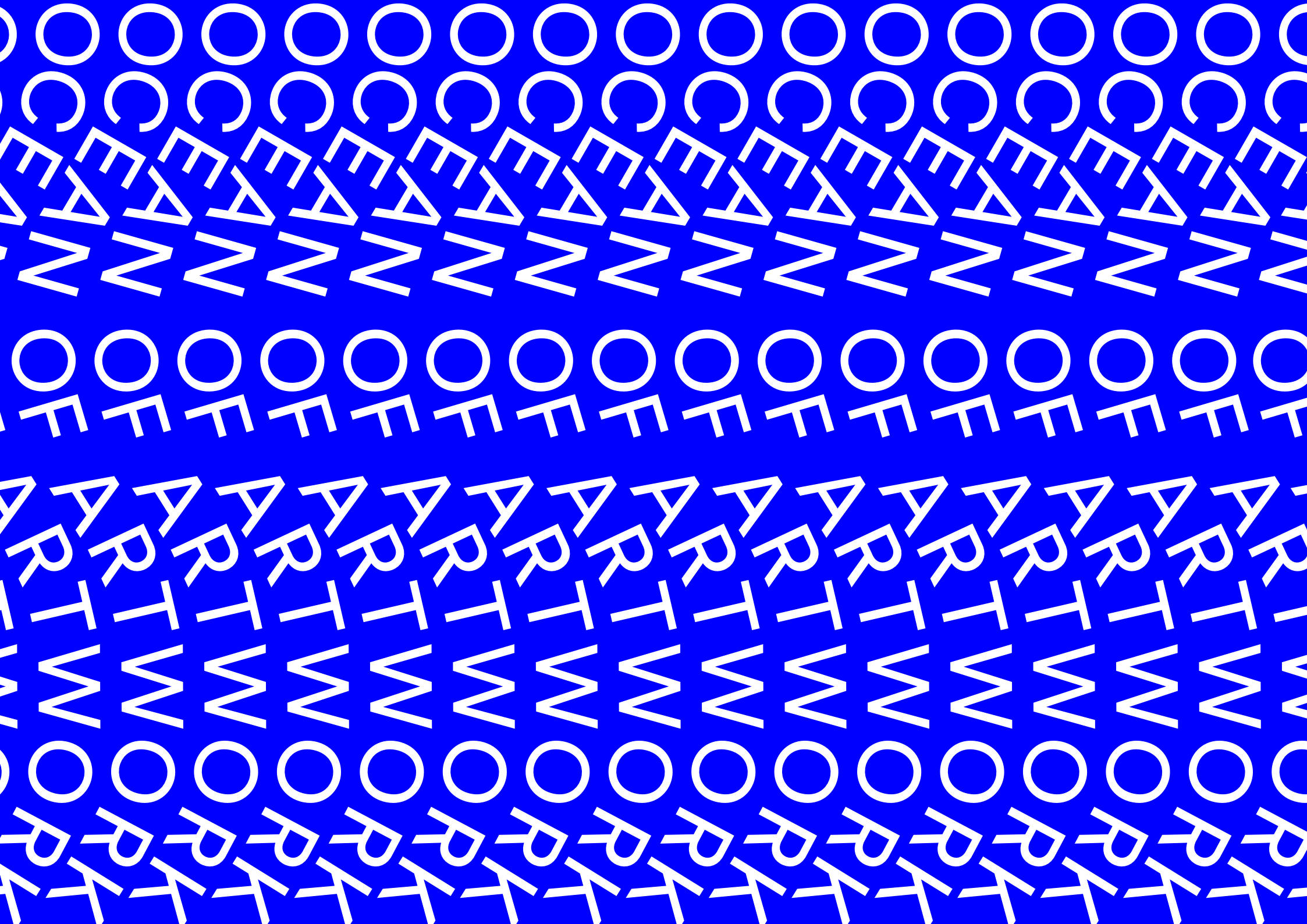
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Ocean of Artwork

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1 Abstract

This paper outlines a created system of navigation and discovery through a collection of artistic artefacts, captured in photographic form. The creators identify a lack of visibility for a gallery's digital, or archived collection, and address issues with the enjoyment, and interactivity of established systems. The system converts the flat, or relational databases to 3D mapped exploratory virtual realms. This system demonstrates a novel approach that within the given testing criteria, is evaluated positively and progressively improved by the chosen user-evaluators. The system also purports successful interaction from their users with little to no set-up training. It is projected within the paper that with future refinement and development, usability metrics will improve, and that this novel system will remove the identified issues within current systems.

2 Introduction

When navigating a type of environment like a museum/gallery, customers are often struck with inspiration, or a thirst for more knowledge on a topic and its place in the collection. Currently they could either miss this opportunity to explore, or be relegated to using traditional search approaches. Within art museum institutions[1] the museum may often select from a larger collection a series of works to display based on their aesthetic, spacial, or event based criteria. Typically the work that is shown is 'just the tip of the iceberg', where in archived is a deep trove of related, or unrelated works.

We see that it would be complementary to their goal to demonstrate the full set of their works, given customer interest. We take for-profit galleries as having a goal similar to museums throughout this paper, and thus pragmatically equate the two.

"Audience knowledge digest", Morris Hargreaves McIntyre (2007) identifies that intellectual and social purposes are the main motivations for museum/gallery (hereby referred to as a gallery) attendance.[2] We can also see from their work that exploring a galleries collection further would complement a number of their customers reason for attendance, such as "holidays in the area and decided to visit", where repeat attendance would not be possible, and "been before and wanted to come again", where the customer has already established a fondness for the museum/gallery and wishes to explore it further.

We now see that there is a requirement for a solution to explore of a galleries collection from both the museums side, to better serve their customers and their stakeholders goals, and from the customers side to better support their interest in the gallery.

This paper will thus explore these three concepts, outlining the work on system to link the requirements of the stakeholders, and primarily to demonstrate quantitative improvement throughout iterative prototype refinement.

3 Current databases & issues

One traditional approach is the *Stedelijk Museum Amsterdam*'s online collection. This consists of a typical search query database approach. It allows for one directional relational searches from a piece, to its location within the museums collections.

Another is the *Tate Museum* web page. Similar to the *Stedelijk Museum*, this collection features textual search, and relational mapping within their database. When chosen a category to display through either search of relational tunnelling, we are presented with images matching this criteria, with a typical scroll down for more type approach to display.

These collections, although large, identify a "know what you want" type approach to browsing, where the information can be easily found should you have enough in mind in your search criteria. Both exhibit a two dimensional, web-page approach familiar to desktop users, and are interactive at the mouse, keyboard level.

Additionally, in a project similar to our undertaking, installation artist Olafur Eliasson uses a personal archive, “Your uncertain archive”, which has a number of cross-over functions with our identified purpose. Beyond this Eliasson’s work is generally known for its ease of access, and entertainment for a wide range of age and cultural backgrounds. We see co-themes of ease of access, modular forms representing structure, and non-linearity in searching which creates a dynamic engagement beyond the traditional interfaces.

3.1 Limitations to these approaches

These approaches are functional, but do not consider the user environment and are thus limited in their applicability. As we have shown, the customer experience of a gallery is mainly a social or intellectual venture, and a ‘good’ solution should cater to these requirements.

3.2 Problem Statement

From the identified requirements of the stakeholders, and the gap in current solutions towards their environment. We shall attempt to answer within development of an appropriate system, and the evaluations used in this paper:

Can a new form of interaction, within an gallery environment, facilitate playful and practical navigation of a collection of works?

4 Solution

We introduce the user’s smartphone as controller navigating an *ocean* of data. One has to tilt the controller to move in a certain direction in the ocean. The metaphor of an ocean for the spatial layout of the data is appropriate visually as it allows to navigate in all directions, just like a fish can underwater. On top of that, ocean also entails a large amount of water and space, that is also the case with a database: a large amount of images and therefore also space. We use this metaphor to help people understand the functionality of the system and their smartphone.

4.1 System

We developed a system which inputs a photographic collection of work, complete with meta-data such as genre, artist, and year of publication, and outputs a 3D interactive environment, displaying the collection in full, and allowing multidimensional navigation on a large array of TV-monitors. The interaction was achieved with use of accelerometers and buttons accessible on phone. This was implemented as a vertical prototype of the final system, where there were restrictions on information expansion, and left only to the navigation and ‘feel’ of the interaction. This was evaluated as below.

The usability requirements of the system are:

- ✓ Able to be learnt and navigated successfully in less than 5 minutes
- ✓ Have a low retainability
- ✓ Facilitate navigation of an unknown database structure
- ✓ Inviting / playful to navigate and doing so in a satisfying way
- ✓ Incite serendipity and wandering through the information
- ✓ Free of errors and lagging in a controlled case
- ✓ Responsive to user input

4.2 Evaluation

We performed two user evaluations at different stages in the system development. The first evaluation took place on December 12th 2017 where the system was responsive to discrete inputs for velocity control, with set-speeds determined for navigation. The second evaluation took place on December 19th 2017 where the control schema was modified and divided into four categories. These are shown in Appendix A. This was following feedback from evaluation 1.
(More info on the controls and difference User Evaluation 1 & 2 in Appendix)

4.3 Users

Our identified audience will drive the majority of the interface design. Therefore careful consideration must be made on any unknowns or restrictions placed upon ourselves.
Listing our audience conditions:

- ✓ Diverse audience
- ✓ Mechanical limitations unknown
- ✓ Sensory limitations unknown
- ✓ Fully able bodied
- ✓ Transient – not staying at one exhibit too long
- ✓ Untrained – not necessarily previously encountered this interface
- ✓ Multiple encounters possible but not necessary
- ✓ Basic computer skills
- ✓ Level of education unknown and irrelevant
- ✓ Trepidations to touch
- ✓ Between 14 and 65 years old
- ✓ In possession of a smartphone

Within this vertical prototype (vertical) we chose to represent our user demographics through a choice of ease-of-availability on participants from within the Masters program "Media Technology" at Leiden University. Some discrepancies between this set and our end-users are noted. These are the level of skill with new style interactions, familiarity of art, and acceptance of pre-deployment stages of technologies. We have attempted to counteract this through demonstration of progression in user evaluation results.

4.4 Method

In our user evaluations, we have assessed groups between 5 – 10 users. The user evaluation was done with qualitative evaluation questionnaires following the form of the System Usability Scale[3], allowing us to see an overview of the results immediately and users reviewing from a remote location.

Within these evaluations we asked our user-evaluators to perform a series of simple tests consecutively. First, they were to become accustomed with the navigation mode by zooming in and out and moving up and down. Following this, we pointed them to a photograph, which they would attempt to navigate too as quickly as possible. We would then repeat this for each form of navigation. Navigation modes were thus:

User Evaluation 1

Mode	Movement Style	Movement Speed
1	Discrete	Slow
2	Discrete	Fast

Following User Evaluation 1 we implemented a feature in order to allow the vertical axis to be switched, as response to user feedback and observation.

User Evaluation 2

Mode	Movement Style	Vertical Movement Inversion
1	Linear	Yes
2	Linear	No
3	Exponential	Yes
4	Exponential	No

Once completed, we allowed the users to browse for at their leisure for 5 minutes in their own choice of navigation mode. We would then have them fill out the aforementioned questionnaire. The time spent on the entire navigation process was monitored and restrained between 5 and 10 minutes per user to reflect the real-world environment which the system would eventually be deployed.

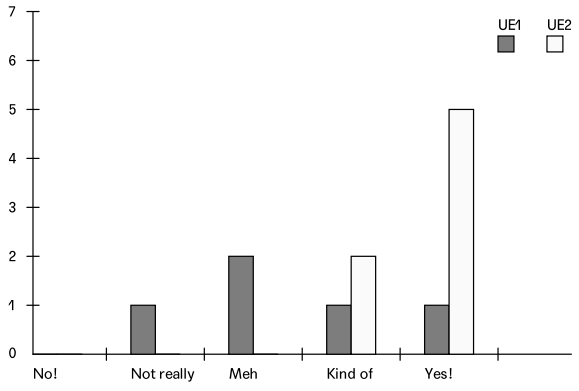
Both user evaluation forms included the same 19 multiple choice questions about the retainability, enjoyment, serendipity, quality and preferred implementation of the system, where the answer could range between 1 and 5 (No and Yes), and 4 open questions in which the user could fill in positive or negative points, extra remarks of ideas for implementations.

4.5 Results

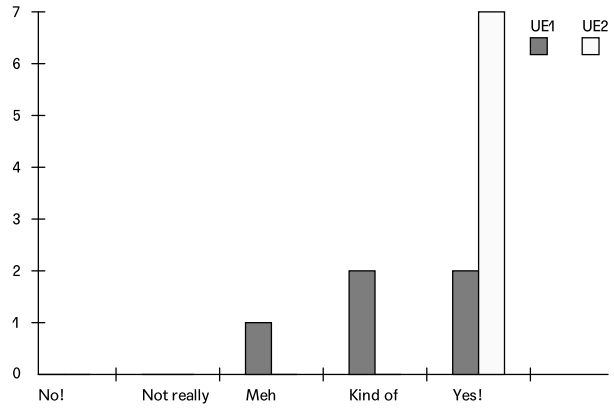
See Appendix for complete results. A compression of these results is shown below for direct discussion.

Score (1-5, average)		
Metric	**User Evaluation 1 (n=5)**	**User Evaluation 2 (n=7)**
Retainability	4.15	4.9
Enjoyment	4.2	4.9
Serendipity	4.0	4.5
Implementation	4.3	4.5
Responsiveness	4.2	4.2

Between our first and second user evaluation, the results clearly improved, as did the usability of the program. As the usability increased between the first and second, the program was reviewed to be considerably more enjoyable.



Enjoyment [I particularly enjoyed the type of navigation]



Serendipity [I felt motivated to keep on using the program and wander

The amount serendipity with users also increased considerably after the first user evaluation. In one case in User Evaluation 2, the system crashed, due to the user trying to find the (literal) boundaries of the virtual space, an issue we solved since then. This is reflected in the lack of increase in responsiveness score.

User Chosen Favorites		
User Mode	**User Evaluation 1 (n=5)**	**User Evaluation 2 (n=7)**
1	1	4
2	4	2
3	N/A	0
4	N/A	1

A remarkable difference in the results was the preference in navigation modes. We found roughly half of the users strongly preferred to tilt the controller towards themselves to move forward, and found the other way around very unnatural. This was exactly opposed to the other half of the users, that had the same experience, but with tilting the controller away from themselves to move forward. This difference might be due to our user's background and user history: perhaps some are used to a different control mode due to the experience they have had with a certain interface such that gamers that used a certain type of joystick or controller before would have a stronger preference for or against a particular style.

5 Conclusion & Discussion

5.1 Conclusion

We have demonstrated that throughout iterative refinement of the vertical prototype evaluated, we may increase qualitative user experiences to increase usability. It is thus extended that a new form of interaction would indeed facilitate our goals laid out in our research question: "Can a new form of interaction, within an gallery environment, facilitate playful and practical navigation of a collection of works?".

This is shown through comparative user evaluations that we have designed a new form of interaction suited to a gallery environment that facilitates playful and practical navigation of a collection of works. Were the second evaluation garnered strong positive feedback, especially in terms of retainability, however there is still room for improvement in some cases outlined by our user comments, and designer goals.

5.2 Discussion

We identify the main points of the second user evaluation for further development as improving the image resolution and dimensions when browsing, adding settings that users can adapt themselves for the navigation.

Furthermore a weakness in our methodology can be seen that the amount of users in the evaluation was small, and not reflective entirely of our end-user demographics. It is suggested that further evaluation of a large sample size ($n > 30$), in a live environment would produce higher quality data.

Of course, there are many other ways possible to engage the audience with a database in a gallery environment.

6 Future work

We identify a possibility to implement more features. Future work on the prototype would likely include:

- ✓ Customizable interaction settings per user.
- ✓ Implement the feedback of user evaluation 2 further.
- ✓ Even though Ocean of Art was intended for a bigger screen, would be possible to prepare the application for web as well, to make it more accessible to the user.
- ✓ Deploy and test Ocean of Art in its intended surrounding, perhaps in a Dutch art institute, and continue prototype refinement on the basis of this test.

7 References

9 Given that the EU council of museums, defines a museum as a: “non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment”, Museum Definition. (2007, August 24). Retrieved December 20, 2017, from http://icom.museum/the-vision/museum-definition/

10 McIntyre, M. H. (2007, March). Audience knowledge digest. Retrieved December 20, 2017, from http://webarchive.nationalarchives.gov.uk/20120215211331/http://research.mla.gov.uk/evidence/documents/Audience%20Knowledge%20Digest.pdf

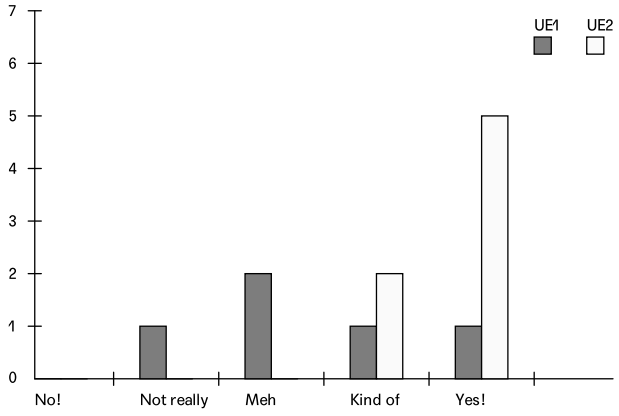
11 Brooke, J. (1996). SUS-A quick and dirty usability scale. Usability evaluation in industry, 189(194), 4-7.

8 Appendix (User evaluation 1 & 2)

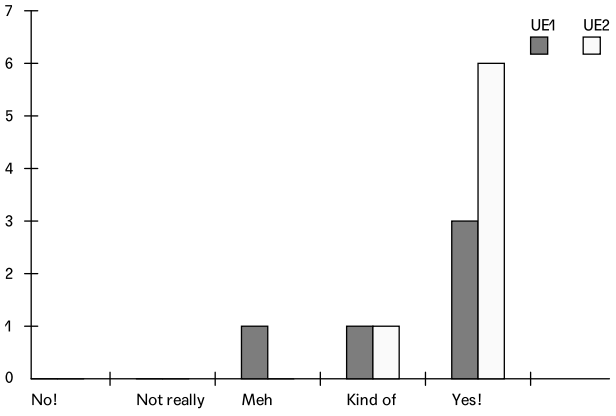
8.0 Preferred user mode

User Evaluation 1	User Evaluation 2
20% mode 2 (slow)	80% mode 4 (fast)
57.1% mode 1 (forwards)	28.6% mode 2 (backwards)
	14.3% mode 4 (backwards)

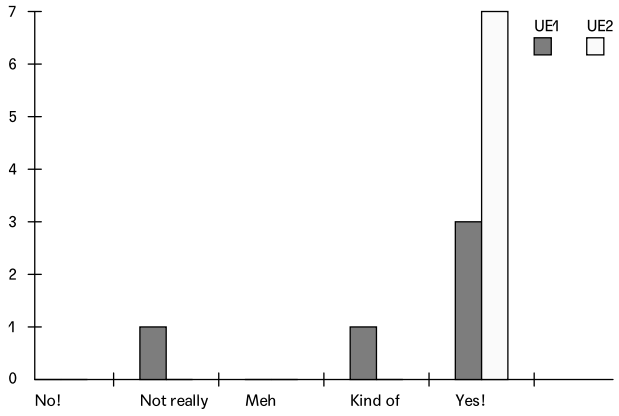
8.1 Enjoyment



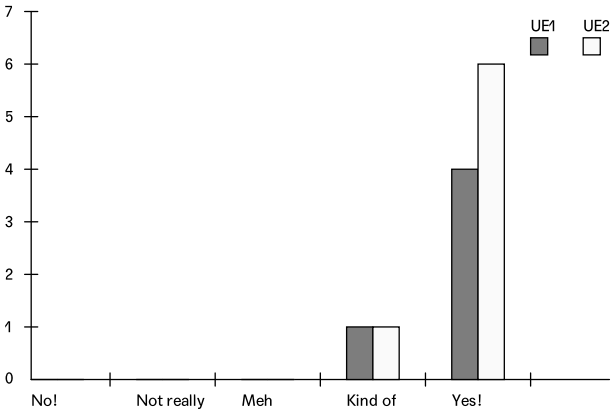
Enjoyment [I particularly enjoyed the type of navigation]



Enjoyment [It was fun to navigate through the database]

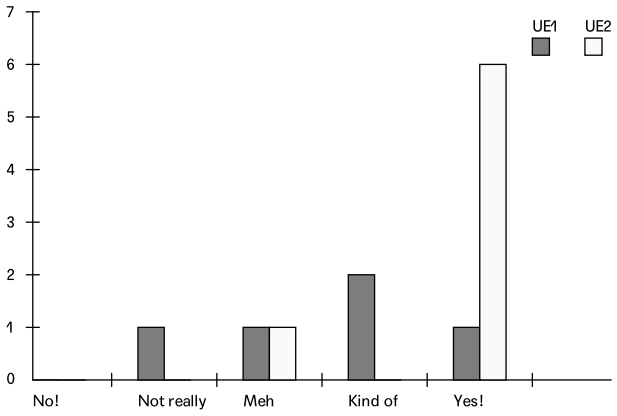


Enjoyment [It was inviting to navigate through the database]

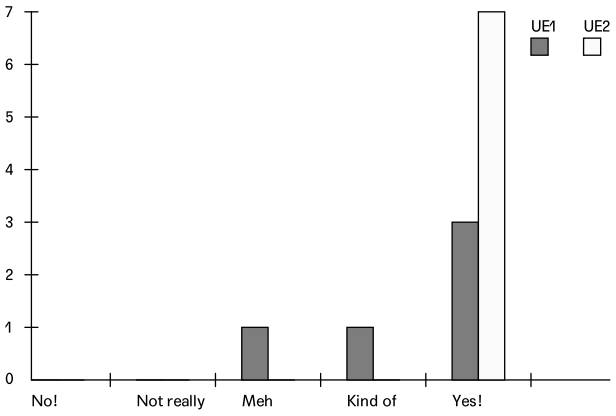


Enjoyment [It was more satisfying to navigate than it would be on a normal spreadsheet]

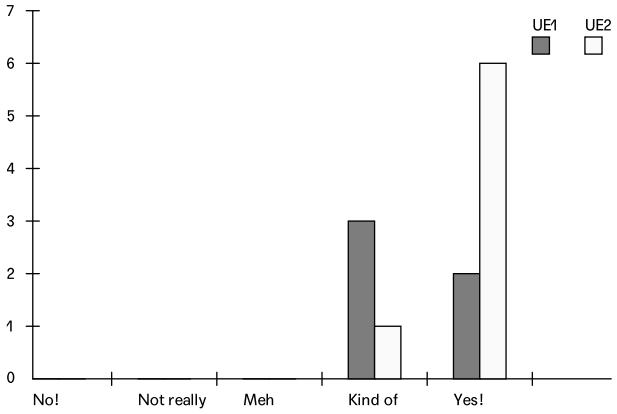
8.2 Retainability



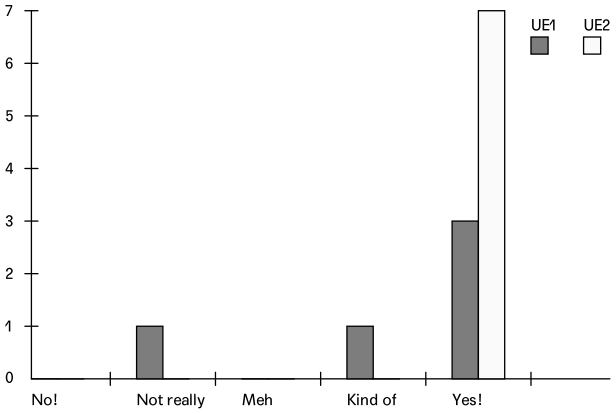
Retainability [I knew where to navigate in this structure]



Retainability [I navigated successfully in less than 5 minutes]

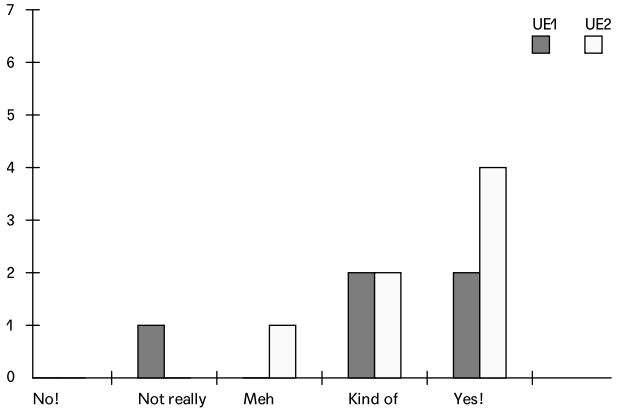


Retainability [I was able to learn how to use the interface quickly]

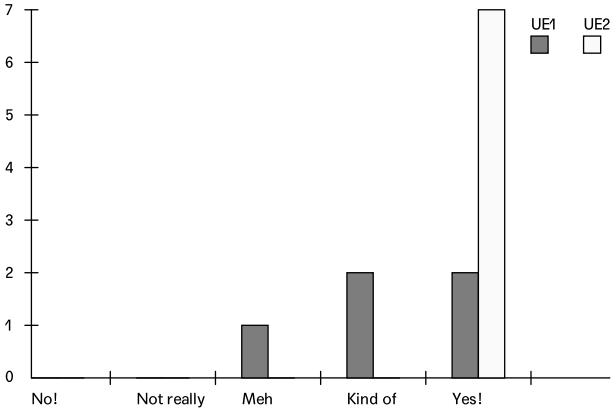


Retainability [If I would do it next year, I would remember how it works]

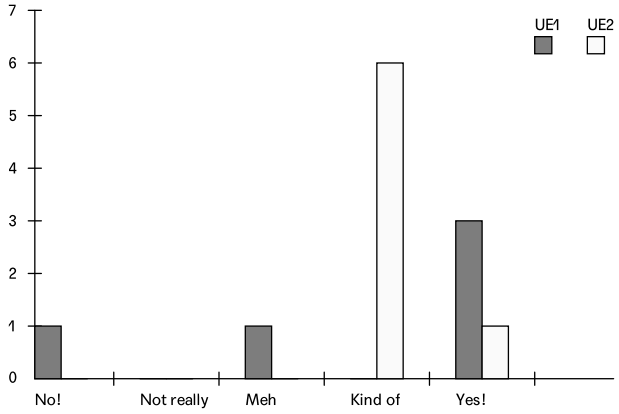
8.3 Serendipity



Serendipity [I could imagine using this when creating a moodboard, browsing for the sake of browsing]

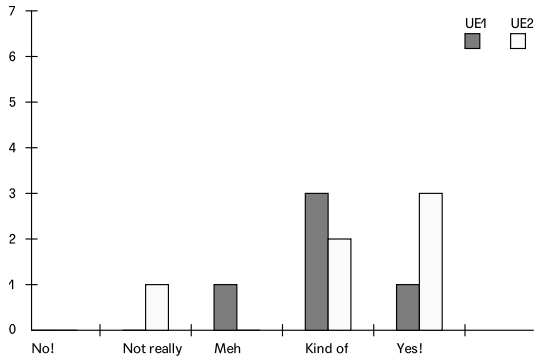


Serendipity [I felt motivated to keep on using the program and wander through the content]

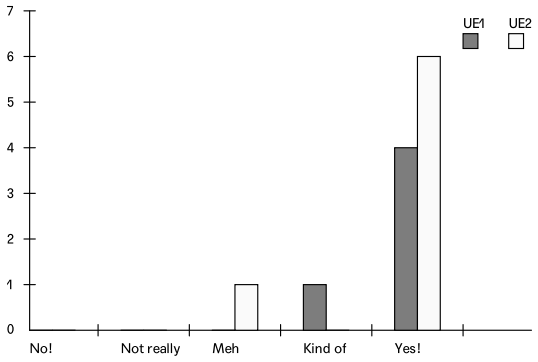


Serendipity [I found material I wouldn't have found otherwise, just by browsing]

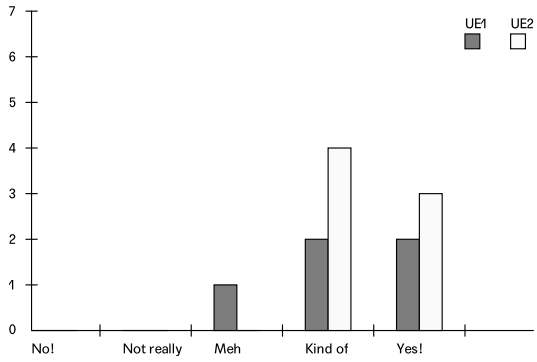
8.4 The implementation / program



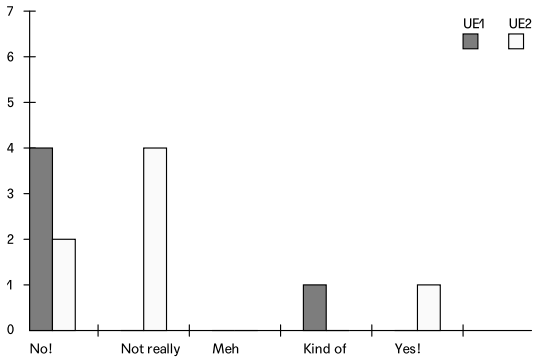
The implementation [I could picture myself using this as a website on my laptop/computer]



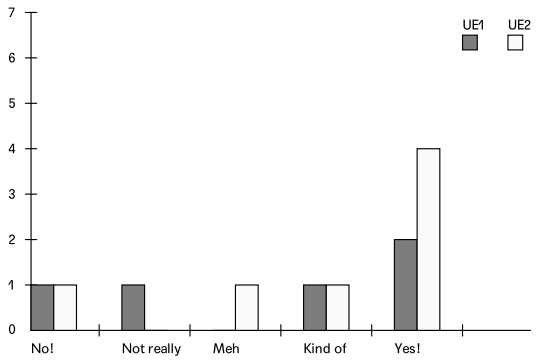
The implementation [I could picture myself using this program in a gallery]



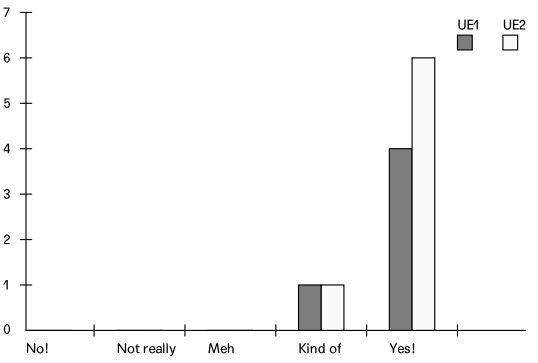
The implementation [I would use this program again if it was easily accessible]



The program in general [The program lagged]



The program in general [The program was free of errors when I used it]



The program in general [The reaction time on my actions was fast enough]

8.5 Positive remarks

User evaluation 1

- ✓ It's a very playful and immersive way of navigation through a database.
- ✓ Very nice and engaging interaction. It is fun to browse through all the images.
- ✓ Interesting way to show information, because it is interactive.

User evaluation 2

- ✓ Very appealing way to browse through data. Really engaging and interactive.
- ✓ Easy to use, and fun, everything is clear.
- ✓ Everything goes really smooth, without bugs or problems. The navigation is very intuitive – especially for a gamer!
- ✓ Really fun!
- ✓ I think the gray background works better than the black one. The navigation method is really nice!

8.6 Negative remarks

User evaluation 1

- ✓ Sometimes I couldn't stop the motion in time to focus on an image.
- ✓ The use of the red button is not intuitive, as the functionality is in 2D, while it affords a 3D interaction.
- ✓ I think it would be better to have a movement that is less all-or-nothing! This makes the interaction more smooth.
- ✓ Movements aren't consequent right now – if you want to go up you have to move "down", but if you want to go diagonal / right, just go that direction. Either make it function completely opposite or the right way.
- ✓ Not really sure why you should make it a circle instead of a rectangle. Would be so much easier if you don't have to or are able to move right or left.

User evaluation 2

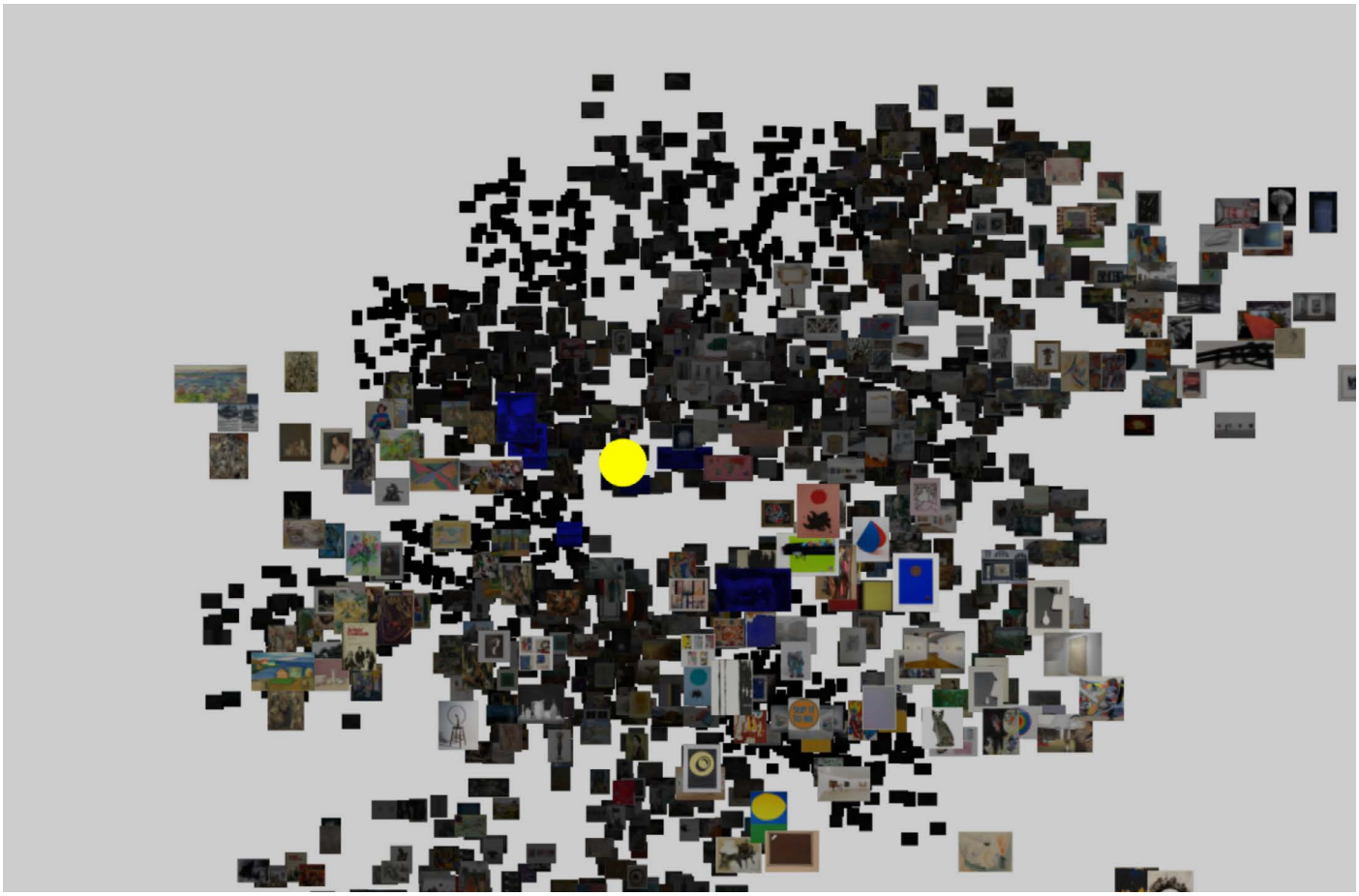
- ✓ Crashed. If you go too far down or up the program crashes.
- ✓ The resolution of the pictures is very low, but I imagine they are gonna be better in the end result.
- ✓ The images are blurry.
- ✓ You can't shoot the paintings. Also an infinite loop would be nice.

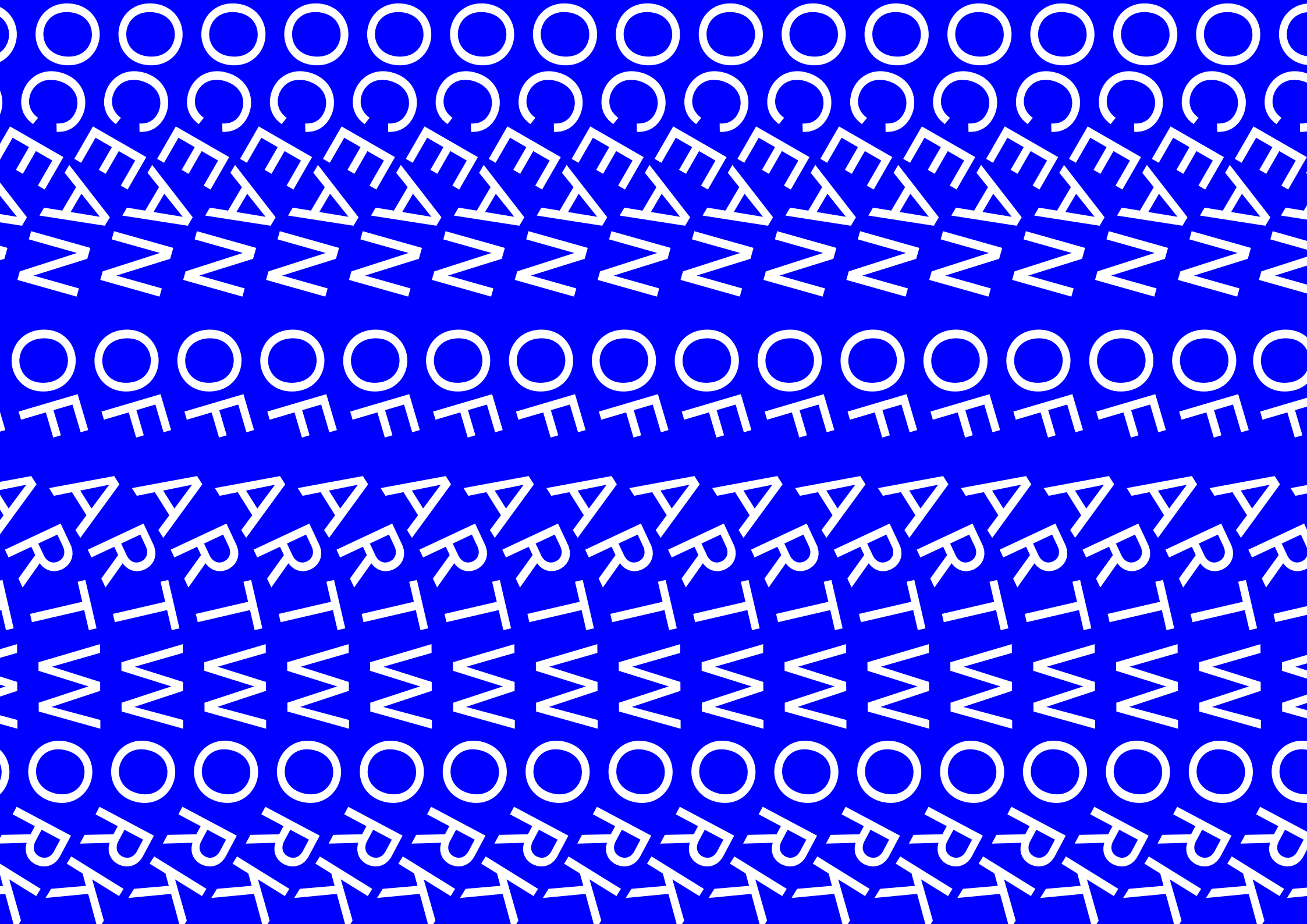
8.7 Other remarks

User evaluation 2

- ✓ I'm not sure whether it would be nice to use this system on a small screen like a laptop, because I think it's power lies in having a big screen and nice therefore a nice overview of all the paintings / data. It would be nice for art galleries.
- ✓ Drag to left and right could be nice.
- ✓ The acceleration could be a bit faster when the phone is tilted more, right now the fasted speed is still not fast enough in my opinion (only for the left / right and up / down movement, the zoom function is good enough).
- ✓ I don't know how I feel about the fact that the artworks are all square, even though the original painting might now be.

8.8 Overview Ocean of Artwork

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