
Ray: Utilizing Museum Visitor Data to Add Surprise to the User Experience

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Abstract

This paper describes a M1.1 design project executed for the Eindhoven Museum. The project tries to capture the clients vision, which is focused on creating a better future by sharing insights from the past, within its design concept. As trends see a rise in museums adopting digital technologies, the proposed concept is manifested as a digital installation. The installation called Ray, provides users with a personalised profile based on their data gathered during the visit. By giving an analysis of personal non-intrusive data back to the visitors, they can learn and be surprised by what data can do.

Authors Keywords

Data enabled design; Interaction Design; Eindhoven Museum; Conversational User Interface

1. Introduction

Eindhoven Museum (EM) is driven by its mission to foster foundations for a better future by sharing the rich insights gained from the historic development of Eindhoven's identity. While EM owns close to 23.000 physical artifacts [2], the museum currently does not have a permanent space to exhibit these items. Instead, it is actively exploring models that allow for a 'pop-up' style museum exhibitions.

With the ever-increasing complexity of technology, visitors have come to demand more from museums [3]. As such, EM is looking into strategies to better serve their visitors in this regard, including in-the-moment visitor data analysis, a more prominent social media presence and highly interactive installations. The result is the concept of Museum In The City: an exhibition style that uses dynamic themes to highlight relatable parts of history, e.g. food and mobility. Installations for these exhibitions are designed to generate insightful data to be used at the closing event. Here, the data is used to provide food for thought on society's views on the exhibition's overarching theme. Especially this element serves as an inspiration to this work.

In this report we describe the iterative design process of creating an interactive installation which aids EM's pursuit of innovation in the context of museums. First, we review

developments on the intersection of museums and technology. Then, we elaborate on the process that guided the design decisions, and introduce the resulting design. Finally, we evaluate the design in-context and discuss the implications for future work.

2. Related Work

While developments in technology offer museums new opportunities, they also create an obligation to adhere to the shifting expectations [5]. Trends seen in the context of museums include a rise in adoption of (digital) technologies, data analytics in museum curation and creating participatory visitor experiences [6]. Moussouri and Roussos argue that mobile sensing and big data can play an important role in audience research by museums [9]. Analytics made possible by data collection can be used to guide the curation of museums. With Constructivist Analytics, Berland poses a framework for employing advanced data analytics in order to cause beneficial social change in museums [1].

Data is not only being used for making informed decisions, it is also used to enhance the visitor's user experience. Yoshimura et al. see a future in using visitor cellphone's bluetooth data beyond analysis: they utilise it for real-time orchestration of visitors to prevent overcrowding [12]. Guided audio tours in the museum dynamically guide visitors towards less crowded areas.

Additionally, Petrelli et al. capture museum visitor's journeys to generate an individual 'data souvenir' [10]. The souvenir is a physical postcard printed at the end of the exhibition (See Figure 1). The researchers highlight its potential for similar mechanics to be used as a means for museums to collect visitor-generated content.



Figure 1: One of the postcard souvenirs, dynamically generated based on a visitor's journey. Taken from [10]. Copyright 2016 by Petrelli, Marshall, O'Brien, McEntaggart and Gwilt.

In conclusion, sensors and data are regarded to have a significant impact on the museum of the future. Sensors and data have traditionally allowed for more informed curation of exhibitions. More recently, data science technologies are being implemented to enhance and personalize the museum user experience on an individual level.

3. Design Process

Design Requirements

EM have a strong vision to showcase the past, present and future of Eindhoven in order to create a more considerate and tolerant society [2]. This implies that they need to design their exhibitions in a way that engages their visitors. In their design brief, EM wish for an installation that helps them in connecting past-, present- and future developments in the Eindhoven region.

An important consideration within the design space is the fact that EM have no permanent exhibition space: the designed installation needs to be flexible- and adaptable in terms of size- and content. Additionally, the museum's staff has not been trained in (information) technology — the system needs to be designed to provide them with a certain ease of use.

Finally, EM wishes for the system to be something beyond a novel user experience. EM are interested in a system that is able to provide them with rich insights: a system that can make suggestive predictions to have a short- and long-term impact.

Ideation

The design process started with a foundation of (user) research. To empathize better with the design context and the envisioned user groups, the research team conducted field research at museums. The field research consisted of observations as well as interviews with museum staff members, including Philips museum's curator, Sergio Derkx. An elaborate overview of the research is included in Appendix B. The research provided us with useful insights about the importance of personal meaning, creating emotions with the exhibition items and strategies to increase the engagement level among visitors.

Additionally, an interview was held with Joep van de Ven, designer of 'Back To The Future' [8], a previous project conducted within the Design for Creatives squad. This allowed us to learn about the intricacies in designing to support EM's vision. Overall, we concluded that the visitor's user experience can be substantially increased in perceived value and enjoyableness by establishing a strong connection between the museum's objects and its visitors.

The concept generation process was kick-started with Google's Crazy 8's technique [4]: a wide range of concepts were generated within a short period of time. Within these concepts, four themes arose: data visualisation- and gathering, museum crowdsourcing, customized museum experience and bridging the physical and digital. From these, three distinct concepts were selected. They are briefly described here, more can be found in Appendix D.

'Personal Stickers' (Figure 2) is based on unobtrusive data gathering. Visitors can pick up decorative stickers based on statements they relate with. The stickers can be used to personalize the information that is displayed alongside historic artifacts to better suit the visitor. This concept generates insights on the audience for EM, while also stimulating social interaction between like-minded visitors.



Figure 2: Physical model of concept 'Personal Stickers'.



Figure 3: Physical model of concept 'Individual Connection'.

'Individual Connection' (Figure 3) is based on creating 'richer' interactions with exhibition items. Tokens resembling game controllers can be used mimic movements related to historic artifacts, engaging visitors motor skills. The tokens can be adaptive, allowing them to be used to participate in quiz-like games. This concept generates data on the popularity of exhibition items, and also on how well the audience knows the history of eindhoven.

'Interactive Data' (Figure 4) is based on gathering- and showcasing visitor data within the theme of the exhibitions. A variety of interfaces allows visitors to answer questions posted by EM staff. A projector showcases a dynamic data visualisation of the answers compared with historical data, available for all visitors to see.

Customer Journey Mapping [7] was used to analyse the users' needs and emotions throughout the proposed concepts. For each concept, touch points were mapped across the different

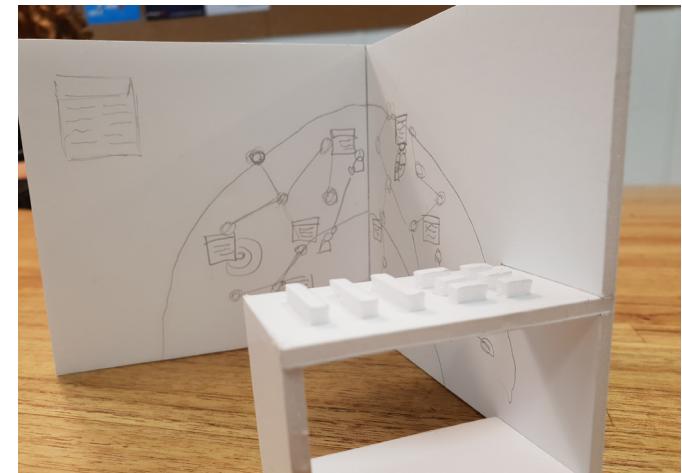


Figure 4: Physical model of concept 'Interactive Data'.

stages of the journey. Through this journey mapping study we found key design principles that were present in all concepts: 'engaging visitors with a better interaction', and 'potential of multisensory interactions'. To meet these principles, a hybrid concept based on 'Personal Stickers' and 'Individual Connection' was chosen as a first full concept iteration.

Early Prototype

For our first concept iteration we designed a modular quiz-style game system that discloses EM's knowledge in a playful, interactive way (See Figure 5 on the next page). Visitors of the exhibitions can use multiple stations to test their knowledge, and compete in teams. The system is modular to provide flexibility and portability: school visits can include two to three installations while longer expositions can include multitudes of that.

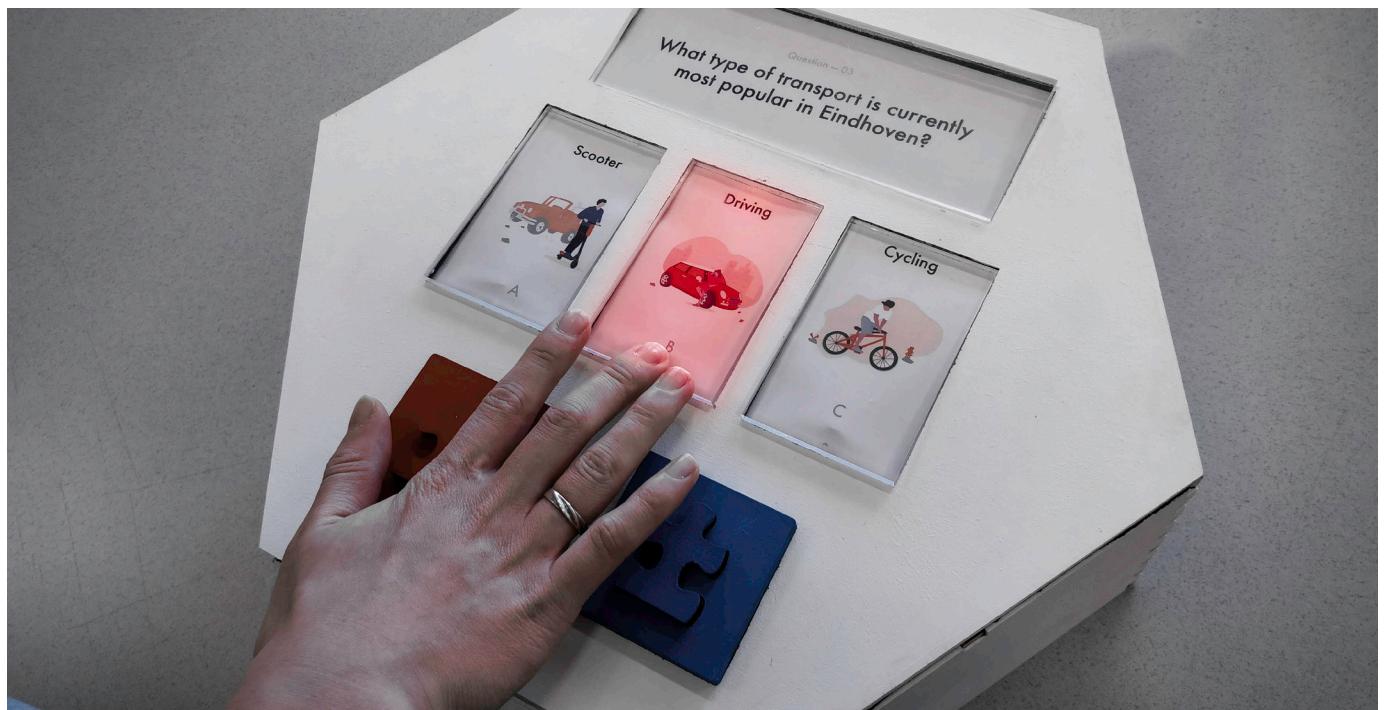


Figure 5: One of the modular quiz-game system prototypes. In this photograph, the visitor is answering a question by pressing the button. However, they answered wrong — luminous feedback communicate this game state.

The prototype has a hexagonal shape, allowing multiple displays to be chained together. The system allows EM staff to create their own quizzes using the supplied digital assets. The prototypes were designed inspired by the honeypot effect as studied by [11]. They explore the common social effect that attracts people to an item, simply because other people are standing in its vicinity.

Visitors can pick up a token which assigns them to a team. They use the token to unlock an interaction at one of the installations. A question related to mobility is presented

alongside three answers that can be pressed. Embedded lights provide functional feedback: a red glow indicates a wrong answer and a green glow indicates a correct answer. Right- and wrong answers affect the team score, displayed centrally.

The tokens can be handed in at the end of the game. The final stand has a speculative question about the future: visitors can share their opinions by putting their tokens back on the answer stack they relate to, or create a new answer.

This concept was presented at the mid-term demo day. When

reflecting on this first design iteration, we realised that the prototype lacked in attraction. Some of the visitors found it hard to see the value of the system, and it was lacking a surprising unveiling of the collected data.

Guided by mentor advice, we put the development of the quiz-game concept on hold, and took the key insights from the prototype to a next iteration.

Ray – Final Concept

The element of surprise that was lacking in the previous concept guided the adjustment of the design vision. After consulting our mentor, we found that we could create value for EM and their visitors by focusing on data integration and visualisation. Previous installations showcased in Museum In The City exhibitions have had the ability to capture various types of visitor data. However, the museum had limited means to create value from the collected data, both in curating exhibitions and in the design of installations.

We perceived the latent need for a system that creates value from data collected by other installations. Data produced by other distributed installations are captured in a central database, where it is processed. This creates two main opportunities, the data can:

Be used to create user profiles of visitors that can be revealed at the end of the exhibition;

Help the EM board with the decision-making in the curation of exhibitions.

The user profiles composed of data generated during their visit is divided in three categories: *Personality*, *Physicality* and *Culture*. As a visitor progresses through the exhibition, the system learns more about them within these categories.

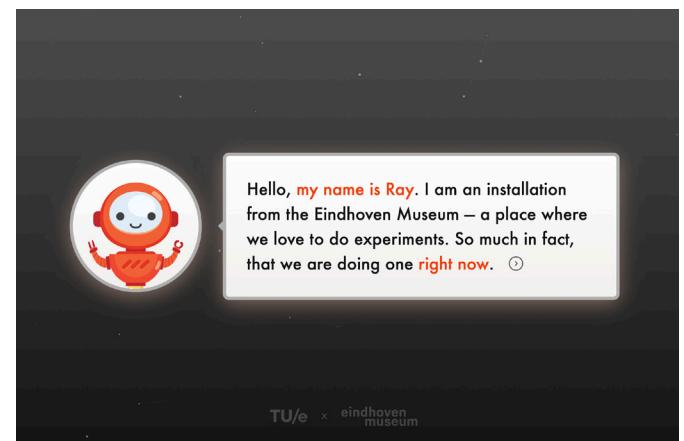


Figure 6: A first look at the ‘Ray’ conversational user interface. In this still, Ray introduces himself to the visitor.

Ideally, a fully correct user profile is generated once they are close to the end of their visit. There, they are able to get insights in what the system has learned about them.

The installation (Figure 6) that is to be placed near the exit of an exhibition is a screen that contains a robot character: Ray. Ray is part of a conversational user interface (CUI), and is a digital manifestation of the artificial intelligence that powers the system. Through a playful, interactive dialogue, Ray shares what he knows about the visitor. For example, he could have learned that the visitor is an American female in the age range of 25-30. Ray discusses what he knows, and shows data visualisations in animated forms to add substance to his claims.

4. Implementation

In order to integrate the collected data into our system and

produce convincing personal analysis, we needed a good collaboration with the other exhibiting designers. We have held multiple meetings with other design groups of the upcoming Museum In The City exposition. In these, we explored how we can make sense of the collected data to create a playful and dynamic conversation.

Based on the other design groups' envisioned installations, it made the most sense to evaluate visitors in the three aforementioned categories: *personality*, *physicality* and *culture*. However, for future themes a different split can be made.

In optimal conditions, data generated by the installations is easily communicated to a central database (Figure 7), and personal identification of data is no problem. However, due to technical limitations a physical token was introduced to store data across devices. This token, realised by the Pre-Master design team, can be scanned at installations to store data.

When the token is scanned at our installation, we have access to the data. All data that enters our installation is stored as a JavaScript object using the JavaScript Object Notation (JSON) format. This format means the data is easily stored, and can be accessed- and edited at any time.

One Museum In The City installation envisioned by a fellow design team is the 'Bike To The Future' Installation. In this installation, visitors take part in a biking race, taking on the challenge to finish as fast as possible. Within their journey, they are shown imagery of Eindhoven in the past, present and future. Data generated during this installation includes time series data on cycling speed and heart rate. Additionally, data such as the person's weight and the time to finish can be recorded. When the finish is reached, a photo is taken of the visitors. All these data points are highly valuable for our installation: they can be used to deduce gender, fitness level, ethnicity and age.

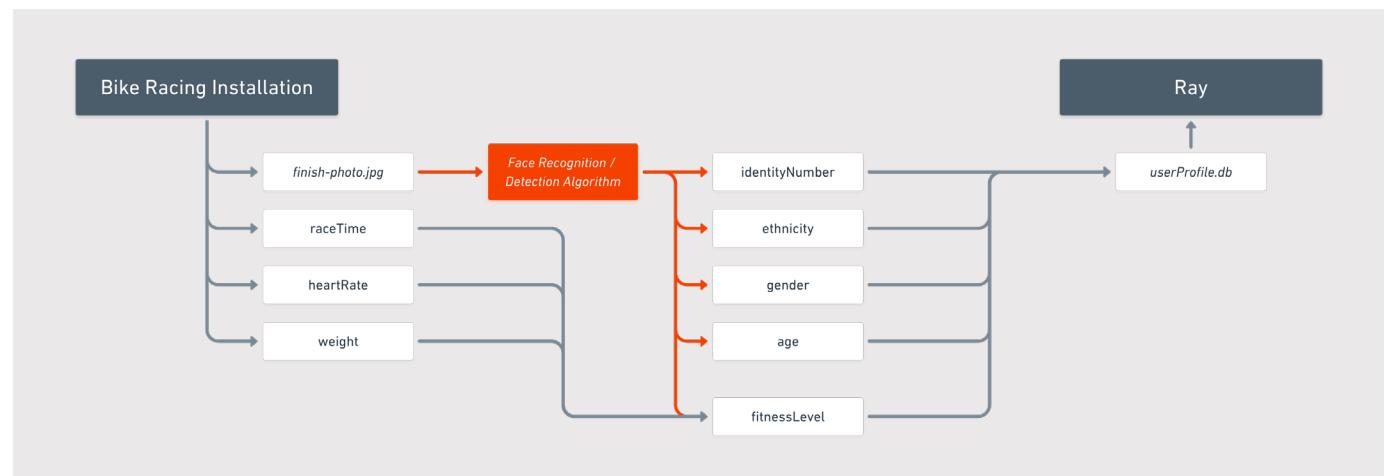


Figure 7: Flowchart of the imagined data streams from an external installation.



Figure 8: Final Demo Day impression.

Similarly, in the ‘Cube / World Map’ installation, from our other fellow students B2 group, valuable data is generated on the whereabouts of EM’s visitors. In their installation, visitors are invited to draw their journey to Eindhoven, on a regional, national and international scale. By parsing photographs of the journeys drawn using a general computer vision feature detection algorithm, a rich list of countries of origin can be deduced. These can be shared with Ray’s database to shed a light on EM visitors’ Culture.

All the personal analysis information will be visualized and presented on the screen in this last stage of experience. This serves to provide a full image of a visitor’s personal analysis and additional barcode allowing the visitors to take their personal profile home on their phones. It could be used as a memento for the visitors.

5. Evaluation

Final Demo Day Setup

Ray was exhibited alongside other student projects on the Final Demo Day at the University of Technology Eindhoven (See Figure 8 on the previous page). All design groups participated in building the visitors route to simulate a pop-up exhibition style and mimic a museum environment. This was done to create a moderately realistic museum experience.

The journey starts with the tokens that were designed by the premaster group. The token is used for activating different installations and collecting data from them. After visitors have completed their journey, they are invited to come interact with our installation. Our final setup contains two parts, an announcing poster at the entrance of the visiting route, aimed to attract visitors attention. The main part of installation is placed at the end of the journey, where visitors

could get their personalised analysis based on the data they generated at other installations that they have used.

Client and Mentor Feedback

The CUI approach of our installation offers visitors a certain guideline when experiencing the installation. This was proven to be a clear and directive way to keep visitors engaged, so they would participate in the entire experience. The experience of our installation, whether the predictions were correct or incorrect, received positive reactions, especially the results of Ray’s predictions inspired discussions amongst the visitors.

The final installation was to be a showcase of different user profiles rather than an actual interactive installation. It would be more engaging in the future to implement different types of interaction to increase the level of enjoyment and engagement for the visitor.

On the other hand, the final design can also be considered as a good example of combining the academic principles of tangible design with an intelligent system. However, some visitors still perceived the experience to be a bit conceptual and were concerned with the difficulties for further development for both museum staff and different age groups.

6. Discussion

Observations

During the project we discovered that when creating a museum experience with an interactive installation, the main focus should lay on how the information is received rather than how it is delivered. In the first concept, the main focus was put on offering visitors rich physical interactions and

delivering knowledge about EM's historical background related to mobility. However, it was perceived to be too unclear for the users to follow the interactions, because the interaction was not attractive and engaging enough. Additionally they were being observed, which resulted in limited patience from them to read through all the text.

When working on the final concept, we were confronted with some issues in realisation. Considering our prototype needed steady data input from other installations, but most installations were only a mockup of the real concept, they did not generate or store real data. Furthermore, on the Final Demo Day, we presented a setup that provided visitors the opportunity to leave feedback by means of post-its. However, it would be more effective to change this feedback into a digital interaction. This would be more in line with the overall aesthetic of interaction. This interaction could be used as a means to check whether the predictions made by the system are valid. This input can be used to further train an embedded machine learning algorithm.

Future Steps

As shown in the discussion, there are ways in which the prototype can be improved. One of the key opportunities is to re-design the interaction. As discussed, this was one of the main concerns for the visitors. Instead of only engaging the visitor's cognitive skills, their motor skills can be engaged by the use of tangible interactions including gesture detection, physical movement and emotion detection.

Additional functionalities like a camera can be implemented in order to more accurately track the movements of the visitors. Metadata can be logged, such as the duration of the experience, favourite installations and overall behaviour.

Additionally, more sophisticated facial recognition tools such as the Kairos API can be used to analyse the gender, age and emotions of the visitors.

Something else to keep in mind is the security of the stored data. For this demonstrator, this was not a priority. However, organisations such as EM are bound by strict laws on data protection.

Finally, an interesting opportunity is the implementation of a chatbot intelligence. In its current state, the branching dialogue is personalized, however it always follows the same stages. We believe a truly interesting experience can take place once the conversations are more dynamic: visitors would really be stunned by the potential of integrating high technology in museums.

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Lastly would we like to thank our squad, especially the EM groups, for their positive energy throughout the project. We all really enjoyed the intensive collaboration in the ending phase of this project.

References

1. Berland, M. (2017). Constructivist Analytics: Using Data to Enable Deeper Museum Experiences for More Visitors—Lessons from the Learning Sciences. *Visitor Studies*, 20(1), 3-9.
2. Eindhoven Museum (2017). Jaarverslag 2017 Museum vol verandering. Retrieved from https://www.prehistorischdorp.nl/storage/app/media/uploaded-files/Jaarverslag_Eindhoven_Museum_2017.pdf
3. Falk, J. H., & Dierking, L. D. (2016). The museum experience revisited. Routledge.
4. Google Design Sprint Kit. (n.d.). Sprint Framework - Phase 3: Sketch - Crazy 8's. Retrieved from <https://designsprintkit.withgoogle.com/methodology/phase3-sketch/crazy-eight>
5. Hume, M. (2015). To technovate or not to technovate? Examining the inter-relationship of consumer technology, museum service quality, museum value, and repurchase intent. *Journal of Nonprofit & Public Sector Marketing*, 27(2), 155-182.
6. Johnson, L., Becker, S. A., Estrada, V., & Freeman, A. (2015). NMC horizon report: 2015 museum edition. The New Media Consortium.
7. Kaplan, K. (Jul. 31, 2016). "When and How to Create Customer Journey Maps". Retrieved from <https://www.nngroup.com/articles/customer-journey-mapping/>
8. Leijtens, L., de Vries, J. van Erp, S., & van de Ven, J. (2017). Back to the future: Designing a product service system for the data collecting museum of the future.
9. Moussouri, T., & Roussos, G. (2014). Mobile Sensing, BYOD and Big Data Analytics: New technologies for audience research in museums. *Journal of Audience & Reception Studies*, 11(2).
10. Petrelli, D., Marshall, M. T., O'Brien, S., McEntaggart, P., & Gwilt, I. (2017). Tangible data souvenirs as a bridge between a physical museum visit and online digital experience. *Personal and Ubiquitous Computing*, 21(2), 281-295.
11. Ten Koppel, M., Bailly, G., Müller, J., & Walter, R. (2012, May). Chained displays: configurations of public displays can be used to influence actor-, audience-, and passer-by behavior. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 317-326). ACM.
12. Yoshimura, Y., Sobolevsky, S., Ratti, C., Girardin, F., Carrascal, J. P., Blat, J., & Sinatra, R. (2014). An analysis of visitors' behavior in the Louvre Museum: A study using Bluetooth data. *Environment and Planning B: Planning and Design*, 41(6), 1113-1131.

Appendix A1

Personal Reflection

Xueqing Liang, 1391291

09.01.2019

Contribution

I have taken different tasks and roles through different stages, and took the responsibility of making the poster and visualisation. In early stage of the project(before the midterm), I did some literature research and took the responsibility of user research. I created a proposal of user research methods and survey. After the midterm, I took the responsibility of posters on the final prototype and test size on them; made personalised analysis that was introduced at the end of the prototype experience; and tried *Kairos* which can be implemented in the future, and made it works in my computer. Background research and concept ideation are discussed and held together with my teammates during the whole project.

Reflection

I am an exchange student studying in the *Jiangnan University*, China at the department of Interactive design. Having this exchanging study experience was challenging but also proven to be very beneficial for me. Here I learned how to combine design thinking with technical means, to solve problems in a specific context, which can also be part of data-driven design. The technology and data part was something I never touched before, but I found it quite interesting after learning, which I believe I'll have further development in the future. I also have further improvement of the skills of visual design as well as doing research throughout the project. Pitching Skills were developed during several workshops, and I even learn more about how to create a design tool when talking with Penny afterwards.

Creativity & Aesthetics

My graphic design was developed rapidly with responsibilities of visual contents of the project. I produced the final posters on the prototype as well as visualization at the ending interface. And the appearance of the prototype received praise from the audience on the demo day, which gave me great confidence. I believe the skill of visual design should be kept developing throughout my design career.

User & Society

In the first stage (before the midterm), I mostly focused on how to design an interactive display that can engage people the most and learned from three aspects: the design tool, the literature, and user research.I implemented the technique of '*Customer Journey Mapping*' for ideation as a design tool , from which I analyzed the user needs and emotions throughout the experience. I found it's a useful way to have empathy with the user and I also used in later stage. I also read several papers and found some literature support-- *honeypot effect* studied by Ten Koppel et al, and learned how social effect can make people attracted to an item configuring chained displays, which later affected the subsequent

design of prototypes. And I found that doing literature research is a useful way as a support and inspiration for design. To test usability and how well people get the contents, I read some relevant books and designed the questionnaire and used observation method. With the awareness of psychology including perception, emotion and cognition when making the user research, I learned how to ask the right questions to get the information we want.

Technology & Realization

After midterm, receiving feedback that we need to use data from other groups and discussing with the team, I realized that with proper use of machine learning, we can generate rich insights about visitors. I started to learn the mechanism of machine-learning and what it can do. From some books, papers, and the lecture given by Jean-Bernard, I learned that clustering, as one method of machine learning, can absorb measurement in the past and make prediction in the future. Through the process of input layer - hidden layer - output layer, the table of value known can finally leads to table of value unknown. And when combined with big data, it can recommend a specific product as someone's favorite on the website. This inspired me to think that we can use other installations as a data-input, learn from people, and make predictions, which also leads to the idea of a centralized intelligent growing system—Ray.

In order to explore some feasible means to implement in the future, I found *Kairos API* as a useful tool for face recognition, by which I analyzed gender, age, race and mood from a photo. It returns JSON response, which can be implemented in the project supporting the user JSON profiles. And I can also use it in many ways in my future projects.

Business & Entrepreneurship

I see the demo-day as one of the opportunities to advocate *EM* to the public. Thus, I design the side posters of prototypes with conspicuous *EM* logo. Besides, I proposed to put an QR code in the visualization page and Arthur helped to realized it. It enables people to download or share the results to their friends through social platform, e.g. wechat and facebook, but it only works with their own consent. I implemented this as is a marketing strategy to expand the influence of EM through the Internet.

Conclusion

Overall, it was really a great learning and teamwork experience, I learned a lot from both project teachers and my teammates. The way they think and solve a problem may be different from what I received before, from which I also learned a lot. I overcame some incompatibility and gradually find some ways to actively communicate, even under a cross-culture background. But my programming skills still need to be improved, and I need to learn more knowledge about technology to have a better understand of data, where I plan to invest more time in my future study.

Appendix A2

Personal Reflection

Arthur Geel, 0907552

10.01.2019

Contribution

This project was team-based, although we were encouraged by our mentors to take responsibilities based on our interests, expertise areas and learning goals. My envisioned professional identity requires me becoming a better design leader — I therefore took an active role in directing fellow team members and taking critical decisions. This role surfaced in all project stages: I hosted UX Design workshops (*Crazy 8's*, *Consumer Journey Mapping*), managed individual contributions using a Trello task board and was actively involved in communicating with our mentors and client.

I was fully responsible for the technical development of the final demonstrator ("Ray"), and took a leading role in its design (both visual- and UX-wise). I explored the possibilities for technical realization, and developed the final demonstrator as a web application, using HTML, CSS and JavaScript. Throughout all deliverables, I strived to make our team's design language match EM's brand identity. To summarize, I consider my role within this project to be:

"A leading team-player with expertise in digital design and digital realization."

Reflection

This semester marks the start of my Master degree in Industrial Design. As an alumnus from this faculty, I have a clear envisioned designer identity: becoming a UX designer with skills in research, interaction design, visual design and web technologies. As such, I tried to incorporate as much of these interests in this project. The design process throughout this project was not at all what I expected. I felt we were making a decent start by focusing on establishing a rich foundation of research before we went into extensive concept ideation.

However, we were strongly advised to pivot from our original concept after the mid-term demo day. Lagging behind the schedule, the entire team stepped up their efforts to design something presentable for the final demo day. I look back on a number of very busy and hectic weeks. Nevertheless, I am content with what we have accomplished in the end. A major insight gained is the absolute need for clearer communication with the mentor on our behalf. We communicated in a way that was very conceptual though vague, resulting in a concept that was not good enough. I believe that if we had *shown* prototypes rather than *explain* them, one of the initial concepts could have been developed to completion with more fitting feedback. The team would have had more time to work on delivering museum-quality finishing, and more thorough validation.

Technology & Realization (TR) / Maths, Data & Computing (MDC)

Being fully responsible for the development of all the software of this project means I have invested a lot of time in developing both TR and MDC. A big challenge here was programming the logic that allows the system to 'learn' about users based on a number of variables — this was something I had never done before. In the end, I wrote a user-profiles.js file that handled all logic. Planning the software infrastructure alongside regular Git version control allowed me to keep the files manageable.

Due to the limitations in time I had to take a number of shortcuts in the development of the prototype. For example, we decided to use pre-rendered videos (made by Shen) to show the advanced data analytics. I integrated a lightbox plugin to display the videos. Additionally, I generalized some of the logic in the 'prediction' program which should have been done using machine learning instead. These measures suffice for a proof-of-concept prototype, but should be re-worked for a full product. Nevertheless, this prototype is in terms of software complexity beyond anything I have realized in the past, and I am very content with its efficient development process.

Creativity & Aesthetics (CA)

The rapid development required for the prototype meant my priority was to finish the prototype in time. I based my choices in aesthetics on Eindhoven Museum's brand identity: I used the powerful EM orange colour for prominent elements in the interface. A deviation from the brand identity is the dark background: my reasoning for this is to create a more contrast and feeling of mystery. In terms of aesthetic interaction I went for intuitive simplicity. I implemented feedforward- and feedback based on Wensveen's Frogger Framework¹ in the interface: small, animated elements such as the right chevron indicate that the system is waiting on user input.

However, as a result of the simplicity, the user experience of the interface was received as too sterile. I attribute this to a lack of time to refine the interface: with more time, we would have been able to design a richer interaction that fully engaged the visitors beyond their cognitive abilities. One idea that I discussed with the team was allowing users to manipulate the device with their emotions: introducing a small mechanic that introduces the element of surprise. A key insight from this project is to go beyond functional aesthetics: we could have narrowed down the scope of the project to allow for more time for refinements.

¹ Wensveen, S. A., Djajadiningrat, J. P., & Overbeeke, C. J. (2004, August). Interaction frogger: a design framework to couple action and function through feedback and feedforward. In *Proceedings of the 5th conference on Designing interactive systems: processes, practices, methods, and techniques* (pp. 177-184). ACM.

Appendix A3

Personal Reflection

Yiwen Shen, 1239664

09.01.2019

Contribution

First of all, I would like to reflect on my contribution to the project. I performed different roles and tasks on different responsibilities, within the project. In the early stages of this project, my responsibilities involved; exploration of background research, conducting user studies and concept ideation. Through the entire project, I also performed actively in designing and building prototypes together with Krishnaa and creating visual contents (the animations) for the final installations.

Reflection

Through the entire project, I believe that my academic skills including research skills, presentation skills and teamwork skills have developed. Especially in the area of my research skills, this will certainly help me in the future to choose appropriate methods and technologies for the M1.2 research project. As for my presentation skills, I find it difficult to develop my presentation skills, especially when I have to make a pitch. So, in order to improve this part, I tried to perform actively when preparing and giving presentations or pitches to my fellow students. Special thanks to Penny Qiong for her insightful guidances on preparing a pitch and for her support after the midterm.

I enjoyed working in this project a lot and we have learned a lot from each other. I clearly recognize the characteristics of my role and I learned to develop my overall competency in the team. What I learned most, when working in a group, is to have a positive working spirit. This is crucial in fulfilling and achieving goals faster and better in a team project. We had received some negative feedback at the midterm demo and therefore needed to change almost our entire concept within a limited timeframe. It was very stressful for us to continue the project. However, we quickly adopted to the situation and worked intensively to evaluate our concept. As a result, we achieved to complete the installation with certain quality.

Here I would reflect on the expertise areas that were developed during the project.

User & Sociality

In the earlier stage of the project, I invested time on developing my analysis skills on user study and background research. Several museum visits and interviews were conducted together with my teammates. After that we also spent time on conducting insights and user analysis for the ideations of the concept. Customer journey mapping was used in this project during the ideation phase. This technique was proven to be an effective tool when addressing user's needs and emotions in different stages of experience. Extra attention was given to the implementation of gamification in our concept as it was presented on the midterm Demo day. I did some theoretical research and generated a guideline for further design development.

Technology & Realization

I also invested time on learning several 3D programs such as Solidworks and Rhino. I have some experience with 3D modelling programs like Maya and 3DS MAX, however, these programs are made for producing architectural visualization or animation, not for fabrications. The workflows are different than I expected, especially when working in Solidworks, this program has a procedural

workflow that requires a modeller well-consider the exact dimensions and scale. As a result, I am able to now create high quality models which meet the requirements of the fabrication standards.

Creativity & Aesthetics

Also I developed my Graphics skills during the project. I produced all the video animations for the final installation. I learned some advanced level of video compositing techniques that allow me to quickly adjust the design elements and structures of the animation. I followed the stylesheet that Arthur made tightly in order to produce animations which were all in line with the brand identity of EM.

Conclusion

This entire project help me to formalize sequences of performing a design & research project. It also raised my awareness of using appropriate methods and planning that can contribute to a research project. I have learned a lot from this project, not only in terms of the academic skills of being a master student, but I also gained practical experience to quickly apply these skills to future research projects.

Appendix A4

Personal Reflection

Krishnaa Seck, 0942613

09.01.2019

Contribution

My contribution was very present in all the physical prototypes and mockups we delivered. I sketched most of our sketches. Furthermore I made the 3d-models that were used to illustrate our three initial concepts. Also together with Yiwen we made the physical prototypes for the midterm and Demoday. Moreover did I do all the hardware and electronics for the midterm Demoday, which were shortly set a set of buttons lighting up indicating a question to be true or false. Eventually I would say that our research, design approach & development and design concept implementation were a team effort. Lastly I created a lot of the presentation material and I presented a lot of our work to our client and squad, which I will briefly reflect on below.

Reflection

For my M1.1 I choose to do a project for the Eindhoven Museum. Since, I was quite passionate about the opportunity to somehow create a link between something traditional (the museum) and something novel (data gathering). Looking back at my growth overall there are a few bottlenecks that I would like to point out. First of all I believe our team dynamics were quite nice. We were able to somehow divide our responsibilities quite evenly. However I did have the feeling that sometimes we got stuck in discussions too much leading to too little making. This resulted in some communication issues with our squad or client sometimes since we did not always show what we meant to avoid confusion.

Looking back at our organisation and planning, I would like to state that by working very structured we evaded a lot of work in the end. This is a big point of development for me, since I find it hard to work very structured. However by keeping the same file template and design style, that Arthur created for us, we were quite consistent in our style and presentation.

Eventually considering we had to turn our concept in a different direction towards the end we were confronted with a limited time frame. This forced us to work very hard in the last few weeks and I am very proud of my group for being able to present a nice design concept and implementation at the final Demoday. Even though we had some ups and downs during this project I was really satisfied with all the other EM museum groups as well and how we were able to tie all the different EM concepts together to create one big exhibition experience in the end.

Creativity & Aesthetics

Looking back at what I learned in relation to my competency areas I would say that C&A is one that I most developed this semester. As mentioned in the contribution, I tried to use my creative skills to communicate our concepts to the client. Most of my development was displayed in; making cardboard models and sketches to visualize our thoughts to the client. Furthermore did I create the physicality of

both the midterm and the final prototype, together with my teammate Yiwen Shen. So simply put I got to develop my prototyping skills a bit further. Especially since we had to take into account that it had to be implementable for the museum, we were really challenged to think about how we realized our concept.

However my main learning point was met when we had to redefine our problem statement and design brief. From this experience I regained better insight in what it means to be creative with data. Moreover how to be creative in such a way that this data can give a surprising effect to the user, therefore create a valuable experience. Also I learned a lot from the guest lecture that was given on creativity by Jean-Bernard, because it gave me a very fresh and interesting perspective on creativity that I was not familiar with.

Technology & Realization

Looking back at my development in the area of T&R, I observed a bigger growth than expected (considering I had put my focus on the area of B&E and C&A). Firstly when working on our first prototype I got to prepare all the electronics, which had to suffice certain demands. This allowed me to get some new experiences with hardware I did not have before (e.g. the circuit had to be wireless and without an Arduino, something I had never not done before).

Furthermore when working on the second prototype I got to learn a lot from Arthur who explained me different elements of data behavior and how to work with data in the context of machine learning. But mostly when building a prototype that existed more from software than hardware, I was challenged to take on a different attitude than I usually have. I saw how the focus shifted from just creating a nice interaction to creating value for the user from his/her data. Meaning that the choices we made for the user interaction were very different than with an installation were the focus would been on the physicality in terms of feedback.

Business & Entrepreneurship

Looking back at my development in B&E, I cannot say I have developed it as much as I wanted. However since I will be doing the DLE track my next project will be more focused on B&E. Also I did get the opportunity to work with a real life client, which contributed to my expertise. Furthermore I tried to take a leading role in presenting to our client and different stakeholders as to get more experience in pitching and selling my ideas.

In the future I would like to use the knowledge I have gained to create design concepts that do not just take physical but also digital interactions in account. Moreover do I want to look into how to design with data to create intelligent interactions, to increase user experience.

Appendix B1

Early Background Research

Yiwen Shen, Arthur Geel, Krishnaa Seck

11.09.2018

Legacy project report: Back to the Future

[Research report](#) by TU/e students with the same project. End result is a token-based system that offers personalized experiences to visitors, whilst also collects data that can be used by the museum staff to predict interesting future expositions.

Their design had four components: [token] → [scanners] → [database] → [data visualisation]

- The group empathized by interviewing stakeholders and visiting/observing museums.
- The way how they collected personal data was not intrusive, but the types of data were limited and they did not write about what they can do with the collected data. There is opportunity for improvement here.
- The deliverable was affordable and easy to repair/maintain. However, this came at the cost of aesthetics: there was no coherent design language. Another opportunity for us.
- In the discussion the members stated that the system was unintuitive for some users, as a lack of sufficient feedforward/feedback. We should avoid this by conducting regular user evaluation sessions and by performing expert audits.

EM 2017 Annual Report

EM put out [annual reports](#) with occurrences, finances and more. This was useful to us to empathize with the stakeholders.

Vision: ‘*Working on the future is impossible without learning from the past.*’

Mission: ‘*Share the history of Eindhoven, educate, create a better informed future.*’

Ambition: ‘*Operate as a platform to connect organisations, initiatives and individuals in culture history- and heritage.*’

- EM has a healthy financial situation in the last year, no debt.
- EM wants to increase the amount of audiences.
 - (In)experienced ‘culture participants’
 - Families with children

- Temporary residents (expats, international students)
- 'Culture tourists'
- EM want to increase financial income.
- EM believes that we cannot work on the future without knowledge from the past.
- EM work as a platform to connect different organisations, initiatives and individuals, by bringing people together in the area of cultural history.
- EM board concerns itself with the future of the museum, risk management and governance.

Appendix B2

Literature Review

All members of M1.1

12.09.2018

Keywords

Museum: Museum Design; Exhibition; Interactive Display; Predictive Exhibition; Adaptive Exhibition; Interactive Installation.

Data: Big Data Analysis; Data-Enabled; Data Clustering; Data Gathering from HCI; Data Visualization; Unobtrusive Data Gathering; Machine Learning; Crowdsourcing.

Arthur's Notes (5 papers)

Paper 1: Home, M. W. Open innovation: Open movements and the role of a museum in the 21st century. Retrieved from <https://mw17.mwconf.org/>

Canada Science and Technology Museums Corporation (CSTMC) are innovating the scene of museums: creating a more engaging user experience with a focus on digital technologies, machine learning and cultural analytics. They believe in **open participation:** “allowing users' voices to both inform and invigorate projects and programs”. Supporting this notion, CSTMC has an open, [online platform](#) for their artifacts.

In their development process, they identified a number of persona's: researchers, locals, teachers, exhibition planners and authors. Staff members were initially hesitant, though when they got to know the portal better, they were a lot more enthusiastic about contributing to the portal. **Conclusion:** positive results, CSTMC are convinced that participatory heritage will be disruptive to the market.

Paper 2: Stuedahl, D., & Lowe, S. (2014). Social Media as Resource for Involving Young People in Museum Innovation: A Cultural Studies Approach to Co-Design. *International Journal of Sociotechnology and Knowledge Development (IJSKD)*, 6(3), 60-80. Retrieved from <https://www.igi-global.com/>

“Distributed museum paradigm”. Strategy of museums to utilize social media to establish relationships with people: especially Instagram. Traditional museums' curatorial, educational and exhibition practice vs. young people's participatory culture.

“The distributed museum paradigm is related to the participatory museum (Simon 2010) introducing digital technology as a new opportunity for interaction with cultural heritage content. This extends the museum space and greatly shifts the implications for curatorial structuring in redefining the museum visitor experience”

Paper 3: Ray, J. (2017). Digital curation in museums. *Library Hi Tech*, 35(1), 32-39. Retrieved from <https://www.researchgate.net/publication/>

Author proposes a framework for digital curation of museums: *LIS DigCCurr*. First mention of digital curation is 2001, though it would not receive mainstream attention until 2008-2010. According to the John Hopkins University, digital curation is a process that ensures lasting preservation of museum items.

Paper 4: Hooper-Greenhill, E. (2013). *Museums and their visitors*. Routledge. Retrieved from <https://www.taylorfrancis.com/books/9781134915859>

Paper 5: Ridge, M. (2013). From tagging to theorizing: deepening engagement with cultural heritage through crowdsourcing. *Curator: The Museum Journal*, 56(4), 435-450. Retrieved from <https://onlinelibrary.wiley.com/doi/abs/10.1111/cura.12046>

Liang's Notes (5 papers)

Paper 1: Akpan, I., Marshall, P., Bird, J., & Harrison, D. (2013, April). Exploring the effects of space and place on engagement with an interactive installation. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 2213-2222). ACM.

Conclusion: The paper concludes that a stimulative social context does need a pretty space and can stimulate interaction. On the other hand a poor social context will not stimulate interaction even if the space is good.

Method: The concept introduced in the the paper simulates shadows that people cast on a white screen. The footage of the shadow in then given back to the user on the screen in real-time.

Note:

1. We can learn from the method it uses in the process of user research, the way it builds up the test can be useful in the process of data collecting.
2. We should consider the view ‘A conducive social context could overcome a poor physical space and encourage interaction’ when setting up our installation.

Paper 2: Parra, G., Klerkx, J., & Duval, E. (2014, June). Understanding engagement with interactive public displays: An awareness campaign in the wild. In *Proceedings of The International Symposium on Pervasive Displays* (p. 180). ACM.

Conclusion: Even if though displays capture attention and stimulate social interaction. Most people do not take the time to interact with them, simply because the threshold is too high and motivation is too low.

Method: Different screens in certain locations reacting at different times.

Note:

1. We can learn from the process of a passenger from noticing and giving attention to these screens.
2. We can control the factors: the position and the orientation of the display, the content type, and the content format and dynamics in our installation. These factors can also be used to divide different crowds (users).
3. There are some methods we can use for collecting the behavior of users that whether he or she is attracted by the installation.

Paper 3: Bogers, S., Kollenburg, J. V., Rutjes, H., Deckers, E., Frens, J., & Hummels, C. (2018, April). A Showcase of Data-enabled Design Explorations. In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems* (p. D302). ACM.

Method: In the paper it studies how to approach data enabled design and its values. The approach is described in its early stages and is explained through the design exploration of a connected baby bottle. The paper describes the combination of sensor data as input to establish behavior patterns with qualitative methods as a data input to create a throughout understanding of experience.

Product: The final product exists from several prototypes both physical and digital ones. The prototypes embody different design concepts and allow people to explore these in the context of healthcare and parent-tracking.

Note:

1. The article explored, in a designerly manner, what and how parent-tracked baby data can be of value in the interaction between parents and HCPs.
2. They built toolkit consisted of a collection of physical data loggers and a parent dashboard displayed on a touchscreen.
3. The method of data collecting is useful, as well as the data visualization part.
4. The process of collecting data for the decision of designing is also concerned of co-operative designing.

Paper 4: Bogers, S., Frens, J., van Kollenburg, J., Deckers, E., & Hummels, C. (2016, June). Connected Baby Bottle: A design case study towards a framework for data-enabled design. In Proceedings of the 2016 ACM Conference on Designing Interactive Systems (pp. 301-311). ACM.

Conclusion:

1. Data that is being used exists mostly from statistics that are quantitative.
2. Different observing perspectives are introduced merging sensory data with qualitative data, which can provide additional value to certain contexts.

Paper 5: Chung, C. F., Dew, K., Cole, A., Zia, J., Fogarty, J., Kientz, J. A., & Munson, S. A. (2016, February). Boundary negotiating artifacts in personal informatics: patient-provider collaboration with patient-generated data. In Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing (pp. 770-786). ACM.

The paper provides a questionnaire flow that states how the survey creates understanding about users current data tracking and sharing in the context of healthcare applications.

The method of survey flow is scientific and give a new perspective of user tracking. Data Visualization is a efficient way by which we can make better decision for designing

Shen's Notes (4 papers)

Paper 1: Gavin Sim (2018). Crowdsourcing ideas for augmented reality museum experiences with children. Retrieved from https://link.springer.com/chapter/10.1007/978-3-319-58550-5_4

Nowadays, museum offers opportunities for kids to experience, learn and explore the cultural objects. Interactive museum is creating engaging and enjoyable experience for their targets. In this project. Children, as a visitor, they could not only create their own storyboard based on the fabulous experience , developing several lo-fi interfaces with the help the AR or VR technologies. The concept of using AR or VR could provides an immersive experiences for them. And people seems to enjoy having such experience with their friends and parents, this means this technology could bridge the gap between people who have different cultural background and age.

Paper 2: Stella Sylaious (2009). Exploring the relationship between presence and enjoyment in a virtual museum. Retrieved from
<https://www.sciencedirect.com/science/article/pii/S1071581909001761>

The most relevant conclusion of this paper explores the perceived experience of using a system, which could able to help museum curator to build, personalised virtual 3d museum, by having such immersive experience that allows people to enjoy more and increase the level of engagements.

The system this museum had developed inspired us to produce maybe similar strategies that allows the visitors to create their own experience and story. Collecting data and making sense of the data that bring the insights to the museum in order to help them for making decisions in the future.

Paper 3: Cun, Li. (2018). Interactive Gallery: Enhance Social Interaction for Elders by Story Sharing. Retrieved from https://link.springer.com/chapter/10.1007/978-3-319-75789-6_8

This paper designed a static gallery style of installation that allows the elderly people to experience a virtual museum. The main attention was given on enhancing the social interactions amongst people and help them feeling engaged to the outside of the world.

Conclusions:

The static gallery might offer less engaging experience that attract people from other age group. So for the longer term in the future. It would be more beneficial if they could rich the forms of the interactions.

The museum is place where people could share their ideas and challenging people brief, which means that old only to attract the older people, but also other age group is highly recommended.

Paper 4: Luigina Ciolfi. (2018). Designing Interactive Museum Exhibits!: Enhancing visitor curiosity through augmented artefacts Retrieved from
<http://citeseervx.ist.psu.edu/viewdoc/download?doi=10.1.1.453.3071&rep=rep1&type=pdf>

This project focused on creating a VR experience for an interactive museum exhibits. They aim to enhance the visitor's experience by using emerged artefacts and bridge physical world and digital experience into one experience.

Method: Diary were used in this project in order to collect daily data. They also used onsite observation in order to collect contextual data that for drawing the qualitative conclusions. The methods that were used in this project are highly recommended for our project since we are also following an elective that we need to implement such methodologies to achieve drawing insightful conclusions or knowledge.

Technology: The installation used RFID system in this project. This allows them to create an unique profile id that is able to track people's data such as movements, the time they spent on certain artworks or project that were perceived interested for them. In the future, we envision that creating a token system that allows us to collect data and track the user information which could contribute the project.

Krishnaa's Notes (5 papers)

Paper 1: Petrelli, D., & O'Brien, S. (2018, April). Phone vs. Tangible in museums: A comparative study. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (p. 112). ACM.

The authors research points out that the participants preferred the most tangible interface (making use of smart object to interact with installations) over smartphone use or interactive cards. The research done involved introducing the user to an app adding a gamification element along with musical features. Even though all interfaces provided the same experience tangibility was preferred.

However it is said that mobile technology can be very easily used as a tool to provide gamification, augmentation and co-creation within musea. Considering it can be carried anywhere and it is highly interactive. Bringing your own device is becoming more and more common amongst different musea to add to user-experience. However extra measures need to be done to support this, such as wifi connection, headphones, social media, exhibition space (when working with augmentation).

Elderly seem to prefer the traditional museum setting, providing audio feedback and text. Whereas kids seem to enjoy gamification a lot and adults make use of their phone and different applications on it. In the paper the importance of creating a connection between what is interacted with and the actual

object is pressed. One very important complications of apps, even though they can be easily personalized and used individually, is that the threshold for downloading them is too high.

Paper 2: Antón, C., Camarero, C., & Garrido, M. J. (2018). Exploring the experience value of museum visitors as a co-creation process. *Current Issues in Tourism*, 21(12), 1406-1425.

The main goal of future musea should be to create memorable experiences for visitors by means of co-creation. Not just during but also before and after the visit. Musea nowadays are not just about educating people anymore visitors want to be entertained as well: Enjoying yourself against Learning. Co-creation before the visit creates knowledge and planning and is usually done through web research. Co-creation during the visit is done by the participants interpersonal interactions and creates Experience Value (which can be enhanced by co-creation prior to the visit). This interactions can be HCI or Human to Human interactions. Then co-creation after the visit is done by intensification and content generation, e.g. posting on social media.

Paper 3: Bourne, L. Fostering Personal Connections: Responsive Environments and Interactive Technology in Museum Settings.

Interactions with different artifacts and social interactions (for example by means of an interactive interface) in musea creates a personal connection. Personal contribution enhances the meaning making and personal connection to the museum content, thereby enhancing user experience. Engaging people is key to provoke these interactions; Mostly hands-on interfaces and Novel devices (such as HCI interfaces) can provoke these interactions.

It is a struggle to provide engaging technology such as augmented reality and virtual reality, while still keeping the visitor focused on the object of the collection. It is pressed that people need social interaction. This can be done by doing the following:

- Using gamification as a tool to engage
- Using products that need some type of teamwork and creativity
- Allowing people to find different products

It is stated that when using the elements above social connections between peoples can be stimulated. Personal contributions are used to; Gather data for the museum and enhance the user-experience.

Paper 4: Wiid, R., & Mora-Avila, P. (2018). Arts marketing framework: The arts organisation as a hub for participation. *Journal of Public Affairs*, 18(2), e1657.

This paper introduces the arts marketing framework; it is a framework for musea based on co-creation, which is believed to be the future of the musea market. The paper dives into a certain art market framework that allows a museum to estimate its funding and partners. Moreover the framework is focussed on using social media and teamwork to create user value. The framework provides use with a relation between the cultural organisation and its government fundings. It proposes that by making use of co-creation through social media, social value is created by different audiences. This social value will increase the museums target audience, by means of humans self-construal (the need to follow social trends and to belong).

Paper 5: Vermeeren, A., Calvi, L., & Sabiescu, A. (Eds.). (2018). *Museum Experience Design: Crowds, Ecosystems and Novel Technologies*. Springer.

The musea are moving their perspectives from being collection centered to becoming more community centered.

Experiential engagement and interactive interfaces are replacing the traditional one-way information. Creative input, appealing to multiple senses, promotion of collaboration and sharing of experiences are replacing the traditional museum interactions. Also the focus is shifting from the individual to the crowd. Even though the visitors journey is becoming more customized, involving platforms like social media and communication interfaces are becoming more popular. Different areas for future museum development are mentioned:

- The first area discusses user engagement, which could be done through tangible interfaces
- The second pinpoints crowdsourcing as a tool to engage, e.g. making use of social media
- Thirdly different novel technologies offer new possibilities: e.g. think of VR and AR
- Fourthly the paper explains how museums are growing into ecosystems

Appendix C1

Museum Interviews

All members of M1.1

14.09.2018

Interview guidelines:

- Ask about the visitors of the musea: Who are they? How many are there? How are they attracted?
- Discuss the vision of the musea: What is their long term vision and how is it influenced? What is their short term vision?
- Ask about Data Gathering: Is it already done and in which ways (digital, physical)? What is done with the data? How is the data being used?
- Talk about the varying exhibitions: How are the themes chosen? How to decide on future themes?
- Ask about the staff: What are the roles of the guides? Which are the different staff tasks? How much of the staff is automated/ digitized.

Interview I: Philips Museum

We visited the Philips Museum in the centre of Eindhoven and interviewed two staff members. One was museum curator Sergio Derkx and the other was a guide. Underneath these the results of these interviews are displayed. Furthermore did we do observations of the different user interfaces and displays within the museum itself. These findings were captured in images and film.

Visitor demographics

The Philips Museum aims to serve all people in showcasing important elements of the Philips history. While they aim to serve all user groups, their actual visitors mainly consist of the elderly (by far the biggest group), schools, internationals and even business parties. Furthermore most of the people that visit the museum have worked or are still working for Philips. The host confirmed that the day and time-of-day were important for the audience. The fact that the museum has a prime location (city center) means it attracts people who might be unaware the museum exists: its prominent placement catches eyes. A figure the host mentioned is a maximum amount of 200 daily visitors, averaging 60,000 visitors annually. [Philips Museum report 78.655 visitors in 2017](#).

Staff demographics

As the Philips museum wishes to provide their visitors with enthusiastic guides, most of the guides are volunteers. They are trained to provide information based on the types of visitors and refer people to more information should they be interested in doing so. Also they use tablets to support their story-telling. When asking the host and curator more about why there were still guides necessary, he reminded us of the fact that people naturally enjoy social contact and a technology could never provide this. Furthermore do they have some desk secretaries to welcome visitors and a curator of the museum, which we have also interviewed.

Engaging the visitors

In order to make the museum more attractive for the different visitor groups, a number of strategies are employed. Over the past two years, the museum have invested in new technologies: there is a special iPad tour available for the ‘digital generation’: younger kids. Additionally, a number of Augmented Reality (AR) hotspots are located throughout the museum. For bigger school visits, the museum asks kids to produce a documentary on a certain museum item: they need to interview, film and edit footage to complete this task. Through this element of play, children can relate to the item better. For elderly people the regular museum experience is targeted. Meaning the collection is shown with additional information next to the items by means of text or audio. Furthermore by providing a museum experience where both the traditional user experience and a more modern user experience is provided a collaborative museum experience is created, making the museum interesting for groups of people with different interests (e.g. families).

The museum curator mentioned the importance of balancing between showing history and engaging people. On the one hand, having ‘live’ pieces is of utmost importance. On the other hand, museums in this day and age need interactive (engaging) elements. The Philips museum has a number of interactive installations: movies, VR setups, Kinect-based installations. Next to supporting this balance mentioned above these transition from products to installations also supports the timeline used to show Philips development as a company. Furthermore as the guide mentioned the goal of the museum is to show the timeline of Philips and how the company created certain products and trends.

For company visits, the museum often employs person-to-person interactions through multiple guides. This is always received well: reviews by visitors show significantly higher scores when compared to non-personal interactions. Furthermore do these personal guide offer the opportunity to talk about their own experience, as an addition to the collection.

Data Gathering

Currently, the museum has a number of ways in which data is gathered. They employ questionnaires at the front desk: one physical notebook and a digital tablet. The physical option was a lot more popular. Additionally, media are being monitored to spot trends in what people would find interesting.

The curator mentioned a set-up they used to have, but was discontinued: the museum used to have a place where visitors could record stories for others to enjoy (= crowdsourcing). However, this was continued because the space would be used for other purposes. *It is unclear if the curator thought the crowdsourcing set-up was valuable or not.*

Museum Curation

The museum has a mostly fixed collection, though there are two exhibition spaces which are frequently changed, one being the current *space/design* exhibition. As mentioned by the curator it is very important for the museum to change over time, there can be no such thing as a “static museum”. Moreover since Philips is now moving their focus from hardware to software the museum should communicate this change. The museum has the obligation to show Philips’s history and to also be relevant for its visitors. For the museum curation, the director mentions it’s important to focus on large groups: the underlying theme needs to be relevant to them: **they should be able to relate to it and to be able to understand it**. Then should any individual be more interested the museum would offer ways to deepen his/her knowledge by means of books for example. It was also mentioned that it

was very important for the museum to radiate the image of Philips as well: Live better. Not just by showing the companies past but its present and future as well.

As mentioned before, trends in society are watched to spot themes which fit the collection (e.g. by means of social media). Also, the curator mentions operating on ‘gut feeling’ some time. However these themes are chosen quite some time before the actual collection is exhibited. As the curator mentioned, for the dynamic exposition there was a waiting list until 2020 already.

When curating the museum, the curator looks for ‘*great, comprehensive stories*’. The museum sometimes has recurring themes: a popular theme is *Eindhoven’s Liberation* of 18 September, 1945.

Appendix C2

Interview with Joep van de Ven

Yiwen Shen, Arthur Geel

18.09.2018

Introduction

On Tuesday, September 18th, we had an interview with Joep van de Ven. Here are the insights we got from him:

Museum Staff

- Listening carefully to the museum, try to be very clear with their vision, what they really want, what worked well in the past and what did not.
- Their group spent three months on museum visiting. They have visited a lot of museums, which is proved to be very helpful for them. For instance, Philips has many different types of museum as well as huge a collection of items. But it does not have enough space to show all the items.
- The curator of the museum usually knows better than the director.
- The staff know less about technology but like to be involved. Which requires that the design of the installation needs to be easy to use and fixed. In their installation, they used internal wifi connections, if the connection is broken then there will be another router automatically connected. The design of the scan box is also flexible and easy to be replaced.

For the Visitors

- The most strong point in his project was the customer journey. Each customer is involved during the entire process.
- A museum is about telling its stories to the visitors, but for visitor it is more interesting that they could create their own story and also being able to share with other people. This will increase the engagements of museum experience.
- The token could create a personal profile and will contribute as a part of the ‘big group painting’. The way how they collected data was pleasing and not intrusive. This is highly appreciated by the visitors.

On the aspect of Technology

- They used Arduino for the internal system of the interactive installation. The Raspberry Pi was used to generate data visualization.
- 3D printing token is fast to produce and recyclable.

Other tips for us

- Try to finish the prototype as fast as possible.
- It will be very helpful to arrange few more demo days before the mid-term to collect more useful insights.
- The squad staff really likes integrated projects: strive to make your technology work with other teams. (e.g. Joep had a ‘plug-and-play’ system that they could place at other people’s stands).

Appendix C3

Interview with Ward Rennen

Yiwen Shen

21.09.2018

Insights from director of EM:

The problem statements:

EM vision:

The future Museum is about to connect people; share with community; delivery a future concept, a learning place, an educational institution, a place for people to find their root.

Their main target group are the people who live in Eindhoven. There are two parts of museum, one is the museum with gallery and the other one is the prehistoric village. Engage the culture and heritage of eindhoven. For example, some of the visitor visit places where they used to do shopping there.

EM would like to explore the new model of museum from a static gallery style to an interactive museum. EM is a historical museum, so they would like to also wants to connect from past, present and future. So the challenge is to find a way allows people travel from different periods. (Shen: maybe a time machine looks like prototype?)

For example, there was an installation shows items from 80s. And these items connect stories from the past, which was interesting for visitors to recall their memories and share their stories with their children or other people. So this installation has changed the impression of a museum how people used perceived. The aim is to create walkthrough time-travel experience.

Installation requirements:

To create a special/customized experience that engages more visitors. The design of installation is able to show the collected items in context (such as its functions in the past, different functions in present and maybe some prediction about the future). At the sametime collecting visitors' data in an obtrusive way. It is not about finding data. But show how data could offer a predictive decision or suggestion.

How they use data ?

EM collects objective data, maybe like a drawing how a province outline should look like. It could be might be inspirational for where they are heading. Can also be scientific data which is already visualized for them. Data visualization needs be easy for them to use. Data from the past and present, and give them idea how they should do in the future.

One month of activity that 5 installations will be shown in the museum.

- Lucas Maassen & Paul Slot

- Chole Rutzreveld
- Mies Loogman

Their target group:

How could we measure other way how people think, you cannot ask people what they think. EM also worked with Urban development and mobility group. They have a lot of research on mobility research with Philips and DAF museum. They would like to work on mobility again.

The answer of the machine is an individual experience, they don't differentiate people whoever with different or education level. Tangible interactions, gives people the engage feeling. Co-creations: people contribute it physically and digitally.

Tips for use VR, AR, MR:

If there are a large visitor. The use of AR/VR/MR should be perceived as an 'easy to use' technology. Obey three rules if you uses these technology:

- Add value to the locations / Giving visitor a reason to use it here not at home.
- Trigger interaction with people. People experience and collaborate together.
- It has to be accessible for people, easy for them to use.

The history of Technology connect the past and the future the history of the region , the history about city, Making people feel home and root here. Bottom line is the offer nice experience, inspirations

Appendix D1

Photos: Background Research

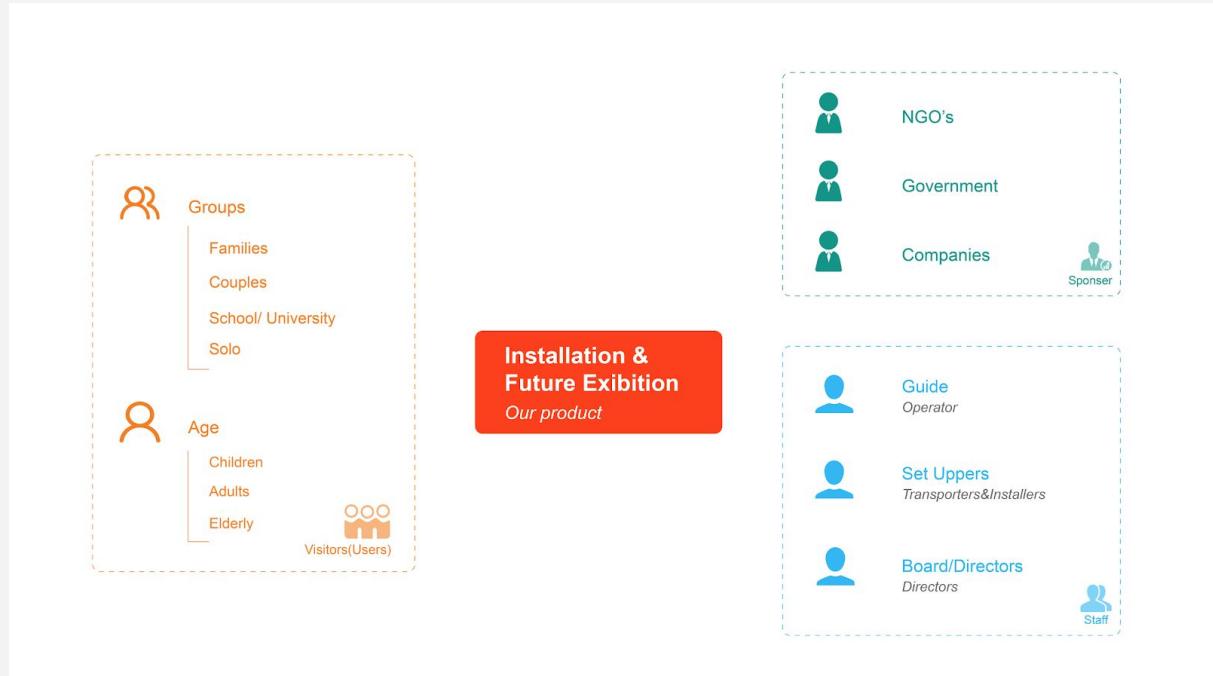
All members of M1.1



September, 2018 — Interviewing Sergio Derkx, curator of the Philips Museum in Eindhoven.



September, 2018 — Philips Museum and the Van Abbe Museum impressions

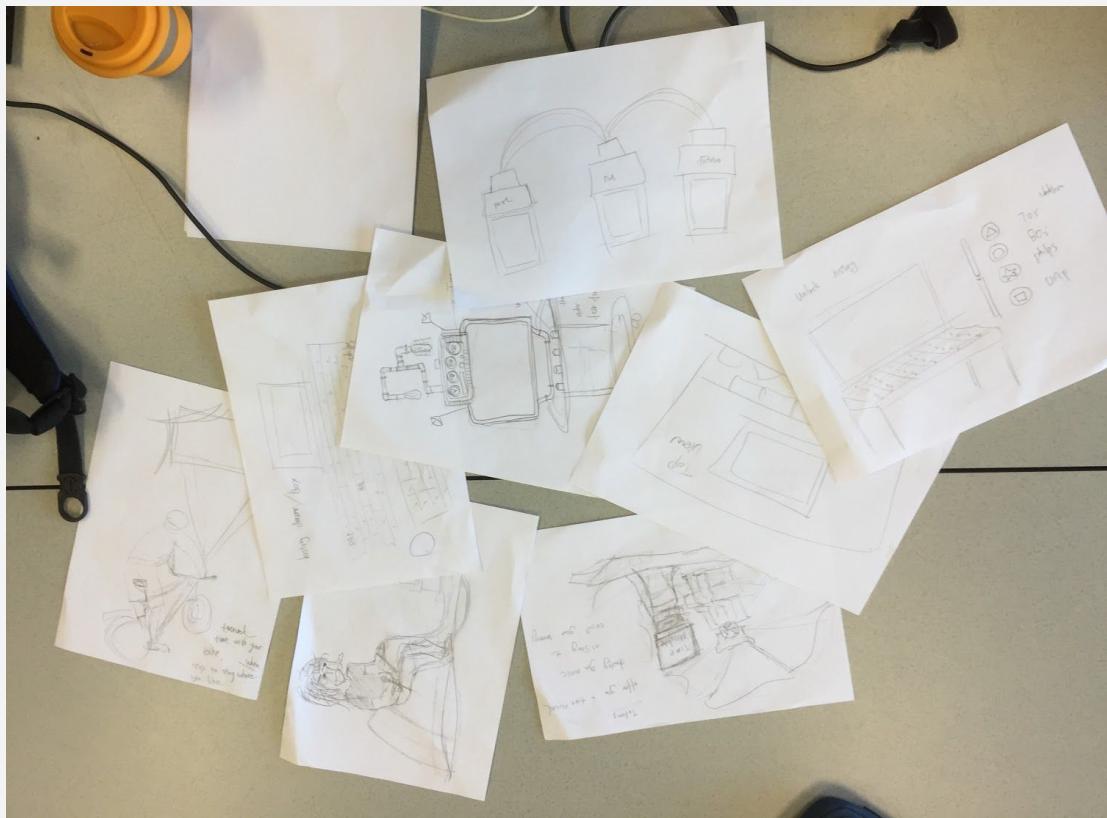


Stakeholder System Map - Exploring the different stakeholders involved in the project

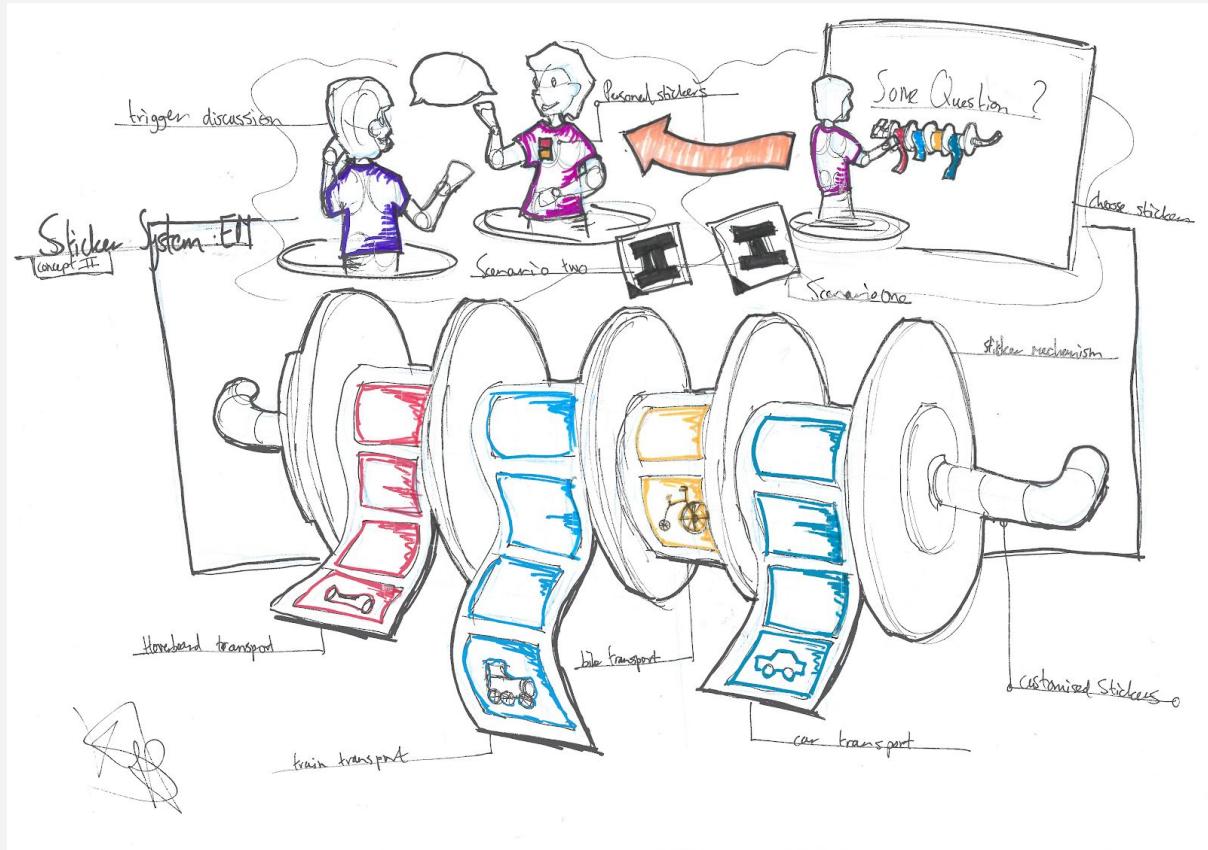
Appendix D2

Photos: Ideation

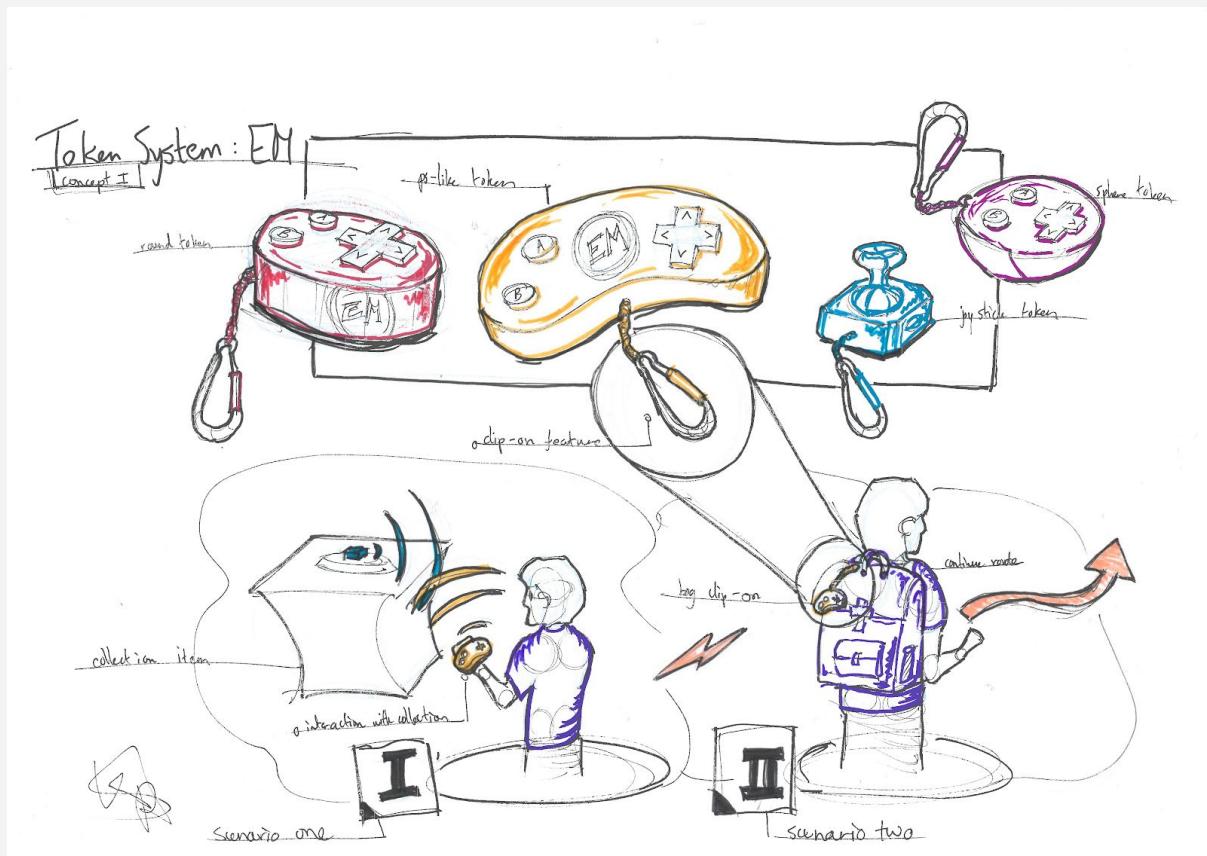
All members of M1.1



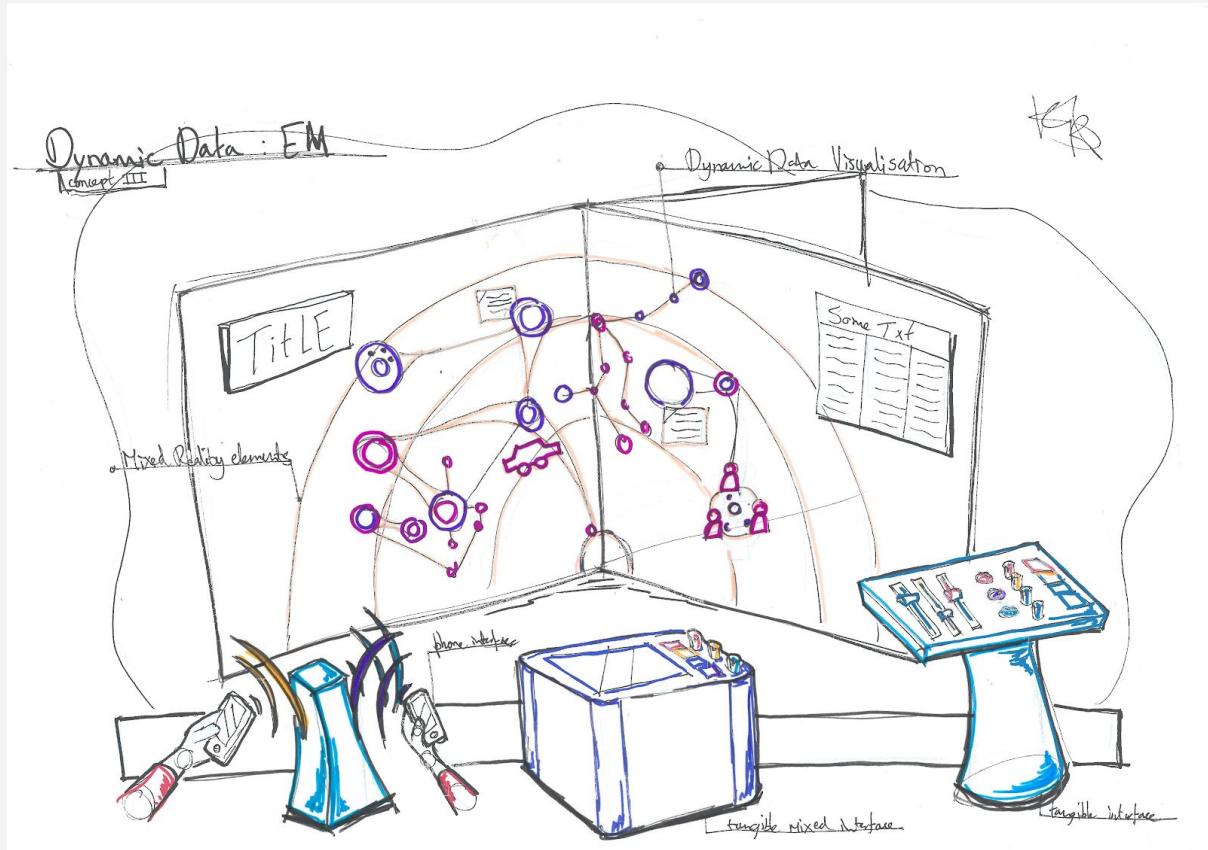
Crazy 8's - Concept Brainstorm sketches



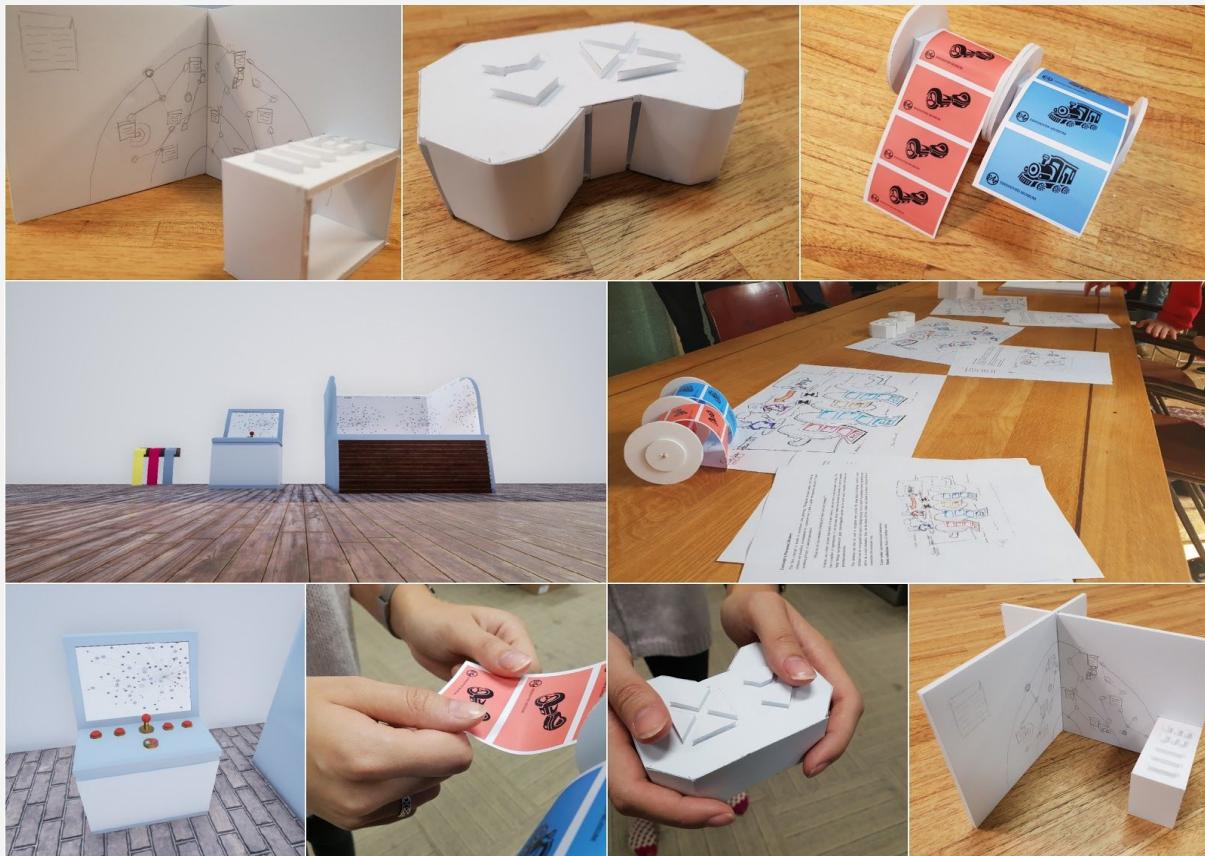
Sketches Initial Concept I - 'Personal Stickers' concept



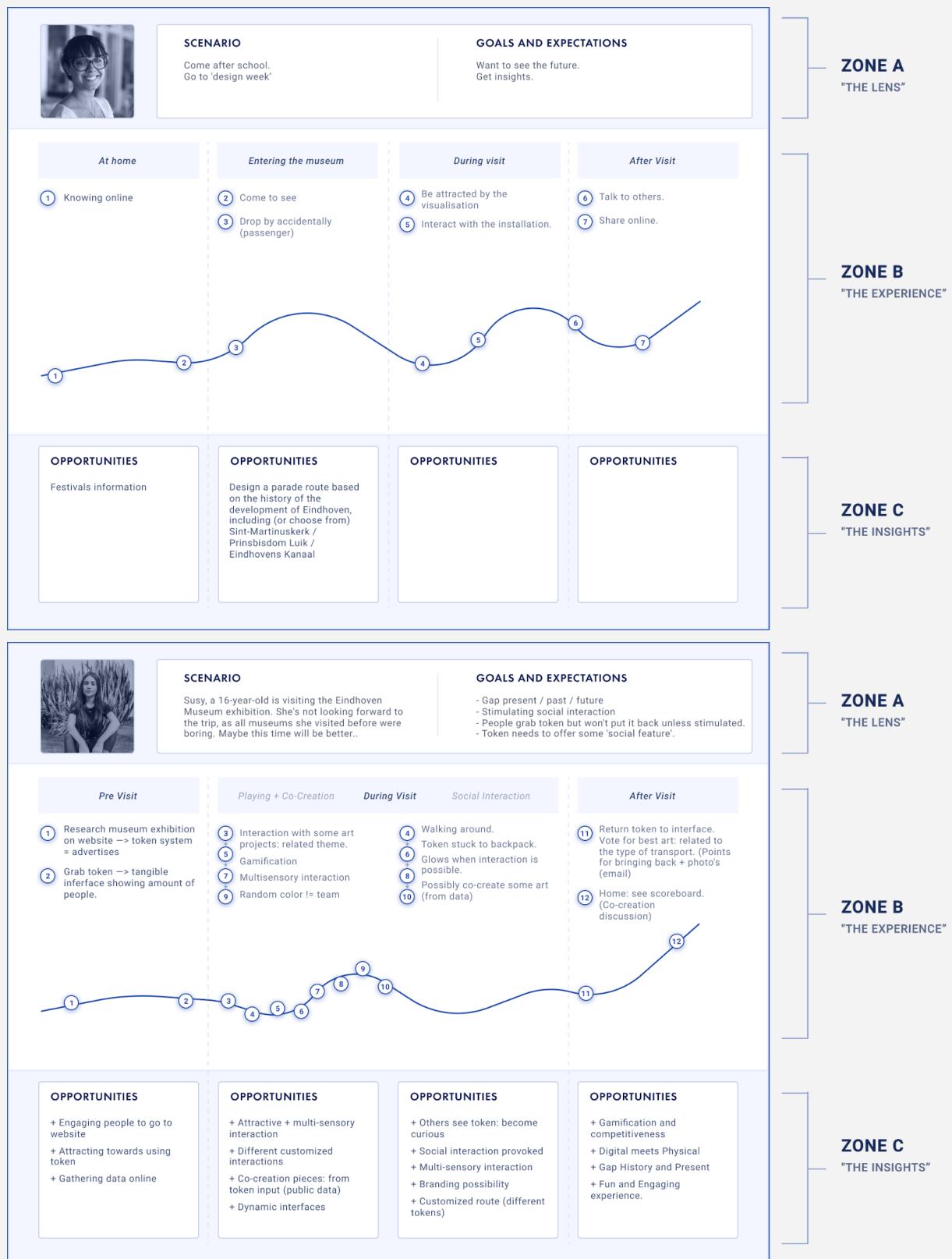
Sketches Initial Concept II - 'Individual Connection' concept

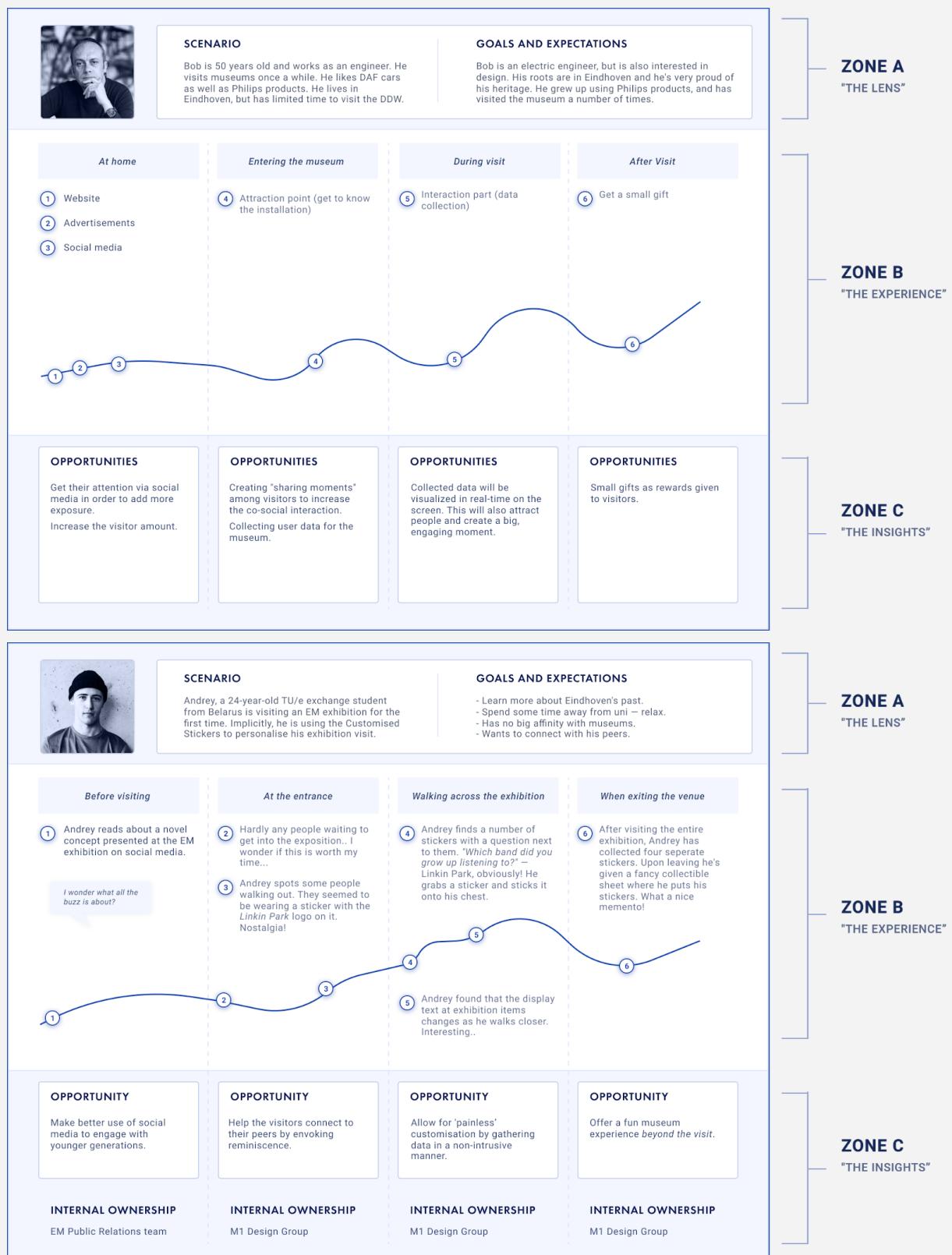


Sketches Initial Concepts III - 'Interactive Data' concept



Sketches three Initial Concepts - Prototype & 3D-Model visualization





Customer Journey Maps - Three initial concepts

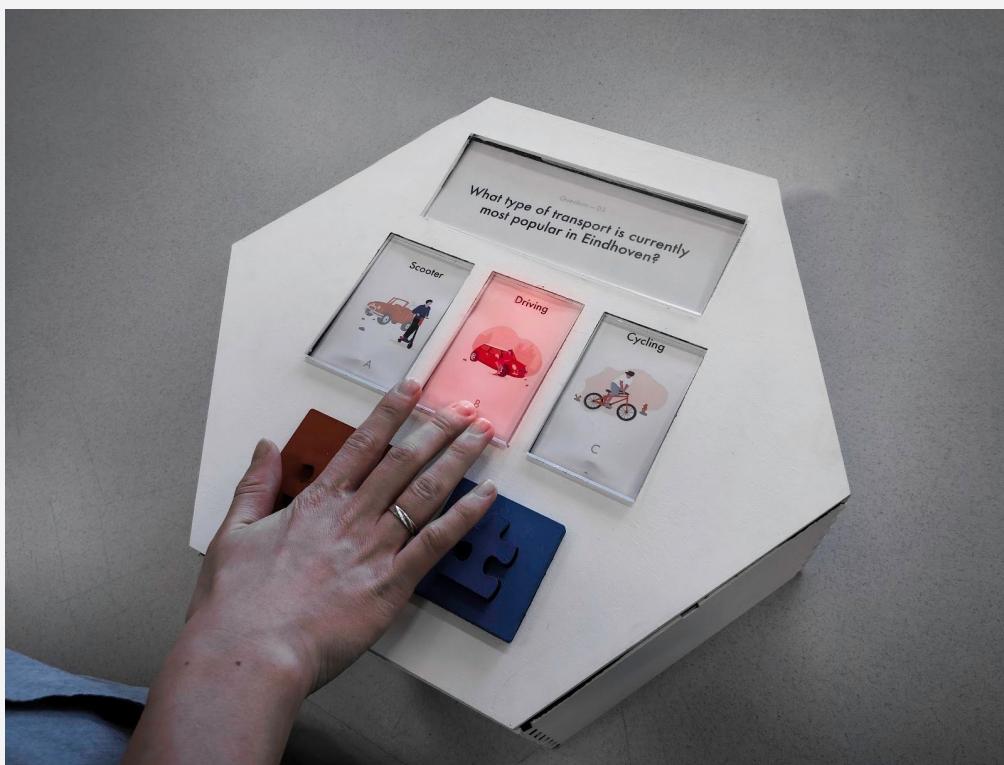
Appendix D3

Photos: Early Prototype

All members of M1.1



Early prototyping Realisation I - Various progress pictures.

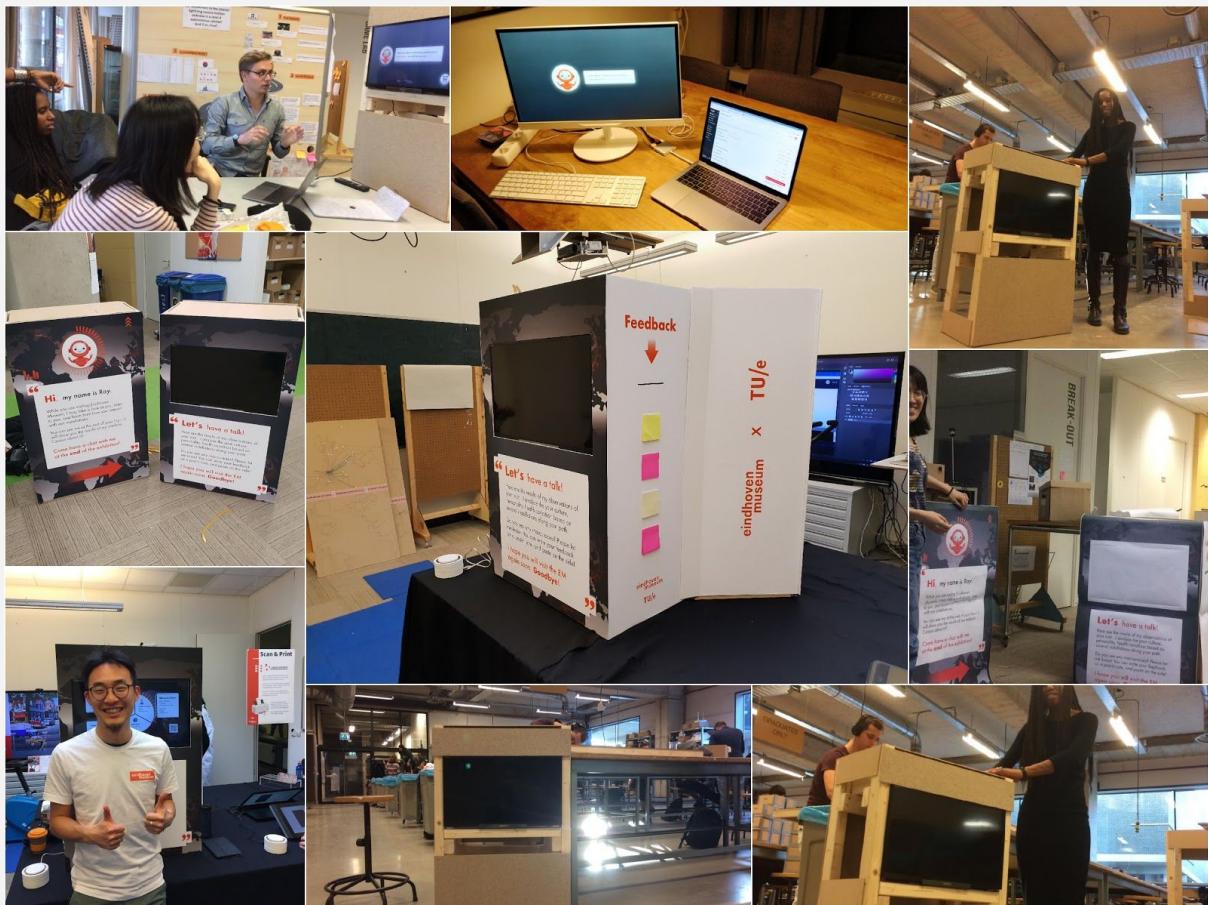


November 2018 - Realization I, Final Prototype Presentation

Appendix D4

Photos: Final Prototype

All members of M1.1



Final Concept - Prototyping Process & Final Product



M11 / Design Project / Design for Creatives
Museum In The City



SCAN FOR
EXPLANATORY FILES

Ray

Over the past decades, data has grown to be plentiful and powerful. Museums now have the opportunity to learn about their visitors by unobtrusively collecting data during exhibitions. Eindhoven Museum adopts a similar approach — and wishes to educate their visitors on the implications of these data-centered advancements.

Data generated during exhibitions is collected in a central installation entitled Ray. This installation analyses the data in real-time, generating rich insights about its visitors, including personality, culture and physique. Visitors can talk to Ray to learn what he knows about them, and how he learnt this. This project was guided by the vision:

"What can we learn about visitors whilst still surprising them?"

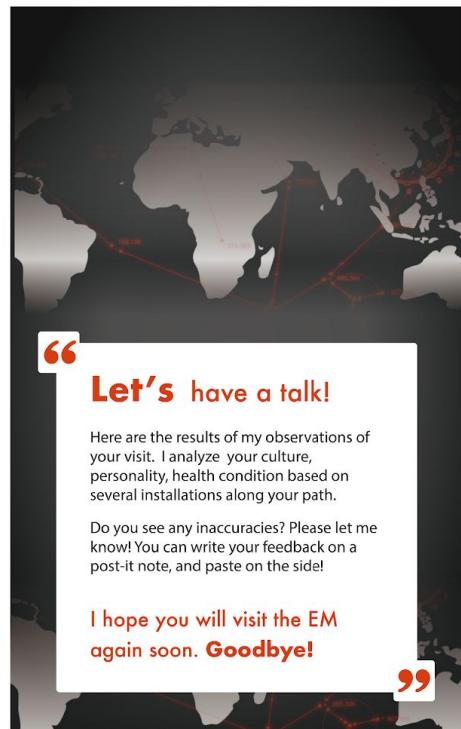
Students A.J. Geel, X. Liang, K. Seck, Y. Shen

Project Coach prof. dr. ir. J.B.O.S. Martens

Expert D. Melis (Soeps Creative Collective)

Client Eindhoven Museum

December, 2018 - Promotional A4 Poster, showcased at the final demo day.



December, 2018 - 'Final Poster' as used in Final Prototype

Appendix E

Final Prototype: Code Overview

Arthur Geel

10.01.2019

Introduction

I developed the 'Ray' demonstrator as a modern web application, using a combination of HTML, CSS and JavaScript. Throughout the development, I controlled the versions using Git and GitHub. A live version of the prototype is hosted on <https://arthurgeel.comclairvoyant/index.html>.

Below, a high-level overview of the program is given. However, all of the code is open source, and documented in crucial areas. A GitHub repository containing all files can be found at <https://github.com/AJGeel/clairvoyant>.

About the Program

The 'Ray' web application has a number of functionalities. In essence, Ray is an interactive web-page that retrieves data from a `user_id`, and shares this in an animated dialogue. The Document Object Model (DOM) is written in HTML, styling and positioning of elements are defined in CSS, and JavaScript is used for data handling, manipulation of DOM content its properties.



Simplified, visual overview of the program's inner workings. The `app.js` script is a continuously looping script, listening for user input and facilitating the interaction.

The application runs on three core scripts: `init.js`, `user-profile.js` and `app.js`. The first initializes the application, and ensures all dependencies are loaded. The second script creates a JSON variable called `userProfile` that stores all of the user data. By using the function `updateUserValues()`, all input data are transformed according to the pre-set logic. For example, a museum visitor from the continent of Asia is attributed the cultural values of *"harmony, wisdom and righteousness"*.

While these are generalisations and not necessarily true, assumptions like these allowed us to create an interactive prototype with a semi-realistic experience, even though the other installations were unable to deliver any data. `updateUserValues()` also updates the `userProfile` for the *personality* and *physicality*.

After the user profile logic has been processed, the app is ready to run. `app.js` animates the avatar and dialogue window in the screen, and starts narrating its *dialogue* using predictions made as a result of the `updateUserValues()` function. For the word-by-word letter animation, the open source library called [TypeIt](#) is

used. The program listens for user input: once the user interacts with the system, the dialogue progresses, and a callback function is sent to the TypeIt instance, starting the animation for the next line of dialogue.

Additionally, the interface has an ambient background with continuously animated particles. These were added as a response to mentor feedback, in order to introduce a futuristic and dynamic feel. For this, the open source library called [particles.js](#) is used.

About the User Profile

As stated before, the user profiles were not based on real data. Instead, their values were modeled by the design team, based on interviews and real-life characters. All user data is stored in a `userProfile.json` file, in subvariables that contain their values. An example of a user profile can be seen below.

We are confident a majority of the variables shown below can be deduced from an individual visit to a Museum In The City exhibition given the other installations are advanced enough. If other museum installations produced more data, more sound logic could be applied as well: non-labelled data could be entered in a neural network, which could generate insights like these.

| | | | | | |
|------------------|--------------|------------------------|---|-----------------------|---|
| age | 24 | cultural values | honesty, straightforwardness, thriftiness | id | 004 |
| alias | "Arthur" | education Level | ISCED_6 | isInGroup | false |
| avatar | Eurasian fox | ethnicity | caucasian | language | Dutch |
| avgEmotion | surprised | favourite Installation | bike-racing | personality | left-brained |
| continent | Europe | gender | male | personality Behaviour | words, facts, analytical, logical thinker |
| country | nl | greeting | "Hallo" | physicality | relaxed |
| countryOf Origin | nl | groupSize | 0 | physicality Behaviour | take it slow, relaxation, yoga |

A selection of variables embedded within the userProfile JSON file.

In this case, Arthur's user profile is shown.

Appendix F

Credit References

All members of M1.1

In this project, we made use of materials created by others. However, all were used whilst respecting *Fair Use* policies.

- 'Ray' avatar design: Graphic was originally created by Freepik, <https://www.freepik.com/>. Its license is 'free for commercial use with attribution'.
- The pre-rendered animations use sounds from Freesound.org:
 - Sound1: Typing sound by clownboy, <https://freesound.org/people/clownboy/>
 - Sound 2: Cinematic impact sound by dragonove89, <https://freesound.org/people/draganov89/sounds/241944/>
 - Sound 3: Info beep sound by divinuX, <https://freesound.org/people/DivinuX/>
 - Sound 4: Scifi-computer sound by Andrew Thomson, <https://freesound.org/people/Andrewthomson/>
- The main theme of the video:
 - Excitebike - Main theme ©1984-2004 Nintendo. All Rights Reserved. Music is Arranged/Composed by Akito Nakatsuka.