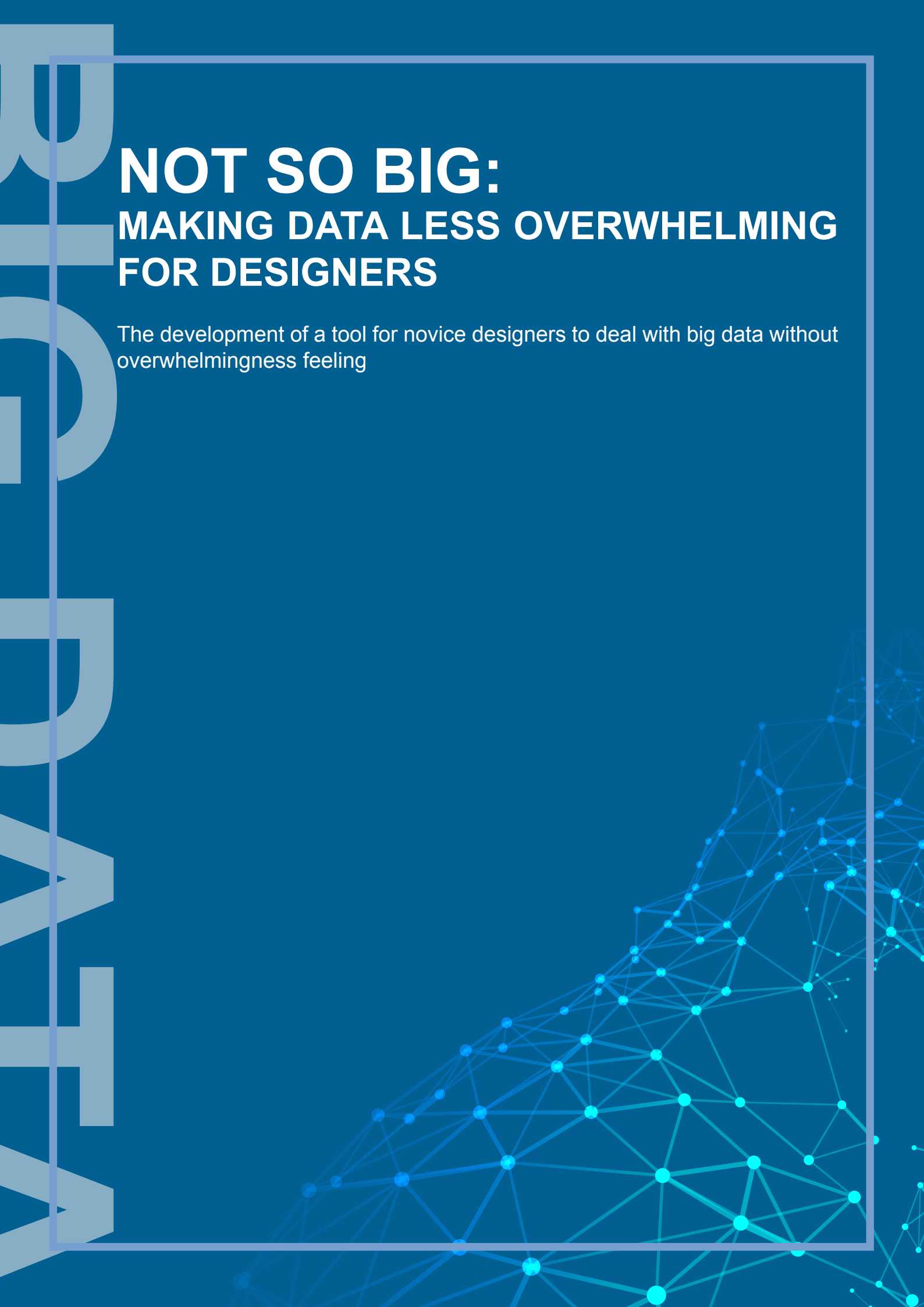


# NOT SO BIG: MAKING DATA LESS OVERWHELMING FOR DESIGNERS

The development of a tool for novice designers to deal with big data without overwhelmingness feeling



## ***Not so big: making data less overwhelming for designers***

The development of a tool for novice designers to deal with big data without overwhelmingness feeling

*November, 2020*

### ***Author***

Jiahao Lu

MSc. Strategic Product Design  
Faculty of Industrial Design Engineering  
Delft University of Technology

### ***Supervisors***

Chair: Mr. Bourgeois, J.

Mentor: Dr. Gonçalves, M.G.

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## EXECUTIVE SUMMARY

From the internet to the sensors in wearable devices, people leave their digital traces behind both online and offline. Data is getting ubiquitous and cheap. Some new fields, like business intelligence, are recognized and emerging. As a trustworthy and precise material, data is also a valuable source for designers. It provides accurate and detailed data on users' behaviors and brings some new perspectives on users' needs in the design process.

Meanwhile, big data is a new field for most designers. Most designers, especially novice designers, often lack big data related knowledge and skills. When they face big data, they usually feel clueless and anxious. It is difficult for them to deal with big data well.

This thesis's foundational objective is to support designers in applying big data in the design process effectively and confidently. It is about keeping exploring the possibilities of design and making sure that design stays at the cutting edge of the big data era. This project focused explicitly on novice designers who are inexperienced with projects involving big data.

To provide this appropriate support, the key pain point was targeted from designers' big data related project experiences, which is the feeling of being overwhelmed by big data when designers face it. In the end, I designed the data management platform to help designers relieve this feeling and have a better performance at big data involved projects.

This thesis will introduce the project process. First, I did the literature review to learn about big data, how the relationship between big data and design is, and how the relationship between big data and design process is. Afterward, Context Mapping was conducted to learn about the designers' experiences in applying big data in the design process. With the literature review and Context Mapping, I understood the project from both a theoretical and design practice perspectives. Then, I held a session to explore the problem space. The session was organized with designers to learn about their difficulties when dealing with big data.

After the session, I realized that the biggest challenge for designers is being overwhelmed by data when translating big data into insights. It results from the massive big data content and cluelessness when designers face big data. It affects designers' efficiency and confidence in the design process. To explore the solution space of the challenge, I held a co-creation session with novice designers.

In the end, Data Management Platform was proposed. The concept's goals are to relieve designers from data overwhelmingness and assist designers in dealing with big data. The Data Management Platform can provide designers an overview of the project and prevent designers from feeling lost in the big data content. By guiding designers to apply big data in an appropriate process and assisting designers with some tools to collaborate with different people, designers can confidently and effectively make full use of big data. In the end, the concept was evaluated.

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# INTRODUCTION

## 1.1 Project Background

With the development of the technology, designers use more and more sensor data in the design process to improve their design. However, designers often lack the big data related knowledge and tools. It is difficult for designers to interpret big data well.

## 1.2 Research Problem

According to the research and my own experiences, involving big data in the design process brings the promising advantages like providing strong evidences and understanding users from a massive scale. At the same time, it is a challenge for designers who lack the related skills and tools. It is important to provide designers support and help them deal with big data effectively and confidently. Hence, the research question of the project is:

*How to help designers to apply big data in the design process ?*

## 1.3 Approach

According to the graduation project's time limitation and my objectives of this project, the project approach was designed (Figure 1). This approach's goal was to help me understand the project context and challenges, address a narrowed and significant design problem, and develop a well-considered solution to the problem in the end. This approach consisted of four parts: Research; Design Challenge; Ideation; and Finalization and Evaluation.

### Part 1: Research

At this stage, I researched with Literature Review and Context Mapping to understand the topic and its context. With the literature review, I built the structure of my understanding of big data, which provided an overview of the role of big data in design. Then, a Context Mapping plan was designed based on the literature review. Designers' big data involved project experiences were known. I also learned about Designers' ideas and feelings on the relationship between big data and design from Context Mapping. The insights from Literature Review and Context Mapping support each

other and help me to understand each other.

### Part 2: Design Challenge

At this stage, relying on the findings from Research, a session was held with designers to find the pain points that they encounter during their big data projects. The problem space was defined. In the end, a key challenge was addressed by the participants and would be used as the design problem to be solved in the second half of the project.

### Part 3: Ideation

After the key challenge was targeted, a co-creation session was held with novice designers to collect their ideas to explore the solution space and understand their needs on the solution.

### Part 4: Final Concept and Evaluation

At the end stage of the project, I finalized the concept and evaluated the concept.

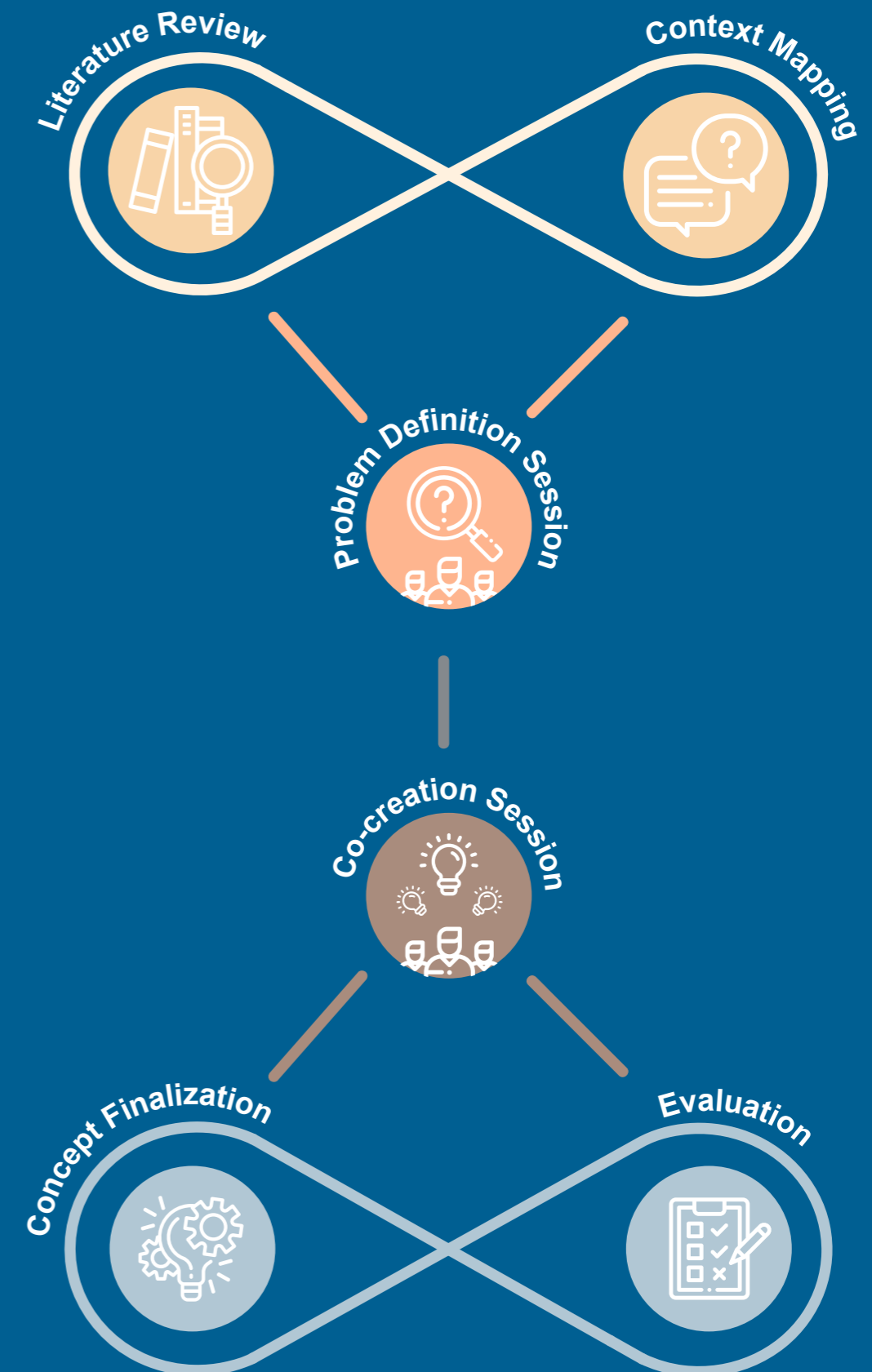


Figure 1: Project Approach

# LITERATURE REVIEW

Involving big data in the design process has been a new trend in the design industry (King et al., 2017). More and more designers encounter projects which require them to have the ability to deal with big data. To be able to understand big data and its application in the design process. I did the literature review. This chapter provides an overview of my literature review.

I did the literature review from what is big data, big data in design, and big data in the design process. Through searching for what big data is, I learned about big data features and had a comprehensive understanding of big data's possibilities. By looking at the big data in the design and design process, not only the relationship between data and design was uncovered, but also the importance of big data in the design process empathized.

## 2.1 Big Data

Big data is the data generated by machines, including data from sensors, social media, the Internet of Things, and so on. It is everywhere and on a massive scale. Big data has become one of the most valuable assets globally because of its potential and possibilities. With the appropriate analyses, big data can bring unexpected insights and values (Yi, Liu, Liu, & Jin, 2014). For example, Facebook collects and analysis users' data to help retail enterprises to advertise the target groups accurately.

Big data has some unique features that make it irreplaceable in providing a behavior perspective. IBM data scientists break big data into four dimensions: volume, variety, velocity, and veracity. With the help of sensors and other machines, users' behavior and even the unaware behavior can be unobtrusively and continuously recorded. Situated behaviors can be collected without interfering with people's daily life (Kollenburg & Bogers, 2019).

Big data has brought valuable benefits to business, companies could better understand their business and markets, and timely business

decisions could be made (Foreman, 2014). However, the value of big data goes far beyond this. It can be used to find behavior patterns, capture the users' real needs, and provide convincing evidence on design decisions (King et al., 2017).To make full use of big data, more and more design agencies have started to incorporate big data into their ways of working (Schwartz, 2019).

## 2.2 Big Data in Design

In the design industry, a trend of applying big data in the design process is occurring. For most designers, thick data, such as data from interviews, sessions, and other in-depth research approaches, has been applied in the design process for a long time. The importance of thick data research has been recognized, and research methodology has been developed for more than a decade (Bryman & Burgess, 1994). Nowadays, with the development of technology, collecting big data is cheaper and easier. More and more big data is involved in design projects and plays a quite important role. Big data helps designers to align design







<i>Big Data</i>		<i>Thick Data</i>
A large number of people		Relatively few people
Behaviors and actions of many people		Behaviors, actions, emotions, intentions, motivations of a few
Collected by machine		Collected by people
Broad and general understanding		In-depth understanding
People are not highly aware of data being collected		People are highly aware of data being collected
Analysis uses statistical methods		Analysis includes developing codes, summaries, themes, and so on

Figure 2: Features of big data and thick data (Pavliscak, 2015)

with business. For example, Google uses big data to learn about users' preferences on the button's color. It brings objective and detailed insights and inspiration, which thick data hardly provides. These two types of data support each other and offer a comprehensive understanding on users (Figure 2) (Pavliscak, 2015).

According to Christian Rudder (Rudder, 2014, p.14), *"It's like looking at Earth from space; you lose the detail, but you get to see something familiar in a totally new way."* Using big data properly provides designers a more general view of the problems. However, design does not rely on the data only but also ideas, intuition, and innovation. Too much data may trap designers in a state of "analysis paralysis" when designers feel directionless and clueless and don't know how to deal with it. Designers' intuition is ignored when they face the overwhelming data (Pavliscak, 2015). Meanwhile, sometimes, designers may drown in big data and cannot achieve the expected design outcome because of lacking the related skills and knowledge.

### Big Data as The Foundational Material

Big data not only can provide the accurate and detailed understandings of the users' behavior, but also can be used as the material to facilitate inspiration and creativity in projects.

Ackoff (1989) proposed the DIKW model (Figure 3) which demonstrated the hierarchical relationship between data, information, knowledge, and wisdom. According to the model, we can learn that data is the basic layer of the model and does not have any meaning by itself. Through relationally connecting different

data, information can be interpreted (Jifa & Lingling, 2014). Gonçalves (2016) introduced a set of relationships (Figure 4) to interpret the definitions of information, stimuli, and inspiration in the design process, based on the theories of information in the design process (Baya, 1996; Howard, 2008). This model reveals the foundational role of information in the design process and how it can inspire creativity in the design process.

By connecting the two models, data can be added as a new layer above information in Gonçalves's model (Figure 5). After data is collected, it can be interpreted into information by adding the context, and then information may become stimuli when it is selected by designers, either consciously or unconsciously. After internalized and understood by designers, stimuli could turn into the inspiration source for generating innovative and creative ideas.

In summary, data is the basic material in the design process and can contribute to inspiration and creativity in a project. For a long time, thick data has been usually the data that designers would use in the design process to get meaningful insights. Because when it is being collected, designers have started to explore the insights. But it's not enough for today's projects. In the more and more competitive markets, the collaboration between big data and thick data in projects may be the only possible path to success. Applying big data in the design process is an unstoppable trend. Spotify and Netflix proved this trend with their rise. They collect big data, like the clicks and pauses, and use them to understand users and predict their interests. As the results, the personalized user experiences can be provided, and more

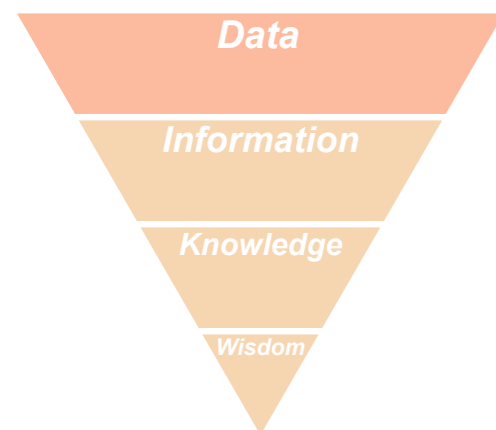


Figure 3: DIKW model  
Ackoff (1989)

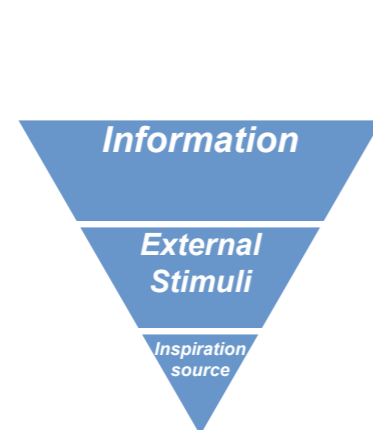


Figure 4: Relationship between  
information, stimuli and source  
(Gonçalves, 2016)

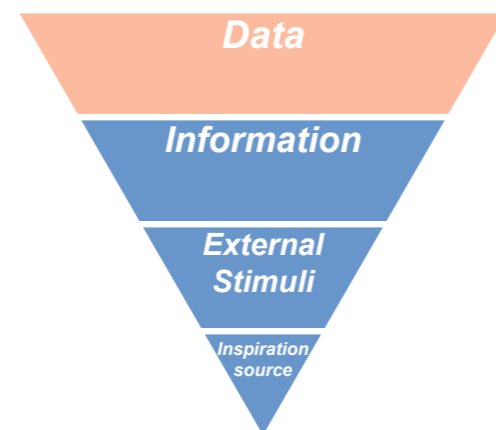


Figure 5: Data in the creativity  
design process

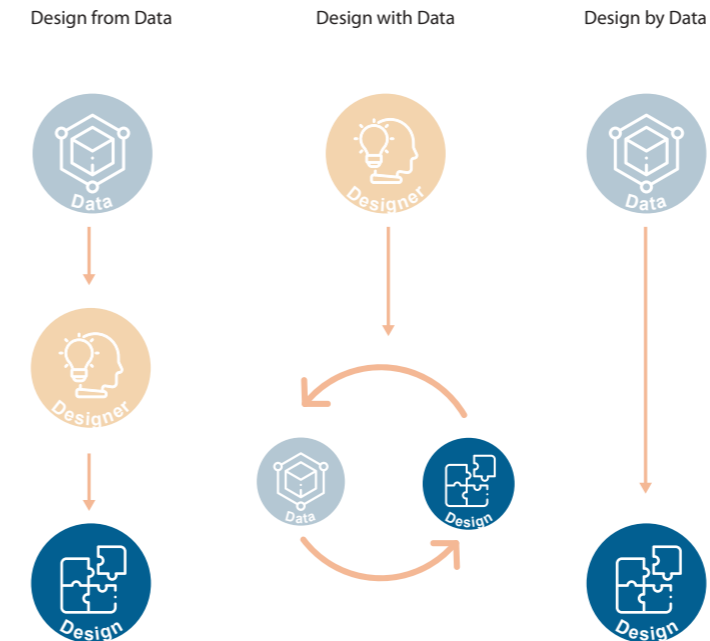


Figure 6: the relationship between data and design by  
Speed and Oberlander (2016)

users are attracted to their services (Pavliscak, 2015).

### Relationship between Big Data and Design

There are two frameworks that have been developed to understand the relationship between design and big data.

The framework which was proposed by Speed and Oberlander (2016) shows what kind of role big data can play in the design activities (Figure 6). For design from data, big data is used as the research material to inspire the design process. Design with data shows the situation when big data is applied as one of the design factors. Designers need to think about the role and value of big data in the solutions. Design by data is an advanced concept which predicts that big data will become the designer to design in the future. It shows the potentials of big data.

King (2017) introduced a framework on designers' data mindset for designing with data (Figure 7). The basic layer is data-driven design. At this stage, data is the answer to a specific problem. For data-informed design,

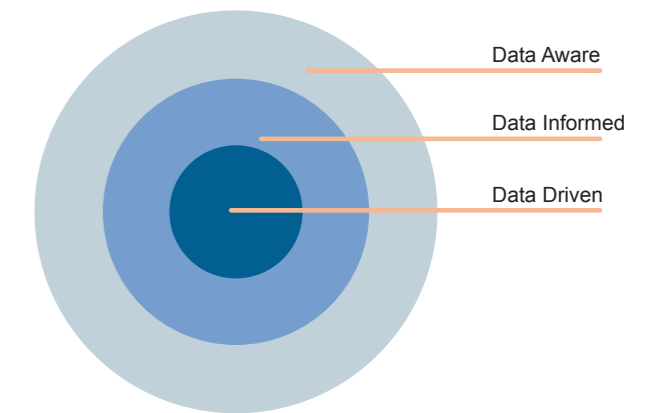


Figure 7: A Framework on designers' data mindset  
by King (2017)

data is only used to inspire solutions. Designers can combine data and other insights to answer design problems. The data-aware design describes the situation when designers well equip with a data mindset. They can realize what kind of data is useful and available to them. Designers could have a big picture of the possible outcomes of applying different big data in the design process (King et al., 2017).

These two frameworks perceive the relationship between data and design from two perspectives which are practice and mindset. Speed and Oberlander identified the different relationships between designers and data in the design process. It helped designers to understand how to adapt the methods appropriately for different situations. King demonstrated how designers should think about data when they face different design problems. It emphasized the importance of the balance between experience, instinct, and data. An appropriate mindset helps designers define the suitable relationship between design and data in practice, contributing to effective and valuable delivery. Through looking at both frameworks, the importance of big data for design can be revealed.

## 2.3 Big Data in Design Process

### Utilization

Kollenburg and Bogers (2019) introduced a situated design approach that uses data as creative material when designing for intelligent ecosystems. In her research, big data is used as design material in the *research stage, ideation stage, and evaluation stage*. These three stages are where big data is involved frequently.

At the *research stage*, big data is usually used as the material for understanding users' behavior. Big data can provide strong evidence that presents a large population, while it lacks the design insights and context to understand the users' needs. Therefore, a hybrid insights approach where thick data and big data are applied subsequently and seamlessly is necessary for today's requirements on human-centric design (Seemann, 2012). Through analyzing big data, the insights can be used to facilitate thick data research. For instance, big data can contribute to in-depth interviews with users and help interviewees recall details of their experience (Kollenburg & Bogers, 2019). From the context that is provided by thick data, designers can understand big data better.

At the *ideation stage*, big data can be used as the creative design material which is what Speed and Oberlander (2016) described as "Design with Data". They talked about the irreplaceable value of big data as the design material for designing products and services in this digital age (Speed & Oberlander, 2016.). Big data can inspire and inform the design interventions. Creativity can be triggered. Big data also can be used as a part of the solutions, especially for the intelligent ecosystem. Through applying the sensors and other devices, the connection between digital data and the physical world could be built (Kollenburg & Bogers, 2019). It provides more possibilities for designers to come up with user-centered products and services.

**Evaluation** is the stage where big data is applied mainly (Kollenburg & Bogers, 2019). From the A/B test to prototypes, big data is used to evaluate the concept or the existing products for improving the user experience (Pavliscak,

2015). With the development of sensors and other devices, data can be collected from a massive scale effectively and efficiently, which helps designers come up with well-considered ideas.

Big data is a valuable material and can be applied during the whole design process. From research to evaluation, it brings possibilities and insights into design and provides strong evidence for the design decisions.

### Designer and Data Scientists

Using big data to research the users' behavior and phenomena is an emerging trend in this digital world. It is becoming a new requirement for designers. However, it is a difficult task for designers, especially novice designers, who do not have big data related knowledge and techniques, to deal with big data (Kun et al., 2018). They need some help.

There is a role that cannot be ignored in this big data era: data scientists. It is named "The Sexiest Job of the 21st Century" by Harvard Business Review. It is one of the most popular jobs in the market. It is difficult and expensive to hire the right data scientists who are creative and have qualified data analysis capabilities (Thomas H & D. J, 2012). They can not only play an important role in analyzing data to support business decisions but also can join in the design projects and share insights from a different perspective. For the big data related projects, a better outcome could be produced with good collaboration between designers and data scientists (Wettersten & Malmgren, 2018). While in practice, designers and data scientists are not working as well as expected. The data scientists overlook designers' value, and designers have no idea on the data scientists' capabilities and possibilities. Some practices like building a mixed team, learning about the data scientist concepts, and making full use of sketching for concepts or prototypes are proved to be helpful for a good collaboration (Hogan, 2019)

The literature review helped me understand my research question better. It provided me an

overview of the big data application in design. It emphasized the importance of involving big data in design and also uncovered some problems in practice. It informed me of how to develop my project.

These two sub-research questions helped me to understand the designers' current situations on dealing with big data in the design process and helped me find the key factors that affect designers' performance.

## 2.4 Problem Definition

According to the literature review, a deeper understanding of the research question context was formed.

*" How to help designers to apply big data in the design process? "*

To be able to provide the critical support, it is essential to understand designers' experience in applying big data and find the pain points. Therefore, two sub-questions were proposed to help me break down the research question. They were used as the milestones for my project process.

### SUB-QUESTIONS:

*1.How are designers' experiences in applying big data in the design process currently?*

*2.What are the challenges for designers to apply big data in the design process?*

## 2.5 Target Group

There was an internal survey done by Alejandra Gomez Ortega for understanding the designers' data practices within the Industrial Design Engineering faculty of Delft Technology University. The survey was answered by 75 members of the IDE Faculty, including Design Practitioners (10), Design Researchers (22), Ph.D. Students (11), and Graduate Students (23).

The survey (Figure 8) shows that the confidence in collecting and analyzing qualitative data is much higher than quantitative data. It interprets the necessity of supporting designers in applying big data. It also shows that experienced designers are more confident in dealing with big data than novice designers. The experienced designers' average score on the confidence of analyzing quantitative data is 3.0/5.0, while the novice designers' score is 2.5/5.0. For the confidence in collecting quantitative data, experienced designers got 2.92/5.0, and novice designers got 2.68/5.0.

(The experienced designers include design practitioners, design researchers, and Ph.D. students. The novice designers are the graduation students.) Although most designers lack experience on dealing with big data and don't have much big data related knowledge. Experienced designers usually know better how to make use of big data. While, for novice designers who are new to big data, it is difficult to find the starting point and take advantage of big data in the design process well.

Therefore, in this project, the main group that I targeted is novice designers, i.e., design students or junior designers. They need help on dealing with big data. They do not have many project experiences. It is difficult for them to deal with big data design projects with the skills and knowledge that are taught in school. They will be the main force of designers in the near future and will work on more and more big data involved projects. It is important for them to be well-prepared.



Figure 8: Outcome of online survey

# USER RESEARCH

From the literature review, I highlighted the role of big data in design and its application in design process. To be able to empathize with designers better, I did user research to learn about designers' project experiences on dealing with big data which can complete my understanding not only theoretically but also practically. At the same time, it also helped me to answer my first sub research question: **"How are designers' experiences in applying big data in the design process currently?"** I chose Context Mapping as the method to do user research. It is good at uncovering in-depth insights from participants' experiences and helping me to empathize with participants easily (Visser et al., 2005). In this way, detailed contextual information could be collected and contributed to my research.

## 3.1 Method

To be able to have an in-depth understanding of designers' experiences within the limited time and resource, I modified the process into three parts: Sensitizing Booklet, Semi-structured Interview, and Analysis (In Appendix). The sensitizing booklet can help the participants recall and reflect on their experiences in advance. Some details and feelings could be brought back. After that, the semi-structured interview was held to encourage them to express their experiences, needs, and motivations explicitly. In the end, the interview scripts would be analyzed with Ground Theory to understand users' experiences in-depth and generate integrated and comprehensive insights.

Because of COVID-19, I planed the whole process online. The sensitizing booklet was sent to the participants with Miro or PowerPoint, and the interviews were organized with Zoom.

I learned about the relationship between big data and design more from big data's perspective from the literature review. Some insights, like the importance of big data for today's project and the role of big data in the design process, were captured. Through Context Mapping, I planned to learn about the designers' feelings, ideas, and reflections on big data involved projects and figure out the impact of involving big data in the design process on designers.

Similar to the literature review structure, the sensitizing booklet was designed with three parts: what are data for designers, data in practice, and the relationship between data and design. It was asked to be finished in 3 days. Day one focused on unveiling what data means to designers. Exercises like "defining of 'design' and 'data' with given pictures and words" were designed to provide an easy and fun starting point. Day two helped the participants recall a memorable project where big data was applied. Tasks like "visualizing the design process" were designed. It helped the participants refresh their memories on the project before the interview and encouraged them to reflect on it. Day three discussed the relationship between data and design with questions like "what do you like/dislike most about engaging data in the design process."

Through filling the booklet, participants could be more sensitive about their experience and organize their thoughts in advance, so that they could share more insights during the interview. The meaning of "data" wasn't specified in the sensitizing booklet because I would like to learn how designers define "data" in interviews.

The interview script was designed based on the booklet. My goal was to discover and reveal designer's experience, reasons, and context related to their design decisions. Data's impact on designers and design process could be uncovered. Through the interview, I would like to learn about the reasons behind the methods which designers chose to deal with data and reveal designers' feelings, needs and motivations on applying big data. Some questions were asked to uncover the reasons and the designers' mind map behind the design decisions :

*"Why did you choose these methods to deal with data?";*

*"Were there any difficult/ inspiring moments when you used these methods?";*

*"Which methods/tools have been the most valuable and helpful for you?"*

.....

Some questions could help me to learn about how designers perceive the relationship between data and design:

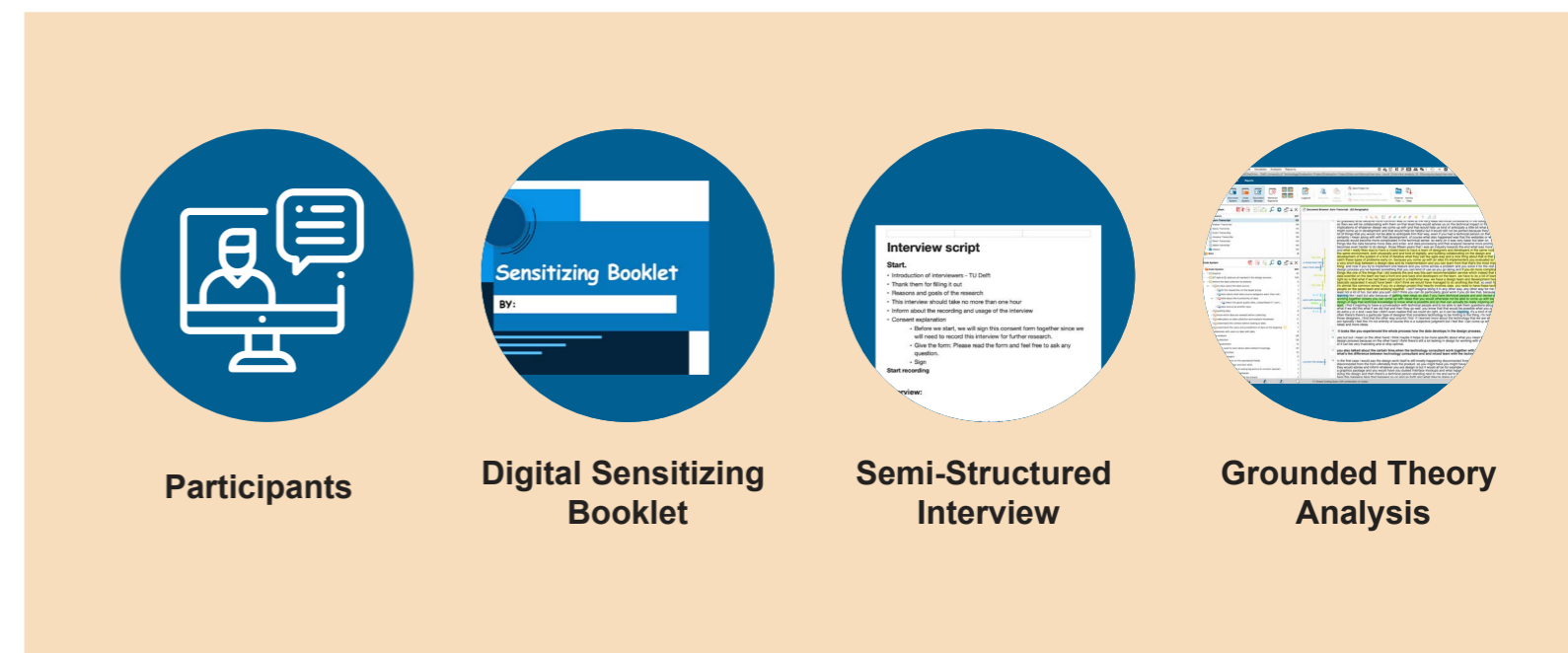
*"How did the applying data in the design process changed over time for you?";*

*"Could you name the two most important insights on applying data in the design projects based on your projects' experience?";*

*"How did you deal with the relationship between data and design?"*

.....

During the interview, the booklet was used as the primary interview material. I asked questions based on what the participants filled in the booklet. At the same time, I encouraged them to share their self-reflection on their personal project experiences and their insights on involving big data in the design process.



## 3.2 Participants

To achieve the intended outcome and get insights from multiple viewpoints and angles, I invited experienced designers as participants who worked as designers for several years. All worked on some big data related projects before. It made sure that all the selected participants were acquainted with many design methods and design theories and had years of practical experience. In that way, they could compare the design process with or without big data to share comprehensive and in-depth reflections and insights.

To find qualified participant candidates, I made the selection based on Alejandra Gomez Ortega's survey. This survey was done within the staff and graduation students from the Industrial Design Engineering faculty at Delft Technology University. Some questions in the survey helped me to learn about if they worked on big data related projects before and the overview of their design experience.

*"How do you identify yourself?";*

*"In which projects are you involved, or have you been involved in which data plays a role?"*

.....

Finally, I invited 9 participants to join the interview. All the participants were either Ph.D. students or researchers in the faculty who had rich work experience and had experience in big data related projects. They already showed some reflections on their project experience, according to the questions in Ortega's survey like

*"Which design directions or methods of your process were impaired by these challenges?"*

*"What functionalities are you looking for when designing with data?"*

.....

In the end, 9 interviews and 1 pilot interview were done, and each lasted around one hour. The pilot test helped me adjust the order of the interview questions, which could better encourage the participants to share step by step. All the interviews were held online with Zoom and recorded for further analysis. All the participants signed the consent form digitally.

### 3.3 Insights and Findings

After the interviews, I transcribed all the interviews and then analyzed them with Grounded Theory (Chun Tie et al., 2019) (In Appendix). With the transcripts, I did the initial coding firstly. It helped to refresh the interviews and discover the missed details. I identified and labeled the important and interesting words or sentences. Then I did the intermediate coding. I looked at the initial codes and explored the similarities and differences within the initial codes. I clustered them into some categories. And the relationship appeared from these categories. With advanced coding, some theories were built and helped me to understand designers' experience of applying big data in the design process.

In the end, I concluded findings into three main topics. They are *designers' roles*, *big data application process*, and *collaboration between big data and thick data*. They were mainly about the research phase in the design process and were developed from three different perspectives to look at the involvement of big data.

**Designer's Role** was about how involving big data in the design process affects designers' responsibilities in the design process. This insight was developed by interviewees' self-reflection and motivations from big data related projects.

**Big Data Application Process** was perceived from the practical standpoint. Through abstracting the project experiences, it showed that, to be able to apply big data well, there are few new steps should be implemented in the design process.

**Collaboration between Big Data and Thick Data** was captured from the point of view of the big data as research materials. By reflecting the big data related project experiences, interviewees emphasized that big data can provide insights on users' behavior and support and collaborate with thick data for a comprehensive understanding of the users' needs.

#### Designers' Roles

With the development of technology, the products that we are designing are becoming increasingly complicated. Meanwhile, data is more and more becoming a part of systems and products. This was accompanied by more demands on designers.

From Context Mapping, it noticed that the roles that designers need to play in the design process become multiple and complex. In the interviews, some comments on the big data involved projects indicated that designers' responsibilities increase because of the big data involvement.

*"Designers need to hold the project, because designers can make nice decisions";*

*"Designers are familiar with the psychology of people, are familiar with the ethnographic aspects of knowing a certain context"*

.....

Decades ago, designers were the only experts in the team. They researched, made the decisions, designed, and delivered outcomes to the clients all by themselves. These all rely on the designer's knowledge and intuition. Nowadays, the concept of "user-centered design" has become the convention in the design industry. Designers involve users in the design process to be able to understand their needs better. Designers are no longer the experts in the design process. They become the empathizers. They are required to empathize with the end-users to explore their experience and define the design requirements. Designers' roles are developing again, with the addition of big data in the design process. According to the interviewees' experiences, designers are demanded to be able to play one or more roles of translators, communicators, project leaders, analysts, and empathizers in one project (Figure 9).

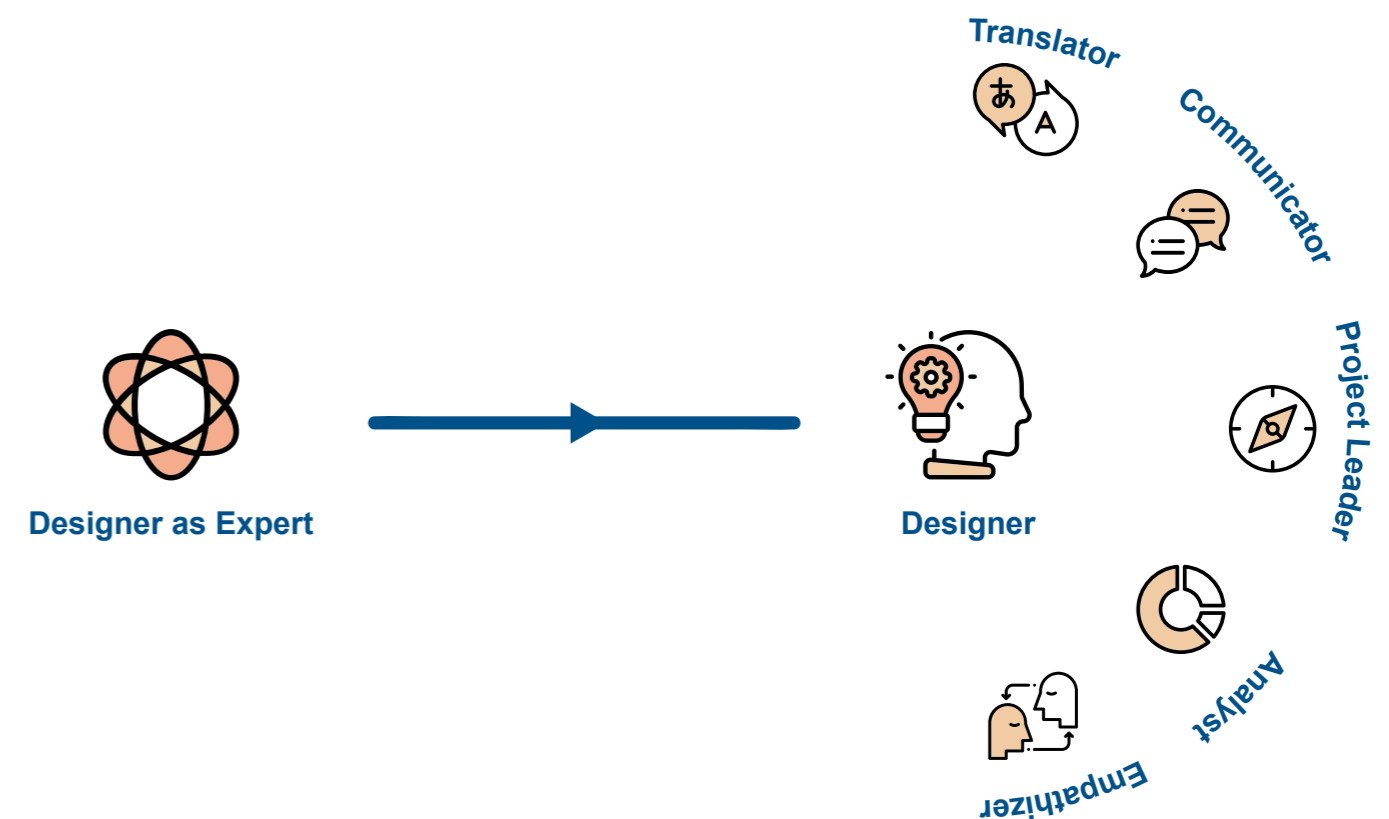


Figure 9: The roles of designers

#### Translator:

Designers need to be able to translate between the practices and big data. With the involvement of big data and data scientists, the design process has become more complex, especially in interpreting data. Data scientists are good at interpreting big data and work on data analysis. However, they lack the knowledge on how to empathize with users and usually disconnect with the context. To get the insights that are in line with the users' needs, designers should help the data scientists understand the data context. Simultaneously, for collecting the right data and achieving the ideal analysis outcome, designers also need to translate the data scientists' needs into practices that can be understood by the users.

The translator is a new role for designers to cultivate and develop in this big data era. Besides communication and empathy skills, designers need to equip the necessary knowledge and skills on big data.

*"At some moments, so that I would ask the data, go back to the data scientists, do you know something about this, is that data already there, or do we need to get more data for that as well, I was continuously trying to translate between end-users and data analysts."----- Interview 1*

*"There is a lot of going back and forth between me, the designer, who's sort of more in contact with the end-user and the designers of the algorithm."-----Interview 2*

### Empathizer:

Empathizing is a significant part of the design and a fundamental requirement for the design thinker. And it is the first stage in the design thinking process for an in-depth understanding of the users' needs (Walter & Falk, 2016). The role as an empathizer is still vital in the design project during the big data era. According to user experience, designers need to come up with precise design requirements. Although empathy mainly relies on the thick data, designers could understand users and context in-depth with the help of big data. Some insights from the big data can potentially help designers empathize with the users better and comprehensively.




*"This data in the design process helps you, as a designer, to understand the user and understand the context."*

*"You need a good idea, and you need empathy for the individual lives of those people that you are designing for. And that empathy you create by doing a qualitative."*

### Analyst:

Even before the involvement of big data, one of the requirements for the designers is to be able to analyze thick data. This ability has been trained from the school and design practices. Analyzing thick data helps designers understand the users' experiences and feelings. It is an essential step before empathizing. With involving big data, responsibilities are extending. Designers need to not only be able to analyze thick data into meaningful insights, but also interpret the results of the data scientists' analysis. Only in this way, designers can discover comprehensive insights by combining both big data and thick data.



*"And then we try to organize it, to the cluster, to identify and tags, or names for clusters, as though I think most Designers are being taught how to deal with data, how to analyze data and how to draw insights or ideas from data."*

### Communicator:

Designers usually need to communicate with different stakeholders and teammates like data scientists, end-users, clients, etc. to understand and leverage their needs during the design projects. Good communication helps to give insights into the development, foresee dangerous situations, and evaluate the products in use.

Communication skills have already been required for designers. It happens in almost every step of the design process. Designers have been trained to use methods and tools to communicate with people from different backgrounds. By involving big data in the design process, more people will join in the design process. It requires designers to improve their communication skills and explore the appropriate communication ways with different people.

*"And this kind of project, the project leader is not a designer, it's someone from a very technical background, usually a lot of times at least. It's someone from a big company. And that companies basically, they are like, ok, we have all this data. So, what do we do with this? And I have some ideas about that. Those ideas are usually not very like human-centered or anything."*

*"there's one thing they are good at and that's kind of connecting the dots, seeing the big picture and facilitating like these different specialists making sure that they work to get a properly so on and so forth."*

### Project leader:

The project leader is the role that needs to estimate the projects' direction and make decisions for the whole team. From the interviews, most of the interviewees want to be the person who makes the team's final decisions. As connectors and communicators in the projects, designers have a comprehensive understanding of the problems according to the insights from different voices. Thoughtful decisions could be made.

Although the role as project leader has been recognized for a long time, it isn't easy to implement in reality. In most situations, designers are not the most powerful people in the project. The designers' decisions would be reviewed and adjusted by the project manager, who may not have any design background. In the end, compromise would be made results and projects may not develop as expected. According to an interviewee, this phenomenon is related to the distrust of the designers. It needs to help the companies realize and recognize the importance of designers in the projects, the abilities, and the potential.

*"I was continuously communicating between people from the fields, like doctors and clinicians, but also patients. And the data scientists." ----- Interview 2*

## Big Data Application Process

As shown in figure 10, there are three stages in the big data application process: Preparation; Collection, and Analysis. To be able to apply big data in the design process well, there is a stage that is emphasized by all the participants. It is the preparation for data collection and data analysis. The three-stage is non-linear in practices. It jumps between each other. Designers can adjust the process based on actual situations. These three phases support each other and iterate with each other till the satisfying insights are obtained.

### Preparation stage

The preparation phase happens before starting the data collection. At this stage, plans for the data collection and data analysis stages are made, including which data should be collected and what kind of collecting and analyzing methods and tools should be used. The existing data set is learned, and data sources are explored. According to the interviews, some thick data research would be done during this stage. According to the collected thick data, designers could be clear about what they want to learn from big data research. The goals of this stage are preventing from wasting time and effort at the later stages and understanding the values and possibilities of data.

### Data collection stage

During data collection, different methods and tools would be applied to collect data from various sources. Not only the big data, but also the thick data would be collected at this stage. By collecting the big data, designers will know what kind of thick data should be collected to interpret the big data and serve the project's objectives. Data scientists might be invited to help the designers set the sensors and other technology tools at this stage.

### Data analysis stage

At the data analysis stage, all the collected data will be analyzed. Insights and inspirations will be revealed. Thick data and big data could be put together to analyze for a comprehensive understanding. From the interviews, I learned that when designers get the collected sensor data, they tend to feel lost and don't know where to start. Because designers usually lack related knowledge and skills to do the analysis. Therefore, at this moment, data scientists would be invited. They will use their specialized knowledge to analyze the big data and output the behavior patterns.

Some issues may happen at this stage. The expectations from the designers cannot be

delivered completely. By concluding the interviews' insights, a part of the issues happens because designers do not have enough capabilities to understand the big data content completely. Designers may misunderstand big data, and some analysis plans might be made with these misunderstandings. It wastes time and effort for data scientists to analyze these ineligible plans. Some issues may result from miscommunication between designers and data scientists because they use two different languages in their specialized fields. Sometimes, it may come down to that designers are still exploring the possibilities and their thought processes are not clear enough for data scientists to follow.

Dealing with big data is a challenging task for the designer. According to the interviewees, they would feel anxious and clueless when they get raw data. It took a lot of time and effort for them to look at the numbers and text, while, in the end, they only got some plain and surface insights.

### Collaboration between Big Data and Thick Data

Based on the interviewees' experiences, combining thick data and big data in the design process contributes to a well-considered solution to the problem (Figure 11). Thick data has been used in the design process for a long time. It plays an unshakable role in the design process. With the involvement of big data, more insights and possibilities are brought to design. These two types of data support each other and facilitate each other in the design process to help designers achieve innovative and convincing insights. The importance of the combination was not only captured from the Context Mapping, but also mentioned in many prior studies (Seemann, 2012; Kollenburg & Bogers, 2019; Wettersten & Malmgren, 2018).

### Thick data

Thick data has been applied in the design process for decades. It became more and more mature since the 1990s (Creswell, 2008). Most interviewees indicated the foundational role of thick data in design research. Through thick data research, designers could get a rich dataset for analyzing. According to the interviews, the most significant impact of thick data in the

design process is helping designers empathize with the users. Thick data can explain the reasons and emotions behind the behaviors that help designers understand users and the contexts. According to one interviewee, "To design a successful product, products touch peoples' lives, come into people's lives. You need a good idea, and you need empathy for the individual lives of those people that you are designing for." Thick data can also bring the human scale into the design process. People who are not only in the design team but also outside the design team, like users and clients, can understand it easily and share similar feelings. It is good for the communication between designers and other parties in the project and helps build the connection between the solutions and end-users.

### Big data

Design relies on data, not only the thick data but also the big data. Big data has become a predictable necessary component in the design process. With the development of tools on collecting big data, it is more and more available (Han & Kamber, 2006). Details of users' behaviors can be collected and recorded. The importance of big data in design practices is more and more visible. Basically, it is the unorganized information showing the behaviors of people. To be able to get inspiring insights from the messy big data, designers need to deal with it. However, from Context Mapping and Alejandra Gomez Ortega's survey, it is evident that designers feel that it is difficult to deal with big data, since most designers do not have big data related knowledge.

Through concluding the project experiences from sensitizing booklet and interviews, it is obvious that big data is a useful design material and could be used at the different stages in design process, including Research, Ideation and Evaluation.

**Big Data Used for Research:** Through analyzing the big data, fresh insights and perspectives can be brought into the design team. And big data can be used as an inspiration to trigger the in-depth thick data researches.

**Big Data Used for Ideation:** Big data could be designed as a part of the design solutions like

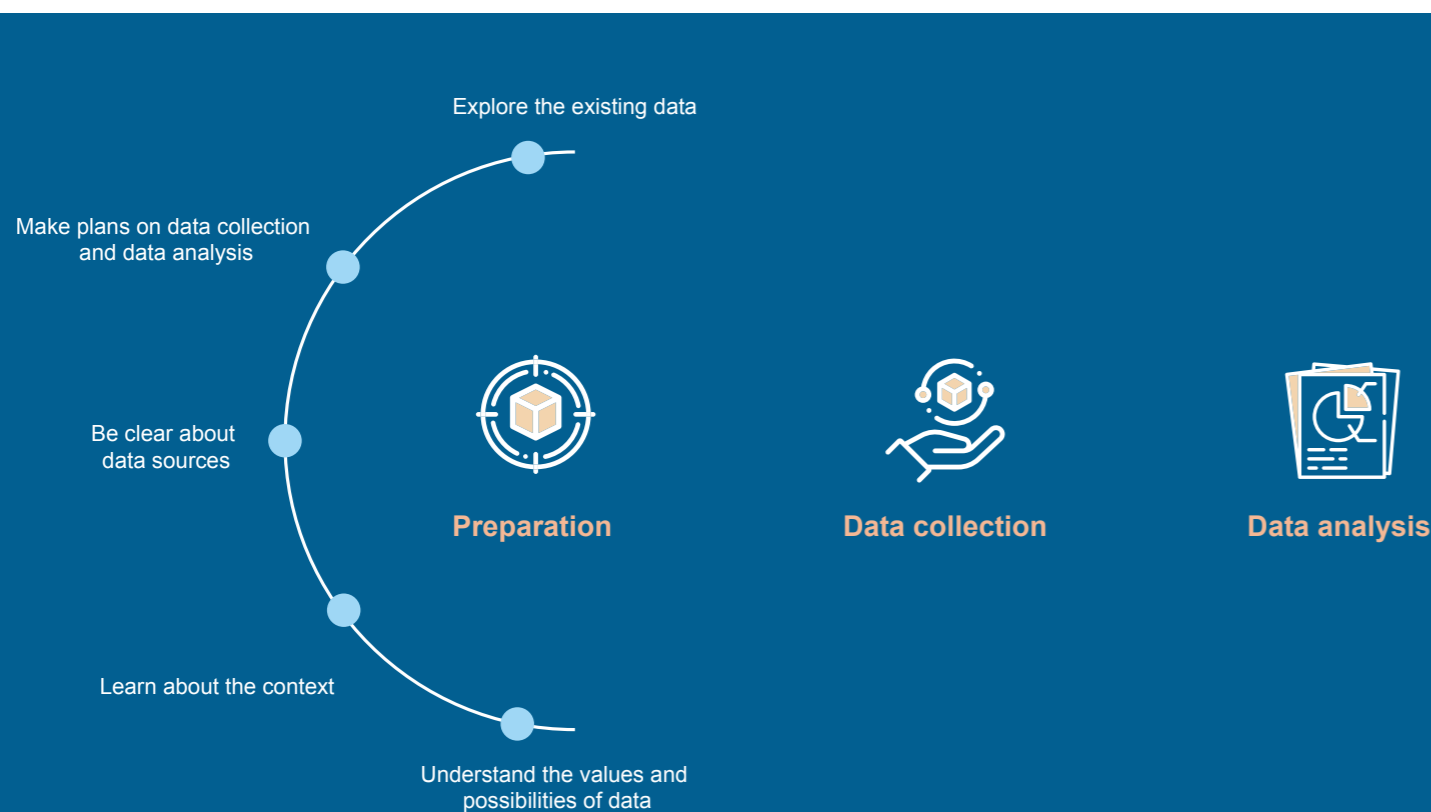
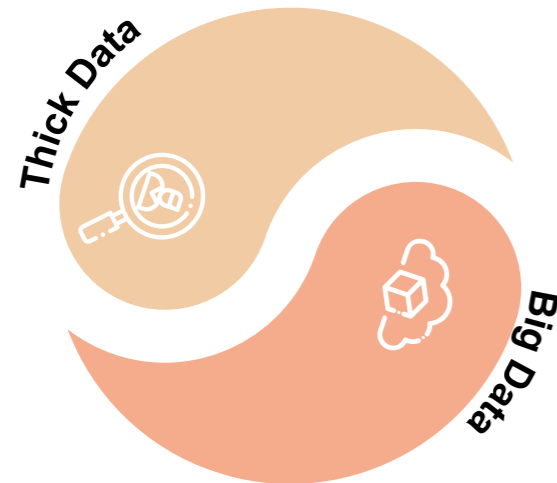


Figure 10: Big data application process

*“if you do qualitative data, you make a qualitative analysis of the context of use and the needs of the user, then you will have a richer data collection that will make it possible for you to generate ideas that are going to fit that the user will like. If you only do a quantitative approach, I think it’s going to be tough. And you will have less success. Maybe a combination of the two can be successful.....”-----interviewee 5*



*“It has made a sort of bigger impact on the world, in the sense that Big data is everywhere. So you need it. And it becomes part of the design process as well. Or at least part of the things that we design.”  
-----interviewee 3*

Figure 11: the relationship between big data and thick data

Siri or Google Searching Engine. These solutions use big data and algorithms to provide users with customized user experience.

**Big Data Providing Strong Arguments for Research and Evaluation:** Big data is the objective material for design research and evaluation. It can help designers explore the relationships between different behaviors logically and reasonably. All the insights that big data reveals are from the detailed group behaviors. No matter for Research or for Evaluation, big data can make use of its features to provide concrete and convincing evidences for supporting the design decisions.

### Use thick data and big data together

Although big data and thick data have their own significant advantages, they have limitations too. According to some interviewees, sometimes thick data could be interpreted inaccurately

because of users’ miscommunication or poor memory. Big data is not a good material to explore and reveal the reasons and stories behind the facts (Kollenburg & Bogers, 2019).

Big data and thick data have a complementary set of strengths and weaknesses and can work together and support each other. Thick data could be used for preparing the big data collection by giving the clues on what kind of data to collect. And it can be helpful in understanding and communicating big data by providing the context. Big data can be used for preparing thick data collection. For example, insights from the big data could be used to design the interview script. It can also evaluate the insights from thick data for further in-depth research.

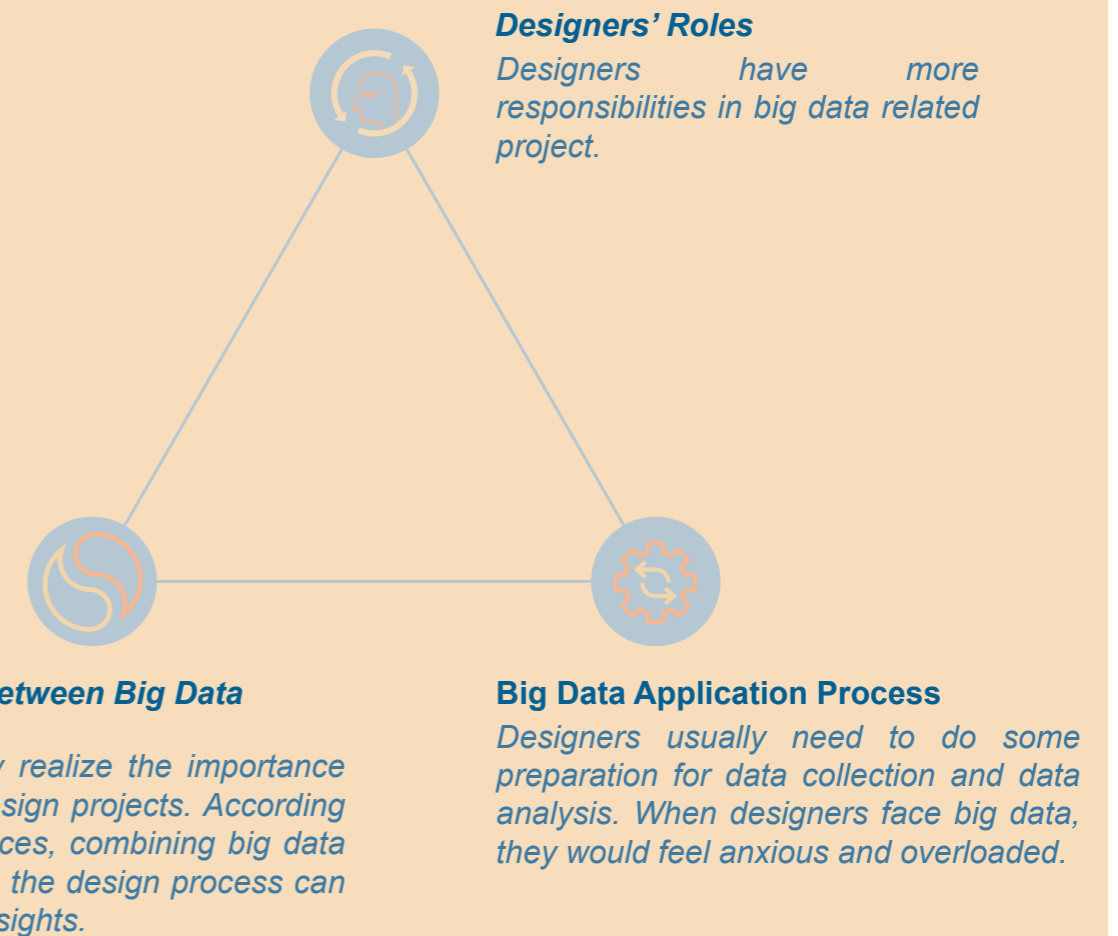
## 3.4 Conclusion

Through the sensitizing booklets and interviews, I learned about designers’ experiences in applying big data in the design process and their feelings. It answered the first sub research question: How are designers’ experiences in applying big data in the design process now?

These findings highlighted that designers’ challenges are not only the lack of skills and knowledge on applying big data, but also the evolution of their roles, more demands for their abilities, and some changes that need to be adapted like the improved design process. According to the interviewees, when they face big data, they felt afraid and directionless.

Big data as a new essential design material brings not only lots of possibilities to design projects, but also a few requirements to designers which bring pressure to designers. To support novice designers appropriately, I held a problem definition session to figure out the most critical challenge for the designers.

### How are designers’ experiences in applying big data in the design process now?



# DESIGN CHALLENGE

From the literature review, I learned about what is big data, the relationship between big data and design, and how big data is applied in design process. It helped me to understand my research question better. During the user research, interviewees shared a lot on their big data related project experiences and their feelings and reflections on involving big data in the design process.

Hence, at the second stage of the project approach, I studied the challenges designers encountered when dealing with big data. The key challenge would be addressed as the design problem, which I would solve later in the project.

For this stage, I used a co-creation session as the research method to define the design problem. A co-creation session is an efficient way to collect insights from different perspectives. At the same time, it makes sure that all the proposed ideas are highly related to the users' needs. With the cooperation with people from different backgrounds, participants could come up with insights they may be unaware of.

## 4.1 Objectives

I held a problem definition session, and 4 designers were invited as participants. The session was organized based on the insights that I learned from the user research. After empathizing with these insights, participants positioned themselves in the situation. Therefore, during the session, they were able to propose lots of challenges from different perspectives. In the end, the design problem was defined.

The main goal of the problem definition session is to explore the challenges that designers encountered when they apply big data in the design process. These proposed challenges answered my second sub-research-question:

*“What are the challenges for designers to apply big data in the design process?”*

## 4.2 Participants

There were four participants taking part in the session. They were 2 experienced designers who are Ph.D. students working at the Industrial Design Engineering faculty in the Delft University of Technology and 2 novice designers who are graduation students from the same faculty. All of them have practical experiences on dealing with big data in the design process. They vary in experiences and applied different types of big data in their previous projects. It is easy for them to empathize with the findings from the user research and share insights from their own experiences.

The reason why I invited mixed participants is that insights can be proposed from different perspectives and experiences. I could explore the problem space comprehensively.

## 4.3 Session Process

Because of the COVID-19, it should keep the social distance. The session was held online with Miro, which is an online platform for remote co-creation activities. There are possible limitations. For instance, it could be difficult for participants to do interactive activities without

face-to-face communication and interaction. To be able to reduce the impact of the online session and get the best out of the situation, I asked all the participants to join the video meeting with Zoom to help participants connect with each other. An ice-breaking activity was designed at the beginning of the session to facilitate their communication.

The session was designed with 4 parts in one and half hour :

### *Introduction:*

At the beginning of the session, I presented the project background and the insights I learned from the literature review and user research.

Participants were able to learn about the project well and have a better understanding of the research question. I also showed the agenda of the session to provide participants an overview.

### *Icebreaker:*

After the introduction, an ice-breaking activity was held to help the participants know each other and facilitate their communication. I asked them to draw themselves with the pen in Miro. After that, they needed to introduce themselves in 30 seconds.

It provided the participants with a chance to know each other and built a casual atmosphere. This activity can also encourage introverted participants to speak up.

### *Problem Finding:*

Problem Finding was the central part of the session, including 4 activities that were H2's, Vote, Spontaneous Clustering, and Restating Problem. This part was designed based on the “Creative Diamond 2.0” proposed by Heijne and van der Meer (2019). The process includes diverging, reverging, and converging, leading the participants to switch from the divergent thinking, systematic overview to convergent thinking. It helped participants better understand the context and come up with valuable insights (Heijne & van der Meer, 2019).

I planned “H2's” as the first activity at this part. It



was designed for facilitating divergent thinking. H2's is the activity which encourages the participants to propose their understanding of the research question in "How to ....." statements as many as they can. This technique was used to explore the viewpoints of the research question from different perspectives and frame the research question more accurately (Heijne & van der Meer, 2019). In the end, there are 48 statements proposed during this activity.

After that, all the participants voted for the best or the most interesting statements. Everyone had 5 votes. Finally, 16 statements were selected and used for the next activity, "Spontaneous Clustering".

During the Spontaneous Clustering, all the participants asked to work together to cluster the 16 statements. This technique was organized for reverging that produces a systematic overview of all the problem statements. In this way, the participants were able to have an overview on what they have produced from "H2's" and prepare for the converging. In the end, all 16 statements were clustered into 6 groups, and each group was defined with a new conclusive "H2's" statement. Finally, the 6 problem statements, as the outcome of the Spontaneous Clustering, were delivered to the next activity.

The last activity at this part was Restating Problem. It was the converging technique that requires participants to conclude their minds and complete the final problem statement together. All the participants shared their understanding of the final problem statements for building comprehensive descriptions. They also chose the most essential challenge for them among the problems, which was defined as the design problem for my project. Meanwhile, these insights proposed by participants during the session were analyzed and reflected by me afterward. They helped me to prepare for the ideation phase.

#### Wrap-up & Closing:

At the end of the session, I asked participants to share insights that they might miss during the session and their feelings on taking part in the session. In this way, it made sure that all the participants could share all the insights and ideas in their minds. I also asked for suggestions on the organization of the session to help me improve my organization skills.

## 4.4 Session Outcomes

Through the problem definition session, I explored the problem space with participants. With the "H2's", the scope of the problem space was discovered. Participants reframed the research problem from different perspectives that provided lots of insights on the challenges when designers face big data.

After voting and clustering, the representative groups are formulated (Figure 12). I organized the groups and found the relationships between them. During the session, 6 statements were framed to conclude the groups. They are:

**"How to evaluate the value of the collected data?"**

**"How to evaluate the usefulness of the data?";**

**"How to guide designers through the laddering process of data analyzing?"**

**"How to combine the data and design process?"**

**"How to avoid data overwhelming?"**

**"How to learn data skills as a designer?"**

After reorganization, I combined *"How to evaluate the value of the collected data?"* and *"How to evaluate the usefulness of the collected data?"*. These two groups are all about the data evaluation. According to the participant who proposed these two concepts, "value" means the data is beneficial for the project directly, especially for the project stakeholders like clients and end-users. "Usefulness" means that the collected data can help the designers design in some internal ways, like the data used to provide insights and reveal the users' real needs. Both of them are all necessary for a successful design project and need to be evaluated at the front end. Hence, I combined these two statements into

*"How to evaluate the collected data based on the valuableness and usefulness?"*.

This problem happens at the data collection stage. Then, "How to guide designers through the laddering process of data analyzing?" occurs at the data analysis stage. The problem "How to combine the data and design process?" discusses how designers deal with the relationship between data and design, facts and creativity in the design process. Those three problems talked about the difficulties which designers face in terms of design practice. Another two problems more focus on the designers' performance in the big data

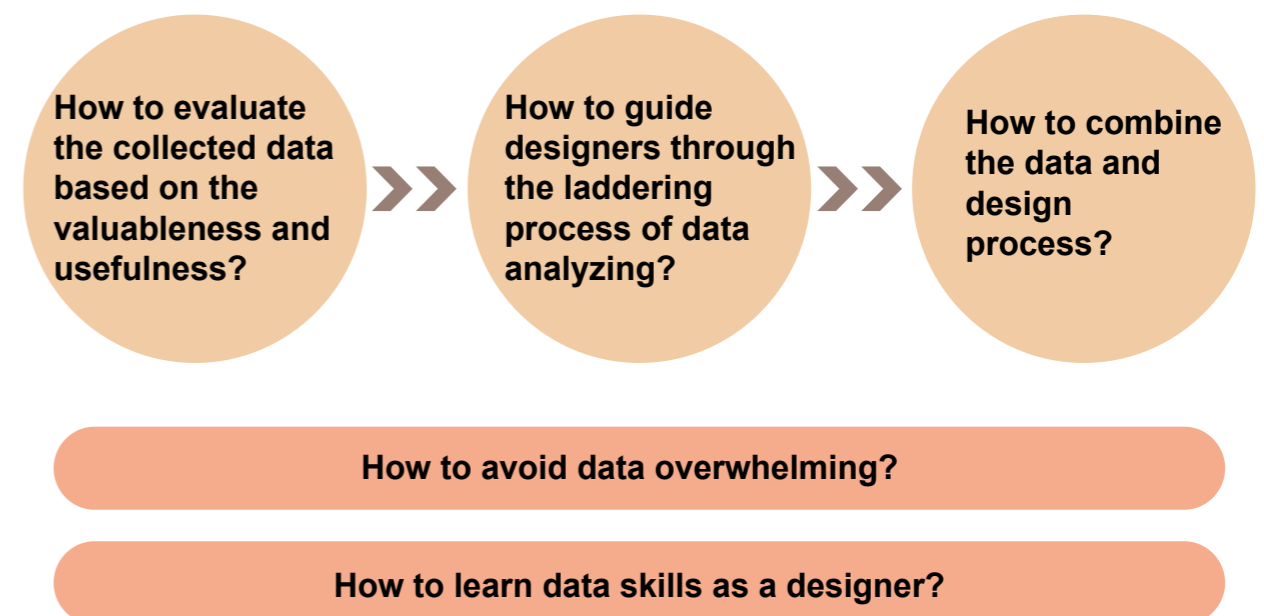
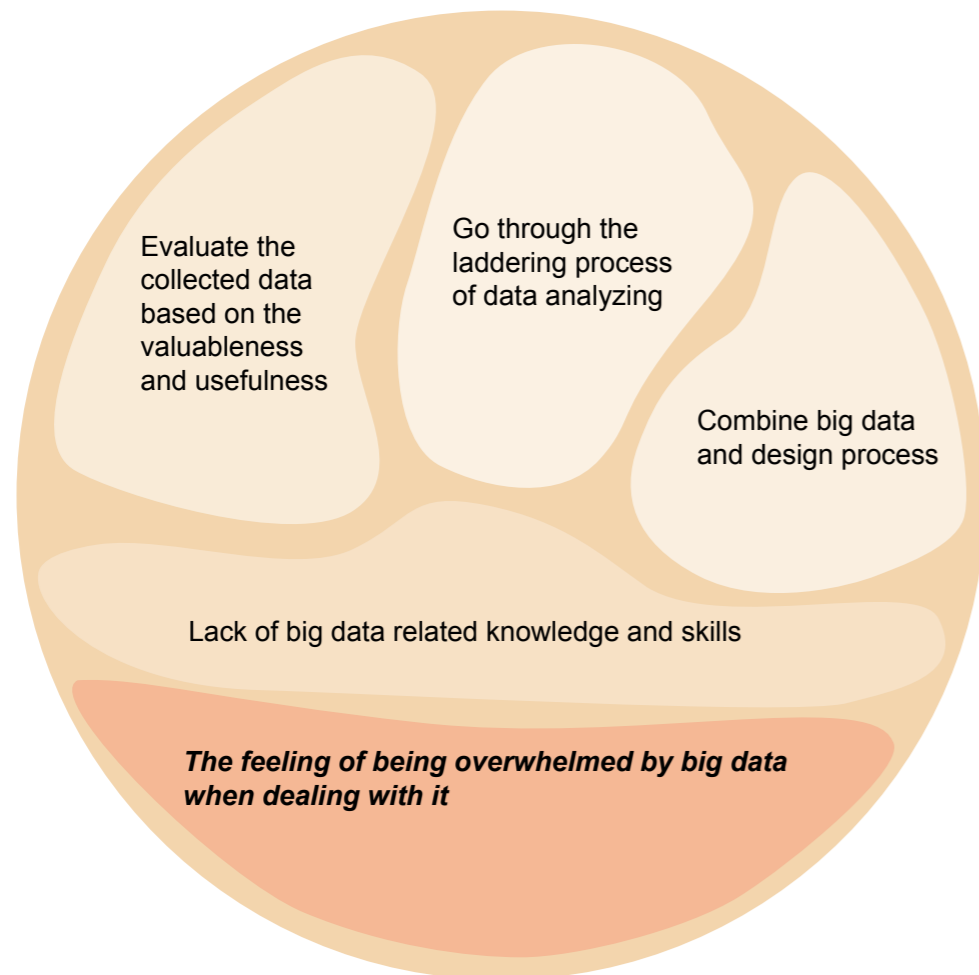


Figure 12: Groups from Spontaneous Clustering

## *“What are the challenges for designers to apply big data in the design process?”*



involved projects generally. All 5 statements helped me to have an overview of the difficulties encountered by designers. They also were the answer to my second sub-question: What are the challenges for designers to apply big data in the design process?

During the “Restating Problem”, participants selected an essential problem for them and completed the problem statement with their own understanding. In the end, the final problem statement was proposed. it became my design problem that would be solved in this project.

### ***Desgin Probelm:***

## ***How to help designers to avoid being overwhelmed during translating big data into insights?***

According to the participants, The problem occurred along with the three-stage big data application process: Preparation, Collection, and Analysis. To better understanding the problem, I defined the data overwhelmingness with the session participants’ explanations and insights from user research. The overwhelming feeling comes from 2 aspects:

1. The collected big data has big volumes, including multiple data sources, which make data complex. It takes designers lots of time to collect and even more time to analyze. It would make designers even more anxious and overwhelmed when there is a time limitation for the project.

2. Lacking data selection and analysis skills make designers feel directionless when they do the data analysis. It is easy for the designers to lost in the big data and have no clue how to clean it. Meanwhile, it would be very difficult to explain it to the others since the designer is in the data deeper and deeper (Armitage, 2009).

## **4.6 Conclusion**

This session was designed based on the findings from user research (Chapter 3.3). Qualified participants were invited, and various ideas were shared. The session was inspiring for me. Lots of unexpected insights were collected. Feeling overwhelmed was a newly uncovered topic that wasn’t yet revealed and taken into account directly during the user research. In the end, the design problem was proposed. It narrowed the research question with a concrete problem and guided the design direction of this project. The outcome of the session was used as the starting point for the ideation stage. All the insights I learned were used as the foundational material for me to do the following development.

# IDEATION

After the wrap-up of the problem definition session, I designed a co-creation session for the idea finding and solution finding. The session was held for exploring the solution space to the design problem that was proposed at the last stage. The reason why I decided to hold the co-creation session was that it is an efficient and effective method to collect various creative ideas from different perspectives. It supported me to seek inspiration from different people to help me to explore the solution space.

## 5.1 Objective

After the design problem was confirmed, this session was designed to help me to explore the breadth and depth of solution space. With the involvement of participants who had different experiences, diverse ideas could be proposed from different perspectives. Some inspirations could be explored and help me to come up with the final concept. An understanding of the solution space can be built.

## 5.2 Participants

To make sure that the solution space fits my target group's needs, the participants I selected belong to the target group who were novice designers. I planned to invite participants who have different backgrounds, which is good at collecting insights from diverse experiences. On the other hand, they should be familiar with big data. In this way, they could empathize with the project and the design problem easily.

In the end, there were 4 graduation students taking part in the session. All of them were from the Industrial Design Engineering faculty at the Delft University of Technology. They were from all three majors in the faculty, which are Strategic Product Design, Integrated Product Design, and Design for Interaction. And they all did one or more big data related design projects before.

## 5.3 Session Process

This session was held in Miro. And we used Zoom to have a video meeting at the same time. Participants could see each other, which brings the connectivity feeling to the online session.

The session was designed with 5 parts in two hours. They are Introduction; Icebreaker; Idea Finding; Solution Finding and Wrap-up & Closing.

### Introduction



### Icebreaker



### Idea Finding



### Solution Finding



### Wrap-up & Closing



Introduction

During the introduction, I introduced the project context and design problem. Insights on understanding the “data overwhelmingness” were also shared to help participants understand the design problem accurately. The agenda and the session’s objectives were shared with the participants to provide an overview of the session and help them to be well prepared.

Icebreaker

After the introduction, an icebreaker activity was held. All the participants introduced themselves and their hobbies in 30 seconds. It created a comfortable feeling for the session.

Idea Finding

At the idea finding part, I designed three activities, which are Brainstorm; Vote, and Idea Gallery. The objective of the idea finding was to encourage the participants to come up with creative ideas as many as possible. I could explore the breadth of the solution scope from the outcome of the idea finding.

At the Brainstorm, I asked the participants to write down all the ideas in their minds to solve the problem. They were encouraged to think from different perspectives and imagine themselves as different stakeholders in the problem context. In the end, 28 ideas were proposed.

They were then asked to vote for the most important and essential ideas. 7 ideas were selected. The idea proposers took one minute to explain the ideas in detail. After each explanation, all the participants discussed the proposed idea and shared suggestions and insights.

Solution Finding

At the solution finding part, another 3 activities were organized: Interaction Brainstorm, Elevator Pitch, and Iteration. This part was a converging stage. After participants learned about each other’s ideas, a more comprehensive understanding of the problem was built. They probably generated new and developed insights and thoughts on how to solve the problem. This part of the session

gave them a chance to reflect further on their previous ideas and develop concrete and thoughtful solutions. The depth of the solution scope could be generated by analyzing these proposed solutions.

At the Interaction Brainstorm, participants were asked to propose an idea by themselves. After 10 minutes, the idea was passed to the next participant for further development. It repeated 4 times. In the end, one solution would be gradually completed by all the participants in the session. This activity was applied for developing one solution by four people from four different perspectives. It made sure that the final solution would be well considered.

After four solutions were built, the person who adjusted the solution at last needed to present it in one and half minute. Through the presentation, all the participants were able to understand how the solutions were improved by each other. They could have a better understanding on each other’s perspectives which helped them reflect in the last activity.

For the last activity, everyone got back their initial solutions and had 10 minutes to iterate. At this moment, everyone knew each other’s perspectives well. They had had time on reflecting other’s ideas and self-reflection. Therefore, they could iterate the solutions to be more thoughtful.

In the end, 4 well-developed solutions were proposed.

Wrap-up & Closing

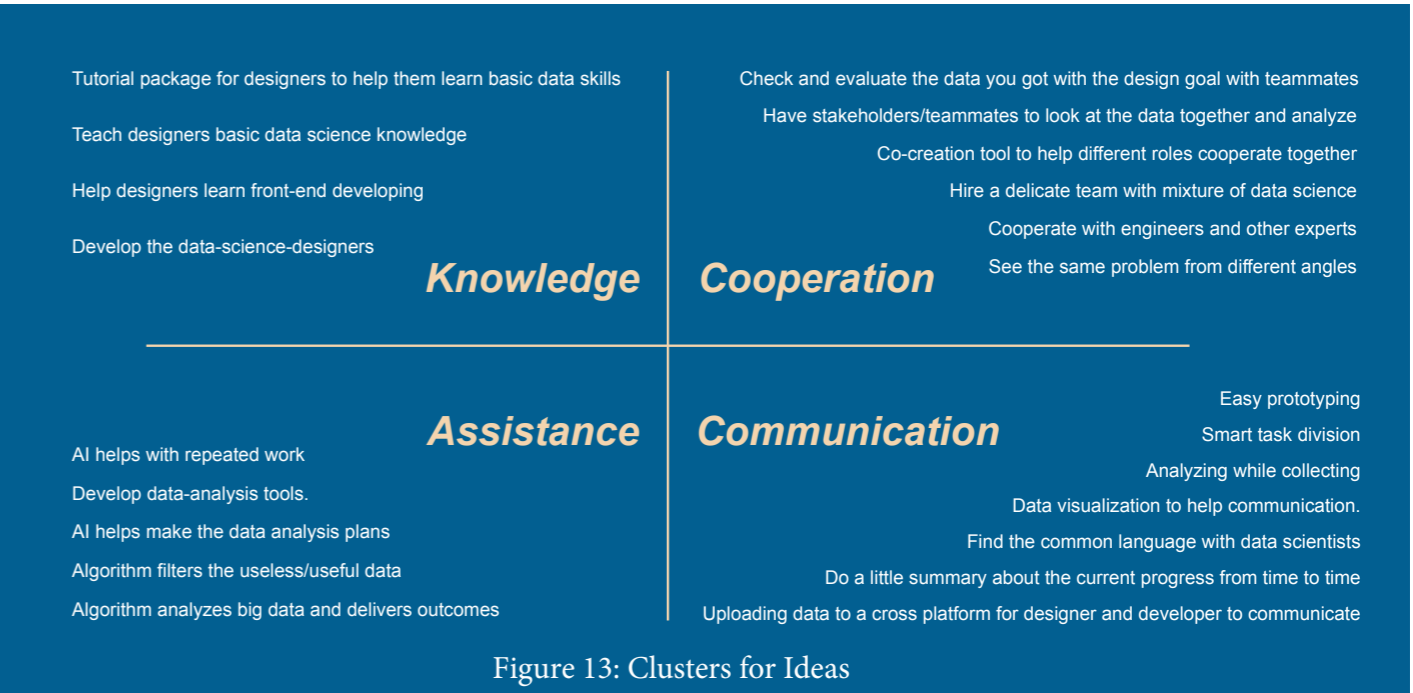
At the end of the session, I encouraged participants to share their insights and feelings on the topic and session. It prevented me from missing interesting ideas and helped me to improve my skills in organizing sessions.

5.4 Session Outcomes

There were two parts of the session outcomes. One of them is the breadth of the solution space from the Idea Finding. The other one is the depth of the solution space from the Solution Finding.

Breadth of the Solution Space

During the Idea Finding, ideas from target users (novice designers) were collected. They were used to inspire the participants at the solution finding part and helped me structure the breadth of the solution space. After the session, I reviewed all the ideas and reorganized them into clusters (Figure 13). In the end, all the ideas were divided into 4 groups. They were Knowledge; Cooperation; Assistance and Communication.



Knowledge (Top left corner of Figure 13)

Under the Knowledge group, the ideas were all about helping designers to learn big data related knowledge. It matched with the insights from user research. Most of the interviewees mentioned the importance of learning big data related knowledge. With data education, a data mindset could also be cultivated (Figure 7). Data mindset can help people have a sense on what kind of data the designers need for the project, how to deal with data, and what to expect from the analysis outcome (King et al., 2017). It is also valuable in developing a new perspective for designers to think about problems.

Assistance (Bottom left corner of Figure 13)

The Assistance group revealed the designers’ needs for outside help on dealing with big data. No matter guidance, tools, or teammates who have big data related knowledge or skills are all helpful. This insight indicates that it is difficult for designers to deal with big data alone.

Cooperation (Top right corner of Figure 13)

The Cooperation group showed the importance of good collaboration with different stakeholders, teammates, and users for understanding big data and applying big data in the design process.

Communication (Bottom right corner of Figure 13)

Good communication can help designers to understand big data and translate big data with designers’ language. Through communicating with different people on big data, a comprehensive understanding of the big data will be built, which would help designers deal with big data.

## Depth of the Solution Space

There are four solutions proposed at the solution finding part. They are Translation Tool; Match Platform; Project Models; AI Assistant

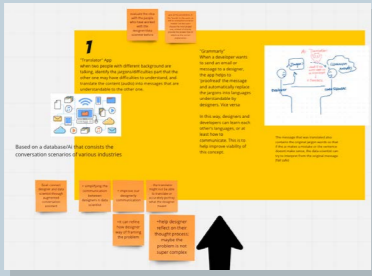


Figure 14: Translation Tool

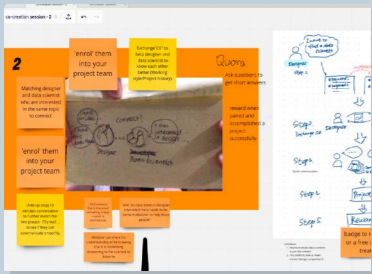


Figure 15: Match Platform

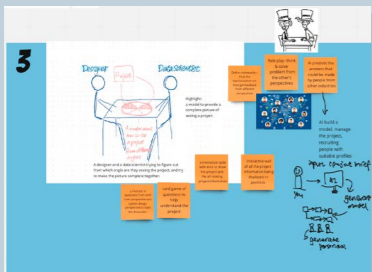


Figure 16: Project Models

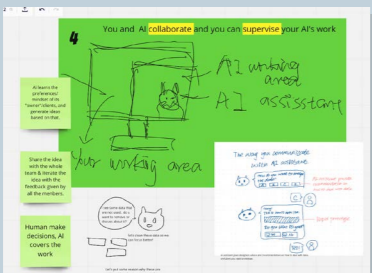


Figure 17: AI Assistant

## Keep the Autonomy

The keyword “autonomy” was addressed as the commonality among these four solutions. From the participants’ explanations of their solutions, I noticed that designers want to make decisions on filtering valuable and useful data and selecting the analysis plans for the hypotheses they proposed. It ensured that designers direct the project, instead of following others’ ideas, which is easy for them to get lost in halfway. This insight revealed the importance of giving control to designers when they cooperate with different stakeholders. It indicated the designers’ needs for a satisfying solution, on a more general level.

## Scope of the Solution Space

In the end, through combining the outcome of the idea finding and solution finding, the solution space was uncovered (Figure 18). It became the guideline for me to come up with my final concept.

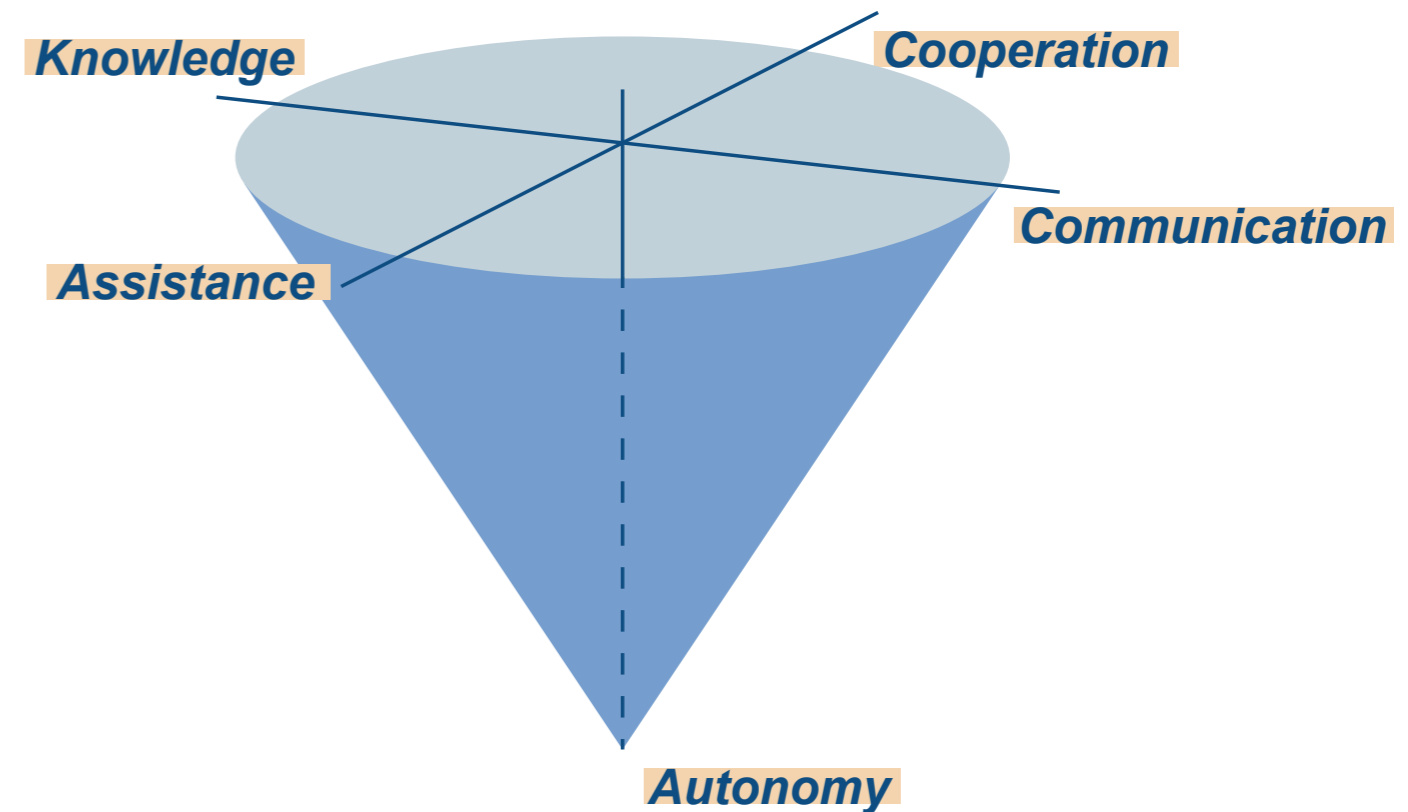


Figure 18: Solution Space

## 5.5 Conclusion

The co-creation session answered the design problem: “How to help designers to avoid being overwhelmed during translating big data into insights?”. Through understanding the participants’ ideas and solutions, more viewpoints of the problem were uncovered, and designers’ needs for the solution were revealed. These insights contributed to formulating the final solution to the design problem.

In the end, I propose the final concept, Data Management Dashboard.

# FINALIZATION

In the end, a tool named Data Management Platform was designed based on the solution space. The design was guided by the leading requirements from solution space, which are Assistance, Cooperation, Communication, and Autonomy. To equip designers with big data related knowledge, design schools and faculties need to offer big data courses and help design students apply in practice. Meanwhile, Designers need to actively learn the related knowledge and skills to adjust to the inevitable trend in this continually changing era.

## 6.1 Concept

According to the insights from the literature review and interviews, it is very important to learn about big data's context for a comprehensive understanding of the big data's value for the project. Because the context can reveal the relationship between the data and users, it shows if the data is valuable for users and makes sense to analyze.

For now, the way experienced designers usually deal with big data is that designers first learn about the content of big data and then connect big data with thick data to explore the data's context. It requires designers to look into the big data and understand it first. It is where the data overwhelmingness happens.

The value of data can be recognized, not only by its content, but also by its relationship with other data and its meaning for the stakeholders and users. If the data is meaningless for the users and stakeholders, it is valueless for designers to analyze. For example, the goal of a project is to improve the online shopping experience on mobile phones. If users say that the phone power does not have any effect on the experience, designers don't need to look at the phone power data and think about the possible relationships between phone power and user experience.

Designers are good at finding people's real needs, which can be used as a significant filtration to find valuable data that is related to users' needs. Based on that, a platform was designed to assist designer to deal with big data. It could help designers to do what they are good at during the big data application process. Designers recognize meaningful data and propose the analysis plan. And, data scientists do their strength, which is analyzing big data with algorithms and programs.

Data Management Platform was designed to assist designers in applying big data in the design process and relieving the feeling of being overwhelmed by data. It is a platform including 4 main functions, which are Data Cards, Data Map, Co-creation Board, and Data Group.

*1). Firstly, this concept is mainly used for the big data application process, including preparation, collection, and analysis. With the assistance of this platform, designers can apply big data through these stages.*

*2). This concept could also help designers to switch between the roles, according to the needs of projects. Data Map can provide designers an overview of the project and build the connection between big data and thick data. It helps designers to play well as a project leader and make thoughtful decisions. Data Card can assist designers in translating big data into the easy-to-understand form and communicating the big data with different audiences. Co-creation Board can help designers be the empathizer and communicator. With the Co-creation Board, designers could easily cooperate with users and other stakeholders with co-creation activities. Designers can also play the role of analyst with the help of Data Group. It helps designers to build analysis plans and discuss them with teammates.*

*3). At the same time, with the help of the Data Map and Co-creation Board, big data could be connected with thick data and users' needs. Valuable data could be addressed. More insights could be developed.*

This concept could help designers adjust to the three changes that I addressed from user research: designers' roles, big data application process, and collaboration between big data and thick data.

Data Management Platform can help designers understand the relationship between different big data and find valuable data. Inspirations and insights could also be explored.

6.2 Functions

Data Card

Data card is the foundational element of the Data Management Platform (Figure 19). It can be used for the other functions in this platform. With Data Card, data is displayed in the form of a card. It is good at showing the valuable elements of big data for designers and preventing too much information interference.

length, and so on. It is easy for the designers to have a big picture of where the big data is positioned in the project and data network. The data card can also show more information. After clicking on it, data type, data source, and tags will show up (Figure 20: Form 2). With data type and data source, designers, stakeholders,

or other readers can understand the data and how data is collected. It provides a general impression of the data. Tag is the function where teammates can add keywords during the design process. These tags translate the big data with designers' own languages and uncover the unique features for a specific project. The data card can show more, including content and comments (Figure 20: Form 3). Content is the one-sentence summary of the data, formulated by designers to explain how this big data can contribute to the project. The comments are the ideas and insights from teammates. It could be about how to understand big data and how to apply this data well.

In summary, Data Card is a designers' way to understand big data. It was designed to relieve designers' feelings of being overwhelmed by big data and facilitate the communication between designers and other stakeholders. Through creating the data

cards, designers translate big data with their own language and don't need to look into the content. With Data Card, designers do not need to face the endless numbers and text, which prevents designers from being lost in big data content when they deal with it. With the help of Data Card, big data can be understood easily and directly, not only by designers, but also by other stakeholders and teammates. Data Cards can be used as the communication material for the designers to discuss big data with other stakeholders to learn about the data relationships and priority, helping designers come up with valuable insights.

Data Map

Data Map provides an overview of the positions of data in user experience (Figure 21). It can be used for making data collection plans in a direct and comprehensive way. It can also be used to explore the pain points. Through interpreting big data with thick data like user experience and users' feelings, designers can capture the pain points as the starting points and research on the related big data to look for the reasons behind these pain points.

Data Map has three basic layers : Stage; Data; and Emotion. The Stage layer shows the activities in the user experience. It could be built with designers' analysis and user research. The Data layer is filled by clustered big data, according to its related activities. It is easy for the designer to think about big data from a big picture. The Emotion layer is used to demonstrate users' feelings, which helps find the users' needs and pain points. Designers can add more layers according to the different projects' context.

From preparation, collection till analysis,

Data Map can help designers to organize existing big data, address the missing data and target the pain points. At the preparation stage, Data Map can be used for organizing the existing datasets, exploring the missed data, and making data collection plans. Designers can create the data cards with the existing dataset and put them in the data map. After analyzing the data map, designers can learn about what data is missing and need to be collected. At the analysis stage, designers can use the data map to organize the collected data and find the relationships between them. Through filling the Stage layer and Emotion layer, designers cooperate with users, and big data connects with thick data. A comprehensive understanding of user experience is revealed.

Data Map can help designers to deal with big data effectively and confidently through providing the starting points. This function provides designers a template for combining big data and thick data. Especially with the involvement of users' emotions, designers can easily target pain points in the user experience which can be used as the starting point and direction to analyze big data. It prevents designers from feeling directionless and clueless when they face big data.

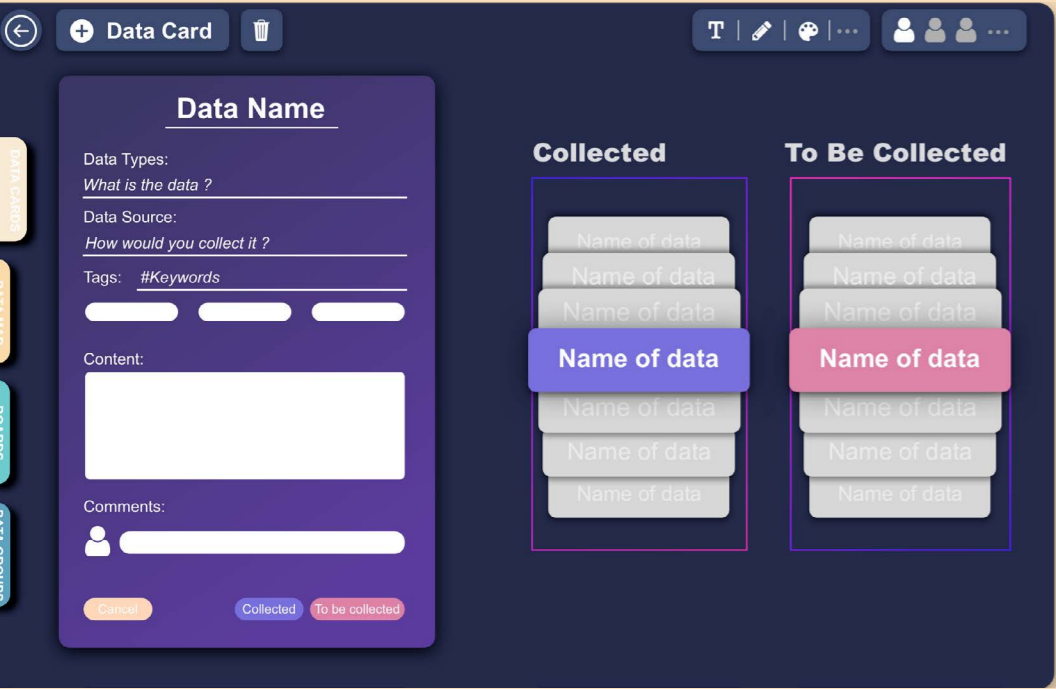


Figure 19: Data Card



Figure 20: Form 1

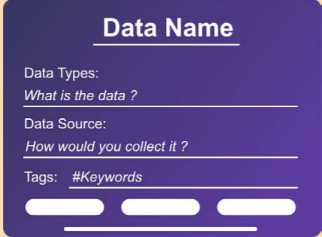


Figure 20: Form 2

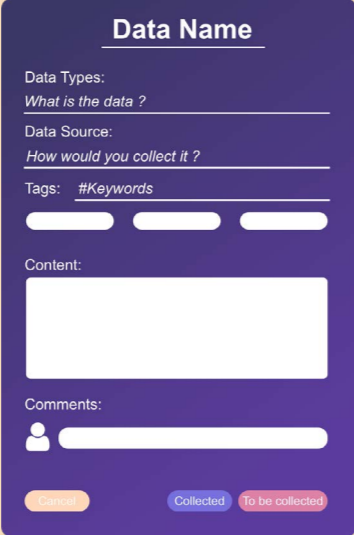


Figure 20: Form 3

Figure 20: Three Forms of Data Card

The data card could be shown in three forms (Figure 20). By default, data card only shows the name of the data (Figure 20: Form 1). For example, the data name could be the price, age,

way to understand big data. It was designed to relieve designers' feelings of being overwhelmed by big data and facilitate the communication between designers and other stakeholders. Through creating the data

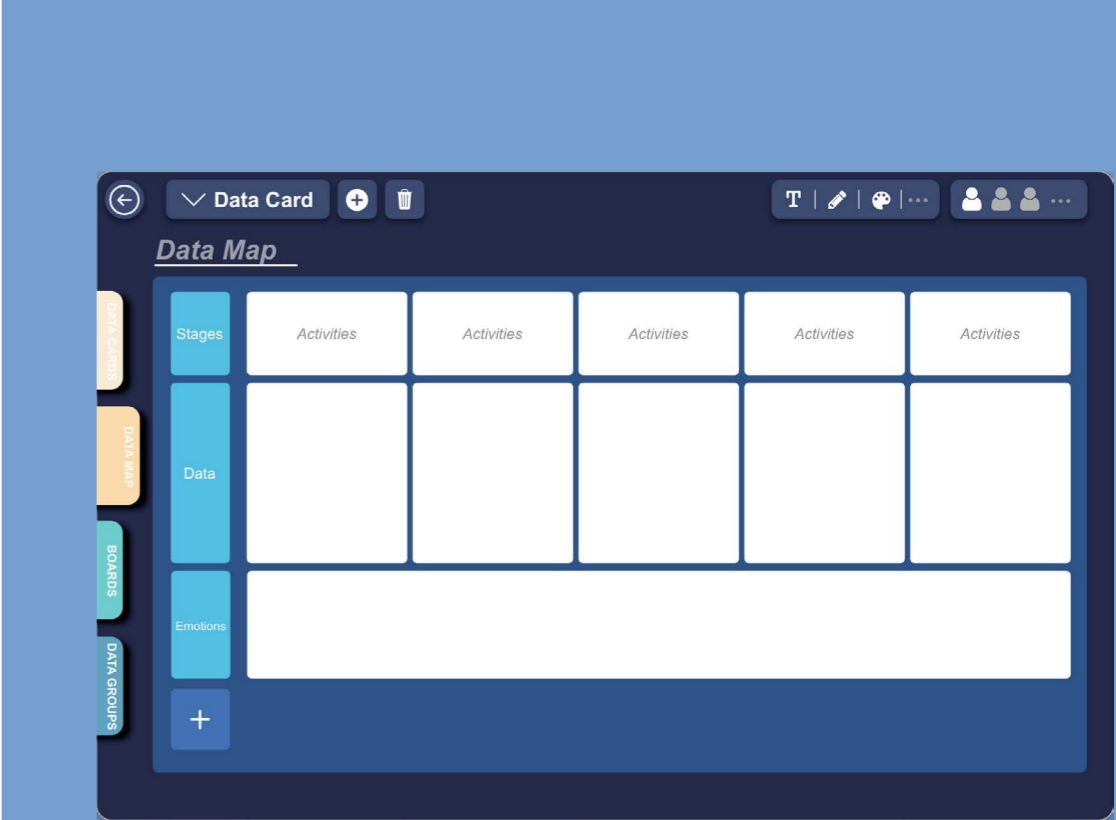


Figure 20: Data Map

Co-creation Board

Co-creation Board is the function that has a very high degree of freedom (Figure 22). These boards provide a visual and interactive communication way for designers to cooperate with different stakeholders, users, and teammates, especially the data creators. With the cooperation, the relationship among different big data and the needs of users and other stakeholders can be revealed, so that designers have clues on how to deal with big data.

In the co-creation boards, data cards are used as the basic material for the participants to explore the data relationship, data priority, etc. Designers and other participants work together on manipulating the data cards, organizing them, and connecting them. In the end, the data network could be built, and different focuses can be captured. It provides insights on which data is valuable and how to analyze them.

Designers can adjust the data cards with different size fonts and colors to show the importance, according to the network built from the cooperation. Comments could also be made on the connection between different big data to note down the critical insights. All the changes on the data cards can be synchronized from all the boards.

Co-creation Boards help designers to explore the insights without looking into the big data content. Through exploring the relationship and priority, in-depth insights can be found, and reasons behind the phenomenon can be revealed. This function facilitates the cooperation and communication between designers and stakeholders.

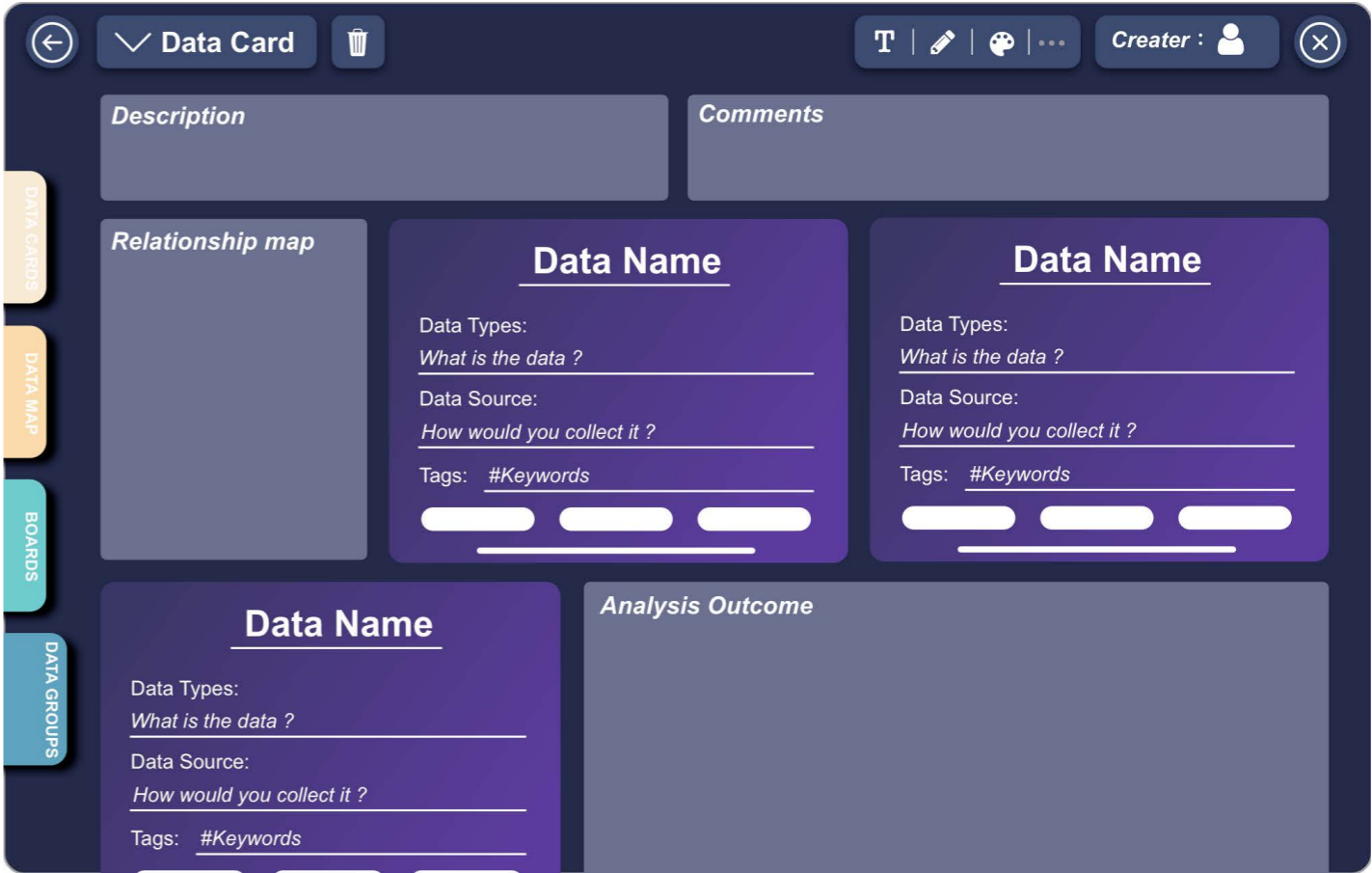


Figure 22: Data Group

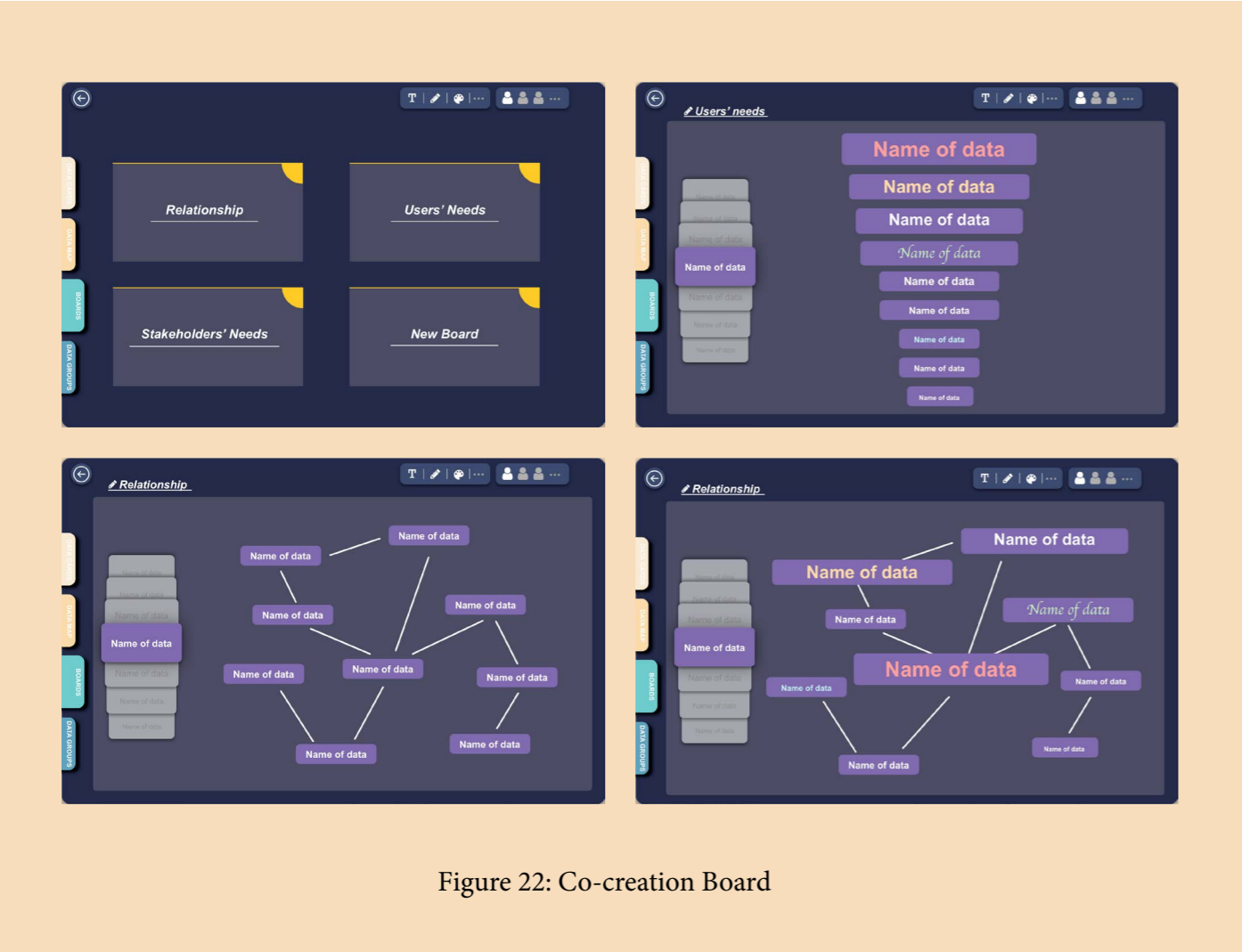


Figure 22: Co-creation Board

Data Group

During the whole process, designers can apply Data Group through adding the related data card into one group (Figure 22). Groups could be formulated according to designers' hypotheses or interesting insights that designers want to learn about. The data groups are used as data analysis plans to share with data scientists to validate these hypotheses and insights.

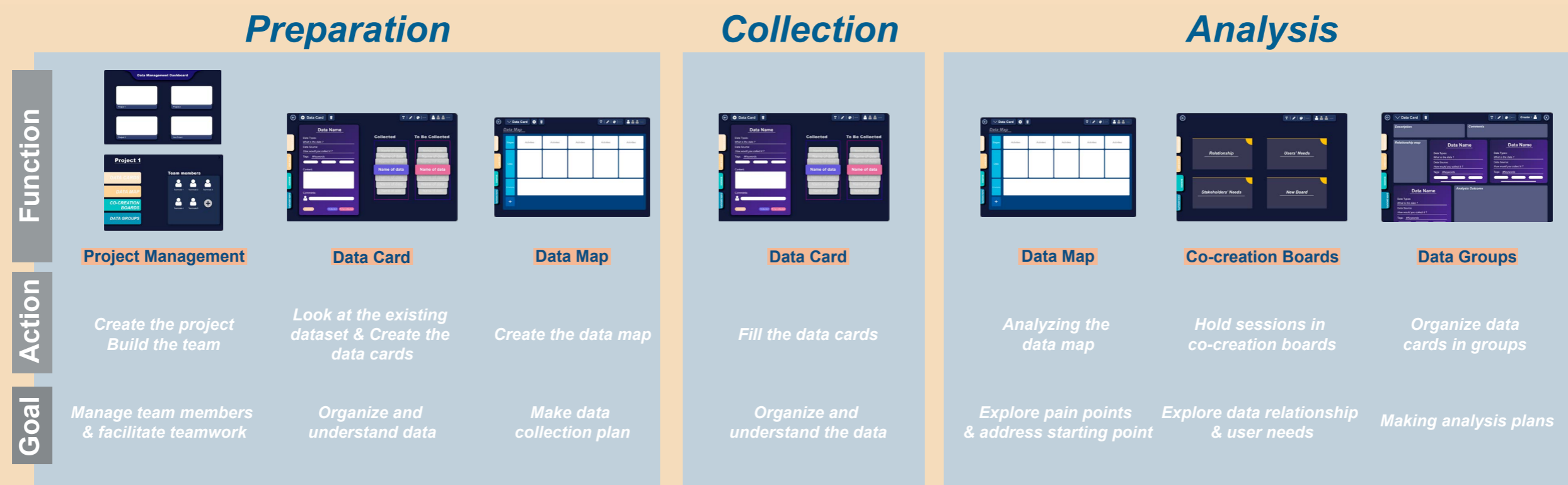
From Data Map and Co-creation Boards, designers can understand big data comprehensively. Some hypothesis may be formed. Insights on data relationship and users' needs are uncovered. Therefore, designers are able to build the analysis plans with Data Group and ask data scientists to verify the hypothesis and explore the insights. During formulating the data groups, teammates and stakeholders

are invited to review the plans. It makes sure that the plans can fit different parties' needs and avoid time-wasting. After well-considered, the analysis plan will be shared with the data scientists to get the analysis outcome.

Data Group provides a clear way for the communication and cooperation between designers and data scientists. From the literature review and Context Mapping, I learned that the communication between designers and data scientists goes not so well. Some misunderstandings may happen because of the different mindsets. Data Group helps designers organize their minds and delivery their ideas in a reasonable way. Not only data scientists but also other stakeholders can understand correctly.

6.3 Workflow

At this part, I interpreted one of the workflows of Data Management Platform. It was designed according to the big data application process, which includes preparation, collection, and analysis. It is a practical process for designers to applying big data.



Preparation

At the preparation phase, designers need to explore the existing dataset, make the data collection plans, and understand the data value. The Data Management Platform can help designers do the preparation well.

At the beginning, designers can use the Data Management Platform to create the project profile and build the team. It could be used for managing the team members and facilitate teamwork. To be able to understand the existing dataset well, Data Card can be used for transcribing it. Through looking at the existing dataset and filling the data cards, all the big data can be transferred into the easy-to-understand cards. It helps designers to organize and understand the existing big data. The next step is creating the data map. Through analysis, designers can develop the general user experience and fill the Stage layer in the data map. Then, the existing data cards can be added into the map. A rough

map could be built. By connecting the activities and data, designers can figure out what data is missed and need to be collected, and how it could contribute to the project.

Collection

After the data map is built, the data collection plan is also formulated. According to the data map, designers can collect big data with help from data scientists, users, and other stakeholders. Along with the collection, data cards can be created and filled. It helps designers to understand big data and internalize it. With the help of data map and data cards, all the collected data is well organized.

At the collection stage, according to the literature review and user research, thick data research is usually conducted at the same time. Therefore, the data for the Emotion layer could be collected and added. More layers can be added in the map according to the different projects.

Through combining big data and thick data, Data Map is built completely.

Analysis

With the completed data map, thick data and big data are connected directly. It would be easy for designers to explore the pain points and users' needs. The starting points for the analysis can be set easily. For example, the analysis could start from the low point of the emotion curve. The related big data could be targeted. Designers can discuss the related data with stakeholders to learn about what affects user experience. The Co-creation Board can be used at this moment.

Co-creation is necessary for user-centered design outcomes. Designers can use Co-creation Boards to collaborate with users, stakeholders, and teammates. Data cards are useful at this stage. It can not only help designers to stay the overall perspective, but also

be easy for the participants to understand big data. Through the co-creation, the big data relationship and priority can be figured out. It provides designer insights to come up with hypotheses and form the analysis plans.

Data Groups as the big data analysis plan can be made along with the co-creation. According to the insights from Data Map and Co-creation Board, designers can cluster the related big data in one Data Group. Whether the purpose is to find insights or verify hypotheses, data groups can clearly present designers' ideas to others. Through sharing with teammates, the plan could be well validated. In the end, the handover between designers and data scientists could be accurate.

The workflow is designed to solve the problem of data overwhelmingness. Through integrating the insights which I learned from designers' practical experiences (Chapter 3.3), this workflow can be suitable for actual use. During the process, no matter project leader, translator, communicator, empathizer, or analyst, this workflow can help designer shift among these roles smoothly. It makes full use of the collaboration between big data and thick data to target the missing data and explore the in-depth insights during the whole 3 steps. When designers experience this process, they do not need to look into big data content and are guided by a workflow that suits designers' way of thinking.

# EVALUATION

After the Data Management Platform was proposed, I designed the evaluation tests to evaluate if the concept is able to solve the design problem: *“How to help designers to avoid being overwhelmed during translating big data into insights?”*, and meet the designers’ needs **Assistance, Cooperation, Communication**, and **Autonomy**. I designed 2 evaluation rounds, which evaluate the process of processing big data with the platform and evaluating the outcomes of the different functions of the platform.

## 7.1 Evaluation Criteria

The evaluation criteria were designed based on the requirements that I learned from the research study, including two parts which are if the final concept solves the design problem and if the final concept meets designers’ needs.

According to the Context Mapping and problem definition session, there are two key aspects contributing to data overwhelmingness.

1). Analyzing big data is a time-consuming and energy-consuming task for designers, especially when they looking into big data content.  
2). Designers may feel clueless and directionless to start big data analysis. Therefore, an eligible solution to the design problem needs to meet the following two requirements:

*1). The solution is able to help designers to deal with big data effectively.*

*2). The solution provides the guidance and starting point which are easy to follow.*

From the co-creation session, the solution space was shaped, and designers’ needs were addressed. This platform was designed to meet the requirements of Assistance, Cooperation, Communication, and Autonomy. Hence, I came up with the following four criteria to make sure that the final concept meets designers’ needs:

*1). The concept facilitates the cooperation between designers and other stakeholders.*

*2). The concept facilitates the communication between designers and other stakeholders.*

*3). The concept provides assistance on dealing with big data.*








*4). The concept keeps designers with autonomy which means that designers make design decisions by themselves.*

These 6 criteria were used for designing the evaluation tests to make sure that the evaluation can validate if the Data Management Platform is able to solve the design problem and meet designers’ needs. These criteria were reflected in the interviews during the evaluation tests. Through the interviews, participants’ feelings and insights on experiencing the concept were understood. In the interviews, some questions were specifically designed based on the 6 criteria to make sure that the evaluation is qualified.

7.2 Process

The evaluation was separated into two parts to make sure that each experiment would not last too long. Participants could focus on the test during the whole process. The first experiment was about validating the user experience of the platform, including the usage of each function and workflow of the platform. The second experiment was designed to validate the delivery of the platform. Through this experiment, I could learn about if the platform could help designers address the qualified insights from data. With these two experiments, the evaluation can highlight if the platform is able to prevent designers from the data overwhelmingness and meet designers' needs

The participants of the evaluation were novice designers who are the target group of the project. There were 3 evaluation sessions held for experiment 1, and 5 evaluation sessions were held for experiment 2. Each session had 1 participant. All the participants are graduation students from the Industrial Design Engineering faculty at the Delft University of Technology. They all had several project experiences on dealing with big data which made sure that they can compare the platform experiences with their previous big data application experience.

EVALUATION 1		EVALUATION 2	
Aspect	User Experience	Heuristics	
Participants	3 novice designers	5 novice designers	
Time	An hour and a half	An hour and a half	
Process	 Introduce the Concept	 Deal with Excel file	
	 Operate the platform by themselves.	 Introduce the Concept	
	 Semi-structured Interview	 Analysis big data with platform output	
		 Semi-structured Interview	

Evaluation 1

The first evaluation was composed of 3 steps: Presentation; Operation, and Interview (In Appendix). The whole evaluation session was organized online with Miro and Zoom. It lasted one and half hour each. The aims of this experiment were to learn about designers' feelings and experiences on using the functions and applying the workflow of the platform and validate if they meet the criteria.

During each evaluation session, participants were introduced to the Data Management Platform, and then asked to do a task with the platform. In the end, an interview was held to learn about the participants' experiences and feelings.

For step 1, I introduced the concept and used the low-fidelity prototype to explain the functions and workflow of the platform.

At step 2, a task on improving the online shopping experience was proposed. It was a fictitious project designed based on a public dataset that I downloaded from Kaggle (Kaggle is an online community where data scientists can share datasets). It required participants to use the platform to deal with a dataset which I provided in the form of Excel spreadsheets. With this task, participants could position themselves in real project environments to reflect on the platform. I would play the different roles in the task, like stakeholders, users, and teammates, to provide timely support when participants need communication and cooperation with other people. The reasons why I would play those roles were that I created the task and was familiar with it, and I could observe and record the whole process to validate if the platform facilitates communication and cooperation. At this step, participants experienced the general workflow, including creating Data Cards, building the Data Map, using Co-creation Boards to analyze data, and coming up with Data Groups for further analysis. (Because of the time limitation, I didn't ask them to re-collect data after creating the Data Map. The Data Map was created by participants only based on the provided dataset in the experiment.)

Next to it, an interview was conducted to learn about participants' experiences, feelings, and

ideas on the platform. The semi-structured interview script was designed based on the evaluation criteria, and some questions would be come up with according to their performance in the task.

Evaluation 2

The second evaluation was composed of 4 steps: Analyze with the raw dataset; Concept presentation; Analyze with the outcomes of the platform functions; and Interview (In Appendix). The whole evaluation session was organized online with Miro and Zoom. It lasted around one and half hour each.

Instead of validating the functions and workflow of the platform in experiment 1, for experiment 2, participants were asked to explore the hypotheses and insights based on the outcomes of the functions. The goal of this experiment was to assess the platform's and validate whether the platform was allowed for a reduction of the overwhelming feeling comparing with analyzing with Excel sheets only. At the beginning of the evaluation session, I provided a project brief to the participants which is similar to the one in the first evaluation session. Through providing a concrete and practical project, the actual situation can be simulated during the evaluation.

For the first step, participants were asked to explore a raw dataset which was in the form of Excel spreadsheets to look for insights and hypotheses. I used Excel because, according to the online survey done by Alejandra Gomez Ortega, it is the most common tool used by almost all the responders. The goal of this step was to help participants to experience the existing analysis process with Excel. It was possible to allow them to recall their previous big data application experiences if they had. At the end of this step, participants filled out an online survey to record their impressions on the Excel analysis experience in time. Questions were designed with 5-Point Likert Scale which is easy for participants to measure their feelings. The answers of the online survey would be used as the material for the interview.

After that, I introduced the Data Management Platform and its workflow to the participants.

During the presentation, I encouraged them to ask any questions to make sure that they know the concept well.

For Step 3, I applied the same raw dataset with Data Cards, Data Map and Co-creation Boards in advance and provided the outcomes to the participants directly. What participants needed to do was coming up with the analysis plans based on the hypotheses and insights they learned from the provided function results. At the end of this step, participants were asked to fill an online survey. It is similar to the one in step 1, and an open question was added to encourage participants to share some suggestions for improving the platform.

In the end, an interview was done to learn about designers' feelings and experiences in detail and figure out if the platform could inspire participants, relieve participants'

feeling of being overwhelming by big data, and meets designers' needs. According to the insights and hypotheses proposed by participants, their thought processes along with the platform application experiences were discussed during the interview. The interview was semi-structured, and some questions emerged based on the observation during the experiment. The two online surveys recorded participants' feelings at step 1 and step 3. During the interview, they were used as the materials and references to discover the reasons behind those feelings.

## 7.3 Outcomes

By analyzing all the interviews, the Data Management Platform was evaluated according to the predefined set of criteria. In the end, 6 insights were concluded from the experiments. Some interesting interview quotes are listed to show the participants' feelings and experiences during the evaluation.

**1). The solution is able to help designers to deal with big data effectively.**

**2). The solution provides the guidance and starting point which are easy to follow.**

**3). The concept facilitates the cooperation between designers and other stakeholders.**

**4). The concept facilitates the communication between designers and other stakeholders.**

**5). The concept provides assistance on dealing with big data.**

**6). The concept keeps designers with autonomy which means that designers make design decisions by themselves.**

### 1. The Data Management Platform could relieve designers from feeling overwhelmed when they deal with big data

*For experiment 1, when asked about his experience of the platform's workflow, P2 said, "The workflow is reasonable and understandable for me; the connections between different steps are smooth." P1 and P3 shared similar feelings when asked if the workflow is easy to understand. P3 added that "Although the step of building the data cards is a brand-new activity for me when I did the following steps, data cards were becoming useful and reasonable."*

*To assess if the platform can relieve the data overwhelmingness, I asked them, "Do you think if the operation process is overwhelming for you?" in experiment 1. P1 shared, "The platform spontaneously guided me to go through the whole workflow." Similar insight was shared by P3, "At the beginning, the process was reminded by you, but when started to operate the steps, the process happened naturally."*

*When asked about their experiences on coming up with insights in experiment 2, P2 said, "The outcomes of Data Management Platform are easy and clear to use, I am not familiar with big data, but I am able to come up with insights with the help of this tool. When I analyzed with the Excel sheet, I felt confused and clueless. The platform provided guidance and assistance to me."*

The evaluation experiments indicated that the Data Management Platform provides an effective and easy way to deal with big data compared with analyzing big data with Excel. Through using the platform and following the workflow, designers are assisted in understanding big data and exploring the insights which possibly make them feel relieved and confident.

### 2. The Data Management Platform likely meet designers' needs on Assistance, Cooperation, and Communication.

*During both experiment 1 and 2, participants could ask for help from me as the teammates, users, or stakeholders of the fictitious project. During the experiment, All of them needed me as one or more of the project's roles to help them. When asked them about how their feelings and experiences on the cooperation with me, P2 from experiment 1 said, "The platform provided a new way for me to work with teammates. Some functions in the platform, like Data Map and Co-creation Board, encouraged me to cooperate with others. And the cooperation was inspiring and brought many new insights from different perspectives."*

*P3 asked me to be the user when using the Data Map and Co-creation Boards, and to be the teammate for the Data Groups during experiment 1. During the interview, I asked her about the general impression of the platform, and why she proposed the cooperation, she said "This platform provides a modeled and visualized process which can cohere different people's thought process. With the platform's help, it is easy for me to communicate my ideas with different people without endless explanations." P5 from experiment 5 had similar ideas from the function outcomes perspective. He said, "The outcomes of the platform outcomes help*

*communicate big data and insights with different stakeholders who are even not the designers or data scientists.”*

*P2 from experiment 1 thought that the cooperation is interesting, after she asked me to build the data cards with her. She said, “It’s fun to create the data cards with teammate through discussion and sharing different insights.”*

According to the participants’ feedback, the Data Management Platform highly meets designers’ needs for a valuable tool for cooperation and communication in the project. In the experiments, almost all the participants asked for help from me as the users or teammates. Functions like Data Map and Co-creation Board encourage designers to work with others for diverse inspirations. Meanwhile, these functions provide visualized information to facilitate the communication between designers and different stakeholders, to some extent.

### **3. It indicated that more in-depth insights could be uncovered, and the reasons behind can be revealed from the platform.**

*Data Map in the platform can put thick data and big data together to help designers understand the data better. During experiment 2, P3 highlighted, “Involving user experience and their feelings helped me address the pain points and know where I should look at first. Combining thick data and big data facilitated the insights generating. I think with the help of the platform, some more interesting insights were proposed comparing analyzing with Excel sheet only.”*

*When asked about the experience on Co-creation Board, P1 said, “With the Excel sheet, I focused on each numbers and text, which takes me lots of time to go through one data type. While with the assistance of the platform, especially the cooperation with you in the Co-creation Board, I looked at the relationship level immediately. it is more meaningful.....”*

*Through comparing the insights from the Excel sheets with the insights from the Data Management Platform, P4 from experiment*

*2 said, “The platform brought me to another thinking level where I focus on the relationship of different data and think about if the big data is valuable for the users and projects.” Other participants from experiment 2 shared similar feelings. After comparing the insights from two processes in the interview, they thought the insights from the platform are more interesting and inspiring.*

From experiment 2, I noticed that when participants had access to the dataset, they usually looked at the numbers or text directly. Some insights which data scientists may spend several minutes figuring out with some data analysis programs took designers lots of time to address. Since the participants were graduation students, most of the participants mentioned they are not familiar with Excel very well, making the analysis process more difficult. After using the Data Management Platform, the participants thought that the insights they got from the tool were more meaningful and interesting than the insights they retrieved from the Excel file directly.

### **4. Involving algorithms might make the platform more intelligent and easy to use**

*When talking about their experience in applying the functions in the platform during experiment 1, P2 shared some suggestions for improvement, “Some algorithms could be involved to automatically generate the basic information in data cards, like data type and data sources. There are some text extraction technologies. You can involve them in Data Card. For example, users can input the raw dataset, and the platform could fill the basic information in data cards automatically. It would save some time”. P3 had similar concerns, “For this experiment, I handled 12 types of data. The process didn’t take too much time. But, if there are dozens of different data, it may take some time. If building the data cards and data map can be done by the platform, it will be much easier and quicker.”*

*P1 from experiment 2 said, “Now that it is already a digital platform, why don’t you involve some algorithms to make the platform help me*

*to do some basic analysis. For example, in the co-creation boards, when designers connect 2 types data, the analysis outcome could be shown directly.” P3, P4 from experiment 2 had similar ideas when they created the data groups.*

When the participants operated the platform, 6 of them mentioned that some algorithms and technologies like information extraction or regression analysis techniques could be applied in the platform. It should make the platform become more convenient for designers. For Data Card, the information like “data type” and “data source” can be extracted from raw data by algorithms automatically. Designers can fill out the other parts of data cards, which could become effective for designers. Some analysis techniques can be added to Co-creation Boards.

### **5. Clear platform instructions and some tips could provide help, especially for the novice of the platform.**

*After experiencing the workflow in experiment 1, P 1 described it, “helpful and inspiring”. Meanwhile, she thought even if every function is used alone, it is heuristic. She shared the idea, “You can design different workflows through combining different functions in different orders for designers who are in different situations. The platform may be valuable for analyzing thick data too”. Similar views were also proposed by P 3 and P 5 from experiment 2. Different functions have different values for different designers and projects. They thought that designers could design the workflow of the platform for different projects at the beginning of the project.*

The platform is a new concept for the participants. All the functions and the workflow are new experiences for them. Explicit and detailed instruction is fundamental for them to learn about the platform, especially for first-time users. During the evaluation, although I explained the concept at the beginning, when participants operated the platform or used the outcomes, sometimes, they still met some details that were not clear for them.

## 6. This platform has more possibilities waiting to be explored

*Although all the participants were satisfied with the platform and thought it could help them develop valuable insights, some of them needed some help when they applied the functions. P1 from experiment 1 said, “It is confusing when operating it for the first time. Those functions are brand new to me. I need some clear instructions.” P3 from experiment 1 also thought so. “You need to clarify each button and how the functions can be switched between each other for first-time users. I can ask you, but you cannot explain to each real user. You need to provide some instructions”. P3 also said, “It will be better if you can provide some tips on collecting data and what kind of stakeholders should be invited. It may be beyond the platform’s responsibilities, but, It will make the platform more reliable.”*

Two participants shared their confidence in the platform. They thought that the platform has more potential for dealing with big data. The platform could assist designers with varying levels of big data related knowledge for different projects. With flexible adjustments, the platform could be used for not only big data, but also thick data. It could be a universal tool for designers to research at the earlier stage of projects.

## 7.4 Conclusion

Insight 1 indicated that the platform was validated to provide designers some assistance in relieving the feeling of being overwhelmed by big data. At the same time, insight 5 highlighted that, as a brand new approach, the platform needs to be introduced in detail. Insight 2 showed that designers’ needs for the solution were also satisfied in a way. Insight 3 showed that this platform is able to trigger designers’ thought processes and give them an approach to think about big data at a different level where the data relationship and users’ needs are priorities.

Insight 4 interpreted the feedbacks on adding more technologies into the platform. Although, the platform could prevent designers from data overwhelmingness to some extent, some repetitive tasks, like transcribing data from Excel to data cards, are still a burden for them. Participants showed the expectations on the involvement of advanced technologies. Insight 6 showed that participants hold high expectations for the platform’s potential.

# CONCLUSION

This thesis aims to help novice designers have a better big data application experience in the design process. During the research phase, I found that the most significant factor that affects designers' performance in the design process is the feeling of being overwhelmed by big data when they translate big data into insights. In the end, the Data Management Platform was designed as a tool to help novice designers to relieve this feeling and come up with valuable insights.

For this project, the research question:

***“How to help designers to apply big data in the design process?”***

was used as the starting point. To be able to answer the research question comprehensively, I designed two sub-research questions based on the literature review:

1. How are designers' experiences in applying big data in the design process currently?
2. What are the challenges for designers to apply big data in the design process?

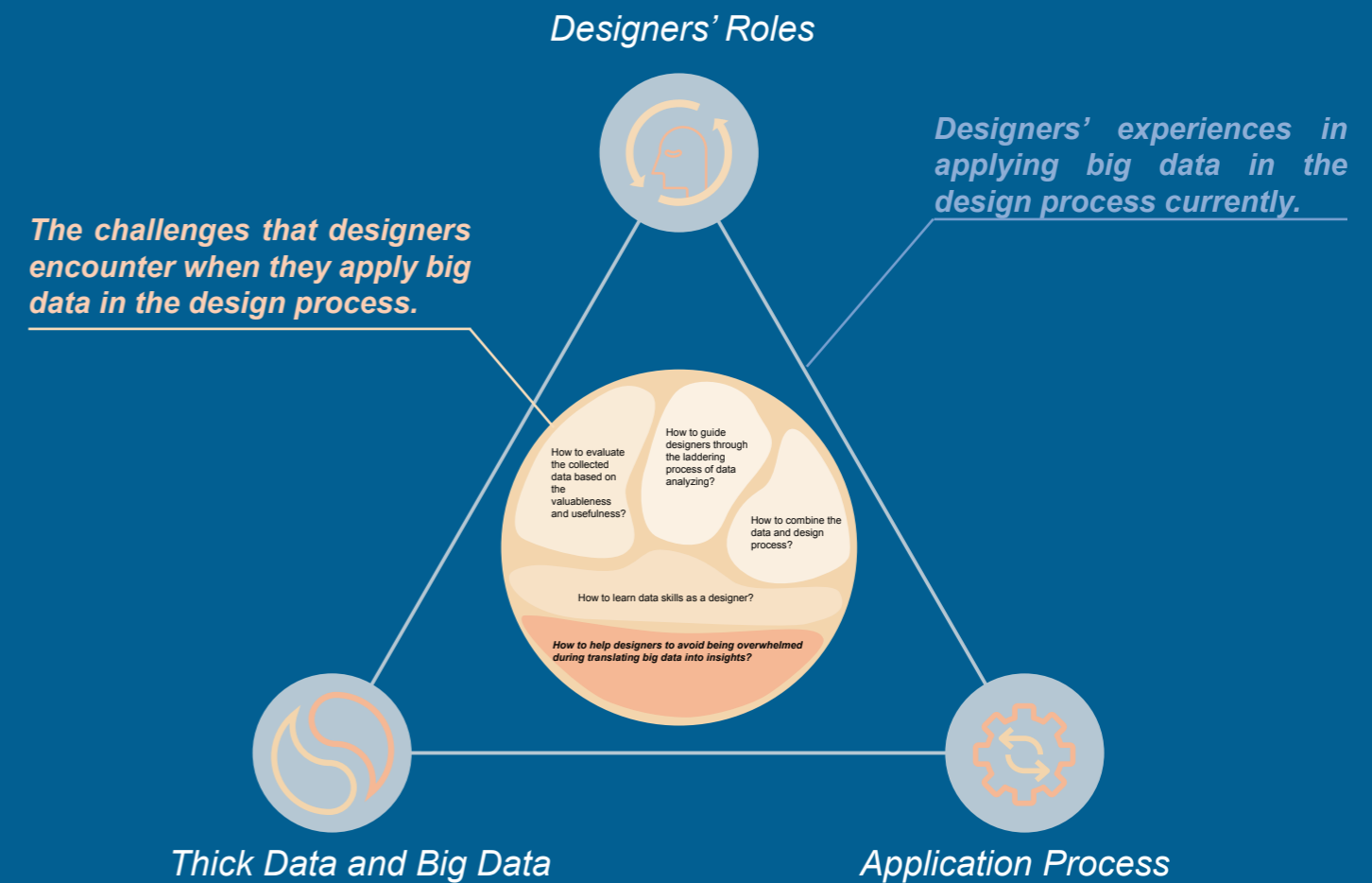
To answer the first research question, I did Context Mapping to learn about designers' experiences and feelings. Then, through collaborating with different designers in the problem definition session, the challenges designers encountered in applying big data in the design process were revealed. The insights I learned from the session answered the second sub-research question. Design problem was also proposed from the session.

***“ How to help designers to avoid being overwhelmed during translating big data into insights?”***

After that, a co-creation session was held with novice designers to collect their ideas and needs for a satisfying tool. The session outcomes built the solution space of the design problem. Based on the insights I learned from the session, the final concept, “Data Management Platform” was proposed.

The Data Management Platform is a tool that can be used for assisting the process of translating

big data into insights. It helps designers to understand data from the relationship level instead of the data content only. In this way, more meaningful and in-depth insights can be revealed, and the data overwhelmingness would not affect designers' performance during the design process.



### Limitation

1. I didn't do any research on data scientists. Because of the time limitation and lack of network. They are one of the stakeholders in the big data application process. At the end of the workflow of the platform, data scientists will be invited, and data analysis plans would be shared. The cooperation between designers and data scientists are inevitable. While, some collisions are happening in the collaborations. Andrew Hogan, the Principal Analyst from Forrester, mentioned, “Data scientists overlook the value of design, and designers don't get what's possible with data and machine learning.” in his research. It could be an interesting field for me to do research. Learning about their ideas could help me to develop the platform comprehensively.

2. The evaluation tests are not enough. During experiments, the platform was validated with the fictional task and using the low-fidelity prototype because of the time limitation. The platform should be evaluated in real cases, after it is well developed.

### Future Work

1. Research on data scientists could be done to learn about their experiences and needs in collaboration with designers. The insights can be used to contribute to the development of the Data Management Platform.

2. The Data Management Platform needs to be developed into a workable program, so that a wider range of evaluation tests can be organized and more insights can be collected. After the workable program is developed, the Data Management Platform should be evaluated with more designers from different fields in their practical projects to learn about the platform's potential

3. Since this platform focuses on novice designers, it has the potential to be the educational tool for designer students to learn about how to manage the relationship between data and design, between big data and thick data. Some research could start from this perspective

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