APPENDIX: PROJECT BRIEF

DESIGN FOR our future

TU Delft

IDE Master Graduation

Project team, Procedural checks and personal Project brief

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

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy".
Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !

family name: Mellado Cruz
initials: D given name: Déborah
student number: 4993411
street & no.:
zipcode & city:
country:
phone:
email:

Your master programme (only select the options that apply to you):

IDE master(s): ( ) IPD (1) DfI ( ) SPD
2nd non-IDE master:
individual programme: - - (give date of approval)
honours programme: ( ) Honours Programme Master
specialisation / annotation: ( ) Medisign
( ) Tech. in Sustainable Design
( ) Entrepeneurship

SUPERVISORY TEAM **

Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair: Milene Guerreiro Gonçalves dept. / section: DOS
** mentor: Senthil Chandrasegaran dept. / section: DOS
2nd mentor: Nicole Eikelenberg
organisation: Ford
city: Aachen country: Germany

comments (optional): Both supervisors have different expertise areas that complement each other for this project: Dr. Goncalves will help with the design process and creativity aspect.

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..

Second mentor only applies in case the assignment is hosted by an external organisation.

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

APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair Milene Guerreiro Gonçalves date 21 - 04 - 2021 signature

Digitally signed by Milene Guerreiro Goncalves - IO Date: 2021.04.21 14:40:04 +02'00'

CHECK STUDY PROGRESS

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

Master electives no. of EC accumulated in total: _____ EC

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

List of electives obtained before the third semester without approval of the BoE

YES all 1st year master courses passed

NO missing 1st year master courses are:

name date - - signature

FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **. Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: APPROVED NOT APPROVED

Procedure: APPROVED NOT APPROVED

comments

name date - - signature

Initials & Name D Mellado Cruz Student number 4993411

Title of Project Interactive Visual Exploration for Creativity

Interactive Visual Exploration for Creativity

project title

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

start date 02 - 03 - 2021 14 - 10 - 2021 end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

Nowadays products are becoming more and more connected and, in combination with various services, are generating large amounts of data, especially when live data streams are involved. With this exponential connectedness, it becomes more complex for companies to make use of the overwhelming sea of available data.

However today's data revolution isn't just being driven by the growing abundance of data; it's being fueled by fundamental technologies that change the way we gather, store, analyze, and transform data.

Since 2014, Ford has decided to take a more comprehensive and strategic approach to data-driven decision-making throughout the entire enterprise (Henschen, 2017). As a result, data-enabled design has become a relevant strategy to implement at the Research and Product Development department (R&D).

Although data science and design have complementary qualities, approaches like data-enabled design that integrate them are less established (van Kollenburg & Bogers, 2019). Data-enabled design is an approach in which data is used as a creative design material that can inspire and inform the design process (Bogers, S. et al. 2016.)

For this reason, two principal goals of data-enabled design are making use of existing tools in new contexts and developing new tools to translate data into insights and to inspire the design process. Among these tools, data visualization could be considered as one of the most relevant. A considerable amount of literature has been published independently on data visualization and creativity that suggest a positive correlation between them due to aspects like:

- It's an accessible way to address the challenge of the overwhelming thin data (Knaflic, 2015) because as scholars have suggested it can make sense of big data by complementing it with sources of highly contextualized thick data (Bornakke & Due 2018)
- It promotes engagement and inspiration. Recent studies like Cawthon and Vande Moere (2007) have shown the positive effect of aesthetics and story-telling on how the viewer interprets information.
- An effective visual triggers discussion between the different observers which can be valuable for boosting creativity inside a design team (Gino et al, 2009).

Due to this potential, data visualization could be a key for Ford towards the transition to an effective data-enabled design process. On one hand, this is a familiar and used tool at Ford but not with the purpose to boost creativity yet. On the other hand, as the use of data visualization as a creative tool inside the design process is a field that has almost never been explored (van Deursen, 2019), there is a big range of possibilities for improvement.

Until now, data visualization at Ford is mostly used as a final graphical step in the data analysis to convey information but what will happen if it is used more dynamically to explore and uncover insights inside the data?

This project will focus on answering this hypothesis by developing a new exploratory role for data visualization, so it can be a meaningful and inspiring way to generate ideas and to identify insights for Ford's design team (Figure 1).

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introduction (continued): space for images

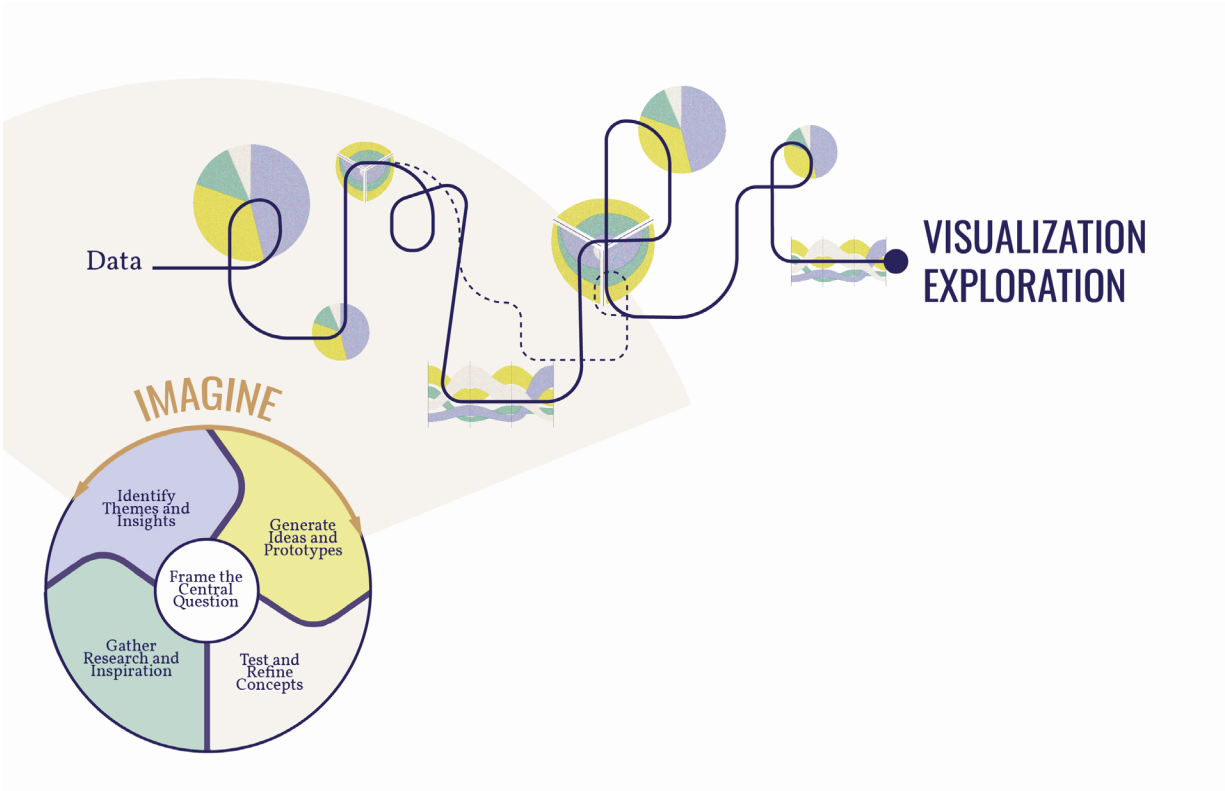

image / figure 1: The project will be framed inside the "Imagine" phase of Ford Data-Enabled design strategy

References

- **Henschen, D. (2017).** *Ford Analytics Team Democratizes Retrieved Analysis.* June 2, 2017.

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- **Bornakke, T., & Due, B. L. (2018).** *Big–Thick Blending: A method for mixing analytical insights from big and thick data sources.* Big Data & Society, 5(1), 2053951718765026.

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- **Cawthon, N., & Moere, A. V. (2007, July).** *The effect of aesthetic on the usability of data visualization.* In 2007 11th International Conference Information Visualization (IV'07) (pp. 637-648). IEEE.

- **van Breemen, D. (2019).** *The use of data visualization during the creative process (Master Thesis) Communication and Information Sciences Specialization Communication Design Faculty of Humanities and Digital Sciences Tilburg University, Tilburg*

- **Davenport, T. H., Kozyrkov, C., Glaeser, E., & Siegel, E. (2020).** *Strategic Analytics: The Insights You Need from Harvard Business Review.* Harvard Business Press.

- **Méndez, G. G., Hinrichs, U., & Nacenta, M. A. (2017, May).** *Bottom-up vs.* top-down: Trade-offs in efficiency, understanding, freedom and creativity with infovis tools. In Proceedings of the 2017 CHI conference on human factors in computing systems (pp. 841-852).

- **van Breemen, D. (2019).** *The use of data visualization during the creative process (Master Thesis) Communication and Information Sciences Specialization Communication Design Faculty of Humanities and Digital Sciences Tilburg University, Tilburg*

- **Fekete, J. D., Van Wijk, J. J., Stasko, J. T., & North, C. (2008).** *The value of information visualization.* In Information visualization (pp. 1-18). Springer, Berlin, Heidelberg.

image / figure 2: References

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

Very few companies have implemented interactive data visualization further than as a mere communication tool to express the results at the end of an investigation to their own team or other stakeholders (Few, 2014). However, as visualization researchers and practitioners are convinced using data visualization as part of the initial analytical process could significantly improve the speed and quality of the knowledge obtained. (Batch and Elmqvist, 2018).
Research has continually demonstrated that designers' creative performance during idea generation is influenced by formerly acquired knowledge (Liikkanen & Perttula, 2006). Therefore, this project will try to answer the following research question: How Ford's design team can use Data Visualization as an exploration tool to facilitate their creative process which can lead to innovative insights?.
Some aspects might be taken into consideration:
- Designers are in general not trained and prepared to work with big data and its visualization (Davenport et al. 2019). Therefore, they highly depend on good communication and collaboration with the data specialists from the company.
-Data visualization can make use of two different data collected at Ford. The first one, extracted from interviews, observations, etc is the main one used in the design process until now but is rarely visualized. The second one, obtained thanks to sensors inside the automobiles, is extensive in numbers but without a context, the value of it gets totally lost.
-As most companies, Ford makes use of advanced heavy analysis visualization tools like Tableau or Qlikview. However, this might not be the best solution as they are generally templates gener (Méndez et al., 2017).
-Designers usually understand data better when it's visualised and presented in a more meaningful way (Cawthon and Vande Moere, 2007).
-There's a whole selection of visualization methods to present data in effective and interesting ways, however most companies use static charts. By contrast, one of the most accepted definitions of data visualization emphasizes how interactiveness is the key for visuals to support the purpose of the visual: "amplify cognition" (Fekete et. al, 2008)

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

This project aims to create a supportive system/tool for Ford's design team to use Data Visualization as an exploratory, dynamic and interactive tool to analyze their data and be inspired to generate more creative ideas.

Depending on the initial research, the system/tool will be developed in a digital or physical form.

This project is embedded in a research collaboration between TU Delft and Ford Research & Innovation Center at Aachen. Currently, different graduation projects are running parallel to explore opportunities to implement a most efficient data use with the objective of mutual collaboration. To contextualize the project, Ford will provide a case-study of commercial passenger vehicles that include thick data extracted from interviews, co-creation sessions, etc, and big data extracted from sensors inside the automobiles.

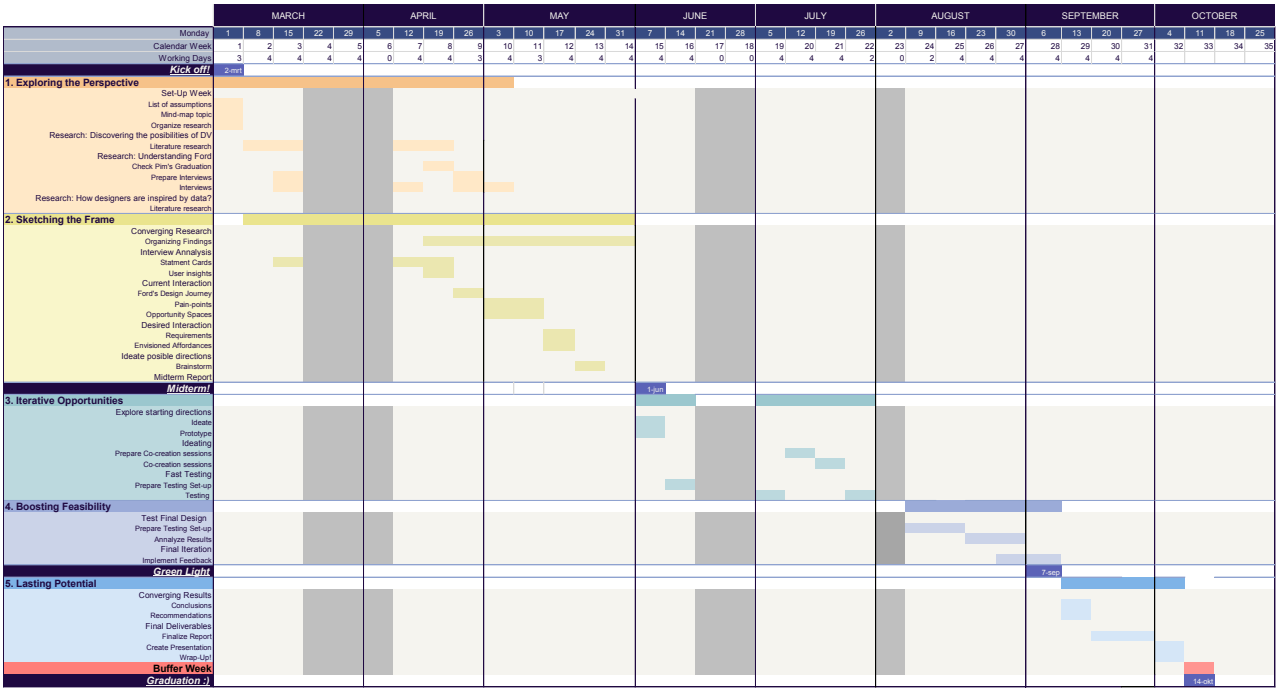
Initials & Name D Mellado Cruz Student number 4993411

Title of Project Interactive Visual Exploration for Creativity

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 2 - 3 - 2021 14 - 10 - 2021 end date



The project will have five main phases:

1. Exploring the perspective (Research)
a)Discovering the possibilities of Data Visualization + b)Understanding Ford Design Team needs and working process + c) Inspiration & Data (*Literature research, Interviews, Questionnaires, Observations, etc.)
2. Sketching the frame (Framing)
Shaping the research insights into easily communicative information to ensure fluid work-flow. Based on these, we further detail the project goals with the client. (*Report, Visual analysis. Creation of personas, Stakeholders maps, Mind maps, etc.)
3. Iterative opportunities (Ideation)
Finding out the best solution gap:the ideation activities take place (*Participatory sessions, creative team working or rapid testing)
4. Boosting Feasibility (Validation)
Evaluating and refining our proposal until obtaining the most suitable design for Ford. (* Prototype testing, data analysis, critical reflection, etc.)
5. Lasting Potential (Final development and Recommendations)
Refining the system that supports Ford. Reflecting and future scenarios.

Initials & Name D Mellado Cruz Student number 4993411

Title of Project Interactive Visual Exploration for Creativity

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

I believe that a Msc Graduation Project, without considering the topic itself, is a huge challenge to take responsibility and maximize my learning process as a professional designer.

Regarding the nature of the topic I want to emphasize three main points that drove towards this opportunity:

1. Wait, If i don't 'see' it, I don't understand it.

If someone asks me what is the most important language I speak I will for sure answer the visual one. Visualizing is not only the most accessible way I have to communicate myself (independently of the audience's sociocultural backgrounds) but is a cognitive process that allows me to bridge the gap between mental abstraction and tangible concepts.

Unconsciously, this was one of the reasons why I studied not only Industrial Design but also a Fine Arts bachelor.

During my MSc in Design for Interaction, I become aware of how visualization is one of the keys to the success of a project. Therefore, I believe there is a need to develop further research on how to implement visualization methods and methodologies into the design process.

2. Everything can be transformed into data so why not working with it?

Data is inherent to human activity and the digital dimension has given us an immeasurable opportunity to obtain, collect and process it. As a designer, I can't even imagine the possibilities to create products, services, etc. that fit the users and promotes the sustainability and wellbeing of humanity.

Until now, I have worked mostly with thick data and I can't wait to understand further how it can be complemented with the use of Big Data.

3. A designer works in a real eco-system!

Lastly, I am looking forward to framing the project within a company environment like Ford. A great chance to work in a bigger and more complex system, where my designer insights might turn into value and opportunities for the stakeholders.

Personal Learning Ambitions

- I want to gain more knowledge on data visualization.
- I want to develop further my visualization techniques, exploring new skills for example coding.
- I want to improve on project management and gain confidence in my practice as a designer
- I want to have a flowing communication with my supervisors and the company, providing my discoveries and results in a professional way (writing, oral presentations, and visuals)

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

Initials & Name D Mellado Cruz Student number 4993411

Title of Project Interactive Visual Exploration for Creativity

APPENDIX: INTERVIEWS AT FORD

Prior to have the interviews, in collaboration with the other URP students, we created a question guideline to follow with the participants:

Questions for R&A project teams

Regarding the preparation for the ideation session

When do you hold a session? Why?

How do you prepare for a session?

What materials do you prepare for the session?

Regarding the team for design session

Can you introduce a bit about the team members for a design session?

How many people are there?

What are their backgrounds and experience?

Are there different roles in the session?

Do you think people in your team have different attitudes or expectations when working together? What are these attitudes?

Regarding the current design process and problems

Can you introduce how a typical design session goes?

Can you maybe give us an example of a recent session?

How does it go?

What do you do to understand the problem? *Ask in a case about methods or materials

Can you refer to any data involved?

What part do you like? Why?

What part do you dislike? Why?

Are there problems occurring in different stages of this process?

Are there any problems with the teamwork? Why?

Do you have any problems working with the methods and materials you mentioned?

How do you deal with them currently?

Regarding the ideal design process

Did you feel not satisfied with the outcome sometimes? If the outcome doesn't go as wanted and you need to redesign a product or service you already worked on, would you have changed something of your first design process?

How will you change the steps be like?

How do you think you would have worked better?

Did you ever reflect as a team after a session?

What would make it a nice team dynamic for ideation?

Regarding dealing with data

How do you usually approach data? Both qualitative and quantitative.

Do you do data analysis? How does that go? What steps are taken?

Do you get support from GDIA? How does that work?

Regarding creativity

What do you think inspires you? Why? What doesn't work?

Do you use any criteria for assessing ideas or concepts from ideation? What matters for you? E.g., originality, novelty, feasibility.

Questions for data specialists from GDIA

Regarding data processing

What are the data resources?

How do you process these raw collected data? Are there any methods or tools?

What is your work flow like with data?

What would the outcome be from your processing?

Do you also work with thick data, or link thick data with thin data?

Regarding collaboration with R&A teams

What is your workflow like with project teams?

What are the challenges and expectations for you on your collaboration?

Regarding Data availability and privacy

How do you deal with data privacy in Ford?

What is the availability of the data source you are handing?

In order to protect company content, this appendix shows an example to understand the method followed:

All the interviews were analyzed by using statement cards (Fig 45). The most interesting quotes from each participant were firstly identified with keywords label (Fig 46) to organize the main topics in the Miro platform (Fig 47). All this information served to understand the design thinking process and the role that data and data visualization has for the Smart Vehicles Concept team. Afterwards, all the quotes were revised creating a physical mind map to identify: challenges, possibilities, barriers and desires.

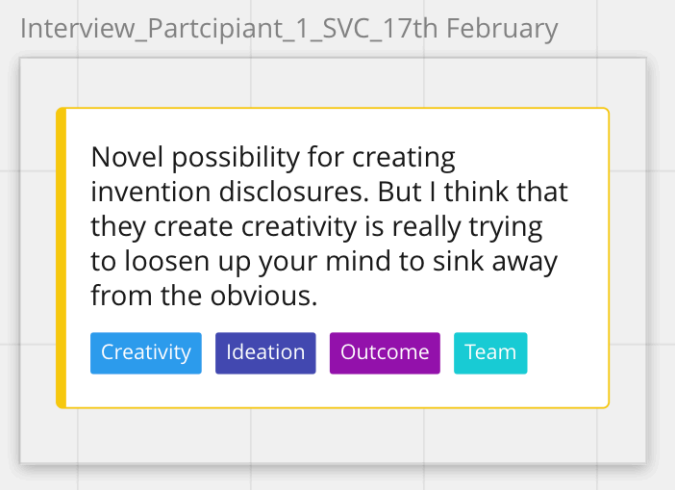


Fig 45. Statement card example of one participant quote

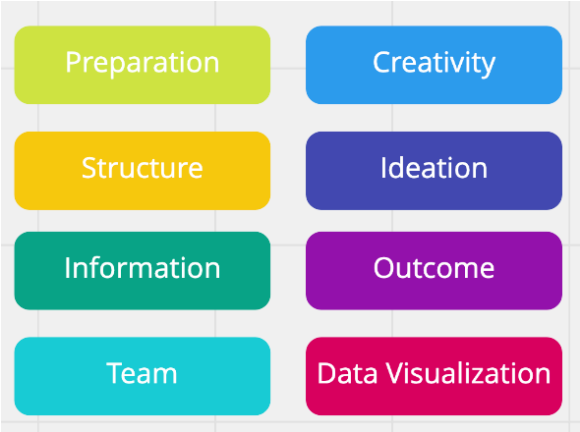


Fig 46. Labels to clearly distinguish the main topics

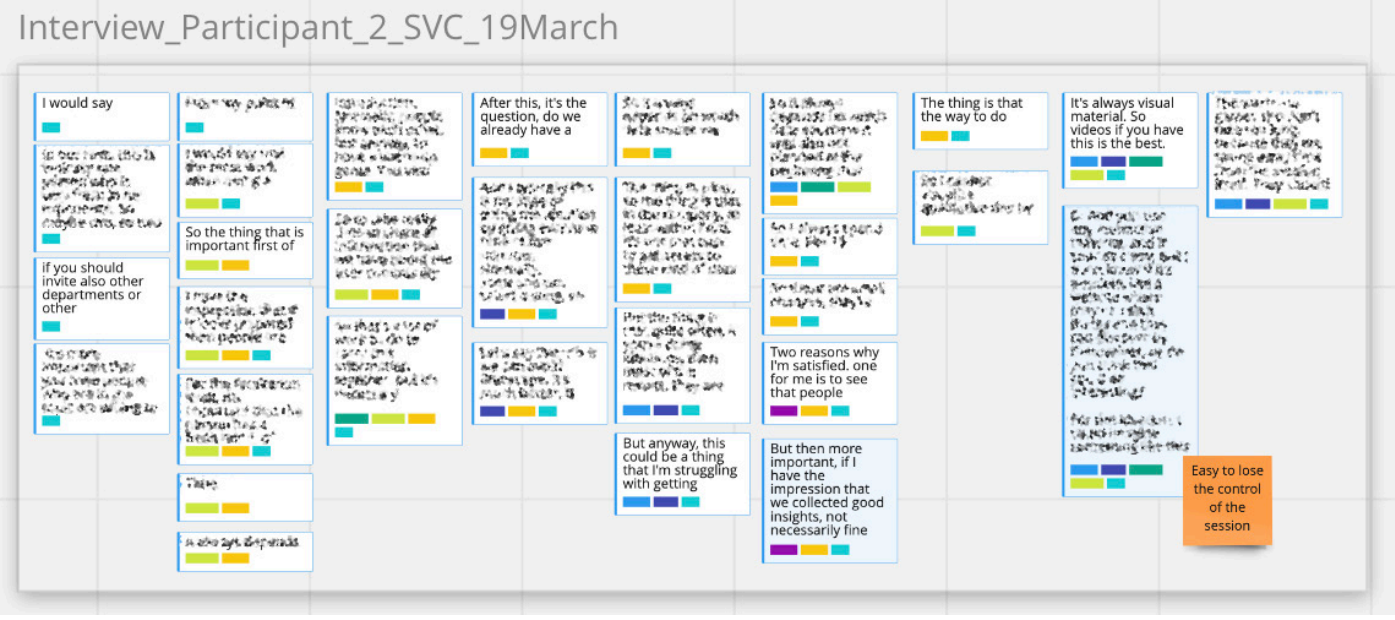


Fig 47. Example of one of the Miro boards

III

APPENDIX: ERIS TAXONOMY COMPLETED WITH PERSONAL EXAMPLES

QUESTION TYPE	SUBTYPE	DESCRIPTION
Low Level Questions (LLQ)	Verification	The questioner wants to know the truth of an event.
	Disjunctive	Verification question with multiple concepts.
	Concept Completion	The questioner wants to know the missing component in a specified event.
	Feature Specification	The questioner wants to know some property of a given person or a thing.
	Quantification	The questioner wants to know an amount.
	Definition	
	Example	
	Comparison	The questioner wants to confront two different concepts.
	Judgmental*	The questioner want to solicit a judgment from the answered by requiring a projection of events rather than a strict recall of events.
Deep Reasoning Questions (DRQ)	Interpretation	
	Procedural	The questioner wants to know the partially or totally missing instrument in the question concept.
	Causal Antecedent	The questioner wants to know the states or events that have in some way caused the concept in question. (Why question)
	Causal Consequence	The questioner wants to know the concept or causal chain the question concept caused.
	Rationale/Function	
	Expectational	The questioner wants to know the causal antecedent of an act that presumably did not occur (Why-not question)
	Enablement	The questioner wants to know the act or the state that enabled the question concept.
Generative Design Questions (GDQ)	Enablement	The questioner wants to construct acts, states or resources that can enable the question concepts.
	Method Generation	The questioner wants to generate as many ways as possible of achieving a specific goal.
	Proposal/Negotiation	The questioner wants to suggest a concept, or to negotiate an existing or previously suggested concept.
	Scenario Creation	The questioner constructs a scenario involving the question concept and wants to investigate the possible outcomes.
	Ideation	The questioner wants to generate as many concepts as possible from an instrument without trying to achieve a specific goal.

QUESTION TYPE	SUBTYPE	EXAMPLE
Low Level Questions (LLQ)	Verification	Yes/No answer _ Did John leave?
	Disjunctive	Is X, Z or Y the case? _ Was John or Mary here?
	Concept Completion	Who? What? Where? When? _ What did Mary eat?
	Feature Specification	What are the properties of X? _ What material is the wheel made of? What breed of dog is Pluto?
	Quantification	How much? How many? _ How many wheels do we have?
	Definition	What is X? _ What is the pneumatic robot?
	Example	What is an example of X? _ What are some flying insects?
	Comparison	How is X similar/different to X? _ Does the small wheel spin faster?
	Judgmental*	What do you think of X? _ Which design do you want to use? What should John do to keep Mary from leaving?
Deep Reasoning Questions (DRQ)	Interpretation	?? _ Will it slip a lot?
	Procedural	What instrument/plan allows an agent do X? How did an agent do X? _ How does a clock work? How did John go to New York
	Causal Antecedent	Why/How did X occur? _ Why is it spinning faster?
	Causal Consequence	What next? What if? _ What happened when you pressed it?
	Rationale/Function	What are the magnets used for?
	Expectational	Why didn't X occur? _ Why is the wheel not spinning?
	Enablement	What enable X to occur? _ What did they need to attach the wheel?
Generative Design Questions (GDQ)	Enablement	What can enable X to occur? _ What allows you to measure distance?
	Method Generation	What way/ How is possible to do X ?_ How can we keep it from slipping?
	Proposal/Negotiation	Can we use a wheel instead of a pulley?
	Scenario Creation	What if the device was used on a child? What about people who use glasses?
	Ideation	What can we do with magnets?

IV

APPENDIX: 5W PROBLEM DEFINITION

WHAT
is the problem?

Insights*

Ford is not sure about how to implement data enabled design = how to use data as a creative material for finding insights to design

Data analysis is not involved on explorative design projects

Data Visualization is a technique barely used for the design projects

Design team struggles to know what they want to know with the quantitative data, Which questions try to ask with the visuals

When DV are used, the visuals are mostly traditional pie charts, histograms or scatter plots.

The design team needs to have specific questions for further analysis to the data scientist

The use of the data usually ends after obtaining the confirmation or refusal of the hypothesis. The data is not examined to explore other opportunities

The data analysis is mostly used to verify or confirm an hypothesis. It follows a closed process: request data, if approved collection, analysis and finnaly delivering the results.

WHO
owns the problem?

Ford Aachen Design Team

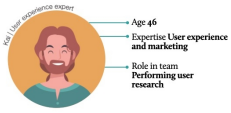
Depend on the GDIA (Global Data Insights and Analytics) and CDF (Connected Data Forum)

Before Covid, GDIA and the Design Team have closer and easier communication as they were located on the same building

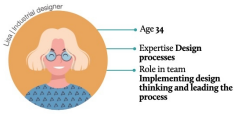
Small team composed by employees with different backgrounds: design, engineering, marketing, ...

They have different attitudes towards design thinking methods

Engineers
Not familiar with the Design Thinking process and hesitant to change, but willing to adjust once convinced



Non designers
Familiar with the Design Thinking process, open to change and innovation



Designer
Experienced with Design Thinking and innovator, often pushing new ideas and techniques on the team

Other departments
Unfamiliar with the Design Thinking process

WHY
there is a p

Ford can collect huge amounts of data but the use of it is inefficient

Right data resou most test a quali

Data exploration implies an unknown goal; due to this is not considered as important or urgent and less resources are derived from the GDIA

The design team is not used to work with data visuals

WHAT
are other relevant context factors?

Ford design projects usually involves different departments on their creative sessions

All data use have to European Data Privacy Laws

Due to time, GDIA have limited resources to help the design team and is not involved through all the process

Describe the motivation, or the objective, or the justification or reason behind a method of working.

Y
roblem?

now, Ford
analysis
urces are
ly used to
nd improve
ty issues

aking sense of
ata for exploration
f ideas will
einforce Ford
osition against
ompetitors

WHEN
the problem occurs?

Initial stage of Explorative Projects

Explorative Projects: Looking for new market opportunities, ideas for services or products.

No clear design goal but the design team has already an open direction, they have selected some quantitative data to explore

WHERE
the problem occurs?

Creativity sessions

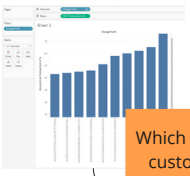
Creative sessions are a crucial part of the design process at Ford

Physical room or Bluespace (similar to Miro)

Brings together the design team of Ford and colleagues from other departments and outcomes of these sessions determine the progress of the project.

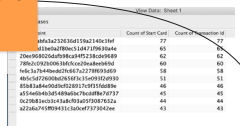
ta results and
lysis are not
shared
ween different
jects

V APPENDIX: PERSONAL EXPLORATIONS

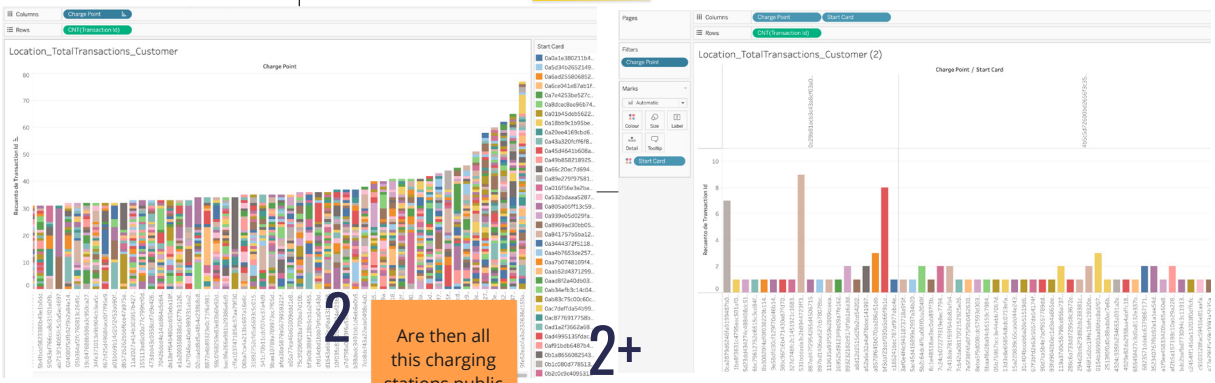


1

Which kind of customers this locations have?



Okay it doesn't seem to matter a lot; some customer returns but in general I dont see a pattern



2

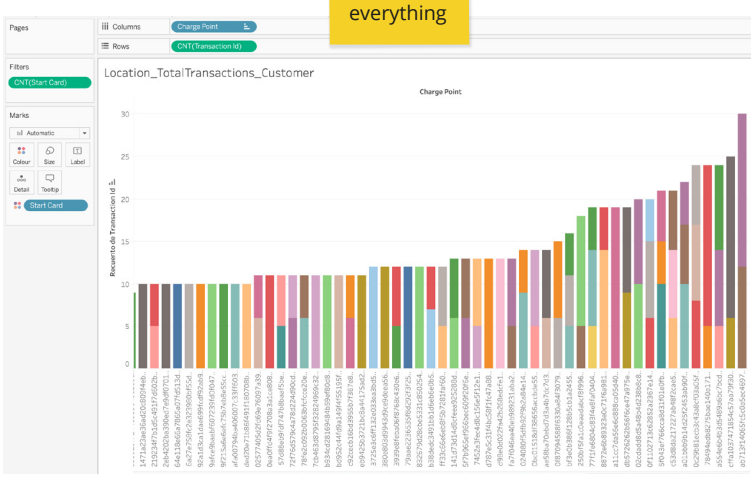
Are then all this charging stations public - work ?

2+

Are then stations only used by one customer?

Its super hard to keep track of everything

It'm not able to visualize



3

If I get the customers that charges more than once– Can I extract the numbers in Tableau?

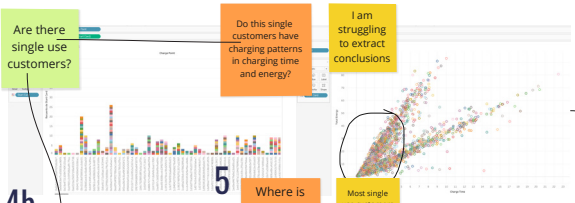
4

Are there single use customers?

4a

Do this single customers have charging patterns in charging time and energy?

I am struggling to extract conclusions



5

Most single use customers spend 3 to 4 h charging

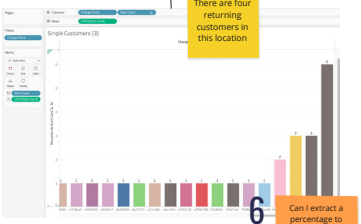
4b

Are there locations really used by different single customers?

Where is this charging station?

Does it also have returning cusstomers?

5+



There are four returning customers in this location

6

Can I extract a percentage to show the returning customers from the total?

4a+

Is this different to returning customers?

4a++

Can I see it better?

7

Which locations are less used?

8

Which locations are more used?

8+

Why some are more used?

8+a

Do that locations supply more power?

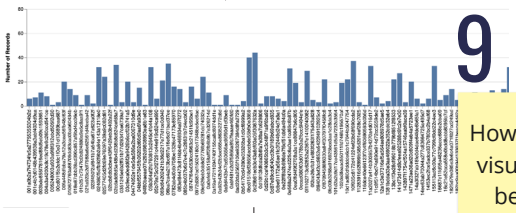
8+b

Are the locations more used the ones with more customers?

8+c

What is the relation between time and location popularity?

This is a really curiosity question and thats why its so open. I have no assumptions

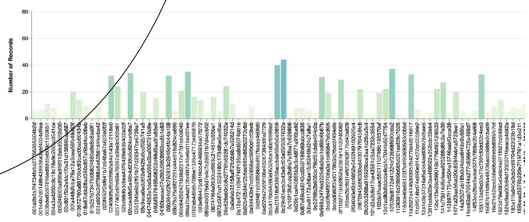


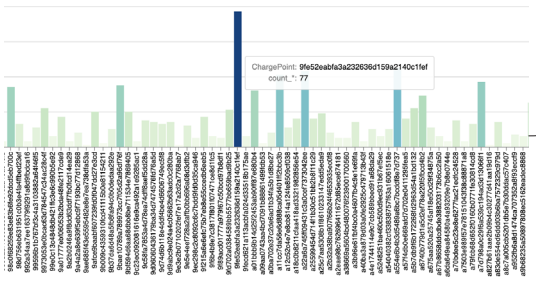
9

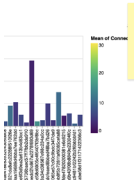
How I could visualize it better?

7+

Could we create different locations prroffiles?

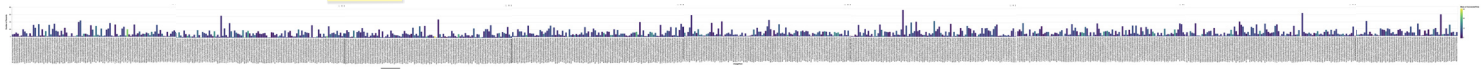






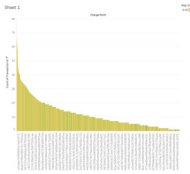
Playing with color filters and scales to identify outliers

The best will be to group the charging stations by num of transactions and then see with the time -- Tableau



10

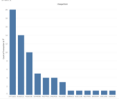
These are the max and mins but how I can put the average?

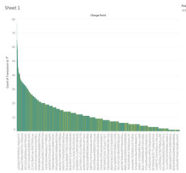


The average connected time is the same independently of the location

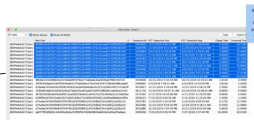
11

Why there is a location that differs that much from the others?





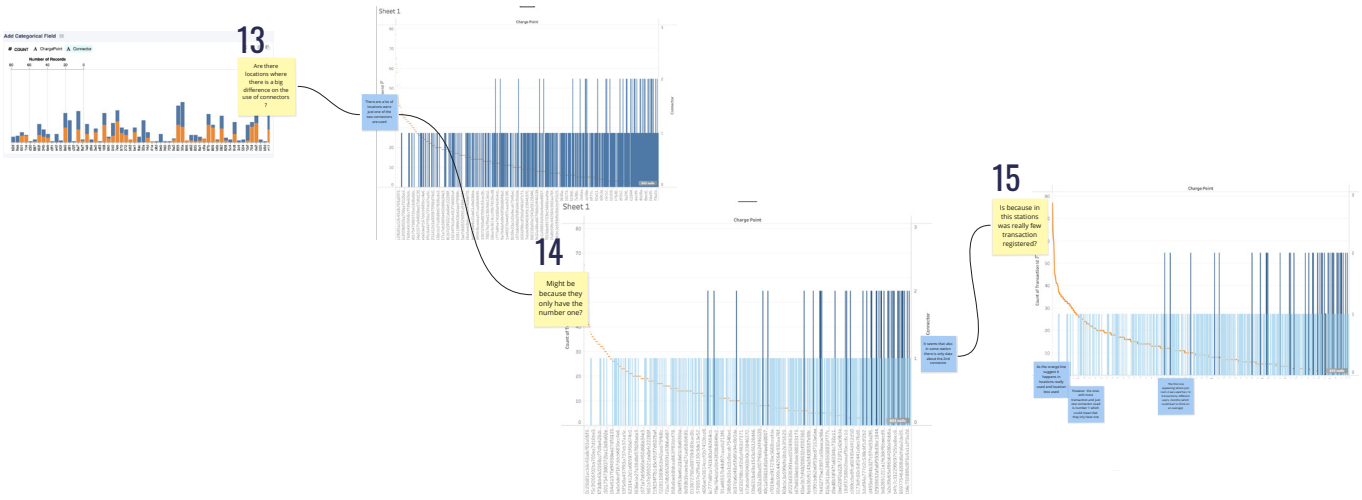
Similar happens with the charging time



Most of the long connexions are from the same user

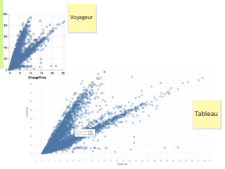
12

Could we identify user profiles based on the time they like to charge their car?

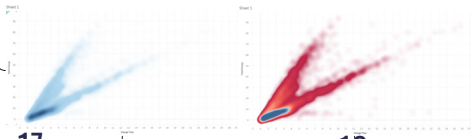

13
Are there locations where there is a big difference on the use of connectors ?
Sheet 1
Charge Point
Count of
Connector
14
Might be because they only have the number one?
Sheet 1
Charge Point
Count of
Connector
15
Is because in this stations was really few transaction registered?
Charge Point
Count of Transaction Id

16

1. Why there are two E-t trends?



2. Trying different Encoding



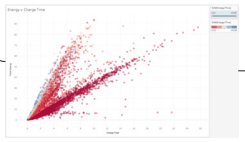
17

How can we divide both trends?

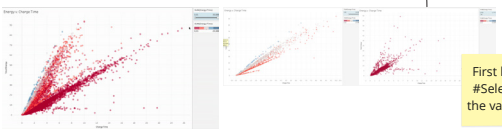
18

Why most of the transactions are in the second line?

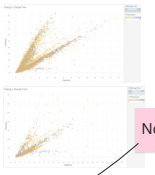
3. Created a new parameter to discern better the trends



4. Use the sliders to #Navigate



First lets #Select? the values



Nop

18a

Could it be because of the type of conector?

Wrong Visuals

18b

Could it be related with the type oof customer (returning/single use)?

18ba

Actually there are really few returning customers un this group no?

Lets #Compare in the full distribution

18bb

Why customers that charge more the car use the "low-charging" locations?

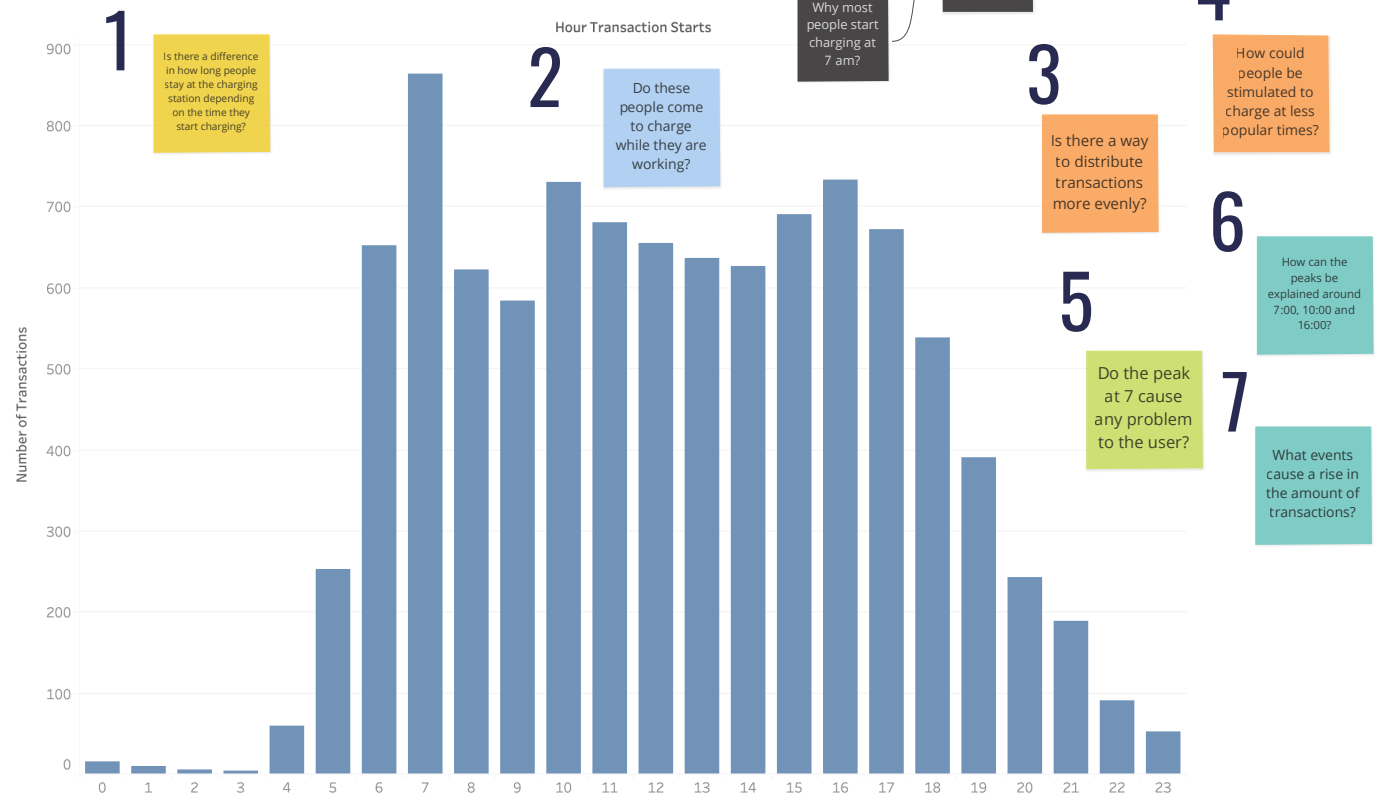
		EXPERTISE		MUNZNER (2014)			ERIS (2004)			PERSONAL CATEGORIES	
Nº	QUESTION	EV	DV	TYPE	SUB	TARGET	LEVEL	TYPE	SUBTYPE	INTENTION	PURPOSE
1	Which kind of customers this locations have?	Novice	Medium	D	H	F	LL	LL	Concept Completition	Created a new DV to answer	Identify types of users
2	Are then all this charging stations public/at work?	Novice	Medium	D	H	F	LL	LL	Disjunctive	Need further research	Understand context
2+	Are then stations only used by one customer?	Novice	Medium	D	H	F	LL	LL	Verification	Created a new DV to answer	Understand context
3	Can I extract the numbers in Tableau?	Novice	Medium		H	F	HL	GDQ	Proposal	Wondering Possibility for DV	Possibilities to create DV
4	Are there single use customers?	Novice	Medium	D	H	F	LL	LL	Verification	Created a new DV to answer	Identify types of users
4a	Do this single customers have charging patterns in charging time and energy? (+ develop a new graph to check it)	Novice	Medium	D	H	F	LL	LL	Verification	Created a new DV to answer	Identify types of users
4a+	Is this different to returning customers? (+ develop a new graph to check it)	Novice	Medium	C	SP	T	LL	LL	Comparison	Created a new DV to answer	Identify types of users
4a++	Can I see it better?	Novice	Medium	C	SP	V	HL	GDQ	Method Generation	Wondering Possibility for DV	Possibilities to create DV
4b	Are there locations really used by different single customers?	Novice	Medium	D	H	F	LL	LL	Verification	Created a new DV to answer	Understand context
5	Where is this charging station?	Novice	Medium	D	H	O	LL	LL	Concept Completition	Need further research	Understand context
5+	Does it also have returning customers? (+ zoom)	Novice	Medium	D	H	O	LL	LL	Verification	Created a new DV to answer	Understand context
6	Can I extract a percentage to show the returning cutomers from the total	Novice	Medium	D	H	V	HL	GDQ	Proposal	Wondering Possibility for DV	Possibilities to create DV
7	Which locations are less used?	Novice	Medium	D	H	F	LL	LL	Concept Completition	Created a new DV to answer	Understand context
7+	Could we create different locations profiles?	Novice	Medium	D	H	V	HL	GDQ	Proposal	Proposing way for "solution"	Identify types of users
8	Which locations are more used?	Novice	Medium	D	H	F	LL	LL	Concept Completition	Created a new DV to answer	Understand context
8+	Why some are more used?	Novice	Medium	D	H	F	HL	DRQ	Causal Antecedent	Need further research	Understand context
8+a	Do that locations supply more power?	Novice	Medium	D	H	F	H	LLQ + DRQ	Verification + Causal Antecedent	Suggesting an hypothesis to the DRQ	Verify interpretation
8+b	Are the locations more used the ones with more customers?	Novice	Medium	D	H	F	H	LLQ + DRQ	Verification + Causal Antecedent	Suggesting an hypothesis to the DRQ	Verify interpretation
8+c	What is the relation between time and location popularity?	Novice	Medium	D	H	V	HL	DRQ	Interpretation	Lack of understanding of the DV	Doubts about the visuals
9	How could I visualize it better?	Novice	Medium	D	H	V	HL	GDQ	Method Generation	Wondering Possibility for DV	Possibilities to create DV

		EXPERTISE		MUNZNER (2014)			ERIS (2004)			PERSONAL CATEGORIES	
Nº	QUESTION	EV	DV	TYPE	SUB	TARGET	LEVEL	TYPE	SUBTYPE	INTENTION	PURPOSE
10	**These are the max and mins but how I can put the average?**	Novice	Medium	D	H	F	HL	GDQ	Method Generation	Not sure how to continue and what are the possibilities for DV, question helps to discoover them	Posibilites to create DV
11	**Why there is a location that differs that much from the others?**	Novice	Medium	D	H	O	HL	DRQ	Causal Antecedent	Need further research	Understand context
12	**Could we identify users profiles based on the time they like to charge their car?**	Novice	Medium	D	H	O	HL	GDQ	Proposal	Proposing way for "solution"	Identify types of users
13	**Are there locations where there is a big difference on the use of connectors?**	Novice	Medium	D	H	V	LL	LL	Verification	Created a new DV to answer	Understand context
14	**Might be because they only have the number one?**	Novice	Medium	D	H	F	H	LLQ + DRQ	Verification + Causal Antecedent	Suggesting an hypothesis to the DRQ	Verify interpretation
15	**Is because in the stations was really few transactions registerd?**	Novice	Medium	D	H	F	H	LLQ + DRQ	Verification + Causal Antecedent	Need further research	Verify interpretation
16	**Why there are two E-t Ts?**	Novice	Medium	C	SP	Ts	HL	DRQ	Interpretation	Lack of understanding of the DV	Doubts about the visuals
17	**How can we divide both Tss?**	Novice	Medium	C	Density	V	HL	GDQ	Method Generation	Not sure how to continue and what are the possibilities for DV, question helps to discoover them	Posibilites to create DV
18	**Why most of the transactions are in the second line?**	Novice	Medium	C	SP	F	HL	DRQ	Causal Antecedent	Need further research	Understand context
18a	**Could it be because of the type of connector?**	Novice	Medium	C	SP	F	H	LLQ + DRQ	Verification + Causal Antecedent	Suggesting an hypothesis to the DRQ + Created a new visual to answer because in this case the parameters belong to the dataset	Verify interpretation
18b	**Could it be related to the type of customer?**	Novice	Medium	C	SP	F	H	LLQ + DRQ	Verification + Causal Antecedent	Suggesting an hypothesis to the DRQ + Created a new visual to answer because in this case the parameters belong to the dataset	Verify interpretation

VI

APPENDIX: STUDENTS WORKSHOP

Number of Transactions v. Hour Transaction Starts



1
Is there a difference in how long people stay at the charging station depending on the time they start charging?

2
Do these people come to charge while they are working?

Why most people start charging at 7 am?

Can we offer a service to this users?

3
Is there a way to distribute transactions more evenly?

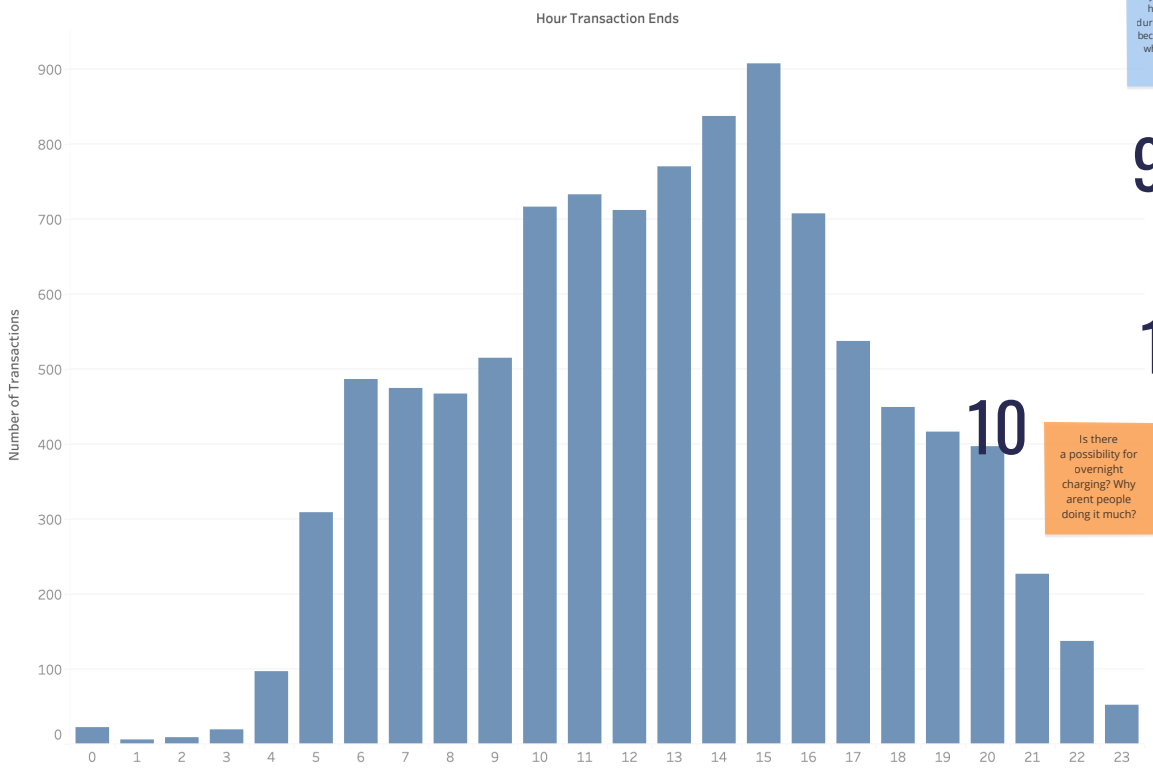
4
How could people be stimulated to charge at less popular times?

5
Do the peak at 7 cause any problem to the user?

6
How can the peaks be explained around 7:00, 10:00 and 16:00?

7
What events cause a rise in the amount of transactions?

Number of Transactions v. Hour Transaction Ends



8
why do transactions happen mostly during the day? is it because ppl charge while they are at work?

9
what time do the transactions start, if they finish at 3pm?

10
Is there a possibility for overnight charging? Why arent people doing it much?

11
Does a large group of people stop charging at 15:00?

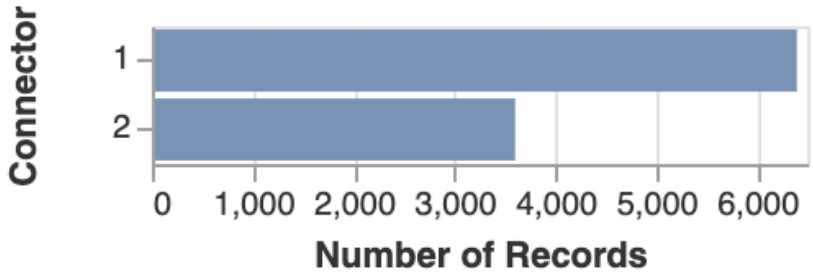
11+
If so, why do they all stop charging at 15:00?

12

Are people only using the second connector when the first one is occupied?

13

Do people have a preferred connector? And to which factors could that be related? Parking spot?



14

Why connector 1 is used much more frequently?

15

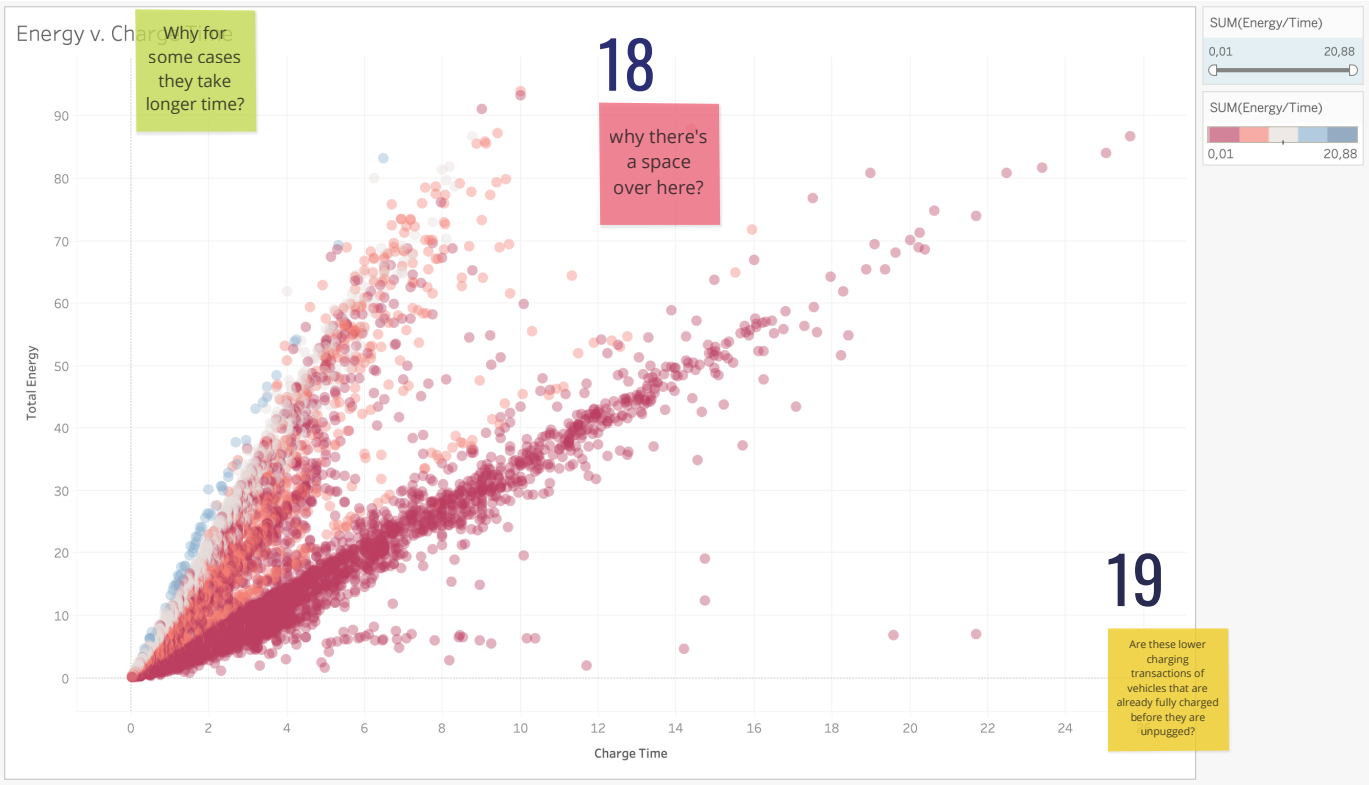
IS this due to the position of the two chargers?

16

How can you stimulate users to use the two connectors both as much?

17

Why for some cases they take longer time?



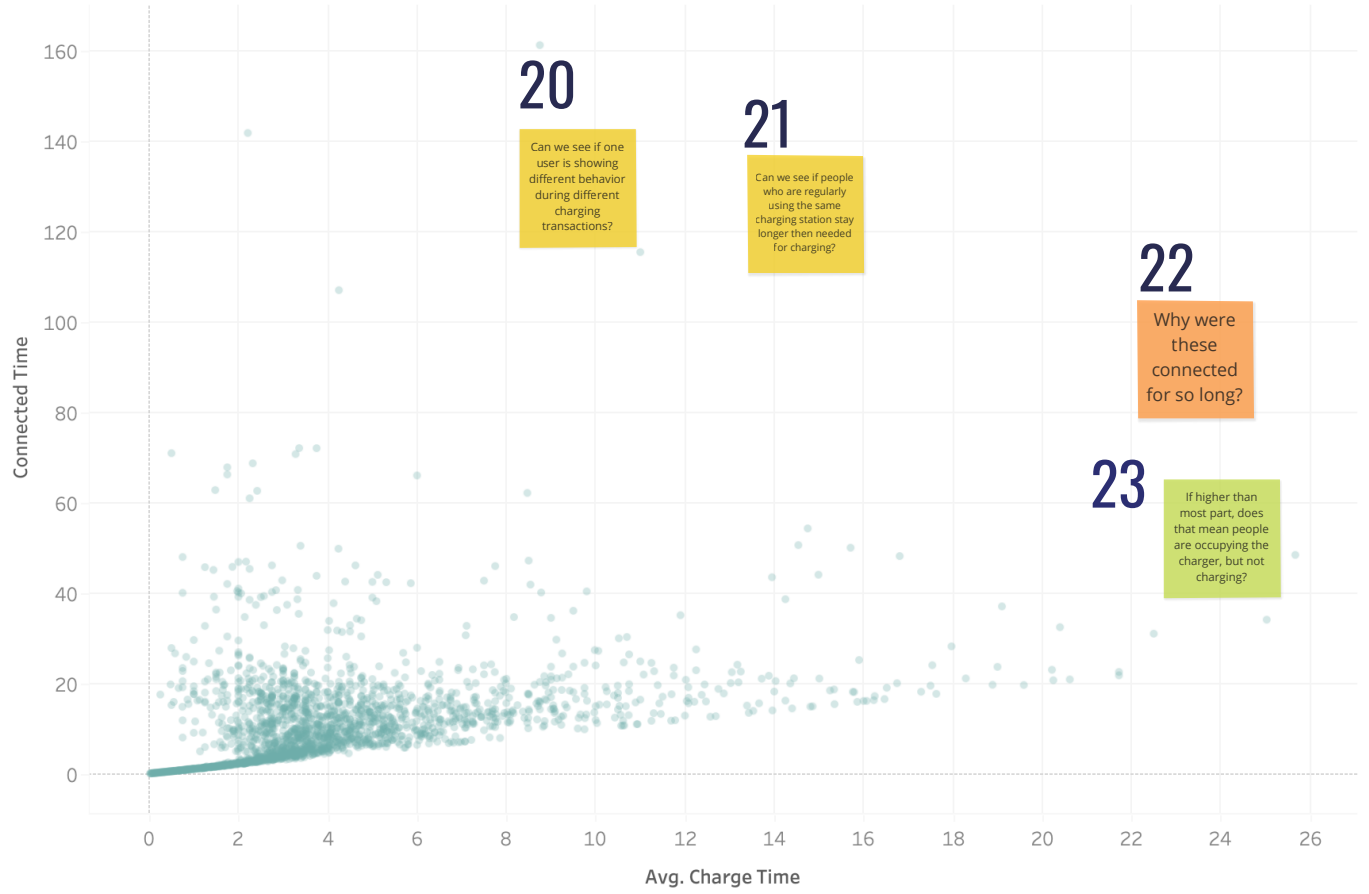
18

why there's a space over here?

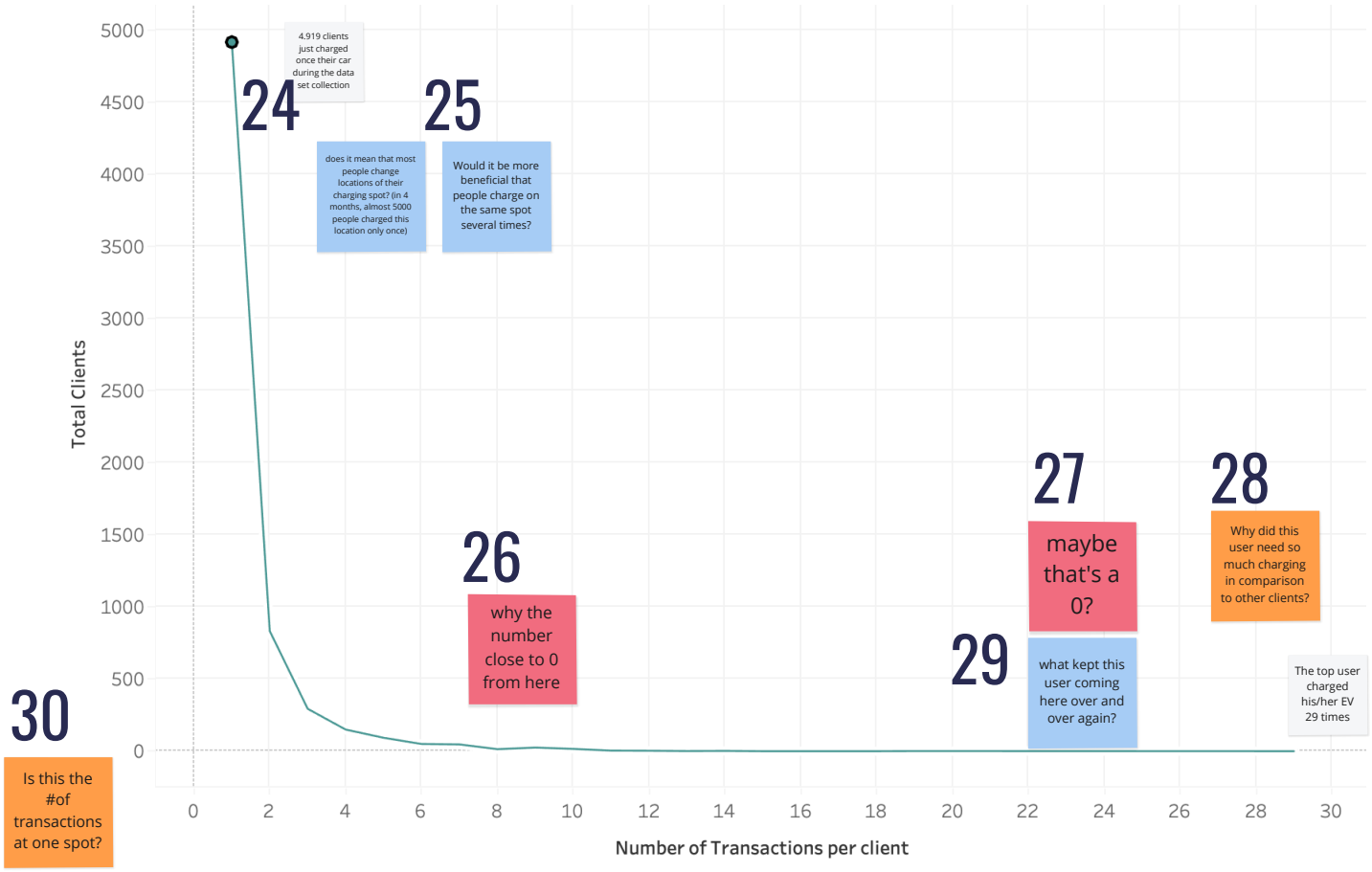
19

Are these lower charging transactions of vehicles that are already fully charged before they are unpugged?

Connected Time v. Average Charged Time



Number of Clients v. Number of transactions per client



Questions that will need futher research

Why most people start charging at 7 am?

Why connector 1 is used much more frequently?

Do the peak at 7 cause any problem to the user?

What events cause a rise in the amount of transactions?

Why do they all stop charging at 15:00?

Why were these connected for so long?

Is there a possibility for overnight charging? Why arent people doing it much?

what kept this user coming here over and over again?

why the number close to 0 from here

Why for some cases they take longer time?

Would it be more beneficial that people charge on the same spot several times?

Why did this user need so much charging in comparison to other clients?

Can we see if one user is showing different behavior during different charging transactions?

why do transactions happen mostly during the day? is it because ppl charge while they are at work?

How can the peaks be explained around 7:00, 10:00 and 16:00?

Verify assumptions

If higher than most part, does that mean people are occupying the charger, but not charging?

Are these lower charging transactions of vehicles that are already fully charged before they are unpugged?

IS this due to the position of the two chargers?

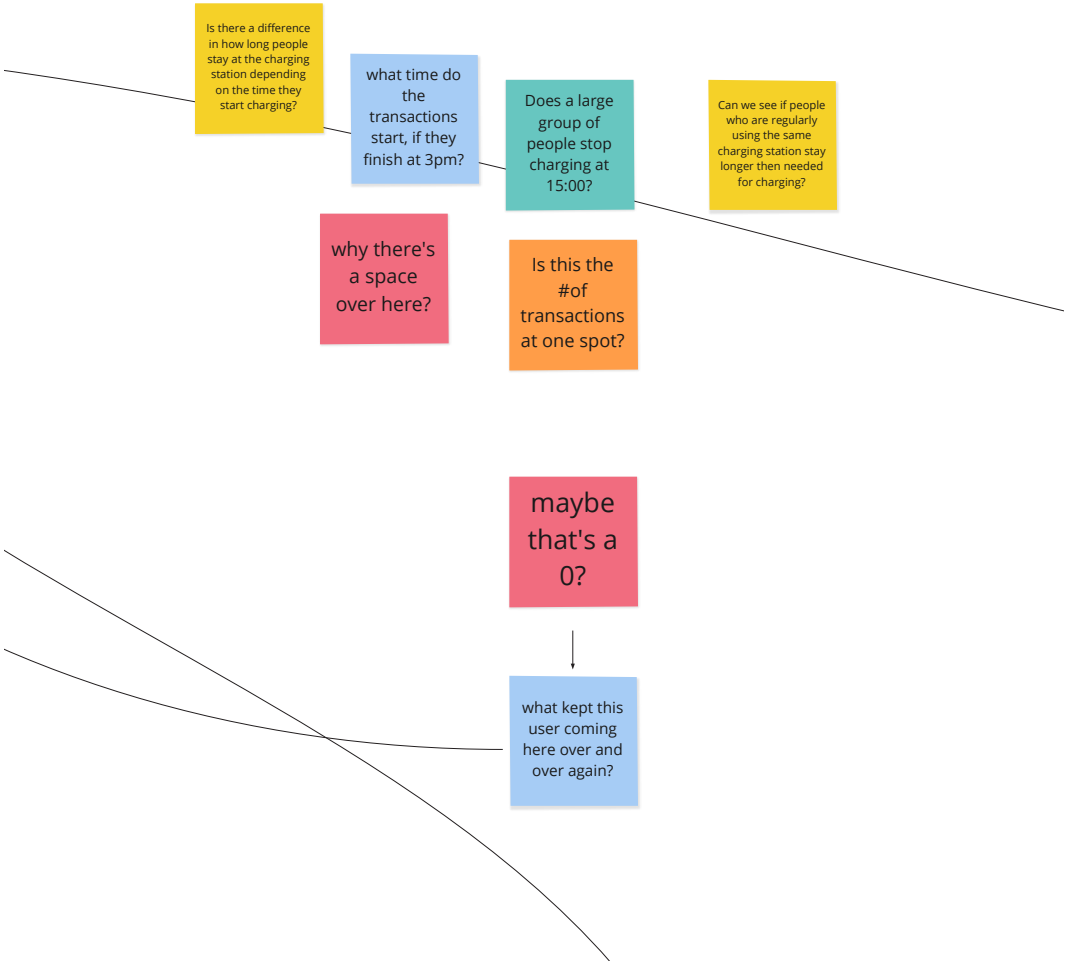
does it mean that most people change locations of their charging spot? (in 4 months, almost 5000 people charged this location only once)

Do people have a preferred connector? And to which factors could that be related? Parking spot?

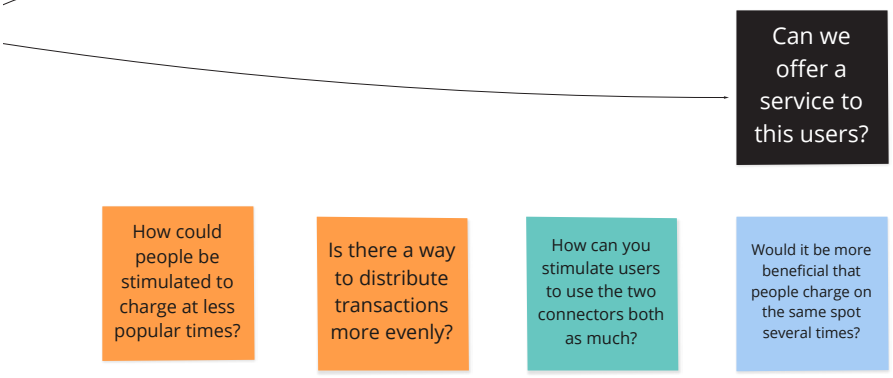
Do these people come to charge while they are working?

Are people only using the second connector when the first one is occupied?

Questions directed to the data visuals



Questions that lead to ideation



Statement Cards

Participant 1

Participant 2

Participant 3

Participant 4

Facilitator

Clusters

Quotes workshop

Self questions

Ideas to implement

Other Observations

Program trough a period of time (different sessions) to get familiar with asking questions to the data

Can it be a sort of trainning?

I thought it was quite nice to do

Yeah, exactly. Yeah, but I think, for me this was, was really insightful I really liked it

Yeah I think it is useful for the design process

It was super interesting.

Postitive experience

I was struggling a bit with what questions I should ask the data or about the user.

And at this moment I really kind of stopped myself to assume that I knew how to do things, so I was not really trying to propose anything already like, how can we make a service, I can start these sentences, and then I removed them and I did something else. I thought that I didn't have enough information, super interesting.

Self-doubts about the questions they "should do"

When explaining that we are looking for the "right questions in the introduction I am already conditioning them to force to make good questions?

They were reflecting through the process? It was because they are really involved on the project?

Half of the group almost did not comment on their experiece

Were they bored? They did not care?

Next workshop give space to everyone to talk

Include more explanations about the dataset

Who would be the best to "educate" than the specialized department?

Also find it interesting that some graphs are easier to read and some are more challenging for me.

But my ability to ask deeper questions really depends on whether I understand the graph or not. So for instance, like, I've seen this graph over and over, you have showed it before but I cannot understand it. This energy versus first time. So the graphs that are on the left they are super easy. But when we get to scatter spots on the, on you know on a timeline, it's not a timeline but. So in this kind of graph, I already feel some difficulties.

Questioning is restricted by participant experience with data visualization

Could maybe this be one of the reason why for the design/research team is hard to develop the questions for the data science department?

Hi D

I forgot to give you some feedback I wrote down during the session this morning. When you were explaining the dimensions, I was thinking that it would be great to add some visuals to them to make them easier understandable. It's maybe also an idea that connects to Tiara's project to make the data more tangible. I got the feeling that that was also one of the issues people had during the session. If you understand the dimensions well, it's also easier to understand the graphs. And the descriptions are normally quite abstract.

Let me know your thoughts!

Kind regards / Mit freundlichen

Nicole Eikelenberg

Make is kind of part of the whole process to have kind of the educational part on how to read visuals, or maybe give a little bit more explanation on because this this graph

Exercise developed together between GDIA and Design?

For me the explorative part is also really into that it makes you think about okay what do I see here, and what other things could the data potentially tell me about the users behavior. So that's for me really the explorative part.

I am wondering How is the "explorative attitude" that Tufte talks about? How can we give the people the freedom exploratory style

In this case, because there were six visuals, I just decided to leave out once I didn't understand at once, that needed more time because I could focus on the other things. So that's what happened in this setup.

That might mean that for your participants. Next times that it's something that you need to pay attention to whether they're able to read the visuals.

Need for discussion with the team

And also, there are some phenomenon that I'm not sure if I interpreted correctly I still want to discuss with others like does this mean. And I want to know if, if others also think so.

I already experience with Senthil that it was easier when there was a three parts involved: him, me and the visuals

Team working

What will be the balance between individual and team work?

Where is the team needed? Before starting asking the questions already? First. too discuss what they see?

Questioning is influenced by time?

So we, as we had questions, we came up with questions for five minutes or something. What would happen if we would keep going for longer. I think that's something also that needs to be kind of tested

Does that then really lead to more, more, more and better questions? or would it be more useful to have indeed, a relatively short question session, then try to answer all the questions that have been created, which are answerable with the data so yeah this this part of the section. And, and maybe even some of the assumptions, maybe we can with based on the data already, answer some of those questions.

I also give the participants in my test this similar graphs that generate insights and it's interesting to see that they also have a lot of questions, and because it's a short session so people have to put the questions aside and just continue with the insights.

Possibilities to discuss with the users

But that actually also means that the graphs already gets quite a directed input to user research so much more specific as when you would go. Yeah, just with some some context knowledge to the user.

I think that potential next step for you or for us, imagining that we are a team that working with data, quantitative data. Now we want to go forward. Now we would have to find a way to cluster into a number of questions that we can continue with. So, we are in exploration. Then, should there be a convergence, so that we can move forward. Or if it's, if it's that we need to set to go several rounds of making visuals, exploring making visuals exploring until we find a good question that we can continue with. So, I would imagine that this has an. Yeah, kind of a follow up, but I'm not sure yet if it's more exploration or already convergence.

Focus the research

What should be next steps should that be for the user research, or can we jump into the ideation do we already have enough input for the ideation, or do we really need to have more complex information

Or jump to brainstorming?

So I guess. I think the way that how the question is formulated also matters but I haven't. Find a nice way to put it. For instance, I assume that first maybe all the why questions are explorative what for instance there is a why there's a space over here that's it's a, it's clearly a question directed to the data, not to further exploration. How can we, it's a super design question.

Actually I thought that we would see more similarities on the questions related to the way they were formulated

Hard to map out appropiate syntaxis

So assumptions are easy. So hypothesis. It normally. As it is written is like, it leads to a question, an answer of yes or no. Does this result in this, yes, no, that's an hypothesis.

There was indeed quite a lot of Why questions underneath the questions that will need further research. And the questions to the data visuals is really like Can we see something? or Can we go into more detail in something? or Is there a way to visualize?

Interactive iteration

Because the other idea was to start with static visuals and I would manipulate them. I could already tried to give you answers to some of these questions. So it could have been like more direct. It's true that this person that facilitates the visual needs to have a lot of data science knowledge, I think, to be able to do it fast.

So, another round of research based on these questions can already help a lot. You don't need to trace back to the data source or the person.

The experience is diverging and it calls for a convergence point at some moment.

Some questions are about the why it happens. I want to know the reason behind it. Some are like some of like my interpretation and whether, if that's true.

Easy to identify some categories

I think my questions were, ranging from forming hypothesis: Iss this is caused because of, so I was already thinking maybe this is the reason, so kind of quit trying to develop my assumptions were right or not. Then there was an explorative. Why does this happen. And then the generative, how can we make this to be improved.

For me, there are really these three categories like. See if you can maybe go go into more detail in the data. And so questions that that can be answered with the data. Then questions that can be answered that which require further user research more qualitative user research probably more into the context. And then the third category is indeed, coming up with inputs for ideation or triggers for ideation.

		EXPERTISE		MUNZNER (2014)			ERIS (2004)			PERSONAL CATEGORIES	
Nº	QUESTION	EV	DV	TYPE	SUB	TARGET	LEVEL	TYPE	SUBTYPE	INTENTION	PURPOSE
1	Is there a difference in how long people stay at the charging station depending on the time they start charging?	Expert	Medium	D	H	F	LL	LL	Comparison	Could be answered creating new DV	Identify types of users
2	Do these people come to charge while they are working?	Novice	Novice	D	H	F	H	LLQ + DRQ	Verification + Interpretation	Suggesting hypothesis to the DRQ	Verify interptretation
3	Is there a way to distribute transactions more evenly?	Novice	Novice	D	H	V	HL	GDQ	Method Generation	Proposing way for "solution"	Distribute equally
4	How could people be stimulated to charge at less popular times?	Novice	Novice	D	H	F	HL	GDQ	Method Generation	Proposing way for "solution"	Distribute equally
5	Do the peak at 7 cause any problem to the user?	Novice	Novice	D	H	T	H	LLQ + DRQ	Verification + Causal Consequence	Suggesting hypothesis to the DRQ	Verify interpretation
6	How can the peaks be explained around 7:00, 10:00 and 16:00?	Medium	Novice	D	H	F	HL	DRQ	Interpretation	Lack of understanding of DV	Understand context
7	What events cause a rise in the amount of transactions?	Medium	Novice	D	H	F	HL	DRQ	Causal antecedent	Need further research	Understand context
8	Why do transactions happen mostly during the day? is it because ppl charge while they are at work?	Novice	Novice	D	H	T	H	LLQ + DRQ	Verification + Causal Antecedent	Suggesting hypothesis to the DRQ	Verify interpretation
9	What time do the transactions start if they finish at 3pm?	Novice	Novice	D	H	F	LL	LL	Concept Completion	Could be answered creating new DV	Identify types of users
10	Is there a possibility for overnight charging? Why arent people doing it much?	Novice	Novice	D	H	T	H	LLQ + DRQ	Verification + Expectational	Suggesting hypothesis to the DRQ	Verify interpretation
11	Does a large group of people stop charging at 15:00?	Novice	Novice	D	H	T	LL	LL	Verification	Lack of understanding of DV	Identify types of users
11+	+If so why do they all stop charging at 15:00?	Novice	Novice	D	H	T	HL	DRQ	Causal antecedent	Need further research	Identify types of users
12	Are people only using the second connector when the first one is occupied?	Expert	Medium	D	H	F	H	LLQ + DRQ	Verification + Expectational	Suggesting hypothesis to the DRQ	Verify interpretation
13	Do people have a preferred connector?	Expert	Medium	D	H	F	H	LLQ + DRQ	Verification + Interpretation	Suggesting hypothesis to the DRQ	Verify interpretation
13+	And to which factors could that be related?	Expert	Medium	D	H	F	HL	DRQ	Causal antecedent	Need further research	Identify types of users
13++	Parking spot?	Expert	Medium	D	H	F	H	LLQ + DRQ	Verification + Causal Antecedent	Suggesting hypothesis to the DRQ	Understand context
14	Why connector 1 is used much more frequently?	Novice	Novice	D	H	T	HL	DRQ	Causal antecedent	Need further research	Understand context

		EXPERTISE		MUNZNER (2014)			ERIS (2004)			PERSONAL CATEGORIES	
Nº	QUESTION	EV	DV	TYPE	SUB	TARGET	LEVEL	TYPE	SUBTYPE	INTENTION	PURPOSE
15	Is this due to the position of the two chargers?	Novice	Novice	D	H	T	H	LLQ + DRQ	Verification + Causal Antecedent	Suggesting hypothesis to the DRQ	Verify interpretation
16	How can you stimulate users to use the two connectors both as much?	Medium	Novice	D	H	T	HL	GDQ	Method Generation	Proposing way for "solution"	Distribute equally
17	Why for some cases they take longer time?	Novice	Novice	C	SP	O	HL	DRQ	Causal antecedent	Need further research	Identify types of users
18	Why there's a space over here?	Novice	Novice	C	SP	V	HL	DRQ	Interpretation	Lack of understanding of DV	Question about the visuals
19	Are these lower charging transactions of vehicles that are already fully charged before they are unpugged?	Expert	Medium	C	SP	O	H	LLQ + DRQ	Verification + Causal Antecedent	Suggesting hypothesis to the DRQ	Verify interpretation
20	Can we see if one user is showing different behavior during different charging transactions?	Expert	Medium	C	SP	O	HL	GDQ	Proposal	Wondering possibility for DV	Identify types of users
21	Can we see if people who are regularly using the same charging station stay longer then needed for charging?	Expert	Medium	C	SP	O	HL	GDQ	Proposal	Wondering possibility for DV	Identify types of users
22	Why were these connected for so long?	Novice	Novice	C	SP	O	HL	DRQ	Causal antecedent	Need further research	Identify types of users
23	If higher than most part does that mean people are occupying the charger but not charging?	Novice	Novice	C	SP	O	H	LLQ + DRQ	Verification + Interpretation	Lack of understanding of DV	Question about the visuals
24	Does it mean that most people change locations of their charging spot? (in 4 months almost 5000 people charged this location only once)	Novice	Novice	C	CS	O	H	LLQ + DRQ	Verification + Interpretation	Lack of understanding of DV	Question about the visuals
25	Would it be more beneficial that people charge on the same spot several times?	Novice	Novice	C	CS	V	HL	GDQ	Proposal	Proposing way for "solution"	Distribute equally
26	Why the number close to 0 from here?	Novice	Novice	C	CS	T	HL	DRQ	Interpretation	Lack of understanding of DV	Question about the visuals
27	Maybe that's a 0?	Novice	Novice	C	CS	O	H	LLQ + DRQ	Verification + Interpretation	Lack of understanding of DV	Question about the visuals
28	Why did this user need so much charging in comparison to other clients?	Novice	Novice	C	CS	O	HL	DRQ	Causal antecedent	Need further research	Identify types of users
29	What kept this user coming here over and over again?	Novice	Novice	C	CS	O	HL	DRQ	Causal antecedent	Need further research	Identify types of users
30	Is this the #of transactions at one spot?	Novice	Novice	C	CS	O	LL	LL	Verification	Lack of understanding of DV	Question about the visuals

VII

APPENDIX: WORKSHOP WITH FORD

1

Customer: Are there charge stations available

2

Customer: How long will I need to charge to complete a journey or have enough energy for the next day

4

Does this mean there is a need for more charging spots?

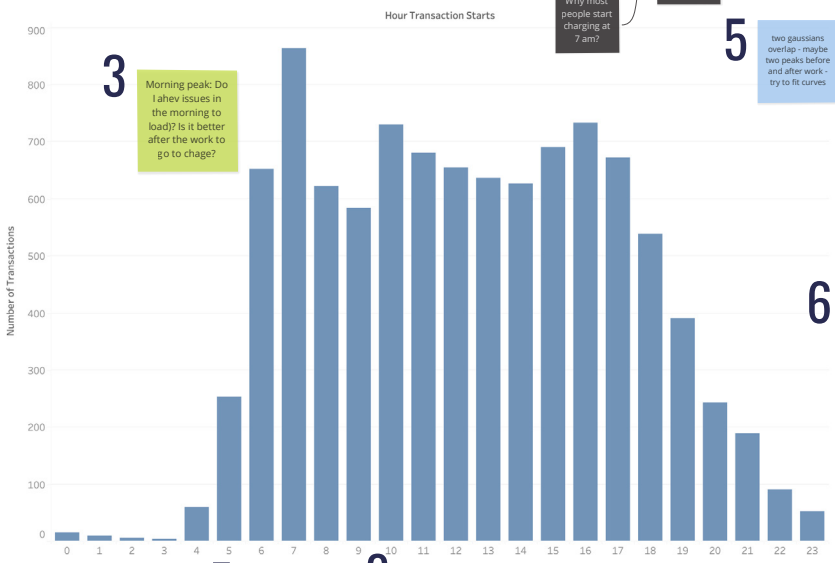
4+

Customer: Will I have to "fight" for a charging spot?

Can we offer a service to this users?

Why most people start charging at 7 am?

Number of Transactions v. Hour Transaction Starts



5

two gaussians overlap - maybe two peaks before and after work - try to fit curves

3

Morning peak: Do I ahev issues in the morning to load)? Is it better after the work to go to chage?

6

How can we shift the time of the transaction?

7

Is there a difference in charge cost over the day?

8

Are customers charging while they are are work rather than home

9

Does the location of the charging station influence if people go there to disconnect during night time?

10

It would be nice to see the correlation of start and end in the graph

10+

Since these are not matched pairs we dont know which session started and ended belong together

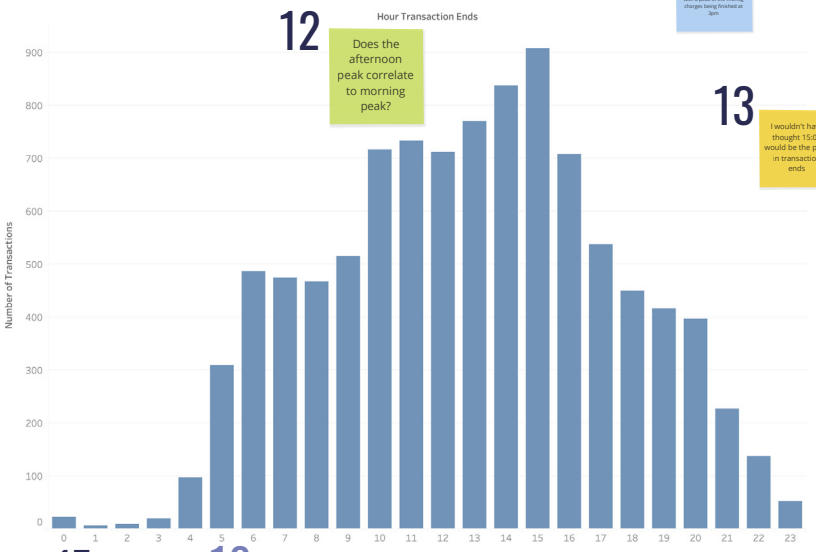
11

Interesting to see the difference of Start and End - feels like a background plateau from 5am to 9pm with a peak of the morning charges being finished at 3pm

Number of Transactions v. Hour Transaction Ends

12

Does the afternoon peak correlate to morning peak?



13

I wouldn't have thought 15:00 would be the peak in transaction ends

14

Is there a charging scheduling table, so that the stations are available for as many people as possible?

15

What are the peaks indicating exactly?

16

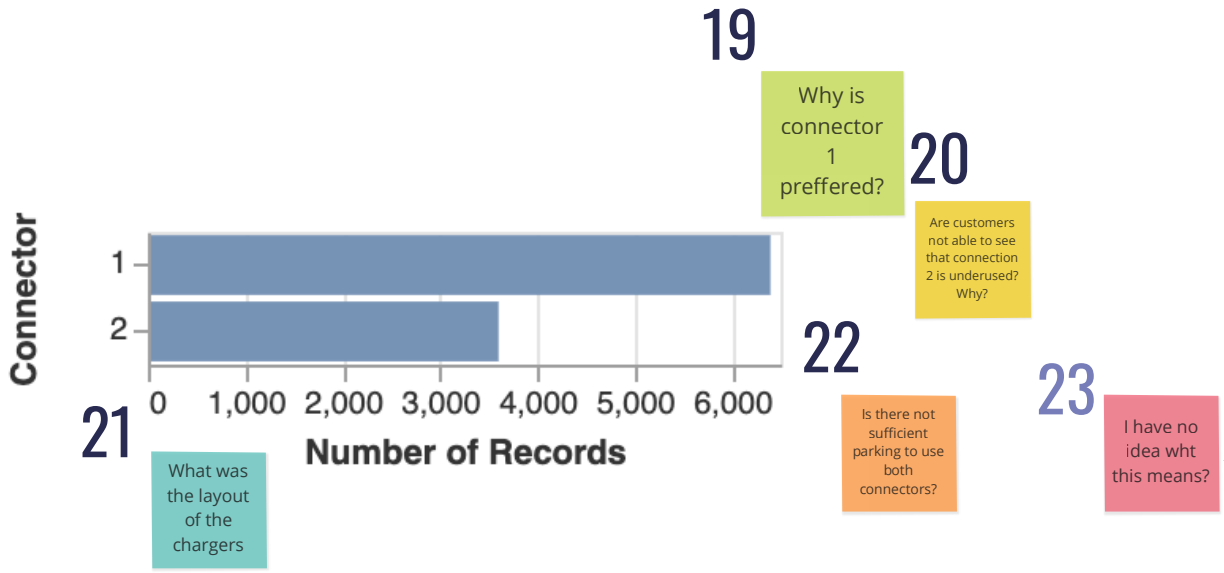
How can we shift the time of the transaction?

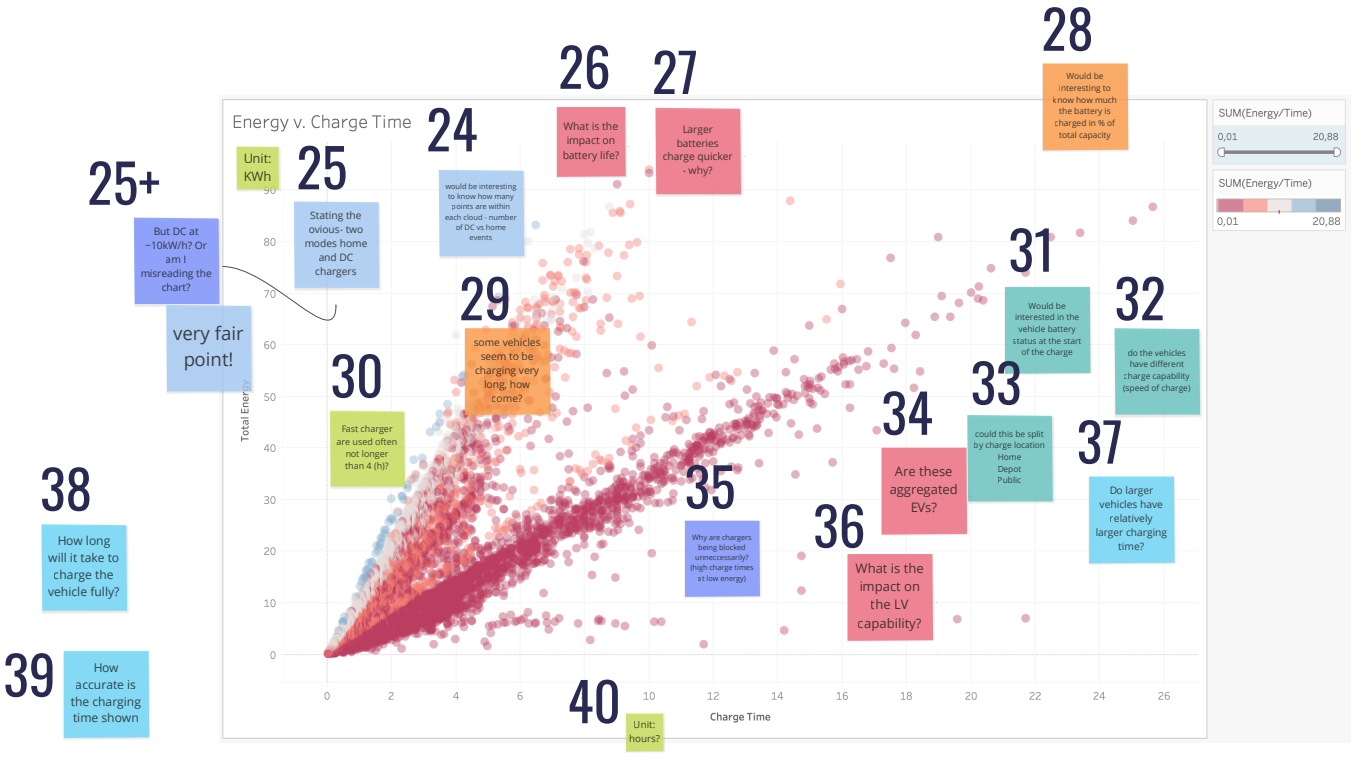
17

Would like to see how the end time correlates to the time people start the transaction

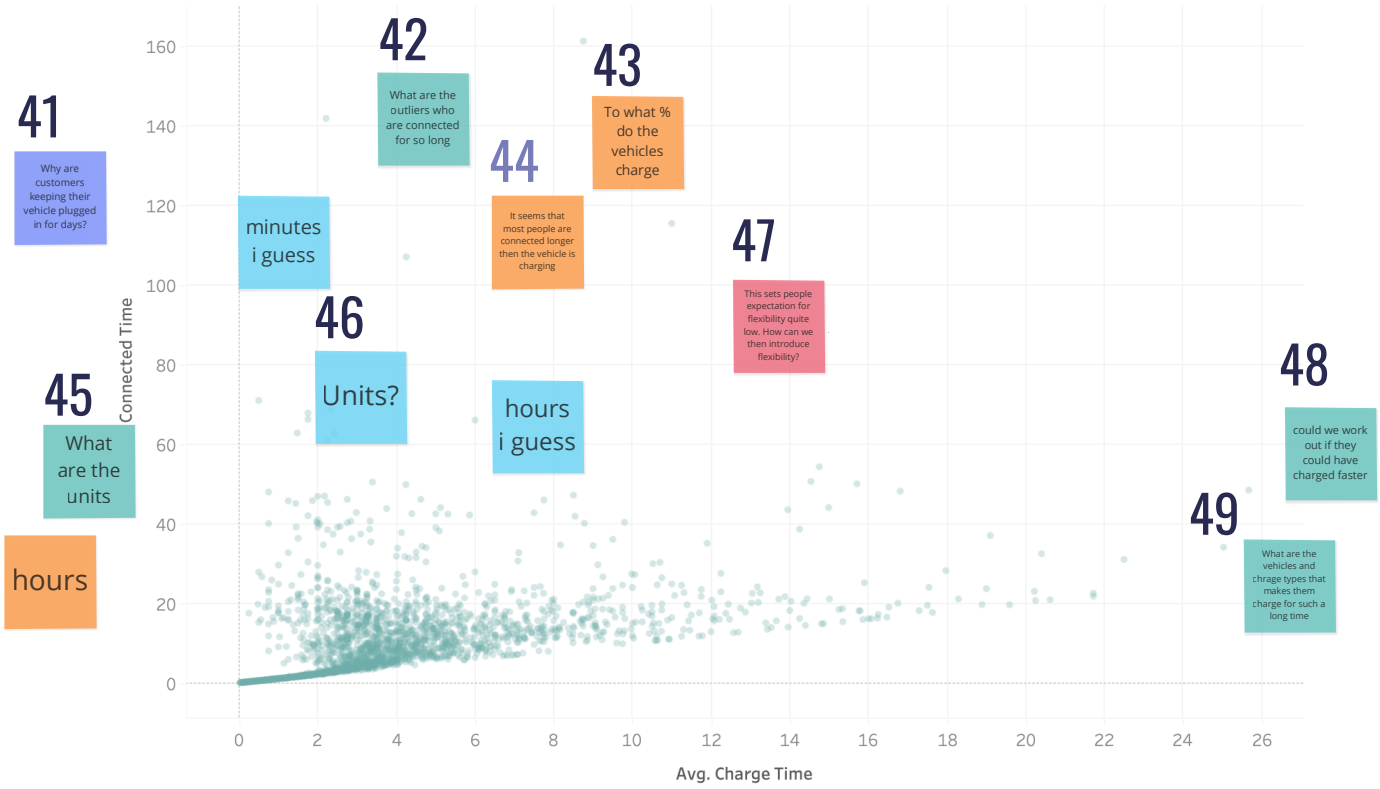
18

The start time and end-time graphs look quite similar

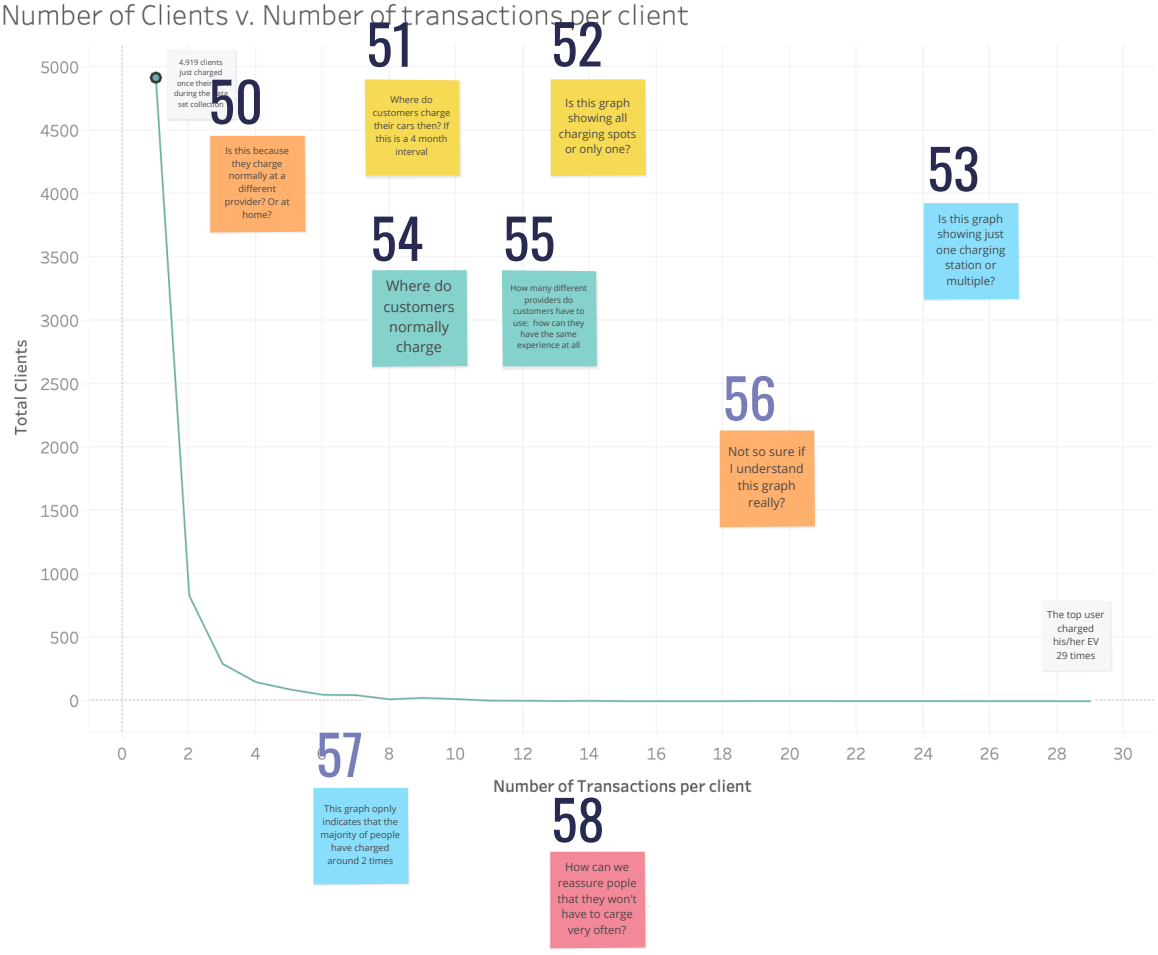

19
Why is connector 1 preffered?
20
Are customers not able to see that connection 2 is underused? Why?
22
Is there not sufficient parking to use both connectors?
23
I have no idea wht this means?
21
What was the layout of the chargers
Connector
1
2
0
1,000
2,000
3,000
4,000
5,000
6,000
Number of Records


28
Would be interesting to know how much the battery is charged in % of total capacity
26
What is the impact on battery life?
27
Larger batteries charge quicker - why?
Energy v. Charge Time
24
would be interesting to know how many points are within each cloud - number of DC vs home events
Unit: KWh
25
Stating the ovious- two modes home and DC chargers
25+
But DC at ~10kW/h? Or am I misreading the chart?
very fair point!
29
some vehicles seem to be charging very long, how come?
30
Fast charger are used often not longer than 4 (h)?
31
Would be interested in the vehicle battery status at the start of the charge
32
do the vehicles have different charge capability (speed of charge)
33
could this be split by charge location Home Depot Public
34
Are these aggregated EVs?
35
Why are chargers being blocked unneccesarily? (high charge times at low energy)
36
What is the impact on the LV capability?
37
Do larger vehicles have relatively larger charging time?
38
How long will it take to charge the vehicle fully?
39
How accurate is the charging time shown
40
Unit: hours?
Total Energy
Charge Time
SUM(Energy/Time)
0,01
20,88
SUM(Energy/Time)
0,01
20,88

Connected Time v. Average Charged Time



Number of Clients v. Number of transactions per client



		EXPERTISE		MUNZNER (2014)			ERIS (2004)			PERSONAL CATEGORIES	
Nº	QUESTION	EV	DV	TYPE	SUB	TARGET	LEVEL	TYPE	SUBTYPE	INTENTION	PURPOSE
1	Customer: How long will I need to charge to complete a journey or have enough energy for the next day?	Not valid									
2	Customer: are there charging stations available?	Not valid									
3	Morning peak: Do I have issues in the morning to load?	Novice	High	D	H	F	H	LLQ + DRQ	Verification + Interpretation	Suggesting hypothesis to the DRQ	Verify interpretation
3+	+1) Is it better after the work to go to charge?	Novice	High	D	H	F	H	LLQ + DRQ	Comparison + Interpretation	Need further research	Understand context
4	Does this mean there is a need for more charging spots?	Novice	Medium	D	H	T	H	LLQ + DRQ	Verification + Interpretation	Suggesting hypothesis to the DRQ	Verify interpretation
4+	+1) Customer: Will I have to "fight" for a charging spot?	Novice	Medium	D	H	T	HL	DRQ	Interpretation	Need further research	Understand context
5	Two gaussians overlap - maybe two peaks before and after work - try to fit curves	Novice	Expertise	D	H	T	HL	GDQ	Proposal	Wondering possibility for DV	Possibilities to create DV
6	How can we shift the time of the transaction?	Expertise	High	D	H	F	HL	GDQ	Method Generation	Proposing way for "solution"	Distribute equally
7	Is there a difference in charge cost over the day?	Expertise	Limited	D	H	V	H	LLQ + DRQ	Comparison + Interpretation	Suggesting hypothesis to the DRQ	Verify interpretation
8	Are customers charging while they are at work rather than home?	Expertise	Limited	D	H	T	LL	LL	Disjunctive	Need further research	Identify types of users
9	Does the location of the charging station influence if people go there to disconnect during night time?	Expertise	High	D	H	F	H	LLQ + DRQ	Verification + Causal Antecedent	Suggesting hypothesis to the DRQ	Verify interpretation
10	It would be nice to see the correlation of start and end in the graph. Since these are not matched pairs we dont know which session started and ended belong together	Novice	Expertise	D	H	V	HL	GDQ	Proposal	Wondering possibility for DV	Possibilities to create DV
11	Interesting to see the difference of Start and End- feels like a background /plateau from 5am to 9pm with a peak of the mornig charges being finished at 3pm	Novice	Expertise	D	H	V					
12	Does the afternoon peak correlate to morning peak?	Novice	High	D	H	V	LL	LL	Verification	Could be answered creating new DV	Possibilities to create DV

		EXPERTISE		MUNZNER (2014)			ERIS (2004)			PERSONAL CATEGORIES	
Nº	QUESTION	EV	DV	TYPE	SUB	TARGET	LEVEL	TYPE	SUBTYPE	INTENTION	PURPOSE
13	I wouldn't have thought 15:00 would be the peak in transaction ends	Comment									
14	Is there a charging scheduling table? so that the stations are available for as many people as possible?	Novice	Medium	D	H	V	H	LLQ+G-DQ	Verification + Proposal	Proposing way for "solution"	Distribute equally
15	What are the peaks indicating exactly?	Novice	Novice	D	H	F	HL	DRQ	Interpretation	Lack of understanding of DV	Question about the visuals
16	How can we shift the time of the transaction?	Expertise	High	D	H	F	HL	GDQ	Method Generation	Proposing way for "solution"	Distribute equally
17	Would like to see how the end time correlates to the time people start the transaction	Expertise	High	D	H	T	HL	GDQ	Proposal	Wondering possibility for DV	Possibilities to create DV
18	The start time and end-time graphs look quite similar	Comment									
19	Why is connector 1 preffered?	Novice	High	D	H	F	HL	DRQ	Causal antecedent	Need further research	Understand context
20	Are customers not able to see that connection 2 is underused? Why?	Novice	Medium	D	H	F	H	LLQ + DRQ	Verification + Expectational	Suggesting hypothesis to the DRQ	Verify interpretation
21	What was the layout of the chargers?	Expertise	Limited	D	H	T	LL	LL	F Specification	Need further research	Understand context
22	Is there not sufficient parking to use both connectors?	Expertise	High	D	H	T	H	LLQ + DRQ	Verification + Interpretation	Suggesting hypothesis to the DRQ	Verify interpretation
23	I have no idea what this means?	Expertise	High	D	H	V	HL	DRQ	Interpretation	Lack of understanding of DV	Question about the visuals
24	Would be interesting to know how many points are within each cloud - number of DC vs home events	Novice	Expertise	C	SP	F	HL	GDQ	Proposal	Wondering possibility for DV	Possibilities to create DV
25	Stating the oviously-two modes home and DC chargers	Comment									
25+	+1) But DC at ~10kW/h? Or am I misreading the chart?	Novice	Medium	C	SP	V	LL	LL	Disjunctive	Lack of understanding of DV	Questions about the visuals
26	What is the impact on battery life?	Expertise	High	C	SP	V	HL	DRQ	Causal consecuence	Need further research	Understand the context
27	Larger batteries charge quicker - why?	Expertise	High	C	SP	V	HL	DRQ	Causal antecedent	Need further research	Understand the context
28	Would be interesting to know how much the battery is charged in % of total capacity	Expertise	High	C	SP	V	HL	GDQ	Proposal	Wondering possibility for DV	Possibilities to create DV
29	Some vehicles seem to be charging very long, how come?	Expertise	High	C	SP	O	HL	DRQ	Causal antecedent	Need further research	Identify types of users

		EXPERTISE		MUNZNER (2014)			ERIS (2004)			PERSONAL CATEGORIES	
Nº	QUESTION	EV	DV	TYPE	SUB	TARGET	LEVEL	TYPE	SUBTYPE	INTENTION	PURPOSE
30	Fast charger are used often not longer than 4 (h)?	Novice	High	C	SP	F	H	LLQ + DRQ	Verification + Interpretation	Lack of understanding of DV	Verify interpretation
31	Would be interested in the vehicle battery status at the start of the charge	Novice	Medium	C	SP	V	HL	GDQ	Proposal	Wondering possibility for DV	Possibilities to create DV
32	Do the vehicles have different charge capability (speed of charge)?	Expertise	High	C	SP	V	H	LLQ + DRQ	Verification + Interpretation	Suggesting hypothesis to the DRQ	Verify interpretation
33	Could this be split by charge location? Home, Depot, Public?	Expertise	High	C	SP	V	HL	GDQ	Proposal	Wondering possibility for DV	Possibilities to create DV
34	Are these aggregated EVs?	Novice	Novice	C	SP	V	LL	LL	Verification	Lack of understanding of DV	Questions about the visuals
35	Why are chargers being blocked unneccessarily? (high charge times at low energy)	Novice	Novice	C	SP	O	H	LLQ + DRQ	Verification + Interpretation	Suggesting hypothesis to the DRQ	Verify interpretation
36	What is the impact on the LV capability?	Novice	Novice	C	SP	V	HL	DRQ	Causal consequence	Need further research	Understand the context
37	Do larger vehicles have relatively larger charging time?	Expertise	Limited	C	SP	O	H	LLQ + DRQ	Verification + Interpretation	Suggesting hypothesis to the DRQ	Verify interpretation
38	How long will it take to charge the vehicle fully?	Expertise	Limited	C	SP	V	LL	LL	Quantification	Need further research	Understand the context
39	How accurate is the charging time shown?	Expertise	Limited	C	SP	V	LL	LL	Quantification	Lack of understanding of DV	Questions about the visuals
40	Unit: Hours?	Novice	High	C	SP	V	LL	LL	F Specification	Lack of understanding of DV	Questions about the visuals
41	Why are customers keeping their vehicle plugged in for days?	Novice	Medium	C	SP	O	HL	DRQ	Causal antecedent	Need further research	Identify types of users
42	What are the O who are connected for so long?	Expertise	Limited	C	SP	O	HL	DRQ	Causal antecedent	Need further research	Identify types of users
43	To what % do the vehicles charge?	Expertise	High	C	SP	V	H	LLQ+GDQ	Concept Completion + Proposal	Wondering possibility for DV	Possibilities to create DV
44	It seems that most people are connected longer then the vehicle is charging	Comment									
45	What are the units?	Expertise	Limited	C	SP	V	LL	LL	F Specification	Lack of understanding of DV	Questions about the visuals
46	Units?	Novice	Novice	C	SP	V	LL	LL	F Specification	Lack of understanding of DV	Questions about the visuals
47	This sets people expectation for flexibility quite low. How can we then introduce flexibility?	Expertise	High	C	SP	F	HL	GDQ	Method Generation	Proposing way for "solution"	----?

		EXPERTISE		MUNZNER (2014)			ERIS (2004)			PERSONAL CATEGORIES	
Nº	QUESTION	EV	DV	TYPE	SUB	TARGET	LEVEL	TYPE	SUBTYPE	INTENTION	PURPOSE
48	Could we work out if they could have charged faster?	Expertise	Limited	C	SP	O	HL	DRQ	Expectational	Need further research	Identify types of users
49	What are the vehicles and charge types that makes them charge for such a long time?	Expertise	Limited	C	SP	O	H	LLQ + DRQ	Concept Completion + Interpretation	Suggesting hypothesis to the DRQ	Verify interpretation
50	Is this because they charge normally at a different provider? Or at home?	Expertise	High	C	CS	F	H	LLQ + DRQ	Disjunctive + Interpretation	Lack of understanding of DV	Questions about the visuals
51	Where do customers charge their cars then? If this is a 4 month interval	Novice	Medium	C	CS	V	LL	LL	Concept Completion	Need further research	Identify types of users
52	Is this graph showing all charging spots or only one?	Novice	Medium	C	CS	V	LL	LL	Disjunctive	Lack of understanding of DV	Questions about the visuals
53	Is this graph showing just one charging station or multiple?	Novice	Novice	C	CS	V	LL	LL	Disjunctive	Lack of understanding of DV	Questions about the visuals
54	Where do customers normally charge?	Expertise	Limited	C	CS	V	LL	LL	Concept Completion	Need further research	Identify types of users
55	How many different providers do customers have to use?	Expertise	Limited	C	CS	V	LL	LL	Quantification	Need further research	Identify types of users
55+	+1) How can they have the same experience at all?	Expertise	Limited	C	CS	V	HL	GDQ	Method Generation	Proposing way for "solution"	Distribute equally
56	Not so sure if I understand this graph really?	Comment									
57	This graph opnly indicates that the majority of people have charged around 2 times	Comment									
58	How can we reassure pople that they won't have to carge very often?	Expertise	High	C	CS	V	HL	GDQ	Method Generation	Proposing way for "solution"	---?

VIII

APPENDIX: CREATIVE SESSION

Creative Session | 28th July 17:30 - 20:00

1

1. WELCOME + AGENDA

2,5 hours

17:30 **2. Introduction** | Icebreaker

3. Presentation | Problem introduction

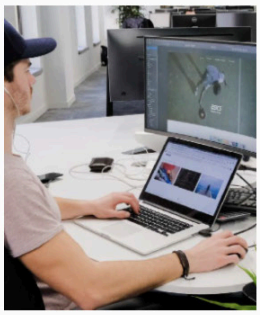
4. Problem Statement | Questions & Answers

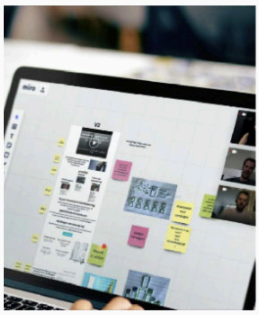
18:00 **5. Activity 1** | Flower association

6. Activity 2 | The idea circle

19:00 **7. Solution Ideation** | The mona lisa

8. Wrap up





2

2. INTRODUCTION + ICEBREAKER

10-15'

For the introduction, please will have to provide visual answer to this question:

If you would have to visualise how is your brain divided right now, how would it look?

WHAT YOU NEED:

- sheets of paper
- a pen
- whatsapp

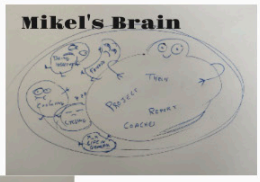
For that:

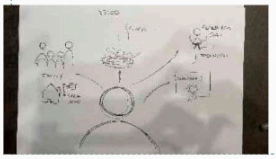
- Take 3 minutes to draw it in a piece of paper
- Send it to your whatsapp or tu us (Deb or Javi)
- Pase it in the square below

When everyone is finished, we will do an introduction round.

Maria	Tiara	Déborah
Sam	Esmeralda	Mikel

Copy and paste the drawing here to start the introduction round





5'

4. PROBLEM STATMENT + Q&A

Problem Statement

How data visualization can be enhanced to trigger explorative questioning and therefore finding insights for Ford design team?

Questions?

15-20'

5. ACTIVITY 1 | Flower Association

For this activity, we are going to open our mindset and freely explore the topic.

THE STEPS:

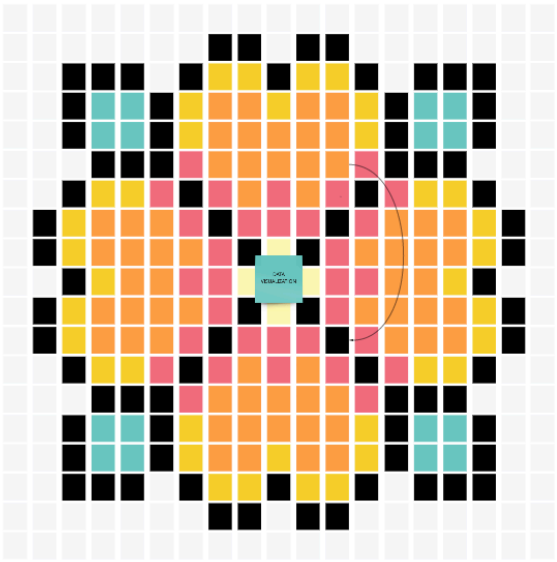
1_ Start making associations to the word in the centre on the adjacent post-its

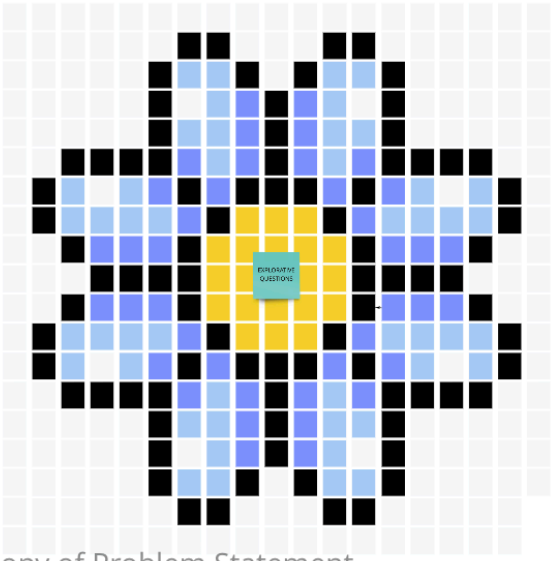
2_ Continue making associations of the associations.

3_ Empty your brain

WHAT YOU NEED:

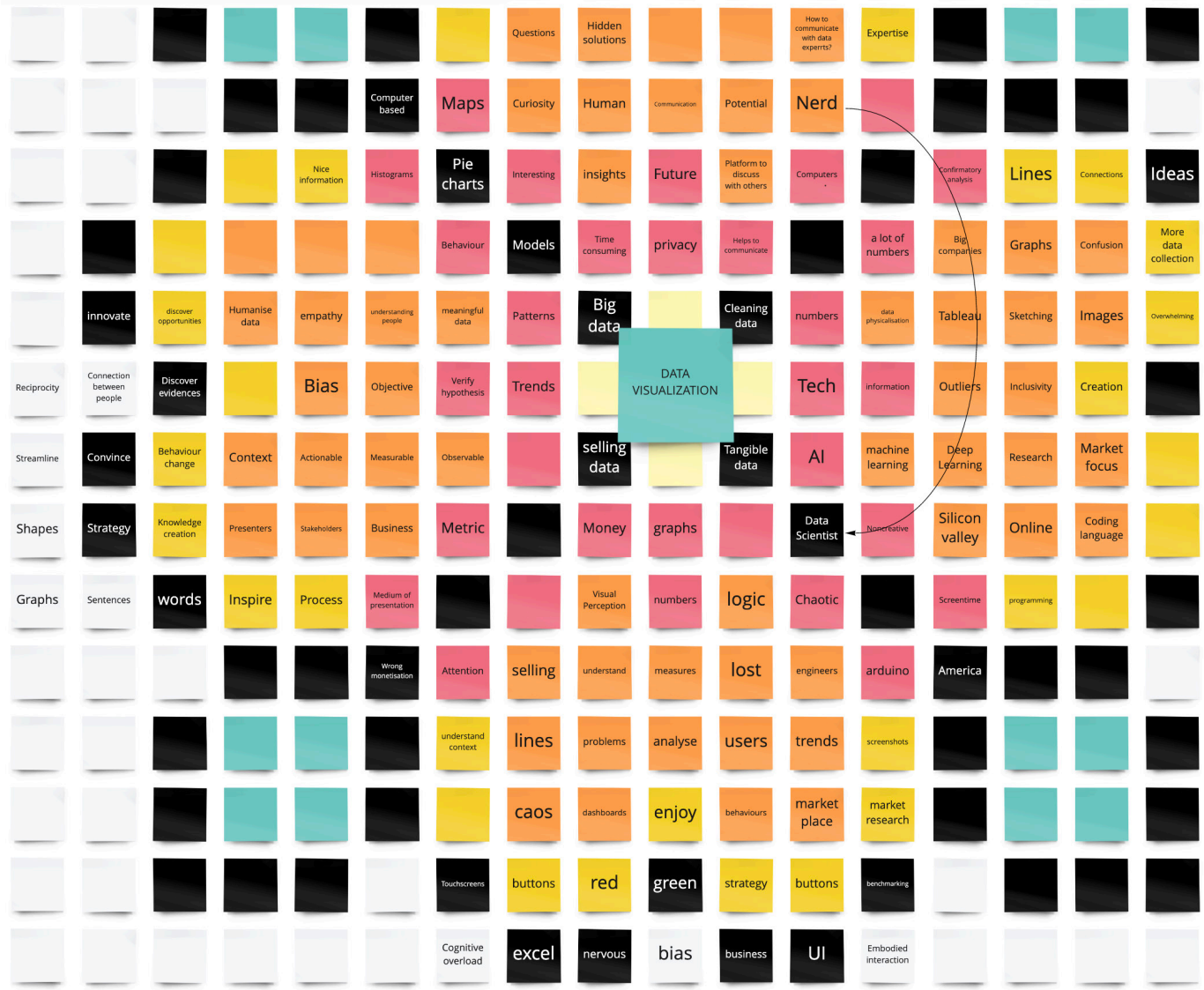
- Miro sticky notes (N)
- Your brain on "Associative mode"

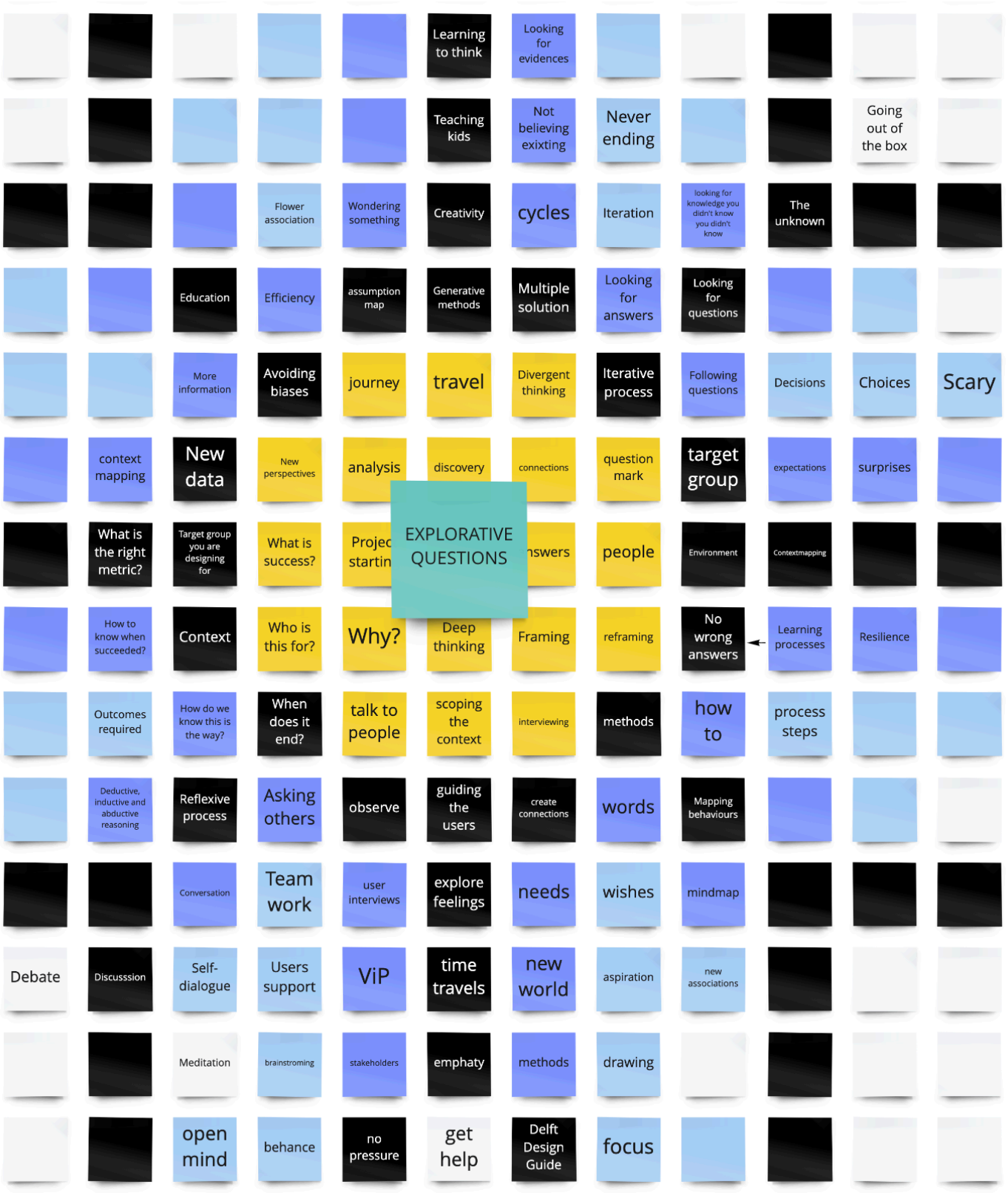




Copy of Problem Statement

How data visualization can be enhanced to trigger explorative questioning and therefore finding insights for Ford design team?


DATA VISUALIZATION
Questions
Hidden solutions
How to communicate with data experrts?
Expertise
Computer based
Maps
Curiosity
Human
Communication
Potential
Nerd
Nice information
Histograms
Pie charts
Interesting
insights
Future
Platform to discuss with others
Computers
Confirmatory analysis
Lines
Connections
Ideas
Behaviour
Models
Time consuming
privacy
Helps to communicate
a lot of numbers
Big companies
Graphs
Confusion
More data collection
innovate
discover opportunities
Humanise data
empathy
understanding people
meaningful data
Patterns
Big data
Cleaning data
numbers
data physicalisation
Tableau
Sketching
Images
Overwhelming
Reciprocity
Connection between people
Discover evidences
Bias
Objective
Verify hypothesis
Trends
Tech
information
Outliers
Inclusivity
Creation
Streamline
Convince
Behaviour change
Context
Actionable
Measurable
Observable
selling data
Tangible data
AI
machine learning
Deep Learning
Research
Market focus
Shapes
Strategy
Knowledge creation
Presenters
Stakeholders
Business
Metric
Money
graphs
Data Scientist
Noncreative
Silicon valley
Online
Coding language
Graphs
Sentences
words
Inspire
Process
Medium of presentation
Visual Perception
numbers
logic
Chaotic
Screentime
programming
Wrong monetisation
Attention
selling
understand
measures
lost
engineers
arduino
America
understand context
lines
problems
analyse
users
trends
screenshots
caos
dashboards
enjoy
behaviours
market place
market research
Touchscreens
buttons
red
green
strategy
buttons
benchmarking
Cognitive overload
excel
nervous
bias
business
UI
Embodied interaction


Learning to think
Looking for evidences
Teaching kids
Not believing exixting
Never ending
Going out of the box
Flower association
Wondering something
Creativity
cycles
Iteration
looking for knowledge you didn't know you didn't know
The unknown
Education
Efficiency
assumption map
Generative methods
Multiple solution
Looking for answers
Looking for questions
More information
Avoiding biases
journey
travel
Divergent thinking
Iterative process
Following questions
Decisions
Choices
Scary
context mapping
New data
New perspectives
analysis
discovery
connections
question mark
target group
expectations
surprises
EXPLORATIVE QUESTIONS
What is the right metric?
Target group you are designing for
What is success?
people
Environment
Contextmapping
How to know when succeeded?
Context
Who is this for?
Why?
Deep thinking
Framing
reframing
No wrong answers
Learning processes
Resilience
Outcomes required
How do we know this is the way?
When does it end?
talk to people
scoping the context
interviewing
methods
how to
process steps
Deductive, inductive and abductive reasoning
Reflexive process
Asking others
observe
guiding the users
create connections
words
Mapping behaviours
Conversation
Team work
user interviews
explore feelings
needs
wishes
mindmap
Debate
Discusssion
Self-dialogue
Users support
ViP
time travels
new world
aspiration
new associations
Meditation
brainstroming
stakeholders
emphaty
methods
drawing
open mind
behance
no pressure
get help
Delft Design Guide
focus

Copy of Problem Statement

20-25'

6. ACTIVITY 2 | The Idea Circle

Now is time to transform those inspiring associations into crazy ideas!!

THE STEPS:

1_ Choose 1 inspiring note from each flower and place it on the doted square on the top left.

2_ Generate ideas for the problem statement in 3 minutes.

3_ Switch to the chart on your right and build up on the notes that are already there.

WHAT YOU NEED:

- Miro sticky notes (N)
- Your brain on "Creative mode"

How data visualization can be enhanced to trigger explorative questioning and therefore finding insights for Ford design team?

7. SOLUTION IDEATION | The Mona Lisa

Aren't we designers?
Let's prove it with some drawing!

In this stage we want to jump from written ideas to visual solutions, so pick a piece of paper and your sharpest pencil.

WHAT YOU NEED:

- sheets of paper
- a pen
- whatsapp

FOLD A SHEET OF PAPER INTO 4 PARTS:

1 | 2
3 | 4

THE STEPS:

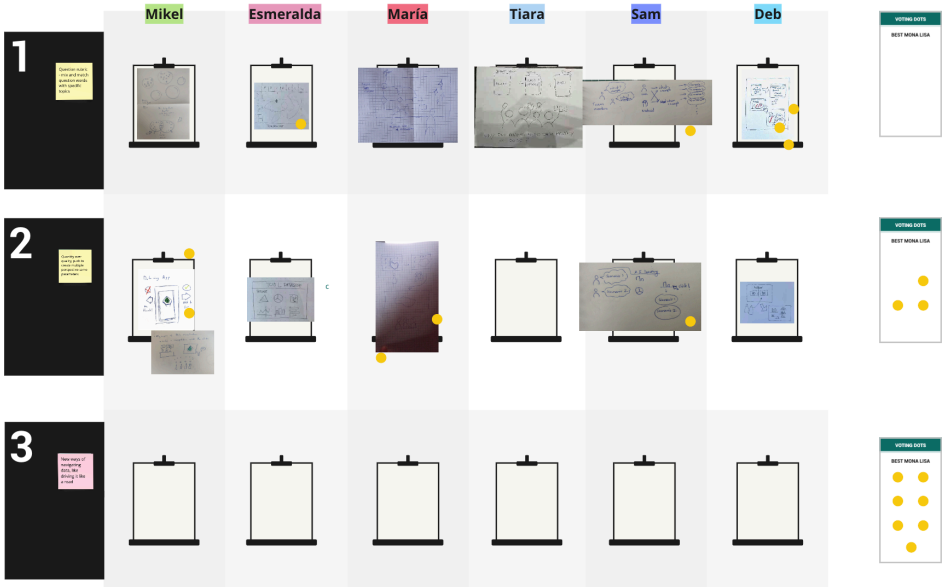
1_ sketch individually 4 solutions around the first idea
3'

2_ out of these 4, choose the best one and draw your final sketch
3'

3_ explain briefly your idea to the rest of the group
30" each

4_ review other participants drawings

5_ vote on the drawing you like the best



Copy of Problem Statement

How data visualization can be enhanced to trigger explorative questioning and therefore finding insights for Ford design team?

ANALYSIS


DV to do further research by using them to communicate with the "vehicle" user
Focus on only time based visuals and create journeymap with them to after question the user
co-creation
Using the visual to create questions to use in interviews with the users
showing images to users
Data that gets cluttered
Clustering method for the data maybe by topics
Declutter data exercise - like Marie Kondo
Statement cards / Clustering with the quantitative data visuals
Focus on question develpment
Just keep asking WHY - like a kid
Game to develop divergent questioning and generative design questions applied to Data visuals
Why? Why? Why? method applied to visual - emphatize with the user to the limit
Question game to look for answers in DV with all the team

New ways of navigating data, like driving it like a road

Interactive DV with multiple different visualizations

Quantity over quality, push to create multiple perspective same parameters

Visuals that change as you hover by

Track visually all vehicle data by journeys

Software that automatically visualizes the data in multiple and different ways

Board to select data and zoom and then open other parameters related

Change designers mindset towards DV

Bring the design team through a journey to learn to read data visuals and have a more data analysis/scientist mindset

DV as conversation triggers between team

Platform that posts data visualisation prompts daily invting members to participate

Visuals that sent questions to discuss between team when looking at the data

Shuffling visualisations between team members as proof of concept xD

Use DV to identify Personas and have questions about the users

Workshop created to focus on outliers and target them as new users

AI that identify similar trends and indicates reprocity between users

AI recognize data visuals and create automatic personas

Use DV to break assumptions, to map ideal situations and to confront with reality

Create "ideal" visuals and think how user behavior should change to get there

Boardgame to create a path towards wanted outcome from data

Map presumptions about context

After having data visuals use a method to came out with the full context description

Data mapping like a bluerprint

Create Ideal scenarios of behaviour with data

Make designers visualize first their assumptions and after compare with the real visuals to find opportunitues

Assumption data gets also visualised to compare to actual data

Designers create journey and afterwards they look for the evidences in data to fill the gaps and came with hypothesis

Breakdown of data visualisations - people explaining from different perspectives

Design team workshop to frame behaviours that have to change based on the visuals

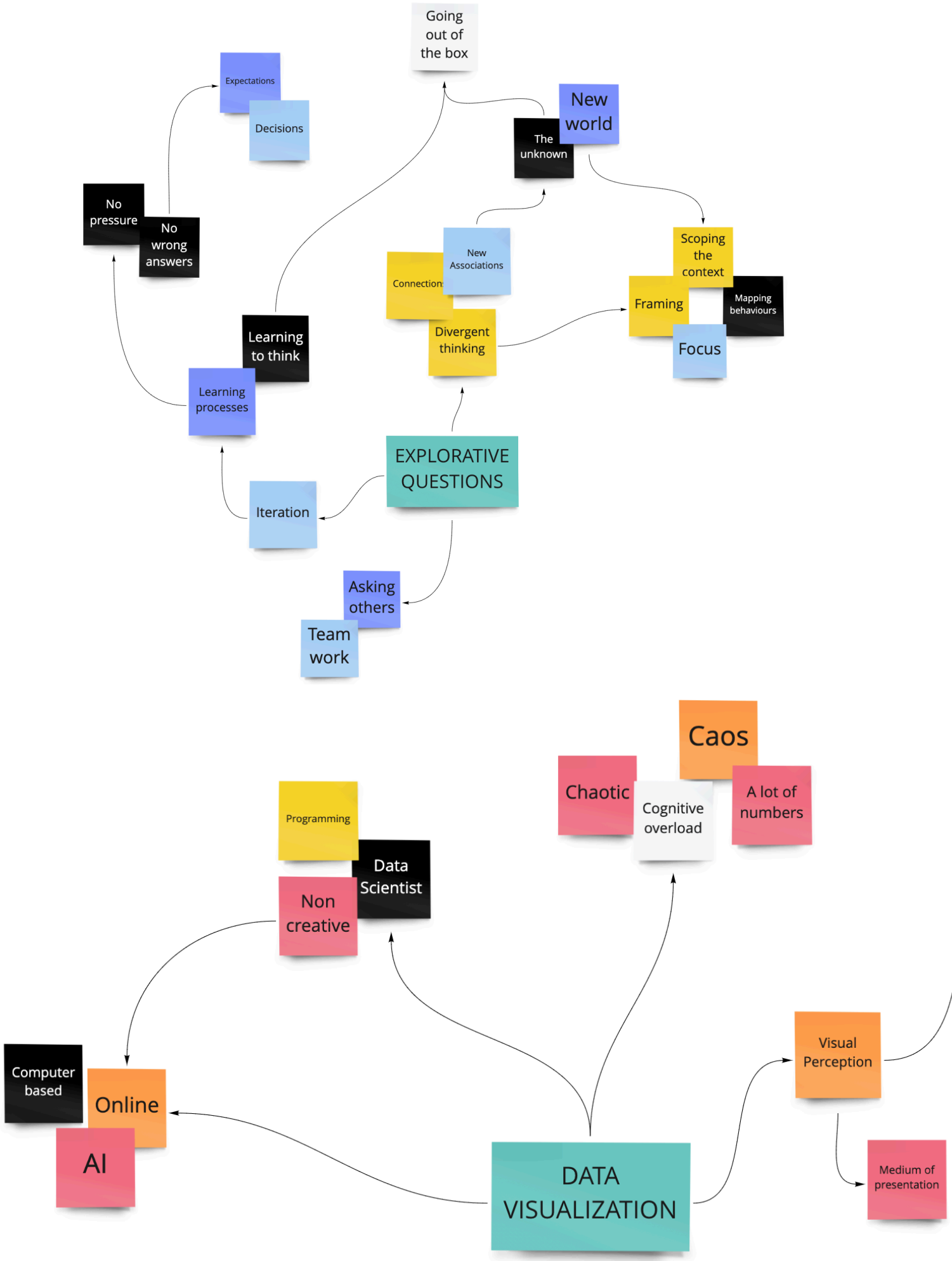
Questioning support to follow when using DV

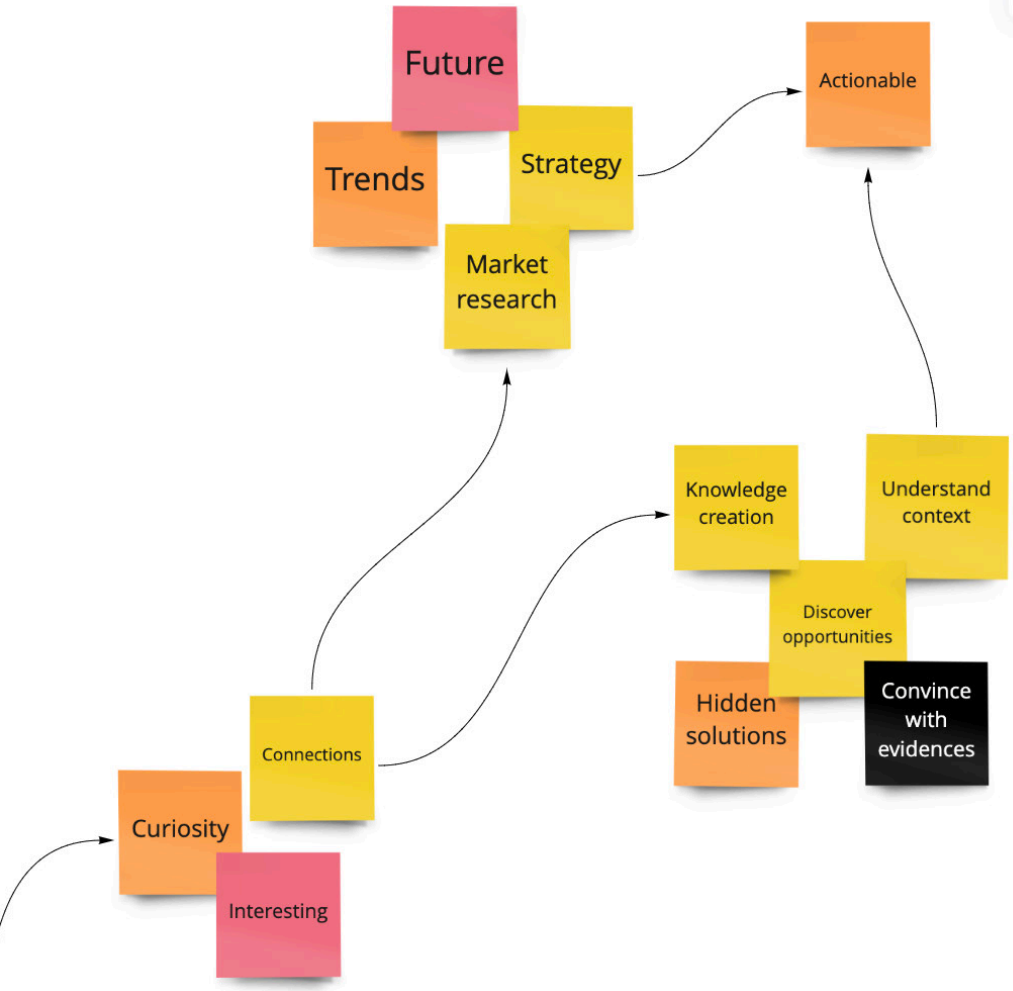
Conversations with data, like having a conversation with somebody

Trigger word cards - each question should contain the word

Question rubric - mix and match question words with specific topics

Questions template that translate Data Analysis ones into a more designer lenguage


Going out of the box
Expectations
Decisions
New world
The unknown
No pressure
No wrong answers
New Associations
Connections
Scoping the context
Framing
Mapping behaviours
Focus
Learning to think
Divergent thinking
Learning processes
EXPLORATIVE QUESTIONS
Iteration
Asking others
Team work
Caos
Chaotic
Cognitive overload
A lot of numbers
Programming
Data Scientist
Non creative
Computer based
Online
AI
Visual Perception
DATA VISUALIZATION
Medium of presentation


Future
Trends
Strategy
Market research
Actionable
Knowledge creation
Understand context
Discover opportunities
Hidden solutions
Convince with evidences
Connections
Curiosity
Interesting