surprising to see?) Neutral score — not surprising. Van Gogh is amazing, nothing surprising but Van Gogh.

P6

xxx

“ (Q: Was it surprising to see and use?) Yeah, agree. I haven't seen anything like this. No, me either. I said agree, but I also... it was really fun.

P5

xxx

“ (Q: Is it surprising to use?) Yes — seeing what it could look like if the flowers were pink or purple changed the whole picture.

P7

The results I have are surprising.

“ (Q: Is it surprising?) Some color combinations look surprisingly nice together. It's cool to see what unexpected combinations you can come up with.

P8

xxxx

“ (Q: Surprising?) Yes, in a good way — unexpected nice colour combinations.

P9

xxxx

“ I have seen it before, but in this place, it's very well used... fits the thing you want to express...

P11

xxxx

“ It was surprising, because I didn't expect the animation. The animation was specifically surprising.

P11

the original group (mostly paintings)

xxxx

“

They want you to recreate this color or like?

P1

I didn't pay much attention to the original group.

“

I was just trying to do something of my own.

P1

xxxxx

“

I guess like as I'm doing it, I'm not totally sure if I'm supposed to be trying to copy like that one, or if I'm just supposed to like do whatever and like for fun and see like what comes up.

P2

The original set helped me realize the different positions of the colours.

“

I did notice that those colors were closer and then those ones weren't.
After I revealed it and got it to like the original actual painting, I noticed that for the top one, they were all closer together.

P2

xxx

“

I have an idea it needs to be some of this [background], and this was the flower, and this was the green... so that was my thoughts. So, it's a little like the original. (Q: "Did you take reference from the original painting?")

P3

xxx

“

Right before I would try to make this one [like the original], but I can't, because this is... so I tried something else." (Q: "Did you notice the original positions we're trying to mimic?")

P3

xxx

“

It was good that you had [the reference] in front of you... otherwise I couldn't say if this was the original or not... I think it's important too because you can kind of see the wool the way he had it when he experimented. (Q: "Would you take the original as a reference when interacting?")

P4

xxx

“

it was more of an experimental experiment, to look at all kinds of combinations and then get closer to the original, what appeals to you aesthetically. Later you kind of go back.

P4

xxx

“

(Q: Did you look at the original reference group?) In the first, I would have thought this is how I should try to make it look like, but it's more fun when I find out that I can do what I want it to look like.

P7

xxx

“

(Q: Did you look at the original painting and text?) Yes — used it just to see how different it is.

P8

xxx

“

(Q: Did you look at the original painting?) Yes — used it for reference.

P9

xxxx

“

(Q: Did you look at the original painting here? How did you use it?) I thought about his choices. Like, I took his art and repeat it. But to make it fun, to feel more approach to him. Not to just stare at it.

P10

xxxx

“

(Q: Did you look at the original painting a lot?) I actually didn't... I was so focused on the colors changing and the animation. In the beginning, I looked at it and then I just kind of forgot about it. At first, I looked at the painting, but the more I played... I forgot about the picture. It was just like, ooh, a new color.

P11

xxxx

“

(Q: Did you look at the original painting a lot?) But overall... it is important... so you can see the difference better.

P11

*interaction context

xxx

“

(Q: Did the wool story connect to your experience?) No — I think I would need more information about the wool. Even though you told me and showed me, I didn't think about it. I listened to your instructions and understood, but if it were out there I would take a little more time to read the text.

P7

*the differences

xxxx

“

It's quite nice. But it's a little too close, this one and this one. It was different in my head. Can I try again?

P3

xxx

“

How the concept of color in the ball is different from the... it is still different in the reality of the painting, even though you see it in the ball.

P5

It was also interesting to see the difference between chosen colours in wool between in the painting.

“

I realized mostly that the choice that we made was totally different than the one we ended up with.

P9

van gogh’s wool story

xxxxx

“

I think it's interesting and I think it helps show the, like how he used the wool, which I didn't realize before.

P2

The experience makes me feel like I am doing what Van Gogh used to do.

“

Yeah, it makes me feel like I'm trying to do what Van Gogh used to do. (Q: "Does it make you feel like you relate to his experience?")

P3

xxx

“

I think that's pretty cool. It's probably kind of to try out the way he did before painting.

P4

xxx

“

I feel like it was rather a fun way to put myself in the shoes of Van Gogh...

P4

xxx

“

Q: Which part do you like the best — the story behind it, the connection with Van Gogh, or just the parts where you can change colors?) I like it all. I think there's a really good through line in terms of what he originally did, taken in a more modern contemporary setting.

P5

xxx

“

Not sure if it taught me much about the colors themselves — more about the history of the wool.

P8

xxx

“

Learned the wool story in more detail after seeing the display here.

P8

xxx

“

Personally, I didn’t connect to the wool as much — I thought more about the idea that different colors look different.

P8

The experience of wool story adds to the overall museum experience.

“

(Q: Related to Van Gogh’s experience with wool?) It’s a good touch to use something in the museum and expand on it(the wool story). Cool to take the wool story as a starting point and turn it into this.

P8

xxx

“

(Q: Related to Van Gogh’s experience?) Yes — the story makes the experience relatable, even if the focus was more on colours than the wool itself.

P9

xxxx

“

(Q: Related to Van Gogh’s experience?) Yes, because now I... Now I wonder how... How was his creative process to choose the colors? And here I notice more the contrast.

P10

xxxx

“

But I think it’s, like, very near to the idea with the rule that Van Gogh had. So you can live a little bit of his life if you play with this.

P11

xxxx

“

(Q: Related to Van Gogh’s experience?) Yeah, I would say that’s the whole thing with it.

P11

wool or painting?

xxxxx

“

I was observing the wool inside, but I think mostly the painting on the left. I think for me, I was wanting to see the painting directly.

P2

xxxxx

“

It's interesting to look at the wool too and then see like how it goes into the painting.

P2

xxx

“

"At first time, before I pushed the button, I looked very much at the wool. But second, I actually just looked there [the painting]... because I was fascinated by it. (Q: "During the process, were you observing the wool first?")

P3

xxxx

“

I prefer to use this one [wool] and look at the painting... but I also like that it comes over here [painting] and I was just, 'what?'... so I also like that. (Q: "Which do you prefer, focusing on the wool first or directly on the painting?")

P3

xxx

“

(Q: Did you observe the wool or the painting first?) First of all, I looked at the wool. I looked at the colors that I like. I’m connected to myself and to what I like. I think that art comes from us. First I look at what colors I like most, and then I try to change Van Gogh’s painting.

P6

xxx

“

I had more focus on the painting. I tried to choose the colors and then looked at the painting and how it looked like.

P7

xxx

“

(Q: Did you notice the wool or the painting first?) I didn’t pay too much attention to it (wool).

P8

xxx

“

I'm more on the painting more... my first look was on the picture... I don't see the wool a lot, I'm more on the picture and on the wheel here. (Q: "During the process, did you observe the wool first or focus on the painting?")

P4

xxx

“

But it's good that the wool changes first, because then you focus on the wool rather than on the painting. I guess that's your thought.

P4

xxx

“

(Q: When you just play with it, did you notice the wool in the center or were you more focusing on the painting?) I was more focused on the painting.

P5

xxx

“

I was more focusing on the wool... I was looking at the combinations (in the wool) and then what I would think it would turn out, and then focus on the painting.

P5

xxx

“

(Q: Did you notice the wool or painting first?) More focused on the wool inside and the input here (physically).

P9

xxx

“

(Q: Did you notice the wool or the painting first?) I noticed the wool changes colors.

P8

The wool is a cool detail, but I pay more attention to the painting.

“

(Q: Did you notice the wool or painting first?) Actually, I was more focusing on the painting... that’s the one who really change. But the wool... changes right away if you change the color. So, you can see before you press the button... a vision how it will look like... it’s also a cool detail, but I mostly looked at the painting on the left side.

P11

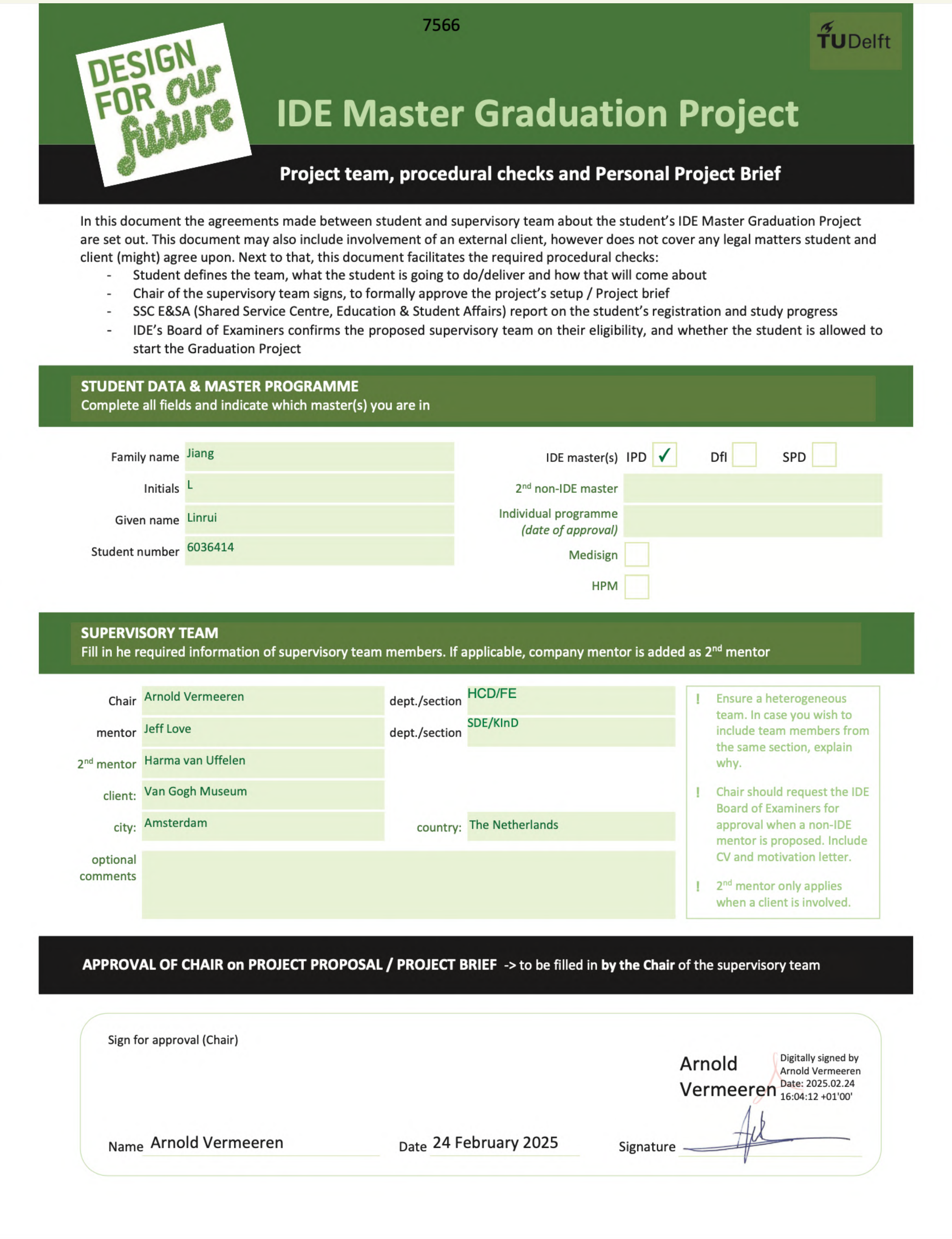
xxxx

“

(Q: Did you notice the wool or painting first?) I focused more on the painting. First the painting, and then the wool.

P10

Appendix S: Graduation Project Brief



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DESIGN FOR our future

TUDelft

IDE Master Graduation Project

Project team, procedural checks and Personal Project Brief

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

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

STUDENT DATA & MASTER PROGRAMME

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

Family name: Jiang

Initials: L

Given name: Linrui

Student number: 6036414

IDE master(s): IPD ☑ DfI ☐ SPD ☐

2nd non-IDE master:

Individual programme *(date of approval)*:

Medisign ☐

HPM ☐

SUPERVISORY TEAM

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

Chair: Arnold Vermeeren — dept./section: HCD/FE

mentor: Jeff Love — dept./section: SDE/KInD

2nd mentor: Harma van Uffelen

client: Van Gogh Museum

city: Amsterdam — country: The Netherlands

optional comments:

! Ensure a heterogeneous team. In case you wish to include team members from the same section, explain why.

! Chair should request the IDE Board of Examiners for approval when a non-IDE mentor is proposed. Include CV and motivation letter.

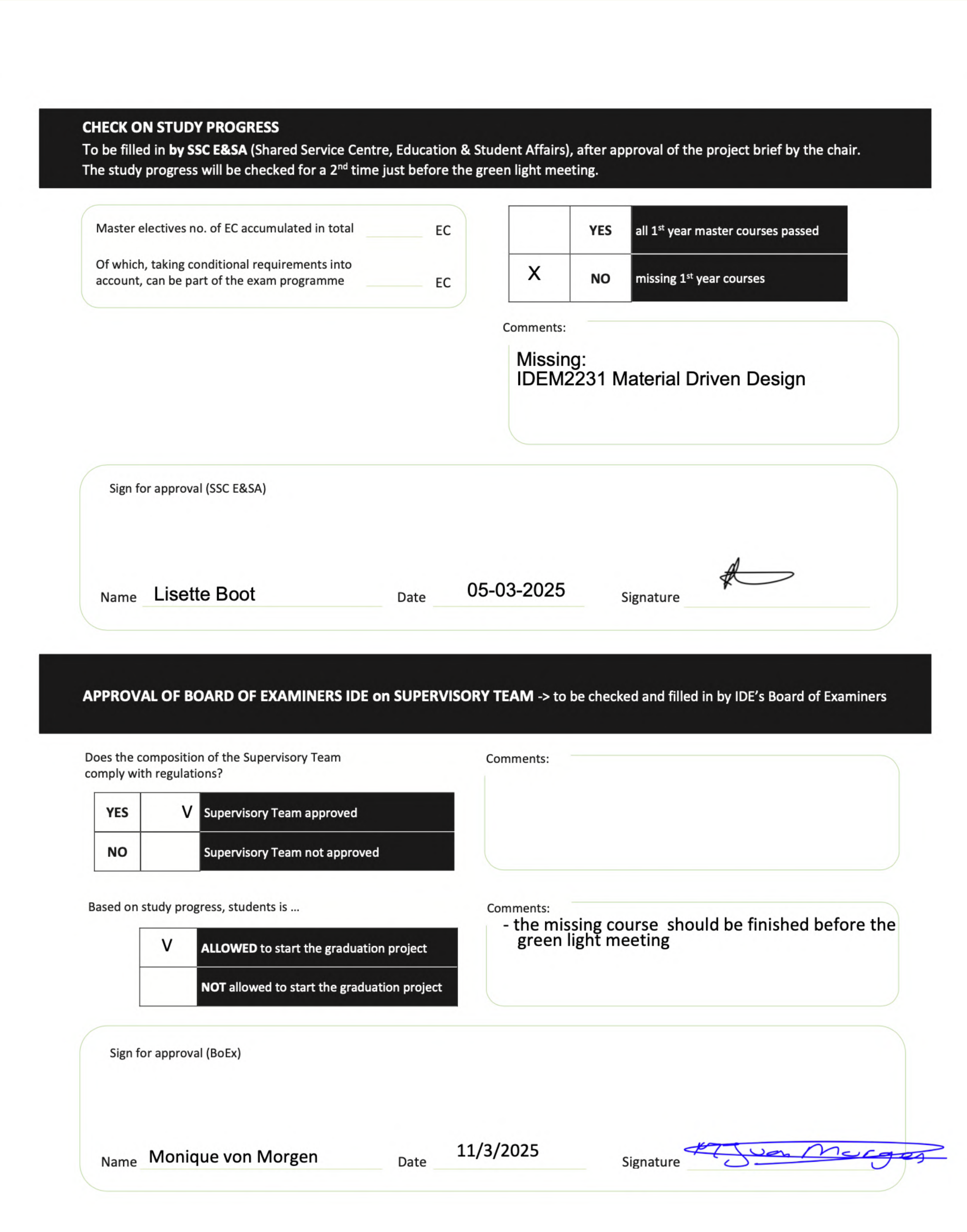
! 2nd mentor only applies when a client is involved.

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

Sign for approval (Chair)

Arnold Vermeeren — Digitally signed by Arnold Vermeeren Date: 2025.02.24 16:04:12 +01'00'

Name: Arnold Vermeeren — Date: 24 February 2025 — Signature:



CHECK ON STUDY PROGRESS

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

Master electives no. of EC accumulated in total ______ EC

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

	YES	all 1st year master courses passed
X	NO	missing 1st year courses

Comments:
Missing:
IDEM2231 Material Driven Design

Sign for approval (SSC E&SA)

Name: Lisette Boot — Date: 05-03-2025 — Signature:

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

Does the composition of the Supervisory Team comply with regulations?

YES	V	Supervisory Team approved
NO		Supervisory Team not approved

Comments:

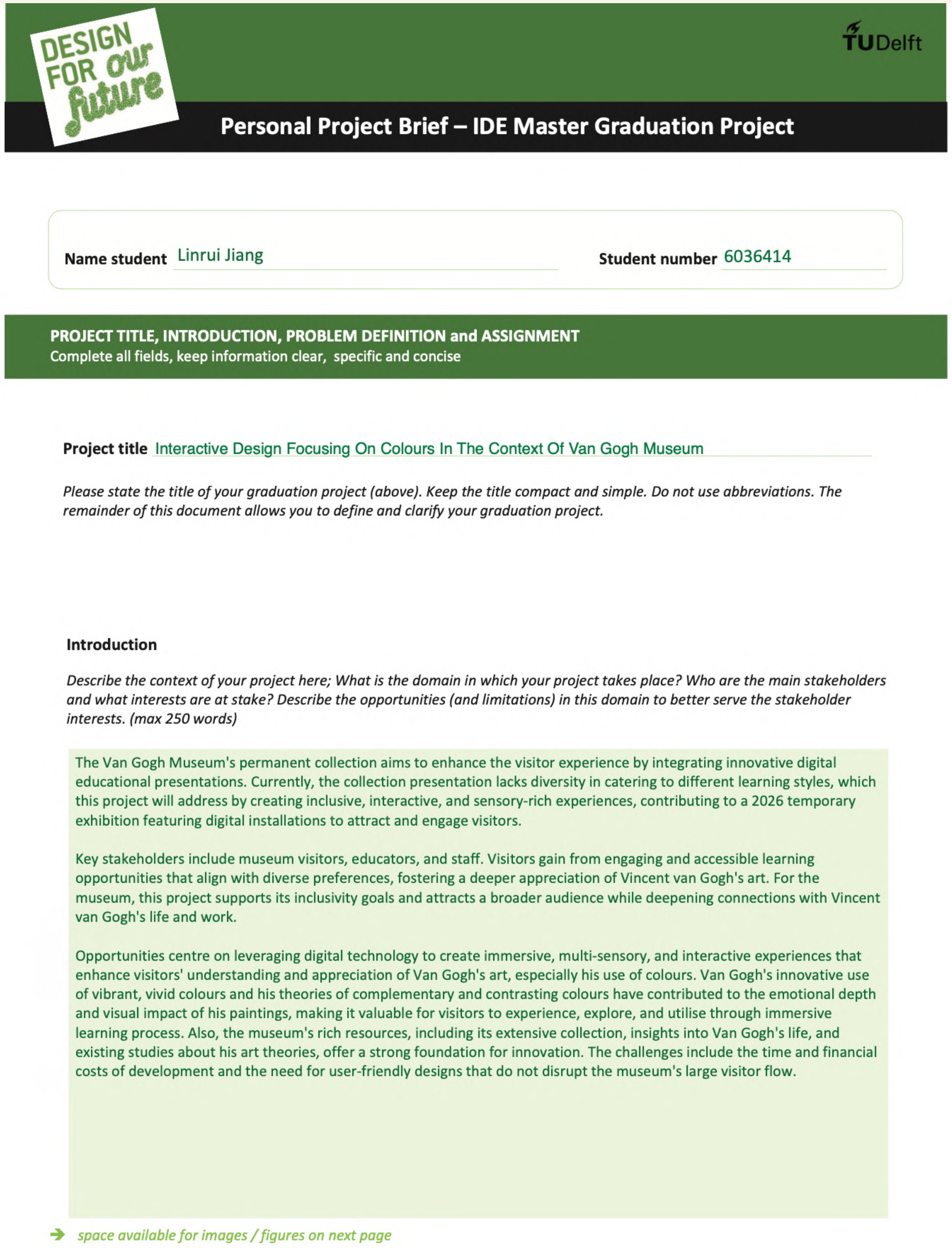
Based on study progress, students is ...

V	**ALLOWED** to start the graduation project
	NOT allowed to start the graduation project

Comments:
- the missing course should be finished before the green light meeting

Sign for approval (BoEx)

Name: Monique von Morgen — Date: 11/3/2025 — Signature: M.J. van Morgen



Personal Project Brief – IDE Master Graduation Project

Name student Linrui Jiang **Student number** 6036414

PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSIGNMENT
Complete all fields, keep information clear, specific and concise

Project title Interactive Design Focusing On Colours In The Context Of Van Gogh Museum

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

Introduction

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

The Van Gogh Museum's permanent collection aims to enhance the visitor experience by integrating innovative digital educational presentations. Currently, the collection presentation lacks diversity in catering to different learning styles, which this project will address by creating inclusive, interactive, and sensory-rich experiences, contributing to a 2026 temporary exhibition featuring digital installations to attract and engage visitors.

Key stakeholders include museum visitors, educators, and staff. Visitors gain from engaging and accessible learning opportunities that align with diverse preferences, fostering a deeper appreciation of Vincent van Gogh's art. For the museum, this project supports its inclusivity goals and attracts a broader audience while deepening connections with Vincent van Gogh's life and work.

Opportunities centre on leveraging digital technology to create immersive, multi-sensory, and interactive experiences that enhance visitors' understanding and appreciation of Van Gogh's art, especially his use of colours. Van Gogh's innovative use of vibrant, vivid colours and his theories of complementary and contrasting colours have contributed to the emotional depth and visual impact of his paintings, making it valuable for visitors to experience, explore, and utilise through immersive learning process. Also, the museum's rich resources, including its extensive collection, insights into Van Gogh's life, and existing studies about his art theories, offer a strong foundation for innovation. The challenges include the time and financial costs of development and the need for user-friendly designs that do not disrupt the museum's large visitor flow.

➔ *space available for images / figures on next page*

introduction (continued): space for images

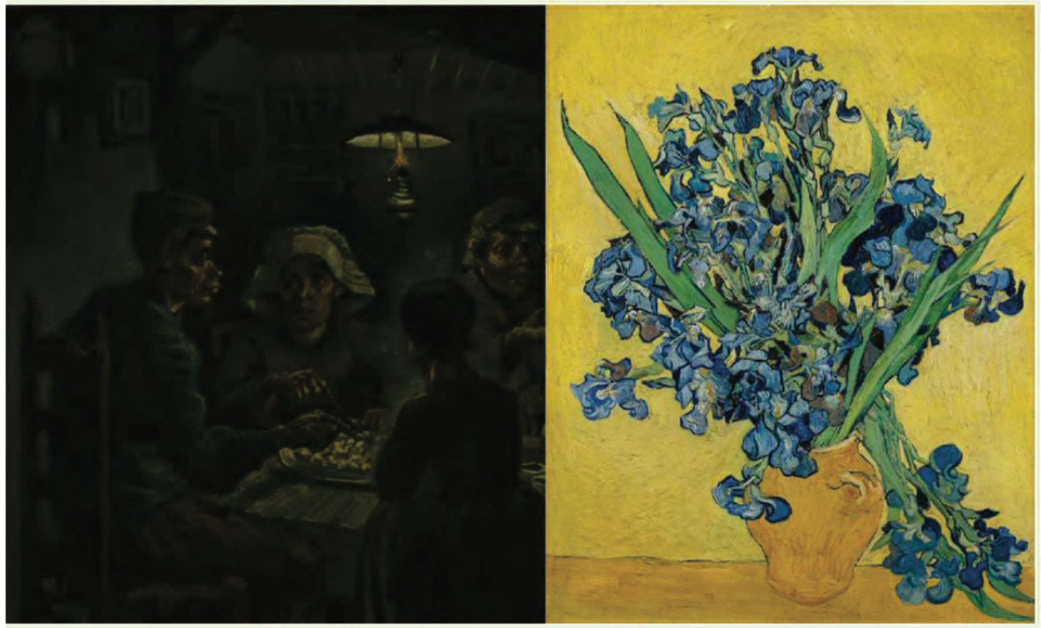
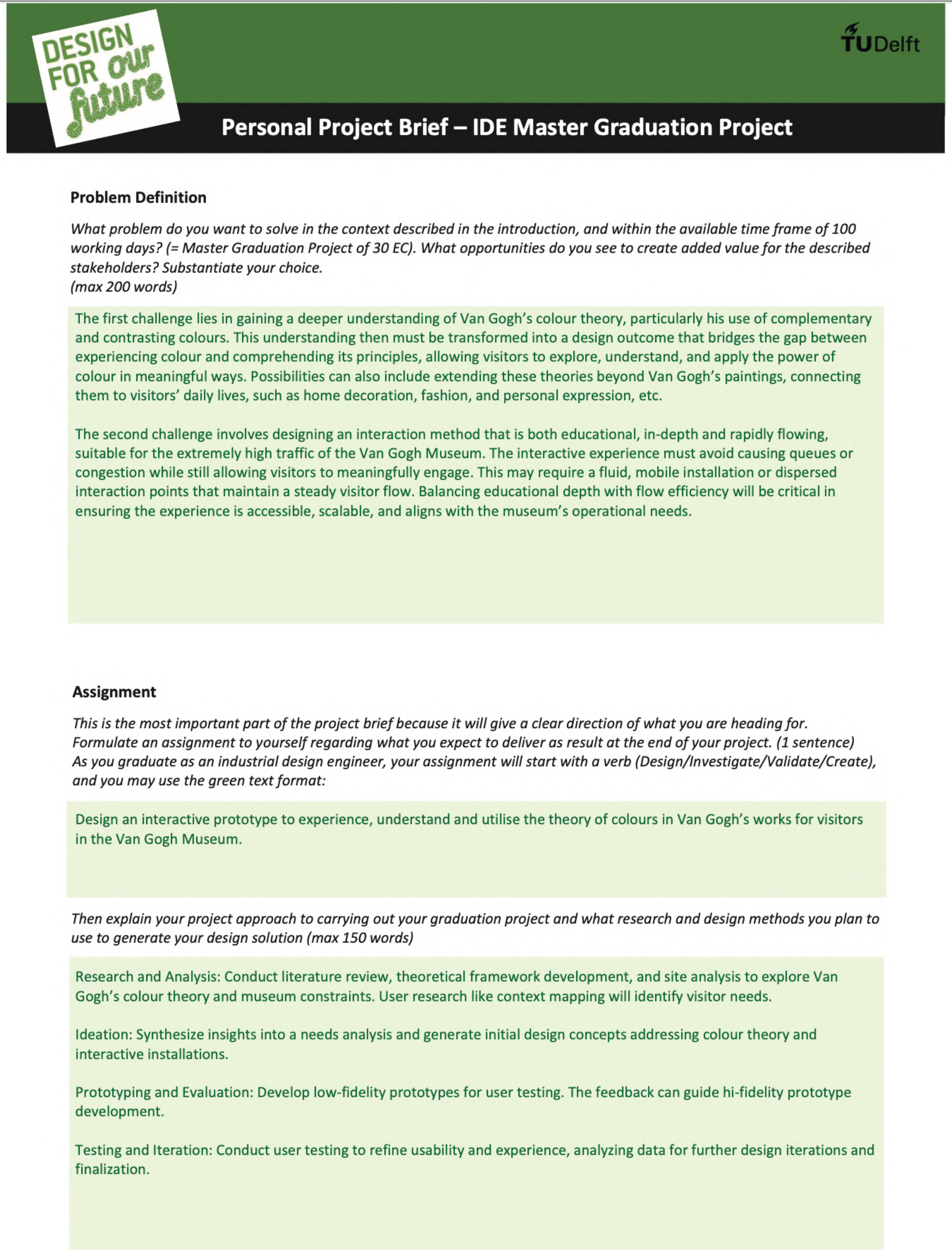


image / figure 1 A Composition of Van Gogh's The Potato Eaters and Irises showcasing different colours techniques (Van Gogh, 1885; Van Gogh, 1890; Source: Van Gogh Museum)

image / figure 2 A visitor smelling a scratch-and-sniff painting at the spring 2015 MediaLab Expo of MET Museum (Ucar, 2015)



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Personal Project Brief – IDE Master Graduation Project

Problem Definition

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

The first challenge lies in gaining a deeper understanding of Van Gogh's colour theory, particularly his use of complementary and contrasting colours. This understanding then must be transformed into a design outcome that bridges the gap between experiencing colour and comprehending its principles, allowing visitors to explore, understand, and apply the power of colour in meaningful ways. Possibilities can also include extending these theories beyond Van Gogh's paintings, connecting them to visitors' daily lives, such as home decoration, fashion, and personal expression, etc.

The second challenge involves designing an interaction method that is both educational, in-depth and rapidly flowing, suitable for the extremely high traffic of the Van Gogh Museum. The interactive experience must avoid causing queues or congestion while still allowing visitors to meaningfully engage. This may require a fluid, mobile installation or dispersed interaction points that maintain a steady visitor flow. Balancing educational depth with flow efficiency will be critical in ensuring the experience is accessible, scalable, and aligns with the museum's operational needs.

Assignment

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

Design an interactive prototype to experience, understand and utilise the theory of colours in Van Gogh's works for visitors in the Van Gogh Museum.

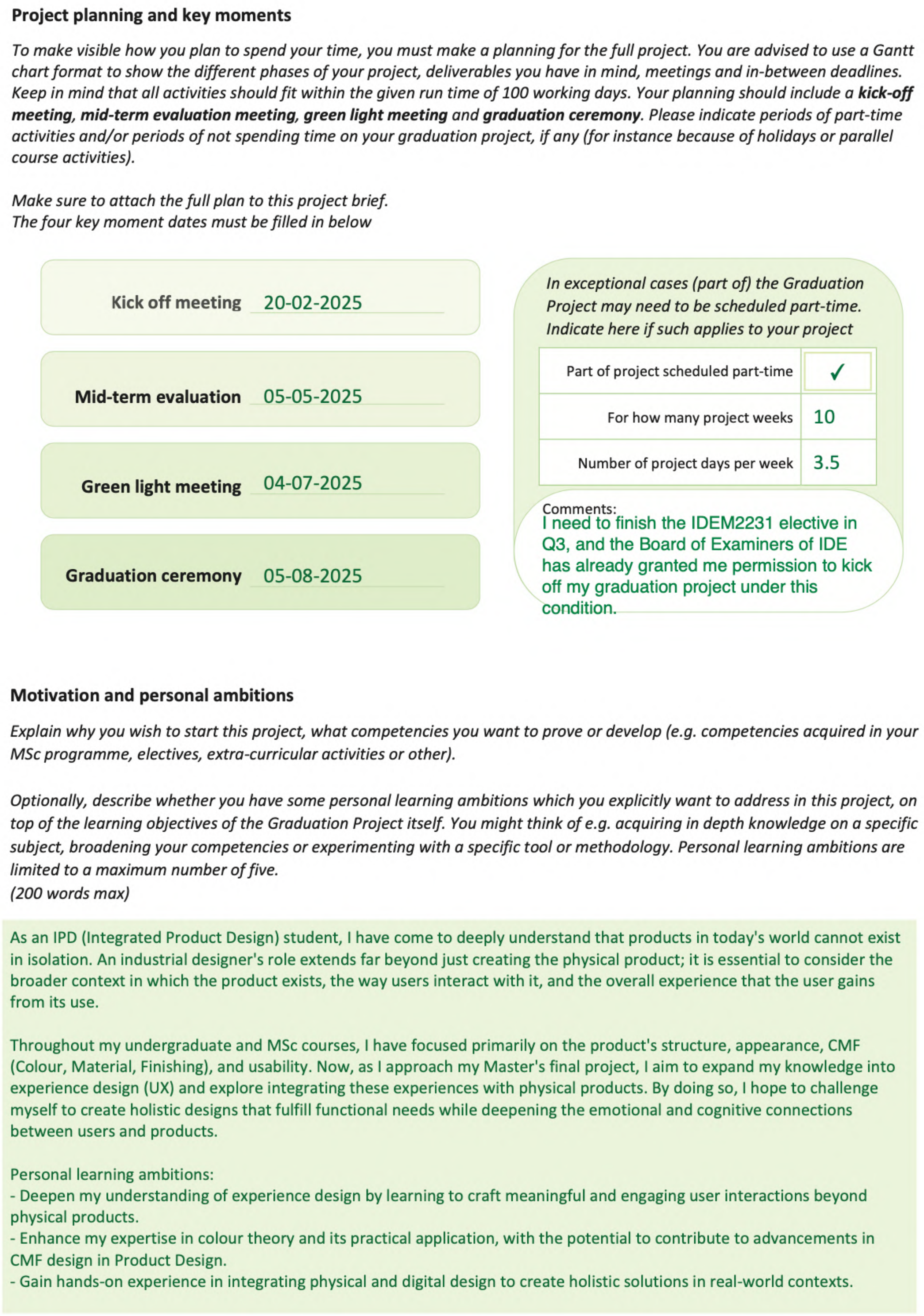
Then explain your project approach to carrying out your graduation project and what research and design methods you plan to use to generate your design solution (max 150 words)

Research and Analysis: Conduct literature review, theoretical framework development, and site analysis to explore Van Gogh's colour theory and museum constraints. User research like context mapping will identify visitor needs.

Ideation: Synthesize insights into a needs analysis and generate initial design concepts addressing colour theory and interactive installations.

Prototyping and Evaluation: Develop low-fidelity prototypes for user testing. The feedback can guide hi-fidelity prototype development.

Testing and Iteration: Conduct user testing to refine usability and experience, analyzing data for further design iterations and finalization.



Project planning and key moments

*To make visible how you plan to spend your time, you must make a planning for the full project. You are advised to use a Gantt chart format to show the different phases of your project, deliverables you have in mind, meetings and in-between deadlines. Keep in mind that all activities should fit within the given run time of 100 working days. Your planning should include a **kick-off meeting**, **mid-term evaluation meeting**, **green light meeting** and **graduation ceremony**. Please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any (for instance because of holidays or parallel course activities).*

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

Kick off meeting 20-02-2025

Mid-term evaluation 05-05-2025

Green light meeting 04-07-2025

Graduation ceremony 05-08-2025

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

Part of project scheduled part-time	✓
For how many project weeks	10
Number of project days per week	3.5

Comments:
I need to finish the IDEM2231 elective in Q3, and the Board of Examiners of IDE has already granted me permission to kick off my graduation project under this condition.

Motivation and personal ambitions

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

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

As an IPD (Integrated Product Design) student, I have come to deeply understand that products in today's world cannot exist in isolation. An industrial designer's role extends far beyond just creating the physical product; it is essential to consider the broader context in which the product exists, the way users interact with it, and the overall experience that the user gains from its use.

Throughout my undergraduate and MSc courses, I have focused primarily on the product's structure, appearance, CMF (Colour, Material, Finishing), and usability. Now, as I approach my Master's final project, I aim to expand my knowledge into experience design (UX) and explore integrating these experiences with physical products. By doing so, I hope to challenge myself to create holistic designs that fulfill functional needs while deepening the emotional and cognitive connections between users and products.

Personal learning ambitions:
- Deepen my understanding of experience design by learning to craft meaningful and engaging user interactions beyond physical products.
- Enhance my expertise in colour theory and its practical application, with the potential to contribute to advancements in CMF design in Product Design.
- Gain hands-on experience in integrating physical and digital design to create holistic solutions in real-world contexts.