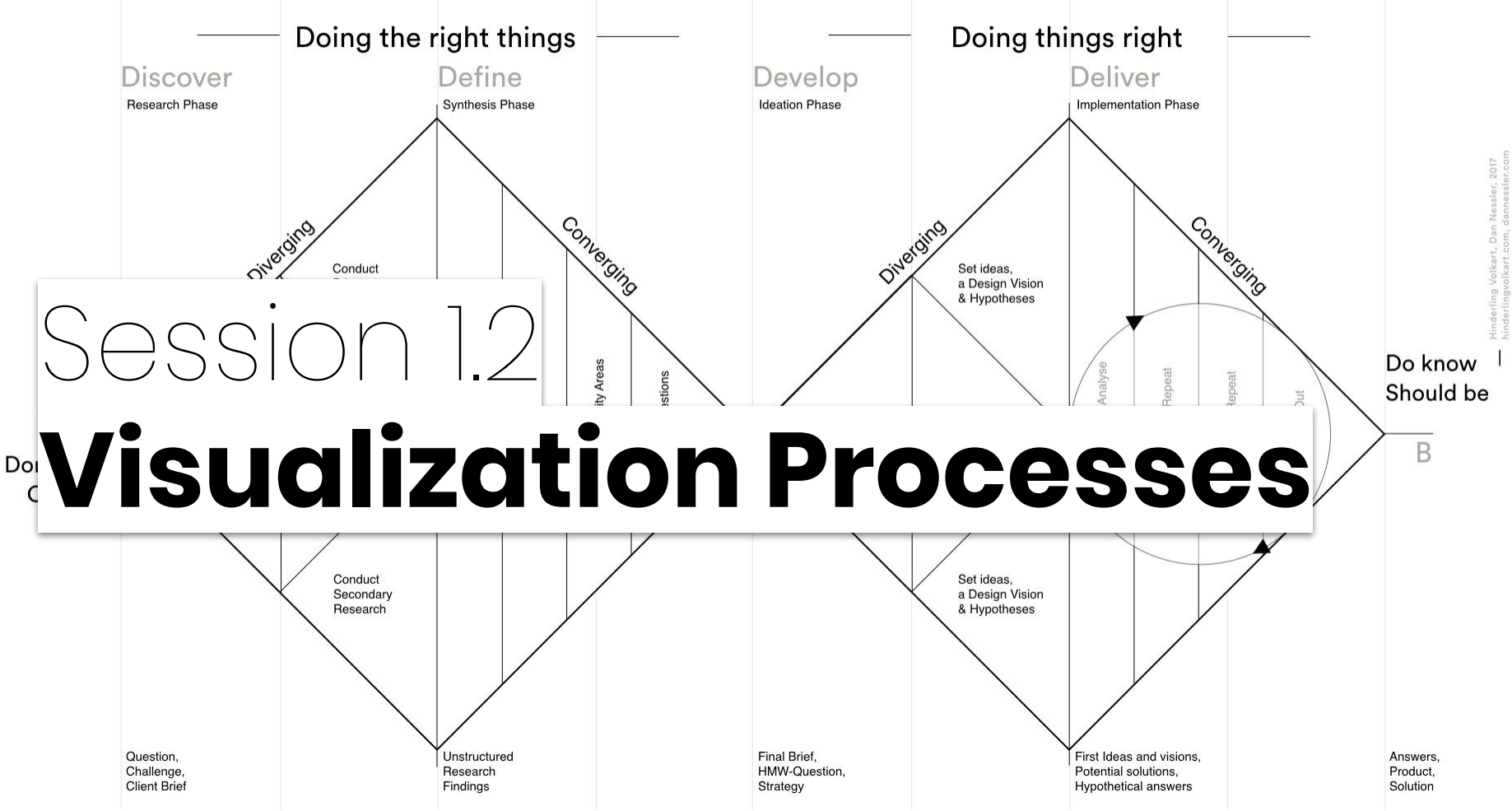

Session 1.2

Visualization Processes

Online Course
Data Visualization for Professionals

THE UNIVERSITY of EDINBURGH

Benjamin Bach

June 2020

http://benjbach.me

https://datavis-online.github.io

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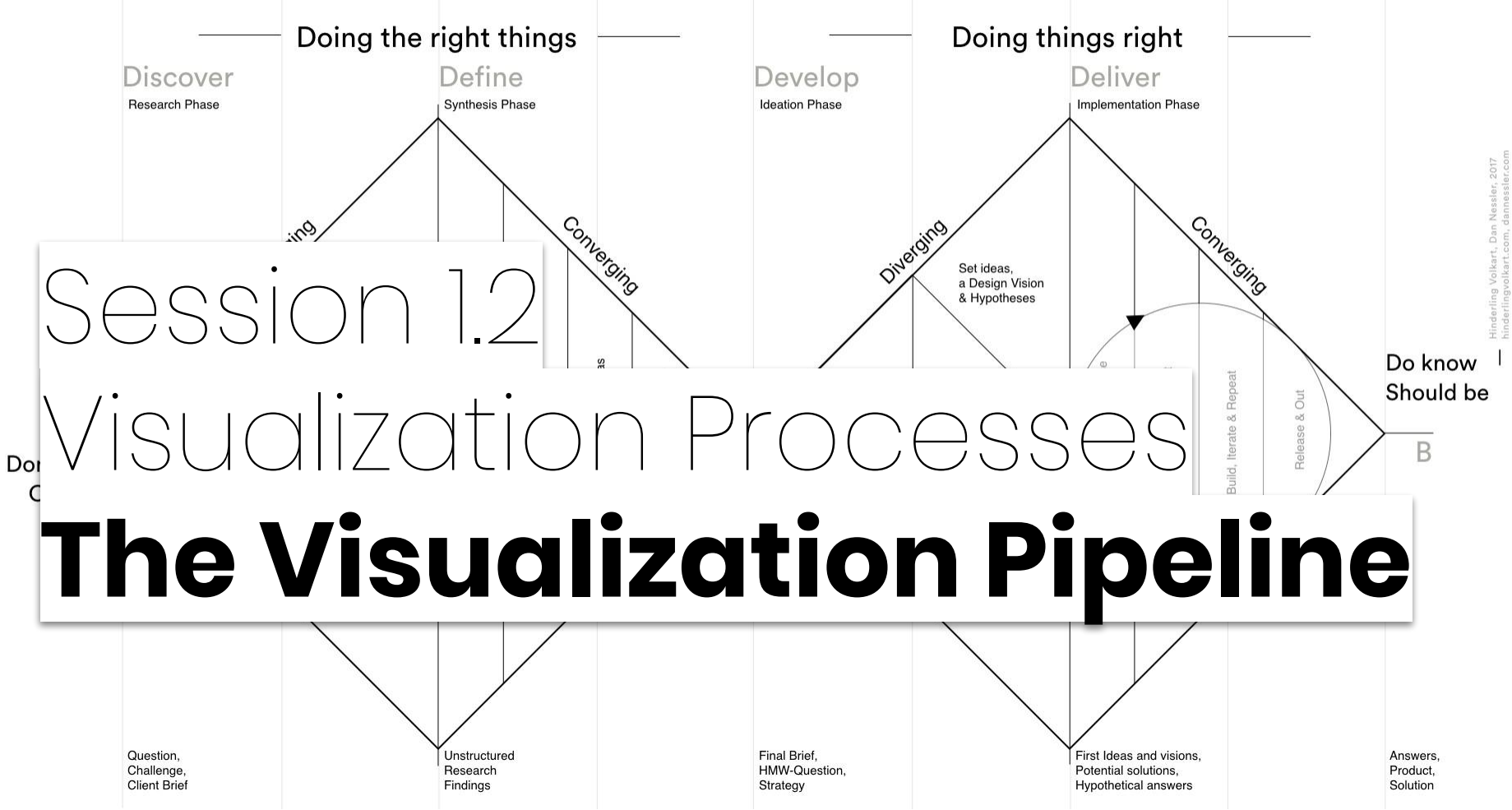
Outline

Which processes are involved around understanding and creating visualizations?

1. The visualization pipeline
2. Design Thinking
3. Defining a visualization challenge
4. Exploratory data analysis



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The Visualization Pipeline

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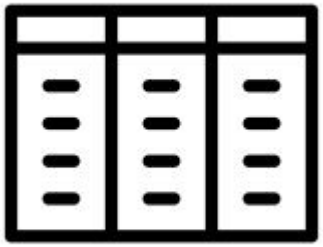
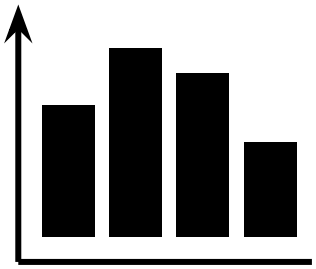
Sense making process





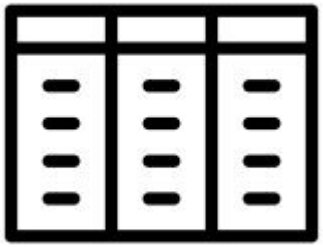
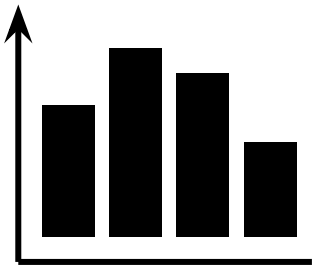
Data
Numbers, relations, records, text, analysis, ...

Visualization
visual representation

Information
Insights, Facts

Action
Decisions Emotions, Knowledge

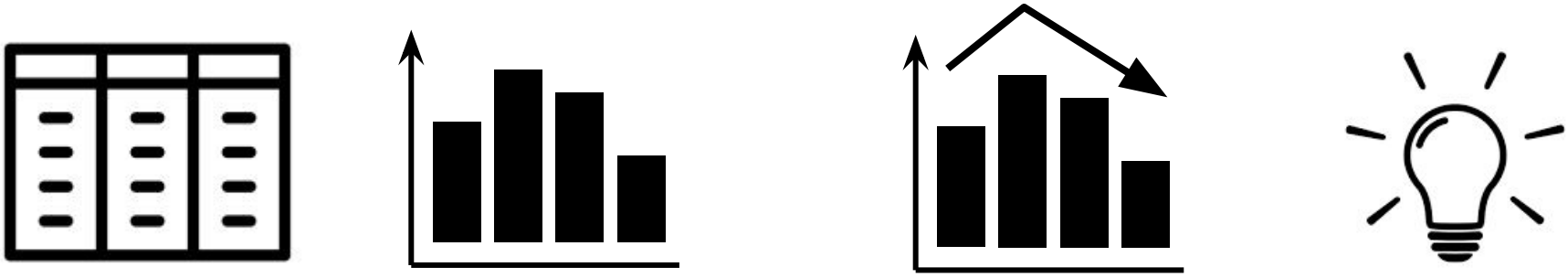
Sense making process

Data → **Visualization** → **Information** → **Action**

Collect
Format
Parse
Filter
Analyze
Visualize
Render
Interact
Annotate
Communicate

Sense making process



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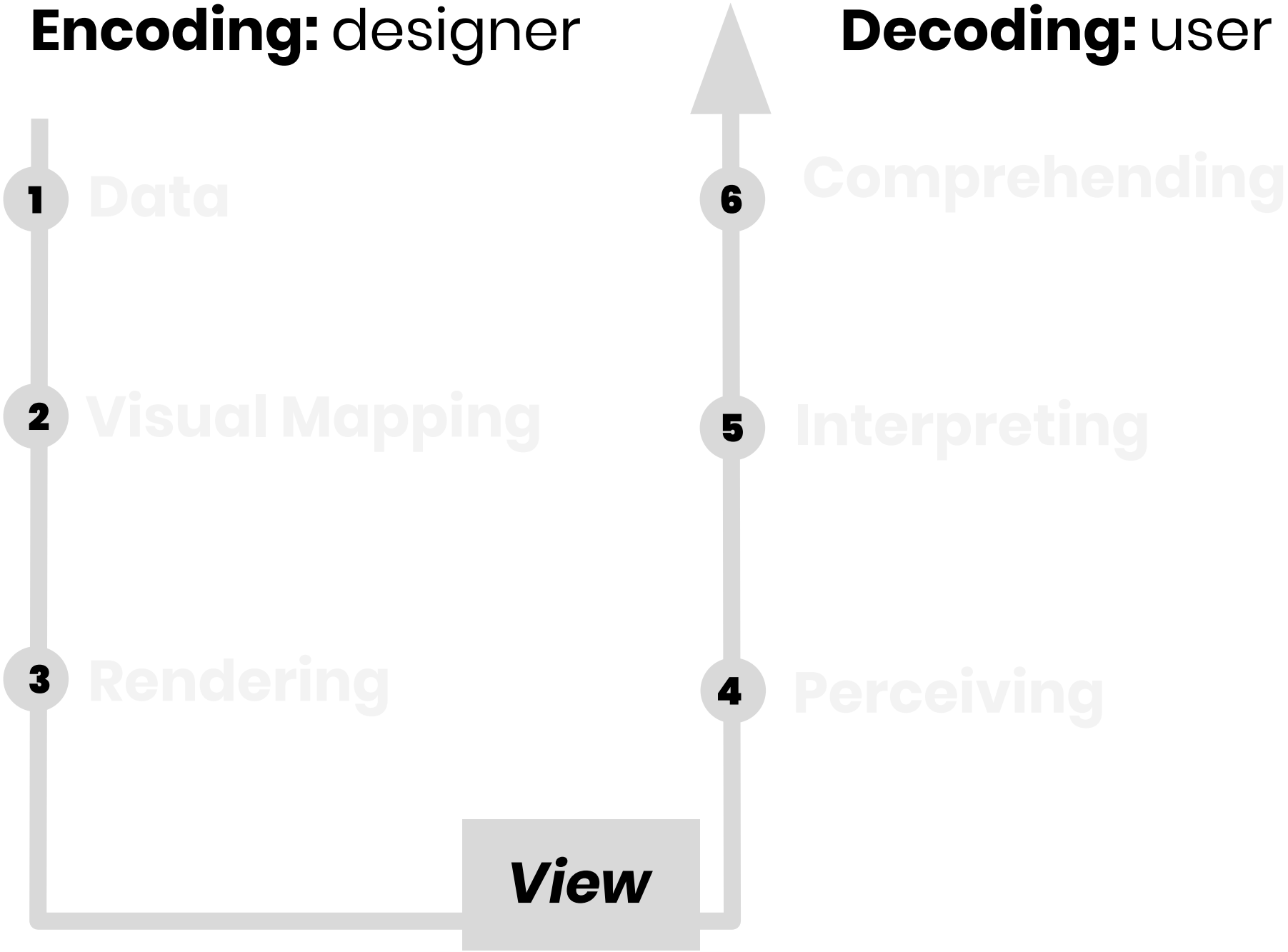
Encoding: designer
Decoding: user
1
Data
2
Visual Mapping
3
Rendering
4
Perceiving
5
Interpreting
6
Comprehending
View

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1. Data

Value

Attribute

Item

		mpg	cyl	disp	hp	drat	wt	qsec
2	Mazda RX4	21	6	160	110	3.9	2.62	16.46
3	Mazda RX4 Wag	21	6	160	110	3.9	2.875	17.02
4	Datsun 710	22.8	4	108	93	3.85	2.32	18.61
5	Hornet 4 Drive	21.4	6	258	110	3.08	3.215	19.44
6	Hornet Sportabout	18.7	8	360	175	3.15	3.44	17.02
7	Valiant	18.1	6	225	105	2.76	3.46	20.22
8	Duster 360	14.3	8	360	245	3.21	3.57	15.84
9	Merc 240D	24.4	4	146.7	62	3.69	3.19	20
10	Merc 230	22.8	4	140.8	95	3.92	3.15	22.9
11	Merc 280	19.2	6	167.6	123	3.92	3.44	18.3
12	Merc 280C	17.8	6	167.6	123	3.92	3.44	18.9
13	Merc 450SE	16.4	8	275.8	180	3.07	4.07	17.4
14	Merc 450SL	17.3	8	275.8	180	3.07	3.73	17.6
15	Merc 450SLC	15.2	8	275.8	180	3.07	3.78	18
16	Cadillac Fleetwood	10.4	8	472	205	2.93	5.25	17.98

2. Visual Mapping

		mpg	cyl	disp	hp	drat	wt	qsec
1								
2	Mazda RX4	21	6	160	110	3.9	2.62	16.46
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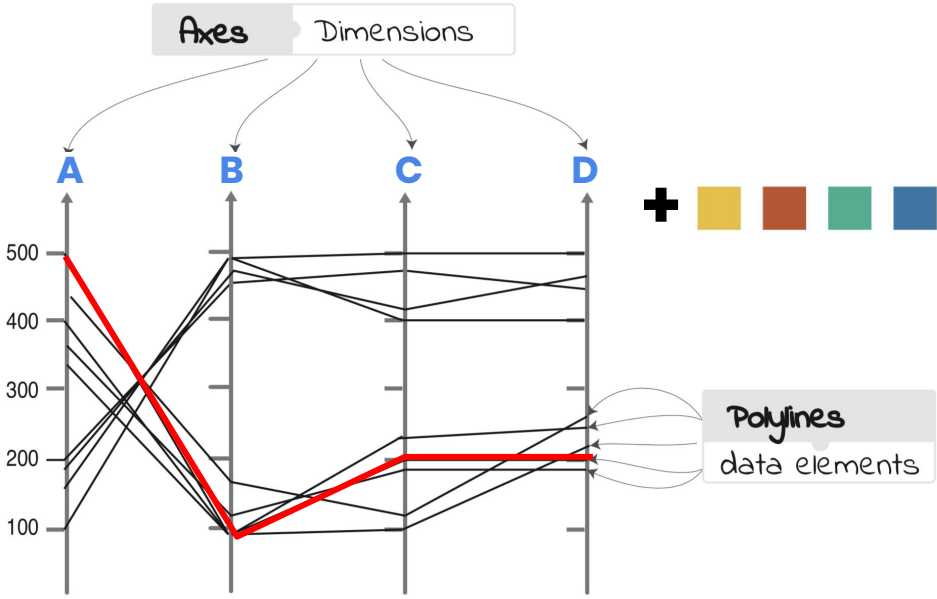
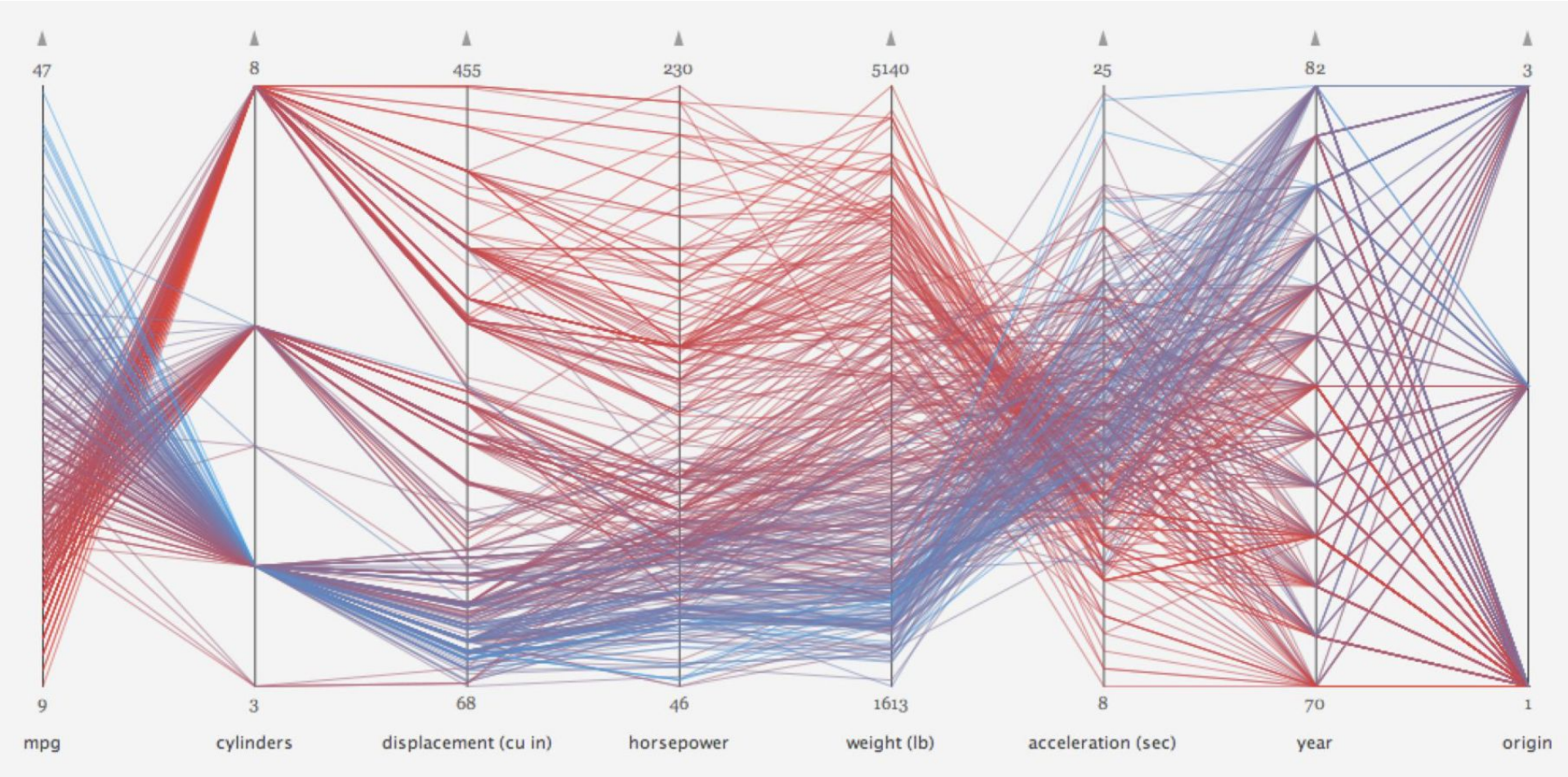
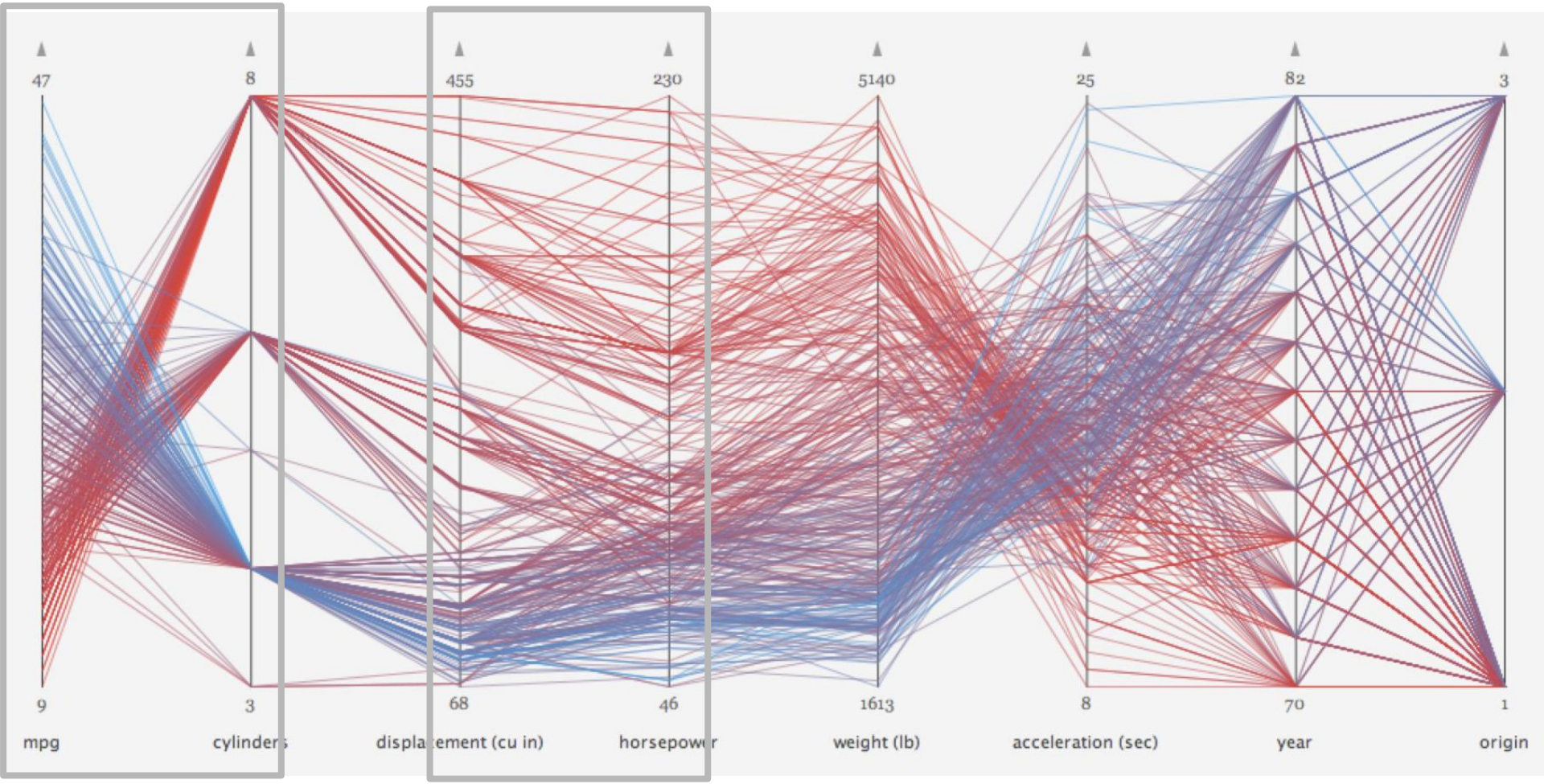


Data → **Visual Representation**

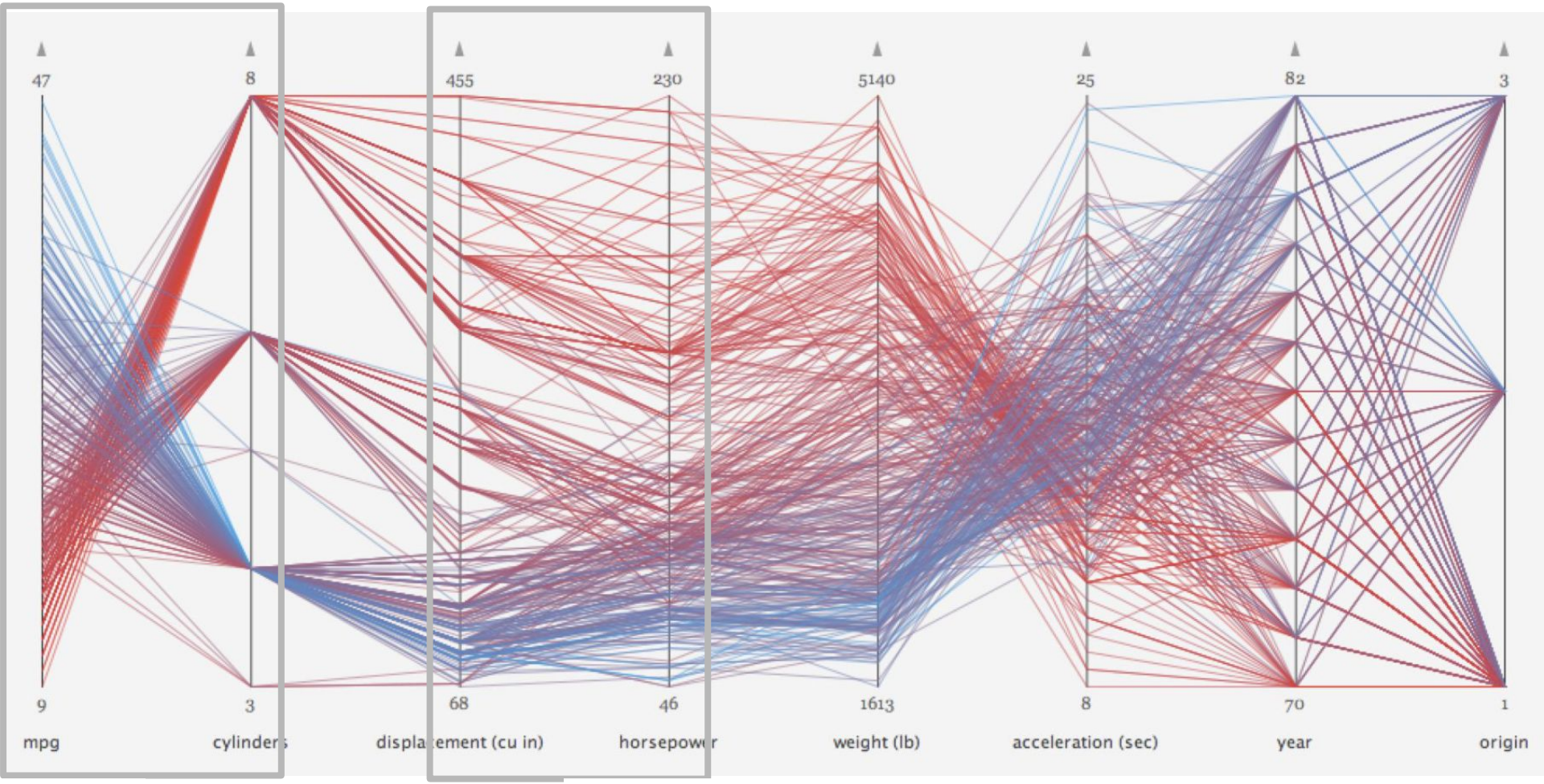
3. Rendering

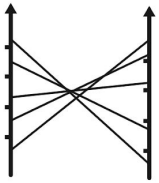

47
8
455
230
5140
25
82
3
9
3
68
46
1613
8
70
1
mpg
cylinders
displacement (cu in)
horsepower
weight (lb)
acceleration (sec)
year
origin

4. Perceiving

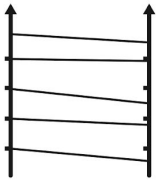


5. Interpretation



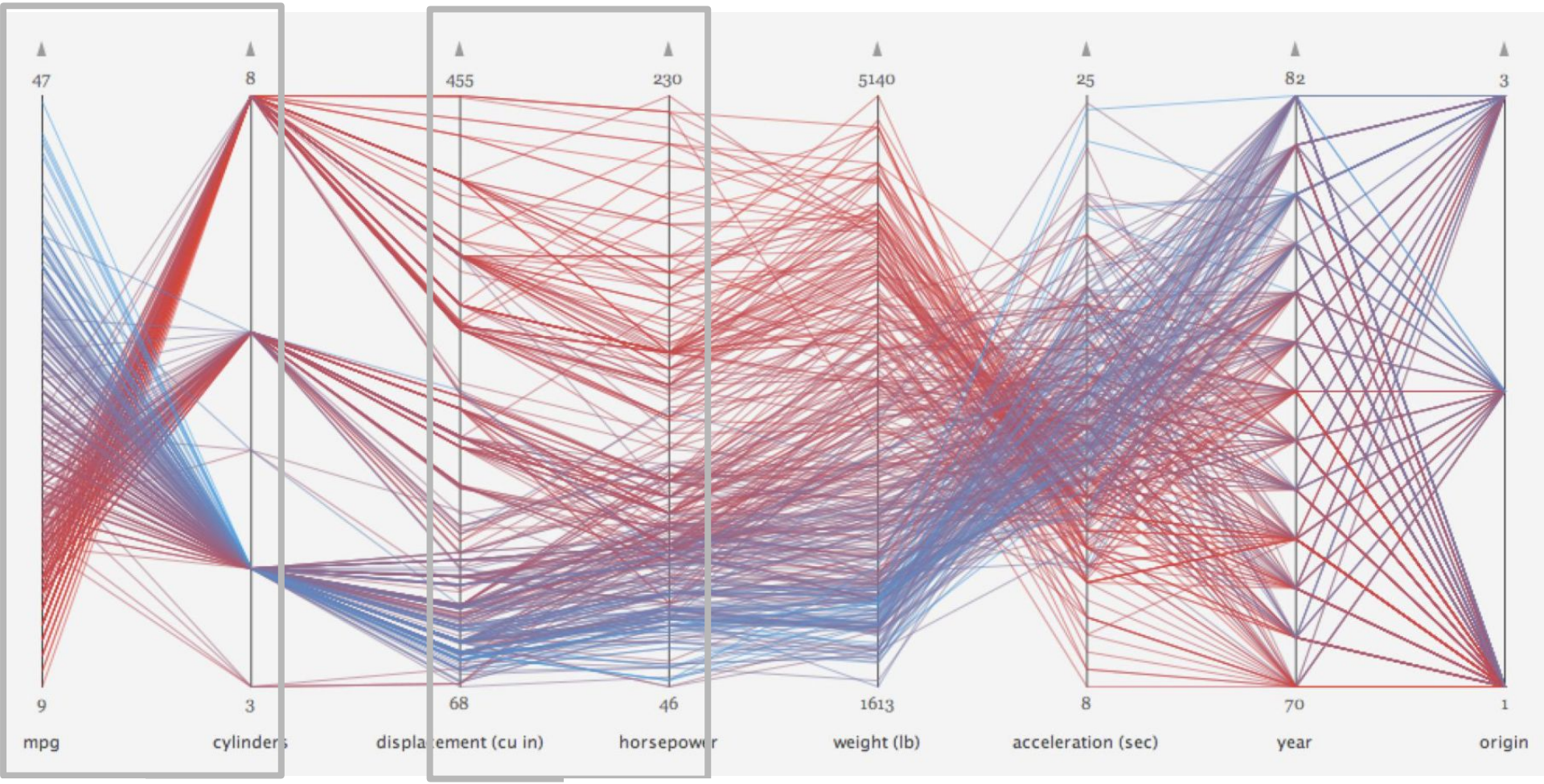


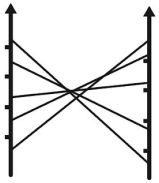
Negative Correlation



Positive Correlation

6. Comprehending





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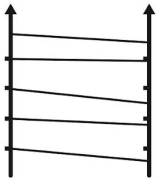

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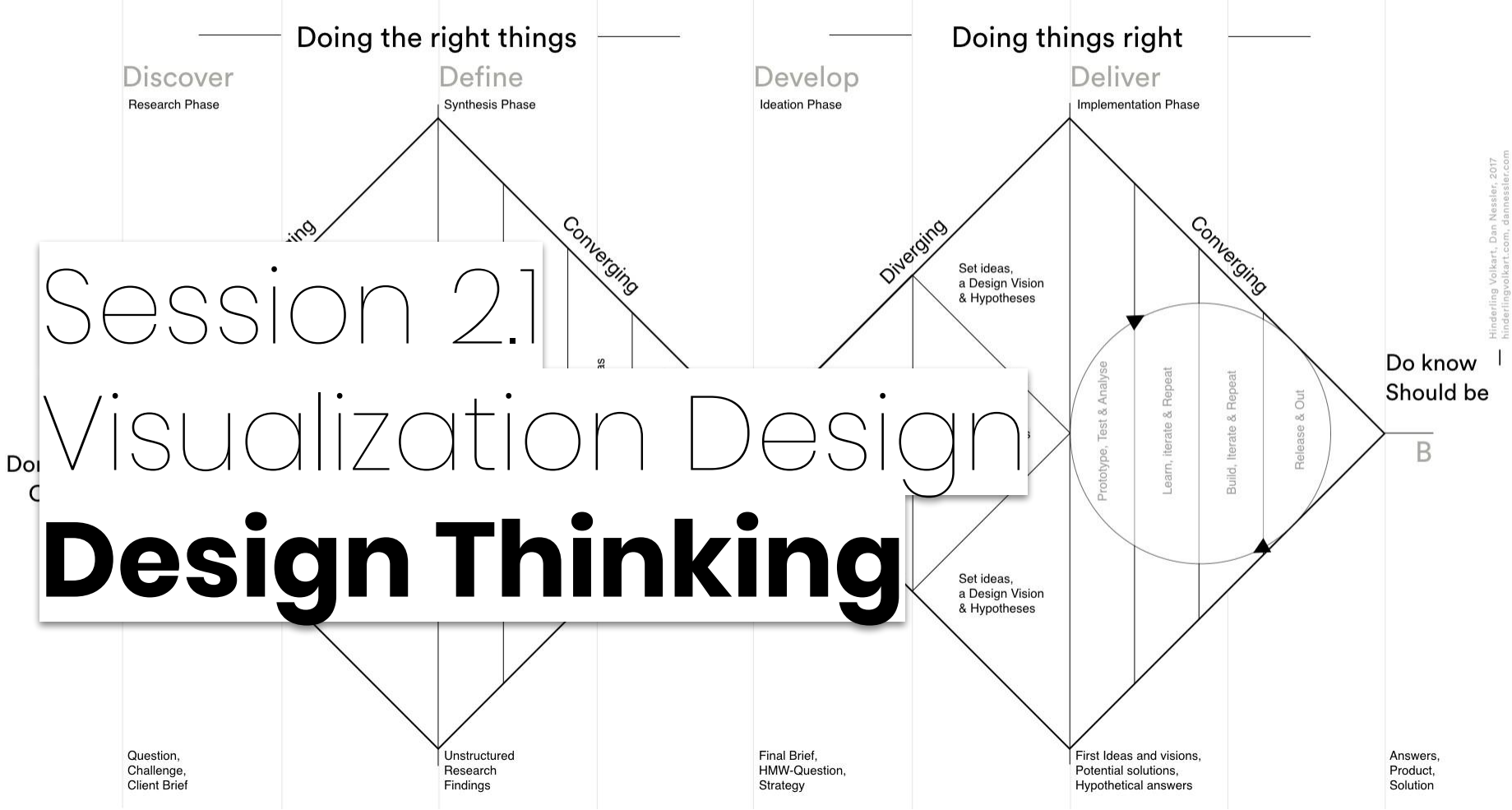

Session 2.1
Visualization Design
Design Thinking

Online Course
Data Visualization for Professionals

THE UNIVERSITY of EDINBURGH

Benjamin Bach

June 2020

http://benjbach.me

https://datavis-online.github.io

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Visualization Design

WHAT:

- Create effective visualizations
- Create efficient visualizations
- Solve a problem
- Design a solution

HOW:

- Visualization can have many forms
- It's **not rocket science**
- Everyone can **design** visualizations
- Everyone can **learn creating** visualizations
- **Solve your own problems**
- There are **many rules**
- There are **many exceptions**

Design Thinking

Design thinking is a human-centered approach to creative problem solving.

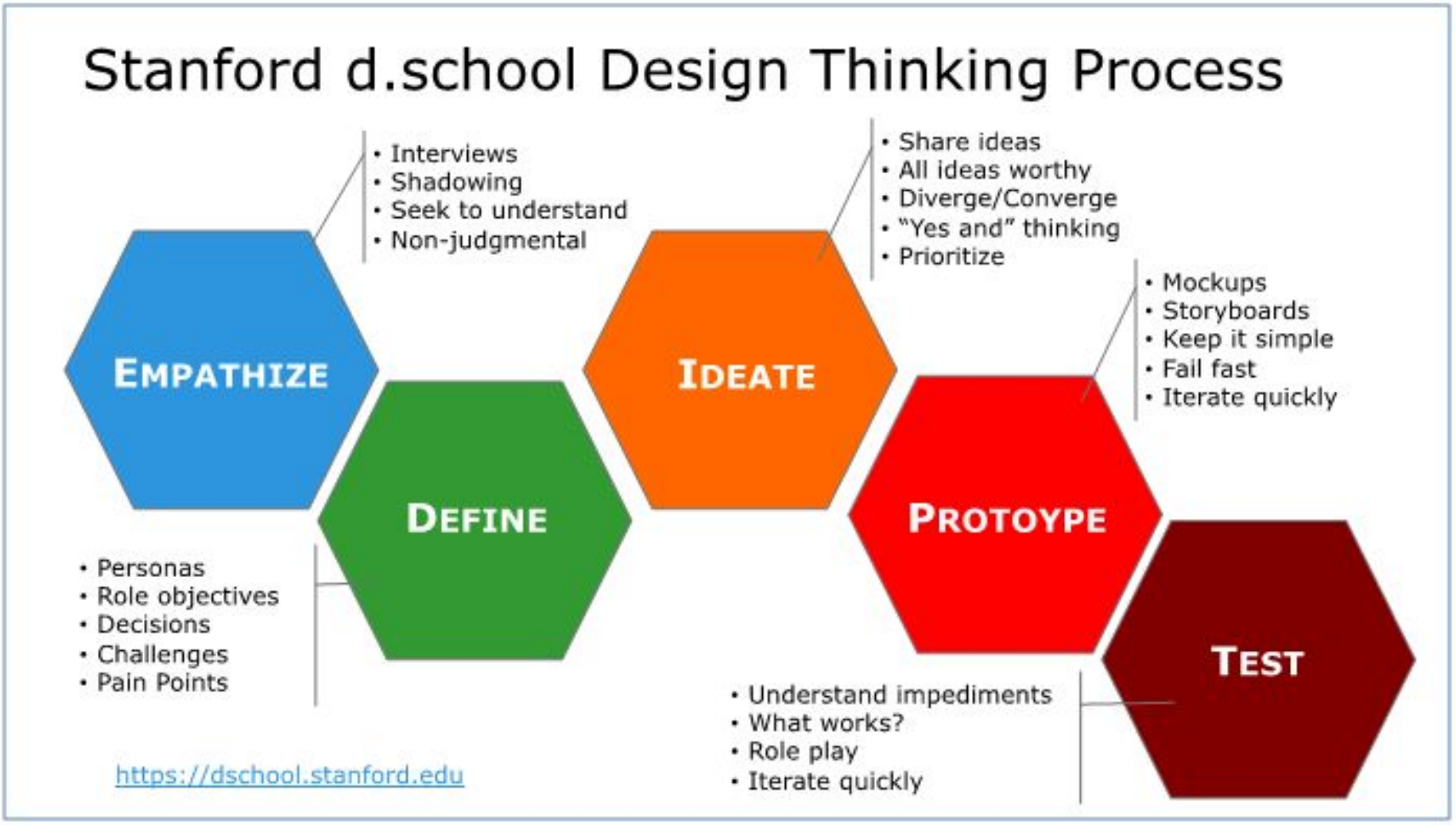
- is about **people**
  - empathy, problems, context, problem
- Highly **creative**
  - ideas, discussion, iteration
- **hand-on**
  - develop, prototype, test, try, ...
- **Show,** don't **tell**
- **iterative**
  - failure, progress, iterate, feedback,...

http://www.theagileelephant.com/what-is-design-thinking/

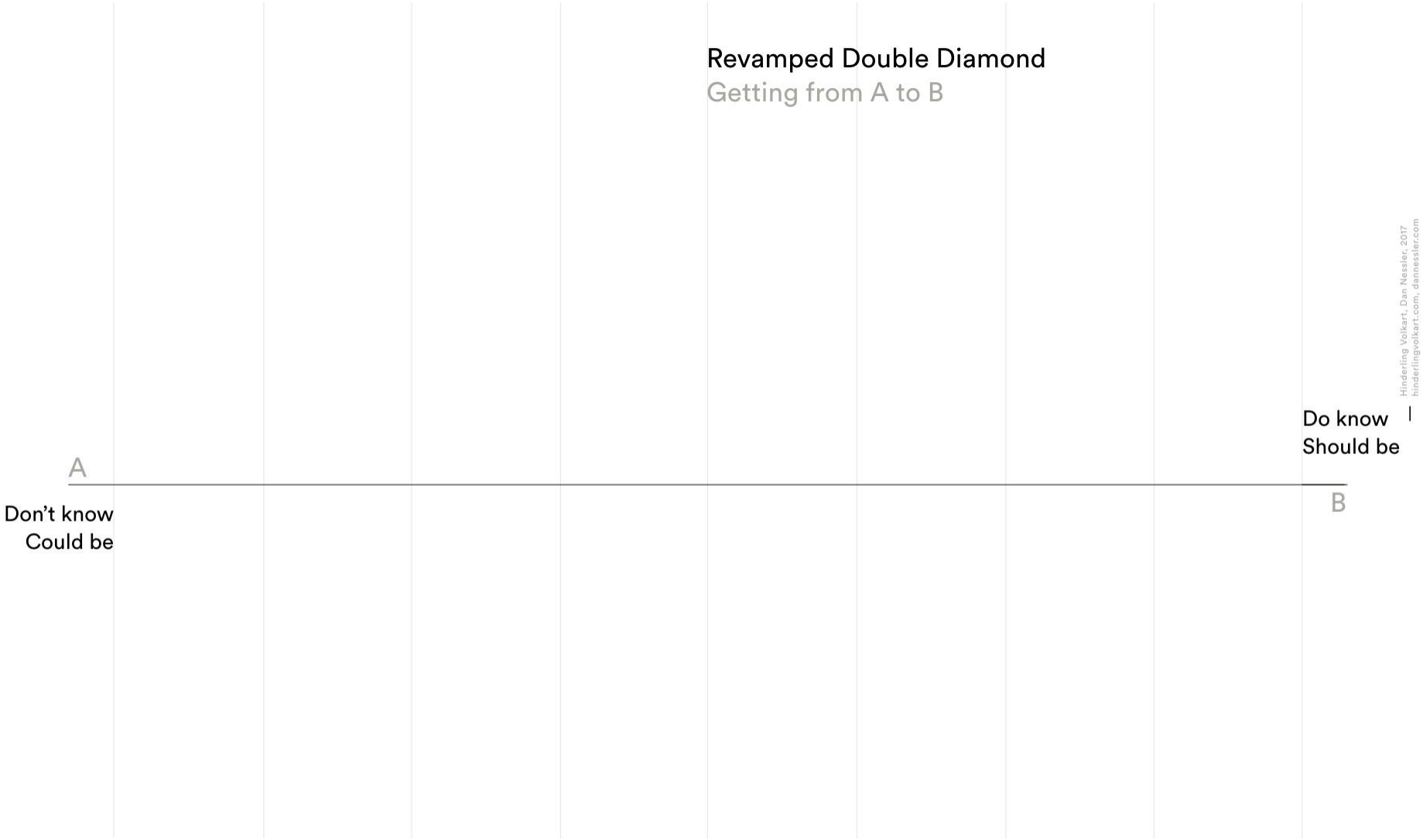
https://www.ted.com/talks/david_kelley_human_centered_design

Rowe, Peter G. *Design thinking*. MIT press, 1987.

Design Thinking—5 steps



Double Diamond



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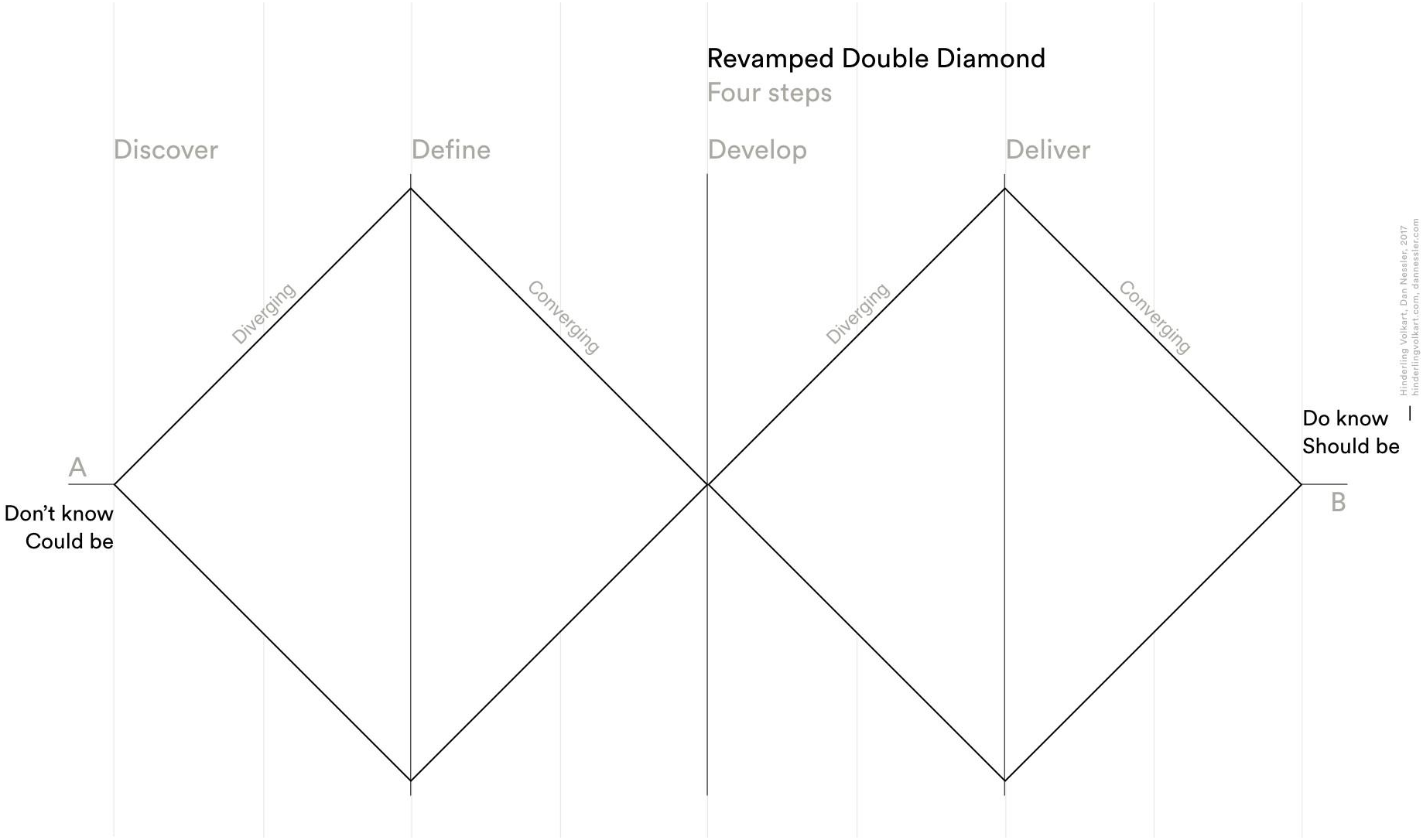

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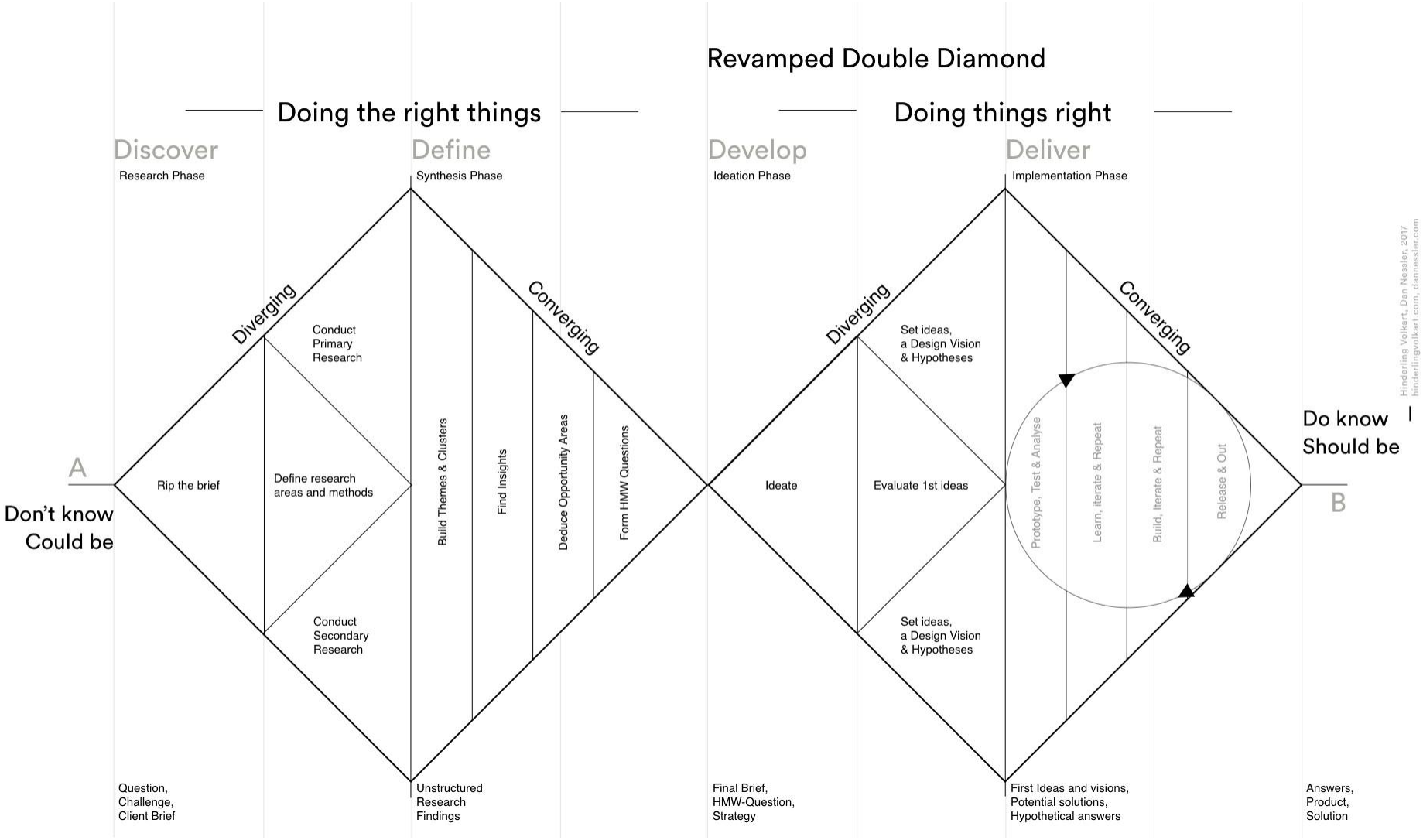

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Design Decisions

Context:

- Audience knowledge
- Data complexity
- Tasks
- Display medium
- …

Visual Design:

- Familiarity vs. unfamiliarity
- Clarity vs. Memorability
- Novelty vs. Tradition
- Facts vs. Uncertainty
- Reader-driven vs. Author-driven
- …

Visualization Design Thinking

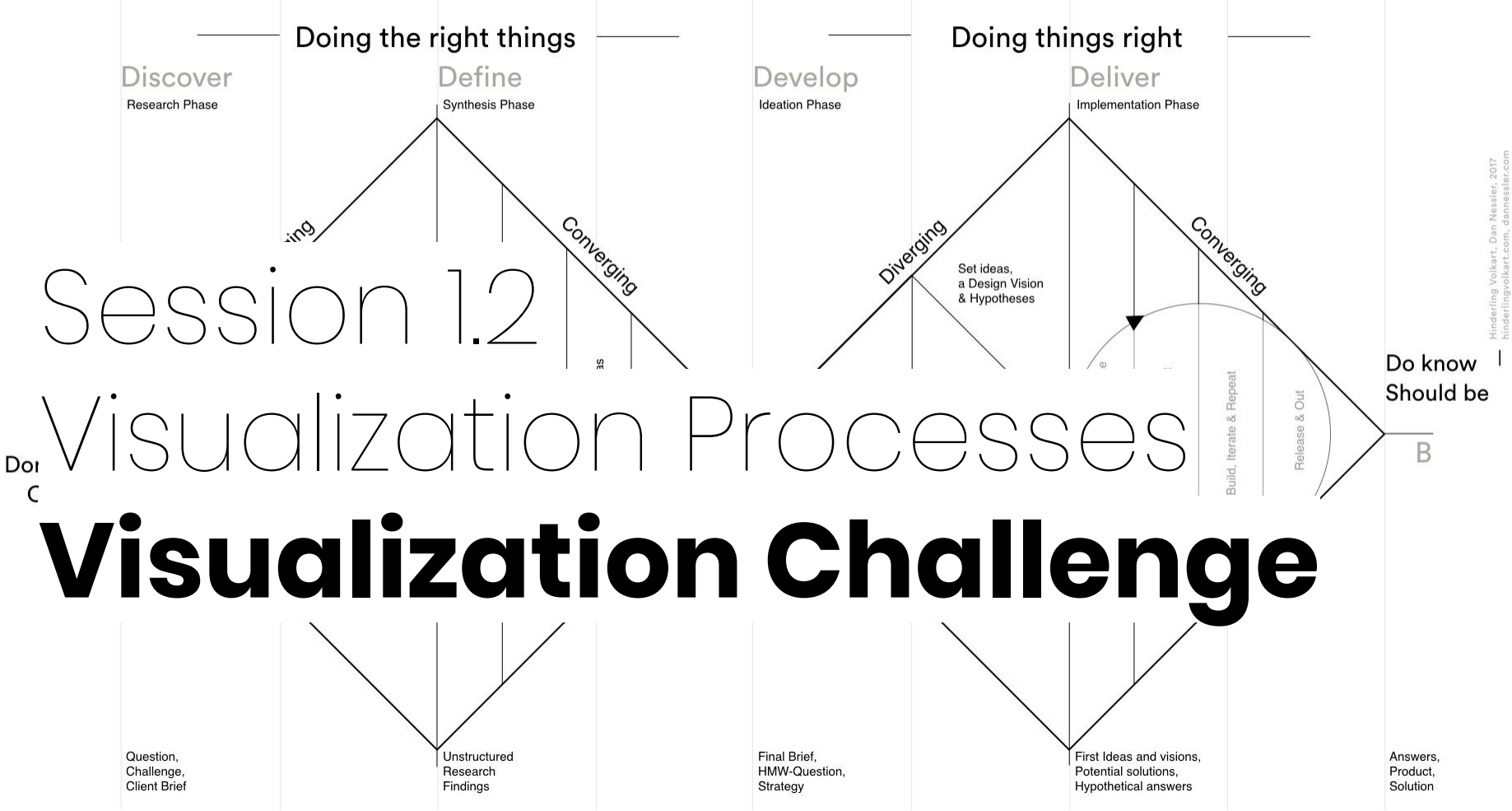
Empathize
- Understand your audience, interviews, observations, reading, conversation

Define
- Create a **Data Challenge**. Set context and constraints.

Ideate
- **Sketch** design ideas
- Develop **visual mapping**
- **Exploratory data analysis**

Prototype
- Use visualizations **tools**
- High-fidelity paper prototypes
- *"Memento data"*

Test
- User-centered **evaluation**



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Visualization Challenge

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Data Visualization Challenge

Data	**Message & Insights**
Audience	**Context**

Challenge **Data**

- What is my data?
- Where is it from?
- How is it characterized?
- How complicated is my data?
- How many dimensions?
- How large?
- What data format?
- What is *not* part of my data?
- …

Challenge **Messages / Insights**

- What am I going to find?
- What am I interested in finding?
- Which questions do I have?
- Which *tasks* do I want to support?
- What am I going to tell with the visualization?
- …

Challenge **Audience**

- Who is my audience?
- How are they characterized?
- What do they know about the data / topic?
- Why are they interested in my data?
- Why should they care?
- What do they know about visualization?
- What questions might they have?
- …

Challenge **Context**

- How will people see my visualization?
- Where will this be?
- How will they be able to engage?
- Will they be able to interact?
- …

Data Visualization Challenge

Data

- What is my data?
- Where is it from?
- How is it characterized?

Audience

- Who is my audience?
- Why do they care?
- What do they know?

Messages / Insights

- What am I looking for?
- What am I telling?

Context

- Where will visualization be seen?
- How do people engage?

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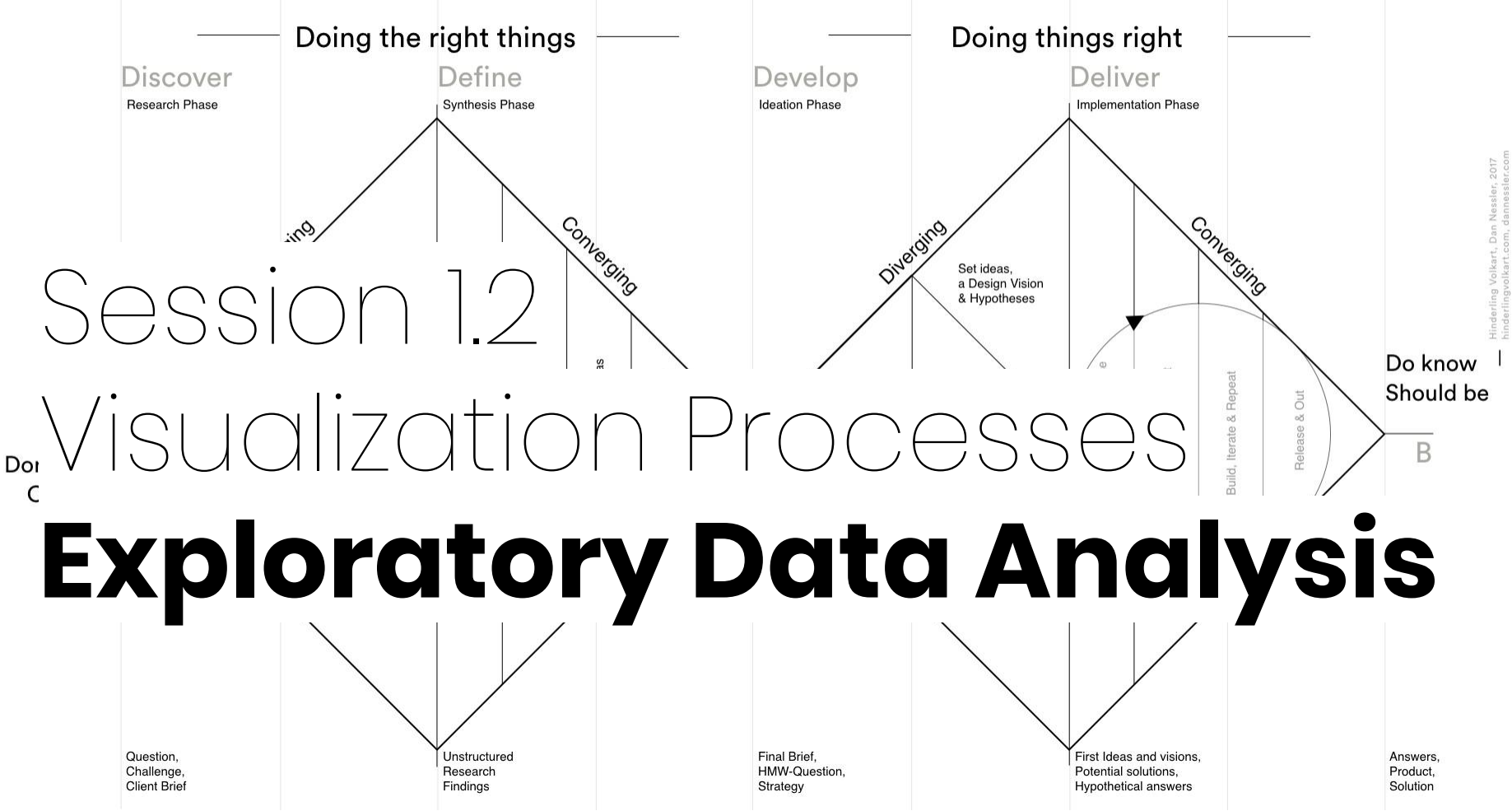

Session 1.2

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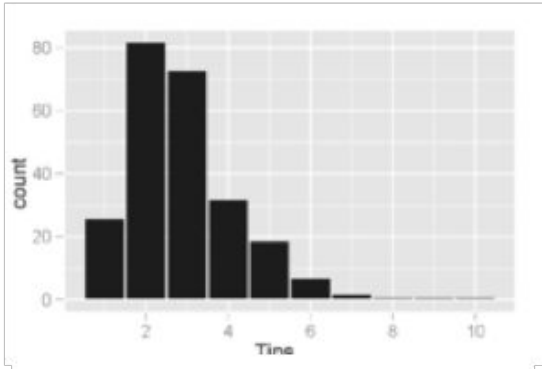
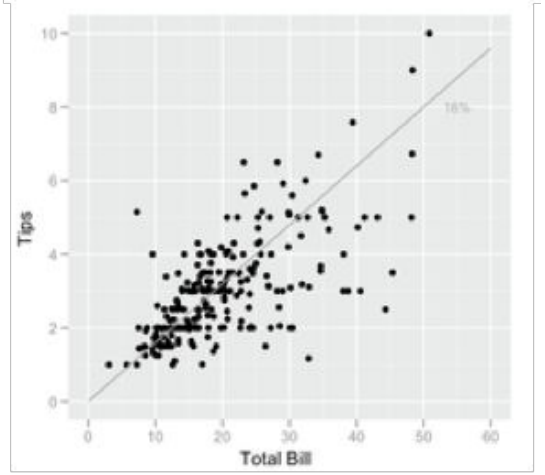
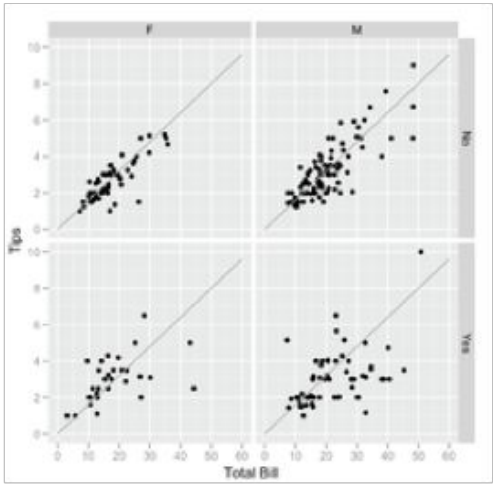
John W. Tukey

EXPLORATORY DATA ANALYSIS







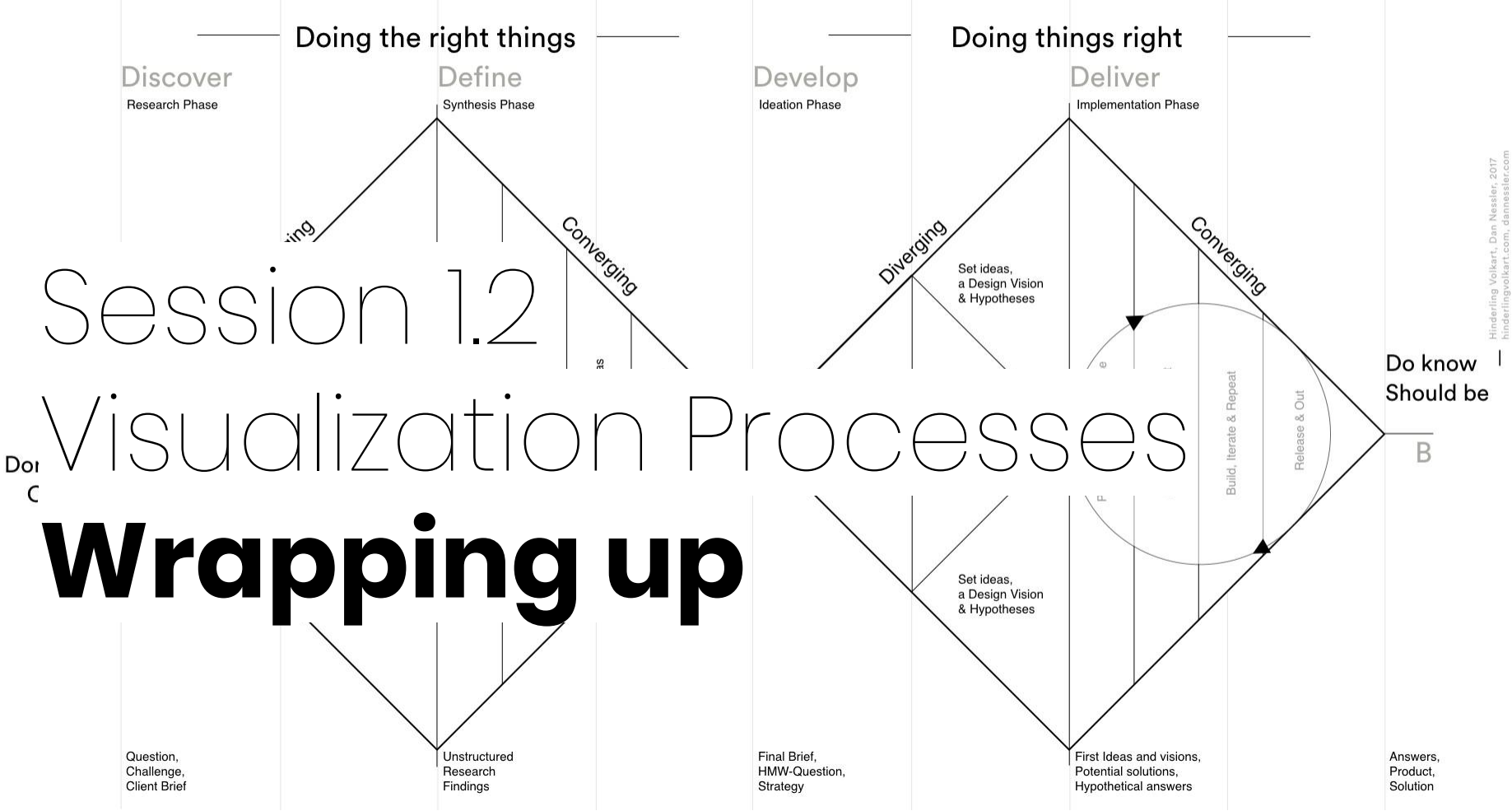
Exploratory Data Analysis

HOW-TO

- Grand tour: create as many views as possible
- Obtain as many different perspectives as possible
- Use multiple views
- Generate hypotheses
- Play with data and visualization
- Use simple visualizations first, then become complex

IMPLICATIONS:

- Understand your data
- Generate insights
- Inform your visualization design



Session 1.2

Visualization Processes

Wrapping up

Online Course
Data Visualization for Professionals

THE UNIVERSITY of EDINBURGH

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June 2020

http://benjbach.me

https://datavis-online.github.io

-- Not for external use --

Wrap-up

1. Visualizing data and creating effective visualizations includes **many steps.**
2. Many **processes** you will use visualization:
   - *Creator*, *user*, *reader*, *analyst*, ...
3. **Design Thinking** is essential for creating effective and efficient visualizations
4. Formulating a **visualization challenge** helps you focusing and start your design thinking process
5. **Exploratory data analysis** helps you knowing your data and informing a design process.