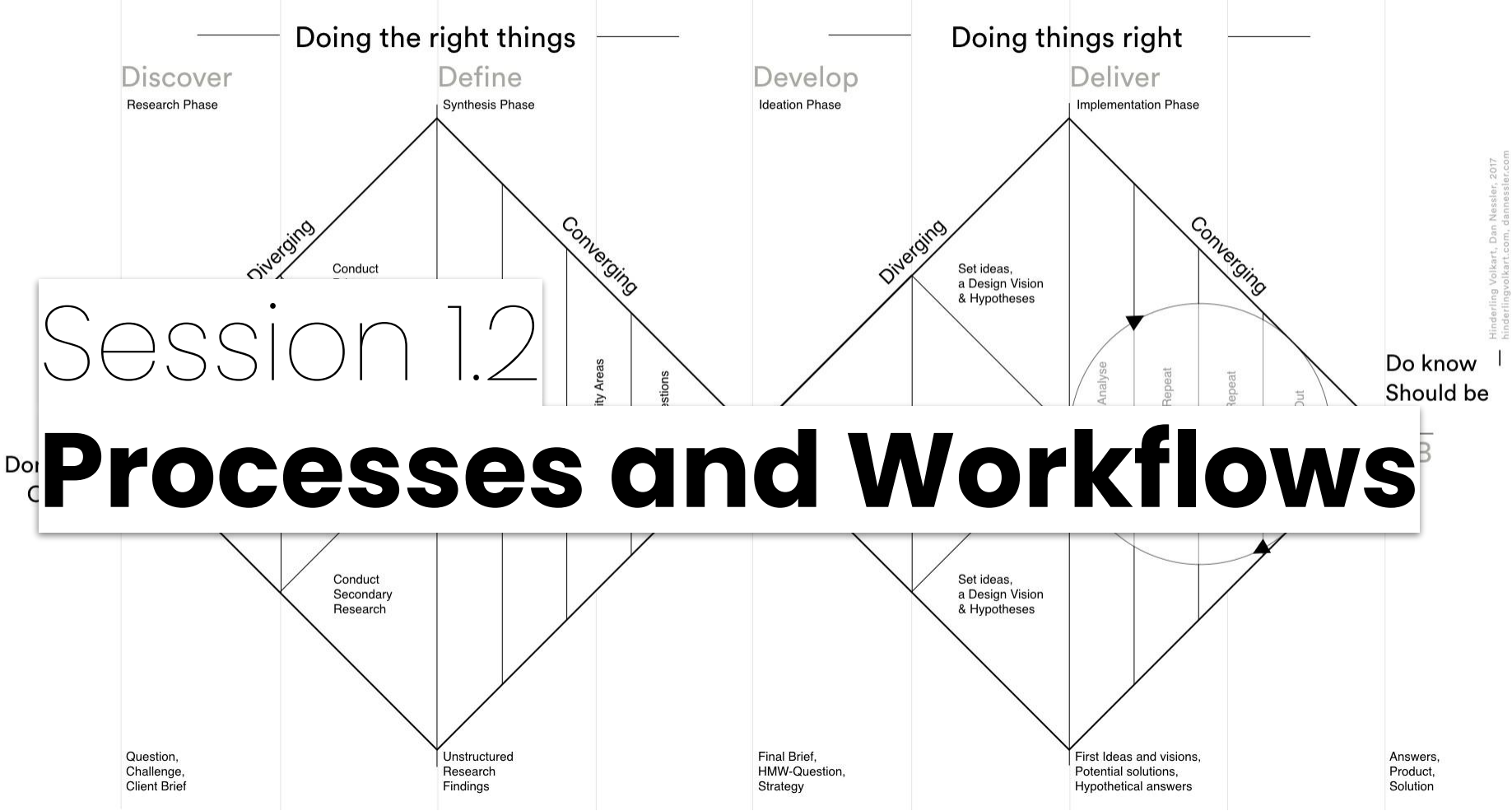

Session 1.2

Processes and Workflows

Online Course
Data Visualization for Professionals

THE UNIVERSITY of EDINBURGH

Benjamin Bach

May 2022

http://benjbach.me

https://datavis-online.github.io

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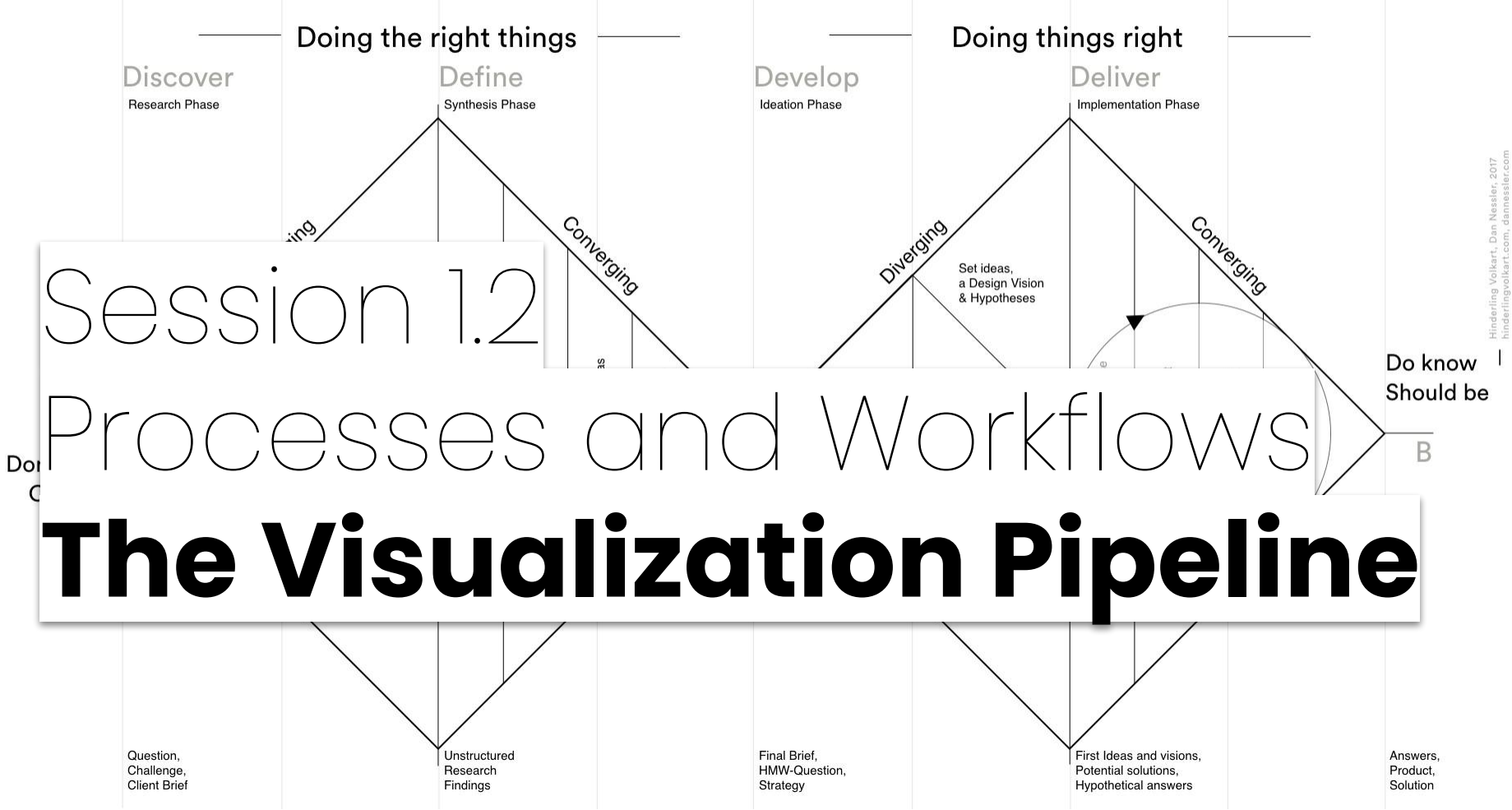
Outline

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



Session 1.2
Processes and Workflows
The Visualization Pipeline

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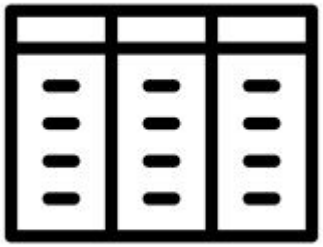
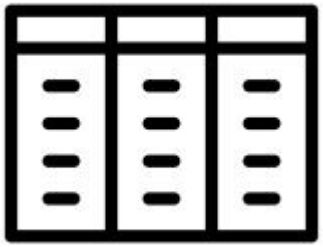
Sense making process

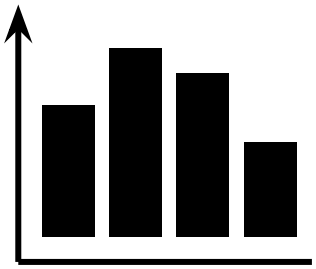


Data
Numbers,
relations,
records,
text,
analysis, ...

Action
Decisions
Emotions,
Knowledge

Sense making process



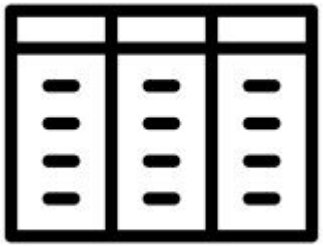


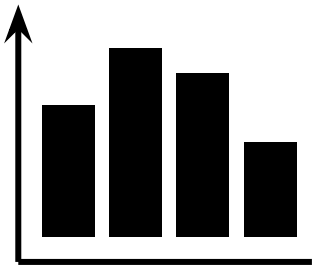
Data
Numbers, relations, records, text, analysis, ...

Visualization
visual representation

Action
Decisions Emotions, Knowledge

Sense making process





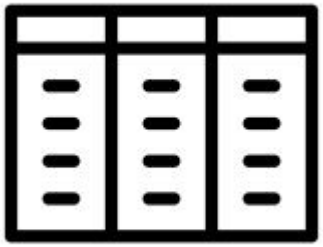
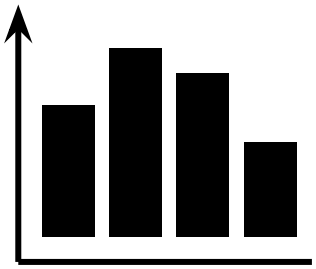
Data
Numbers, relations, records, text, analysis, ...

Visualization
visual representation

Information
Insights, Facts

Action
Decisions Emotions, Knowledge

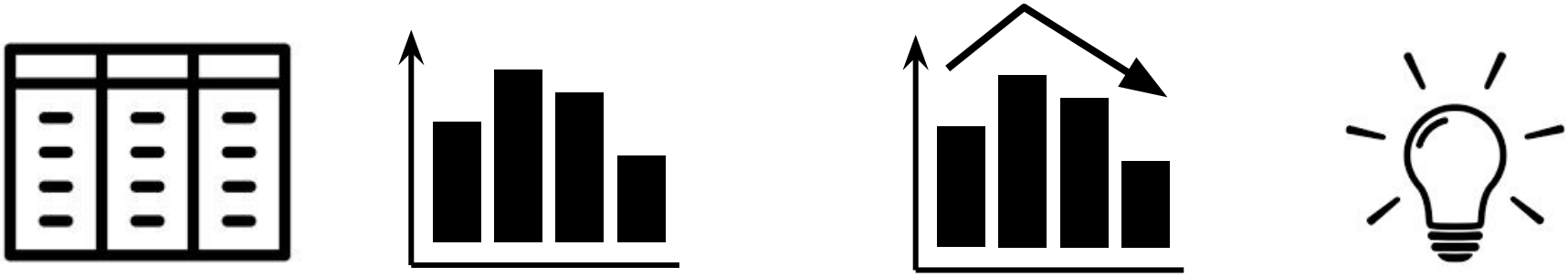
Sense making process

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

Collect
Format
Parse
Filter
Analyze
Visualize
Render
Interact
Annotate
Communicate

Sense making process



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

Collect
Format
Parse
Filter
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Visualize
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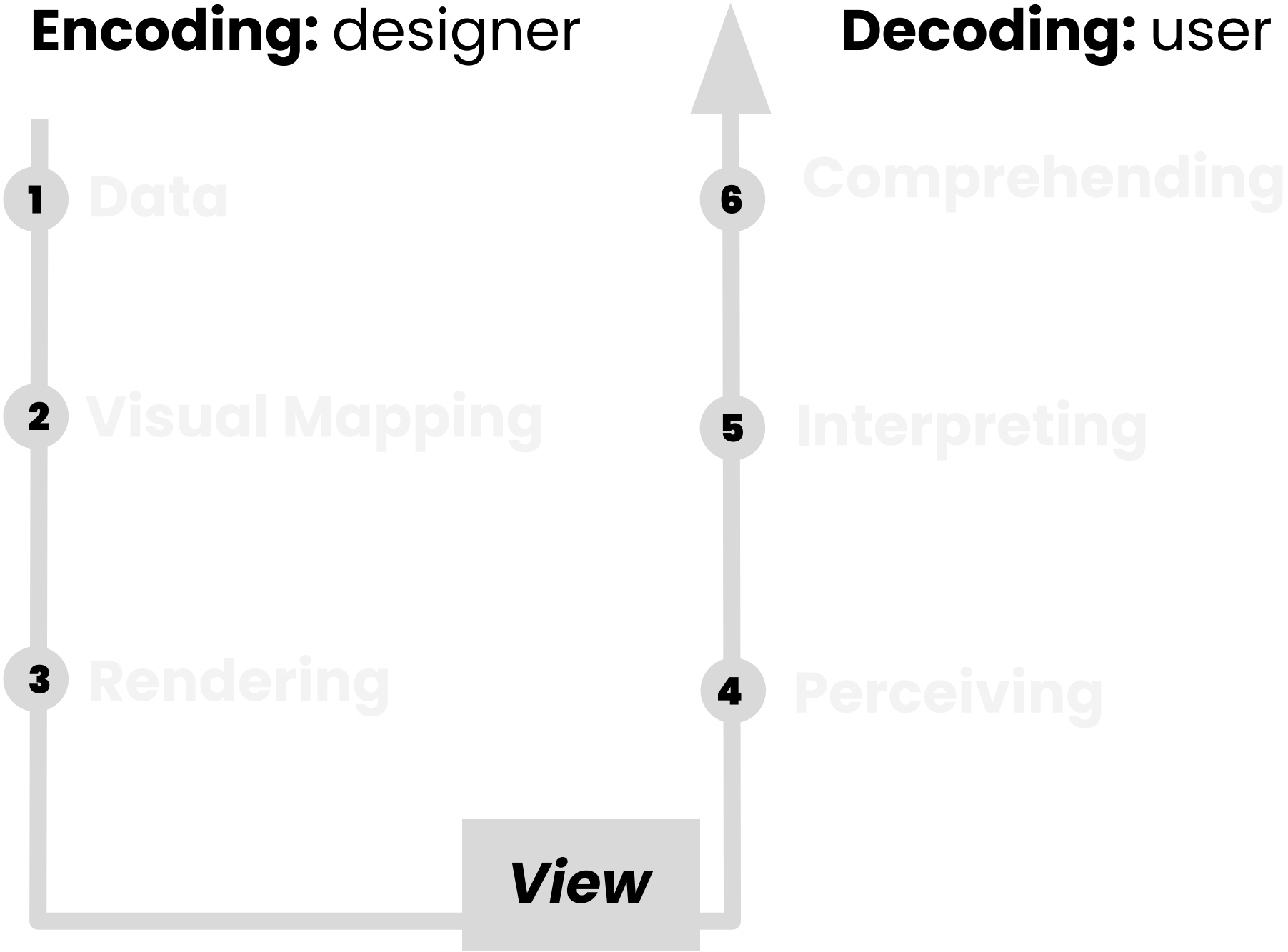
View
Annotate
Communicate

Encoding: designer

Decoding: user



Encoding: designer

Decoding: user

1 **Data**

What is my data?
Which data type?
Ordinal / numerical / categorical?

2 Visual Mapping

3 Rendering

4 Perceiving

5 Interpreting

6 Comprehending

View

Encoding: designer

Decoding: user

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What is my data?
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Which visual variables am I using?
How am I encoding my data?

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Encoding: designer

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What is my medium?
monoscopic/stereoscopic?
Tangiblity?
Print / digital?

View

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View

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What does it show?
Where is big, medium, small?
How do things compare?
What relationships exist?

5 Interpreting

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Encoding: designer

Decoding: user

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What does it mean?
What does color mean?
What does 'up 'mean?
What do these patterns show?

6 Comprehending

Encoding: designer

Decoding: user

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What does color mean?
What does 'up 'mean?
What do these patterns show?

6 Comprehending

What does it mean for me?
What shall I do now?
Is this all true?
What do I learn?

1. Data

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

1. Data

Item

	mpg	cyl	disp	hp	drat	wt	qsec
Mazda RX4	21	6	160	110	3.9	2.62	16.46
Mazda RX4 Wag	21	6	160	110	3.9	2.875	17.02
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Merc 230	22.8	4	140.8	95	3.92	3.15	22.9
Merc 280	19.2	6	167.6	123	3.92	3.44	18.3
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Merc 450SLC	15.2	8	275.8	180	3.07	3.78	18
Cadillac Fleetwood	10.4	8	472	205	2.93	5.25	17.98

1. Data

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
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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

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
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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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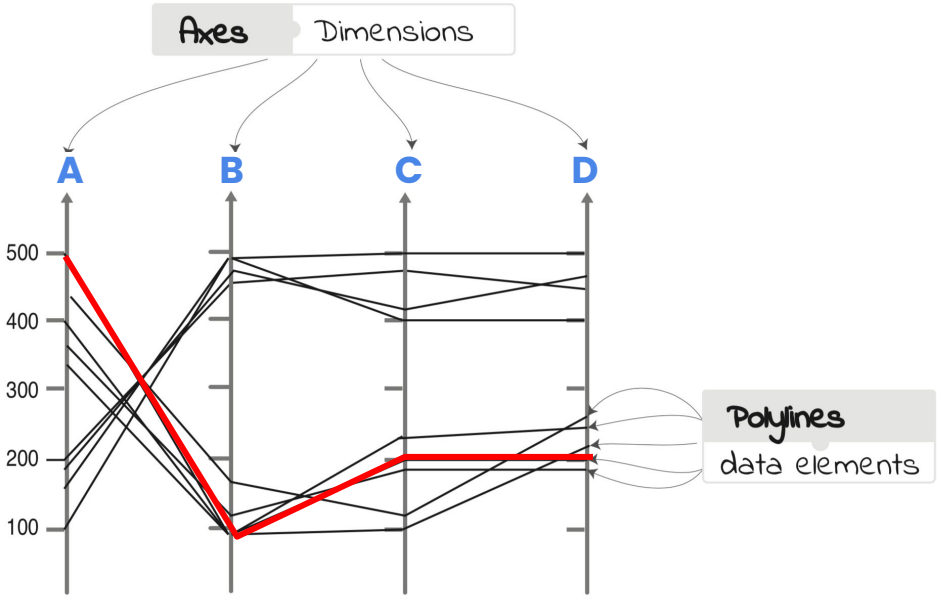

Data → **Visual Representation**

2. Visual Mapping

		mpg	cyl	disp	hp	drat	wt	qsec
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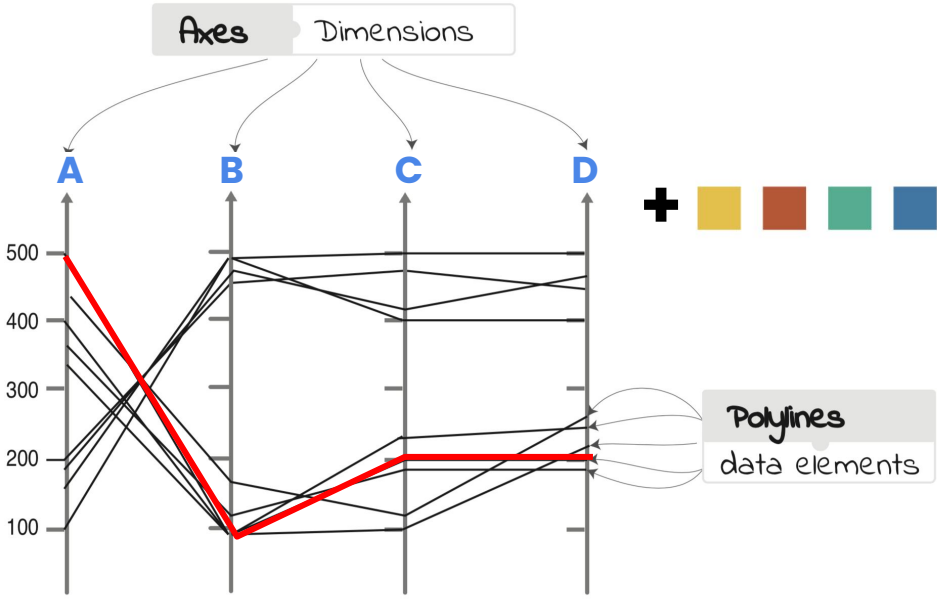
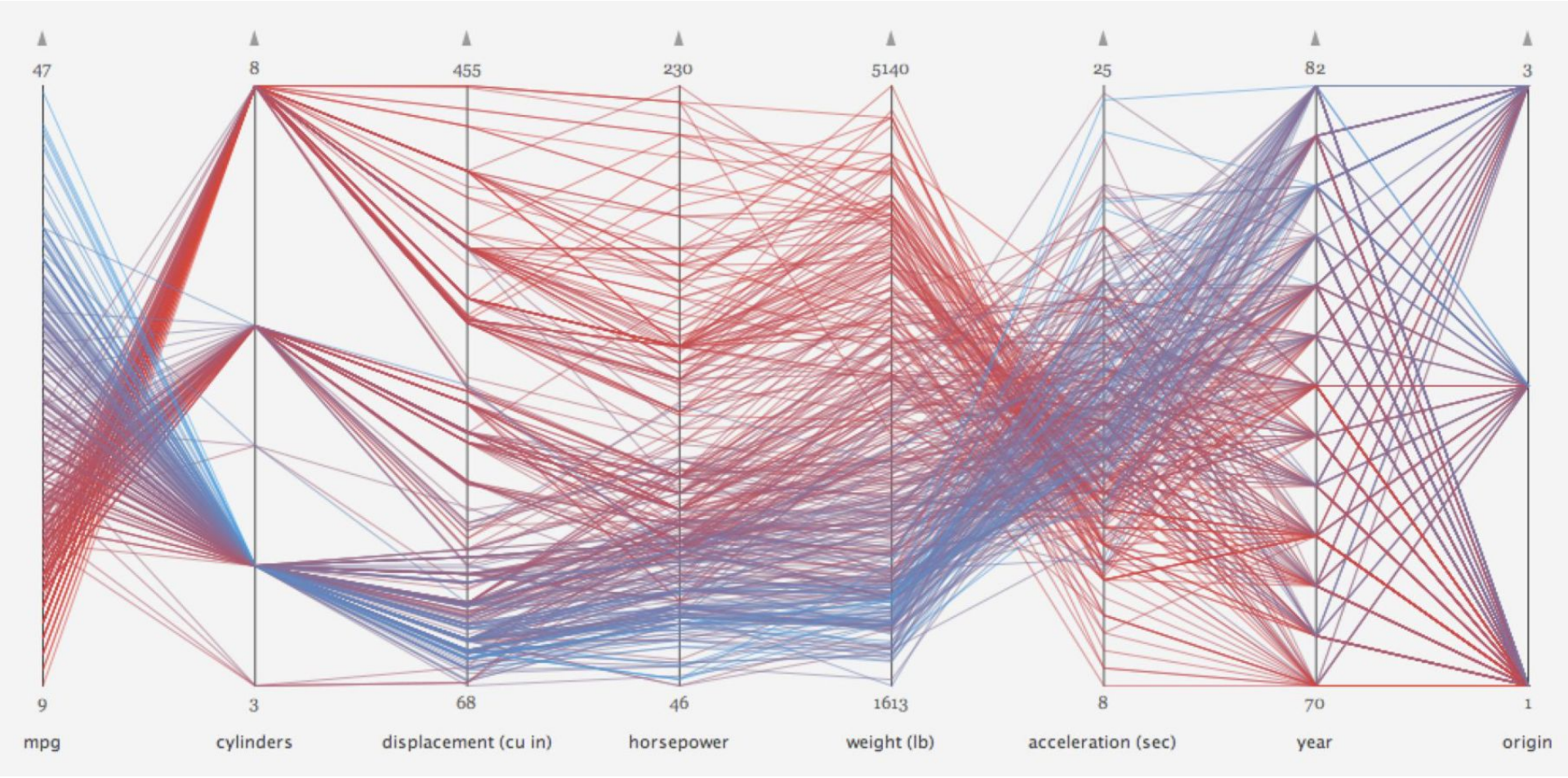
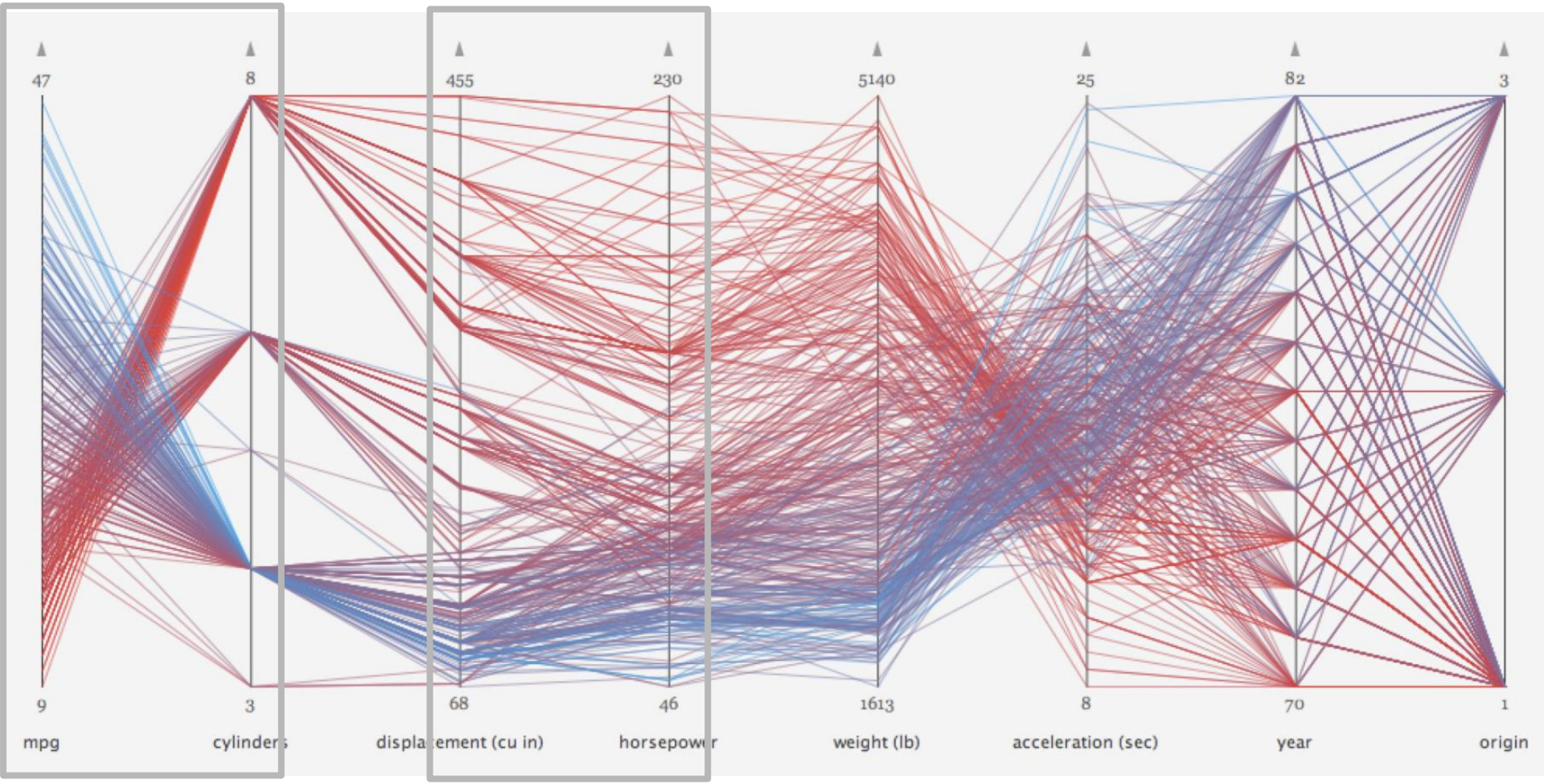


Data → **Visual Representation**

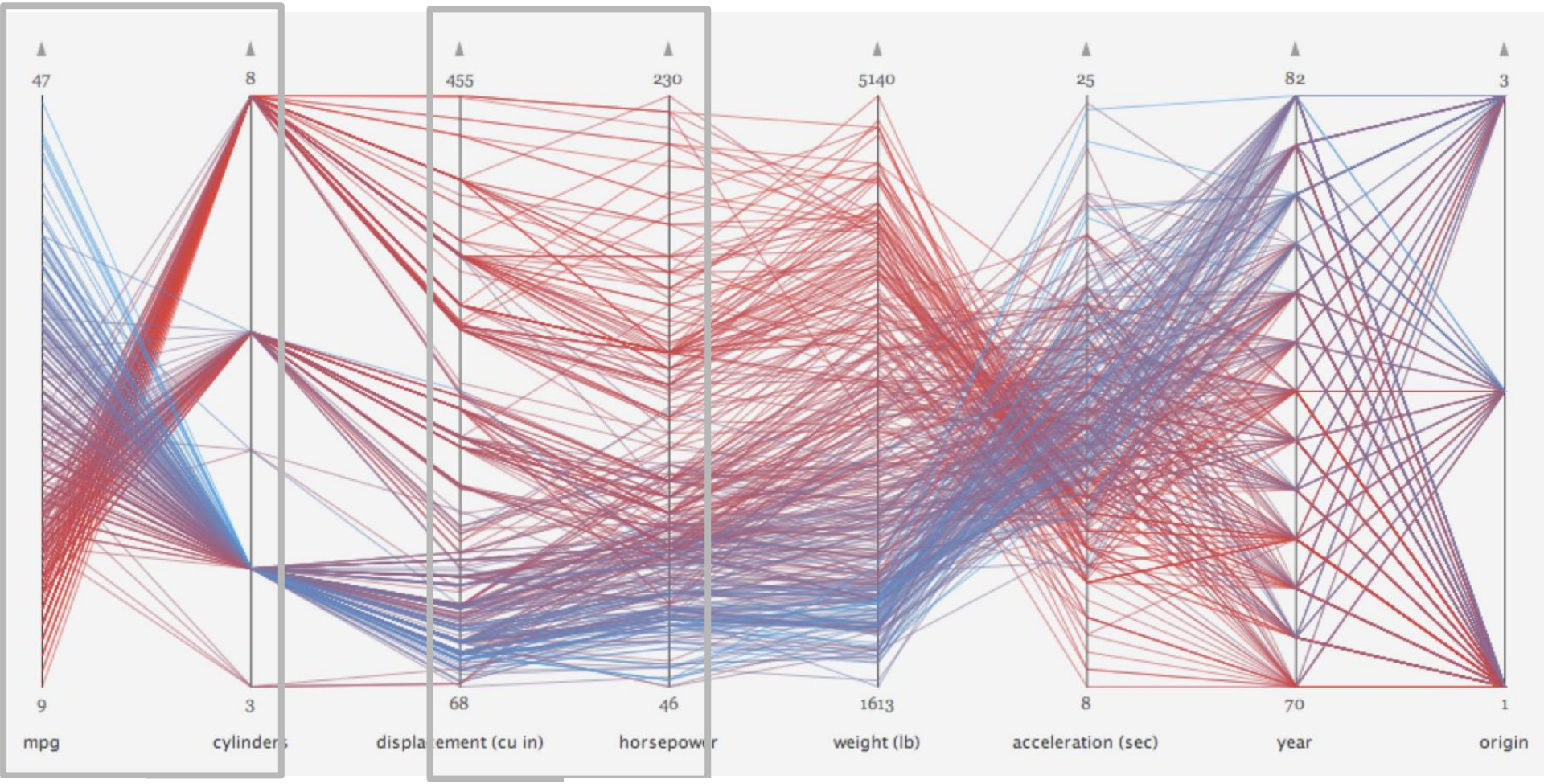
3. Rendering

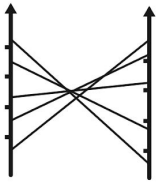

47
8
455
230
5140
25
82
3
9
3
68
46
1613
8
70
1
mpg
cylinders
displacement (cu in)
horsepower
weight (lb)
acceleration (sec)
year
origin

4. Perceiving

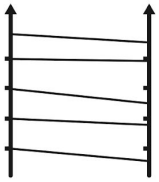


5. Interpretation



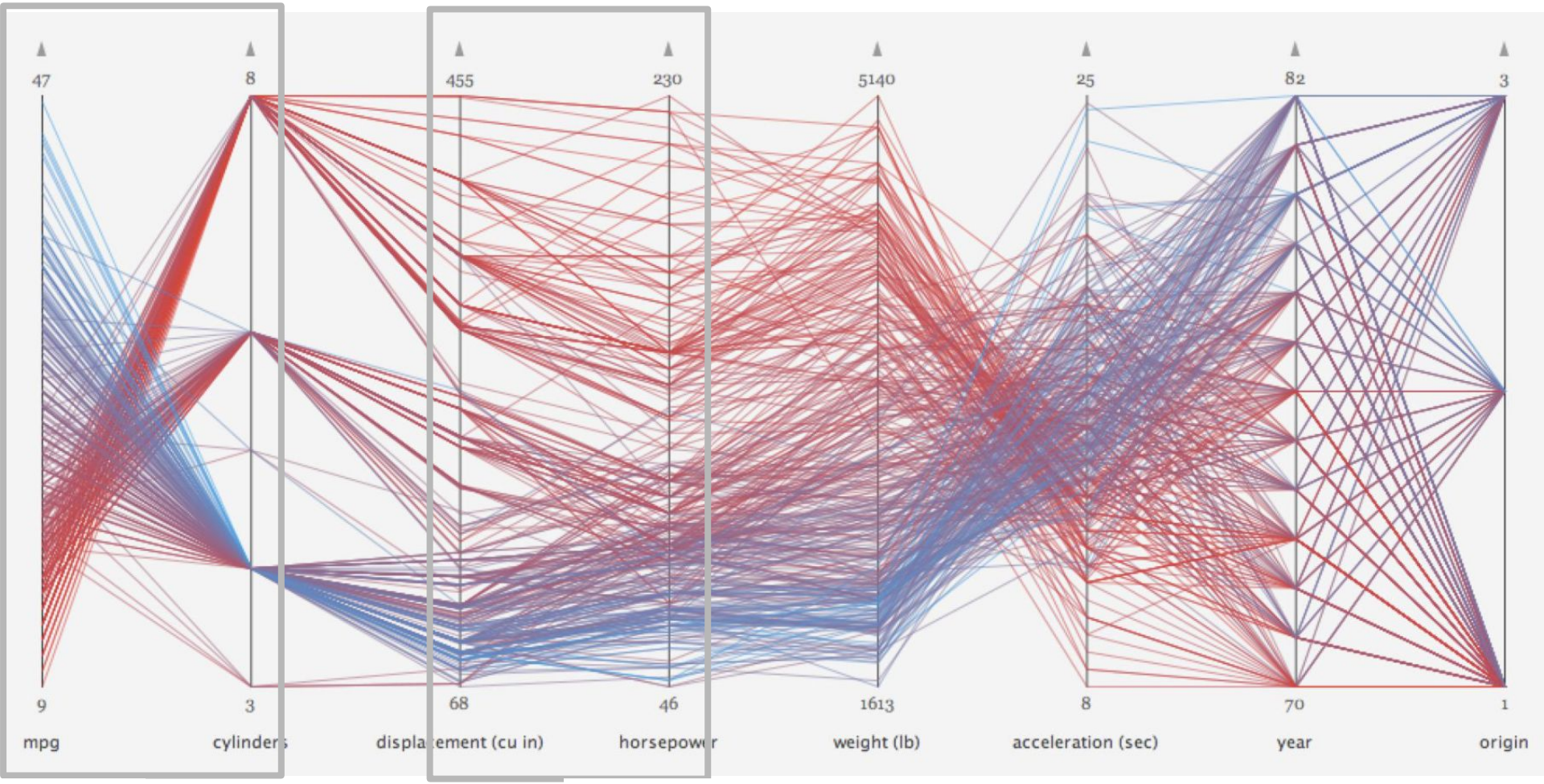


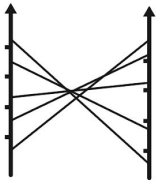
Negative Correlation



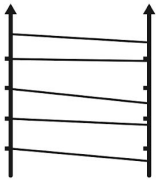
Positive Correlation

6. Comprehending





Negative Correlation



Positive Correlation

Encoding: designer

Decoding: user

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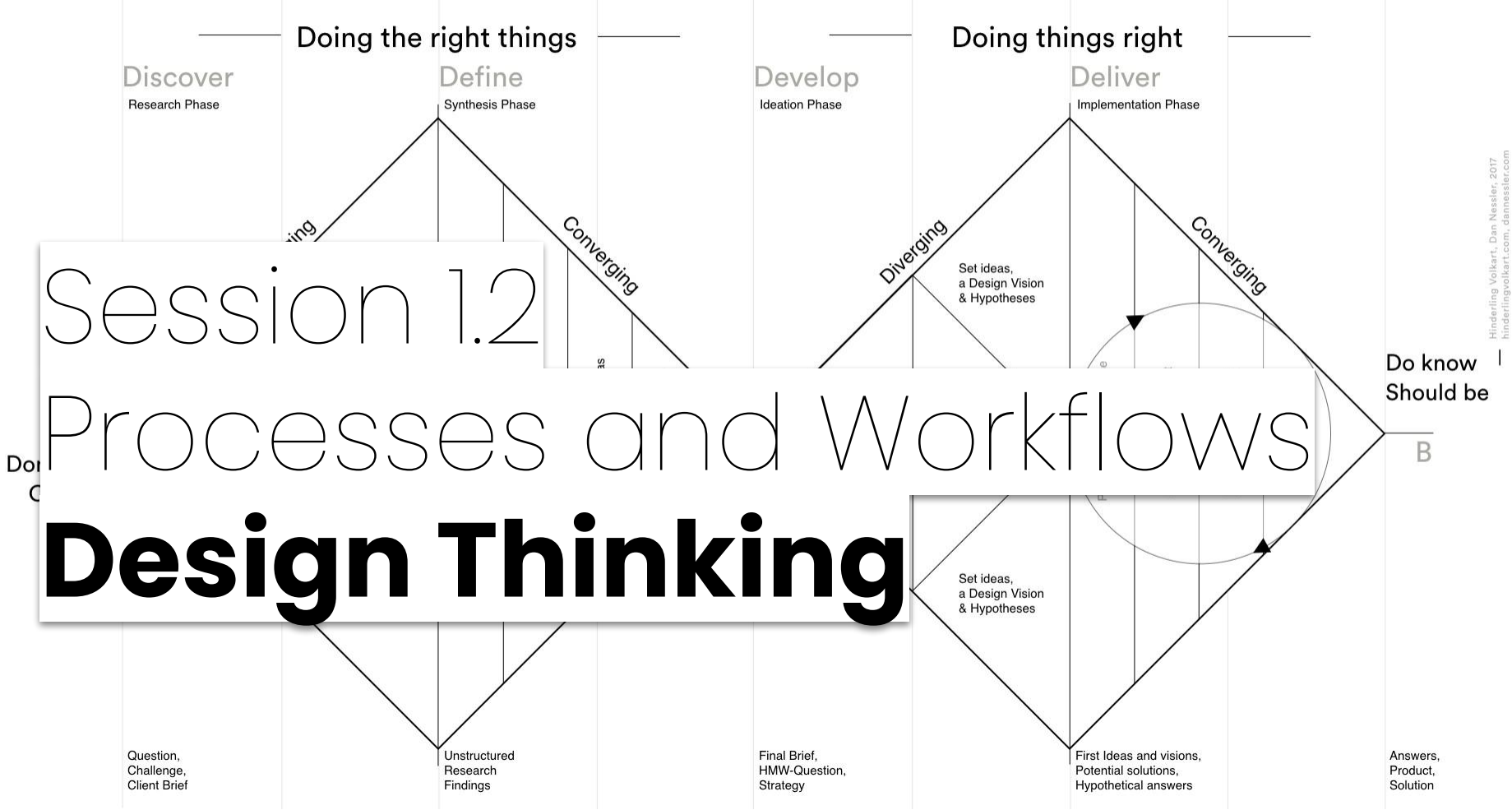
What do I learn?



Session 1.2
Processes and Workflows
Design Thinking

Online Course
Data Visualization for Professionals

THE UNIVERSITY of EDINBURGH

Benjamin Bach

May 2022

http://benjbach.me

https://datavis-online.github.io

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Visualization Design

What:

- Create effective visualizations

How:

Visualization Design

What:

- Create effective visualizations
- Create efficient visualizations

How:

Visualization Design

What:

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

How:

Visualization Design

What:

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

How:

Visualization Design

What:

- Create effective visualizations
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- Solve a problem
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- Visualization can have **many forms**

Visualization Design

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Design Thinking

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

- is about **people**
  - empathy, problems, context, problem

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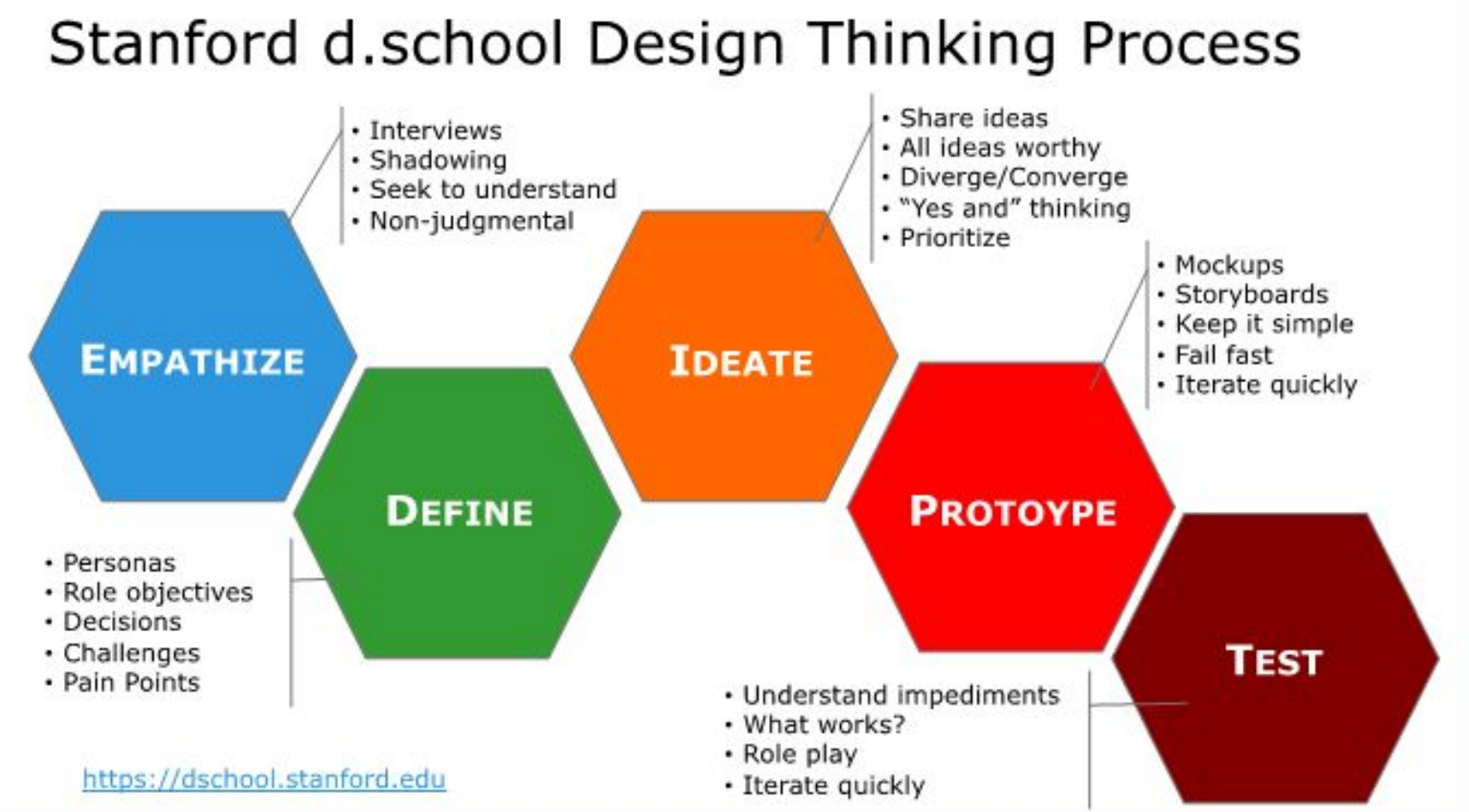
Design Thinking—5 steps



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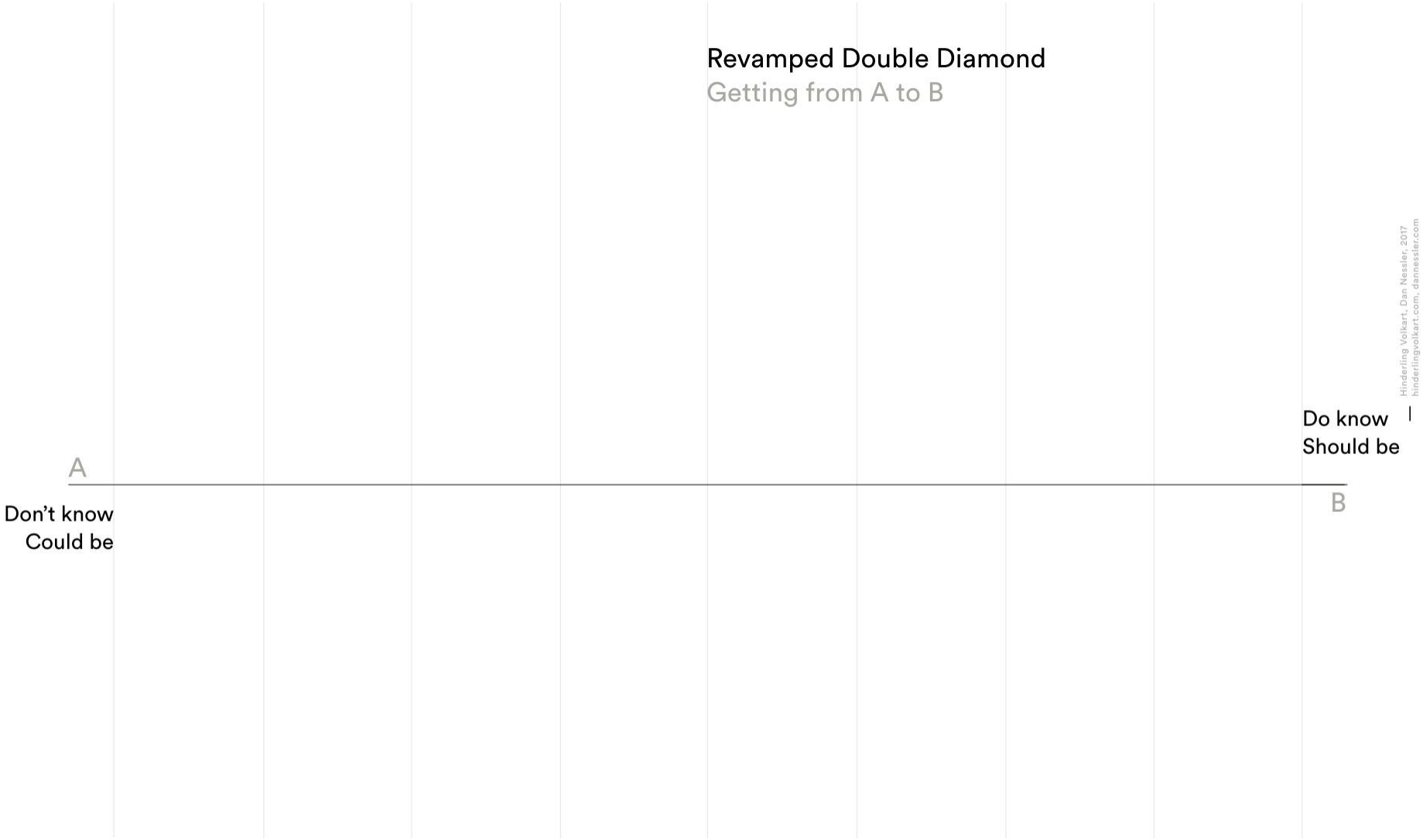

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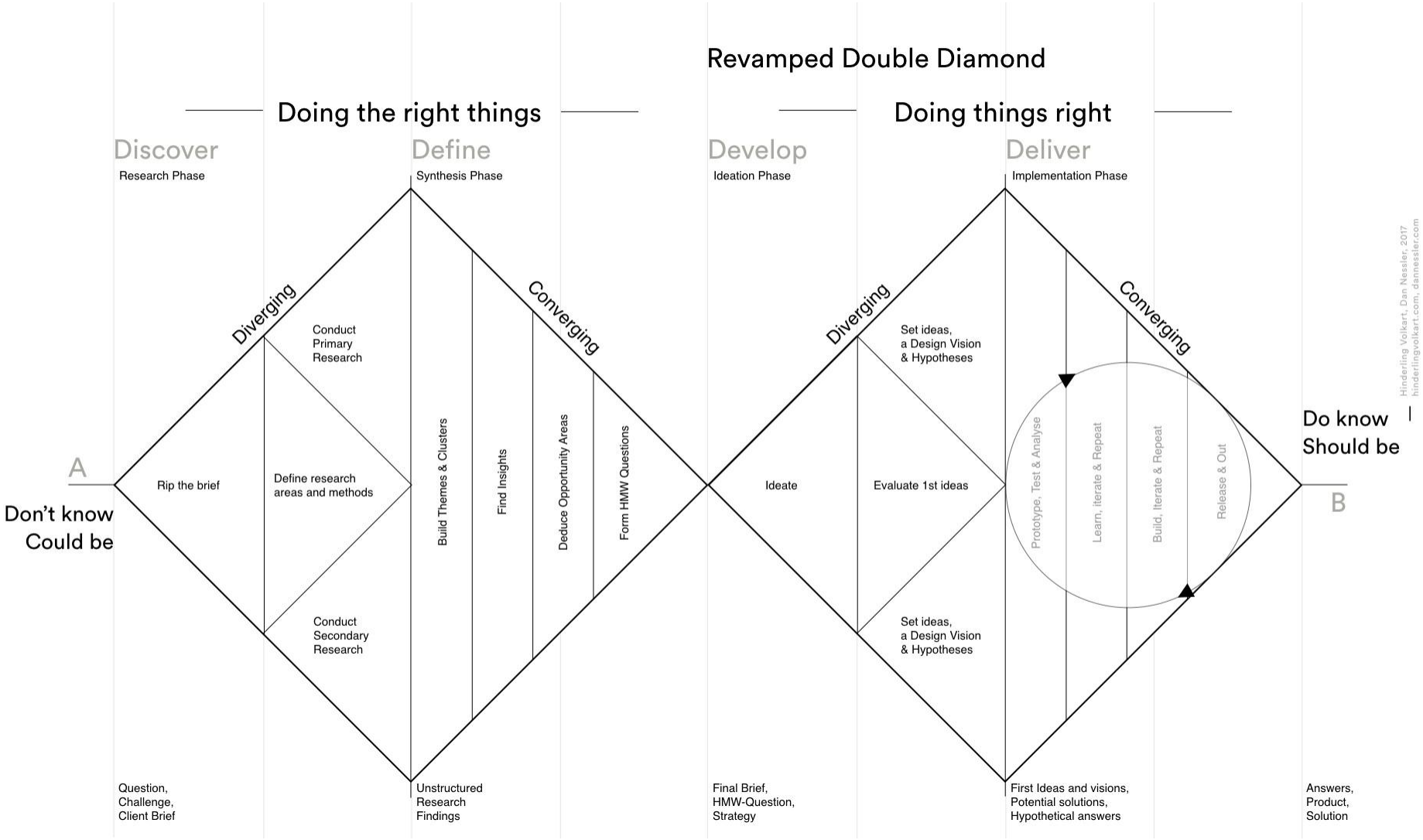

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Design Decisions

Context:

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

Visual Design:

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

Ideate

Prototype

Test

Visualization Design Thinking

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Define

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

Ideate

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

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

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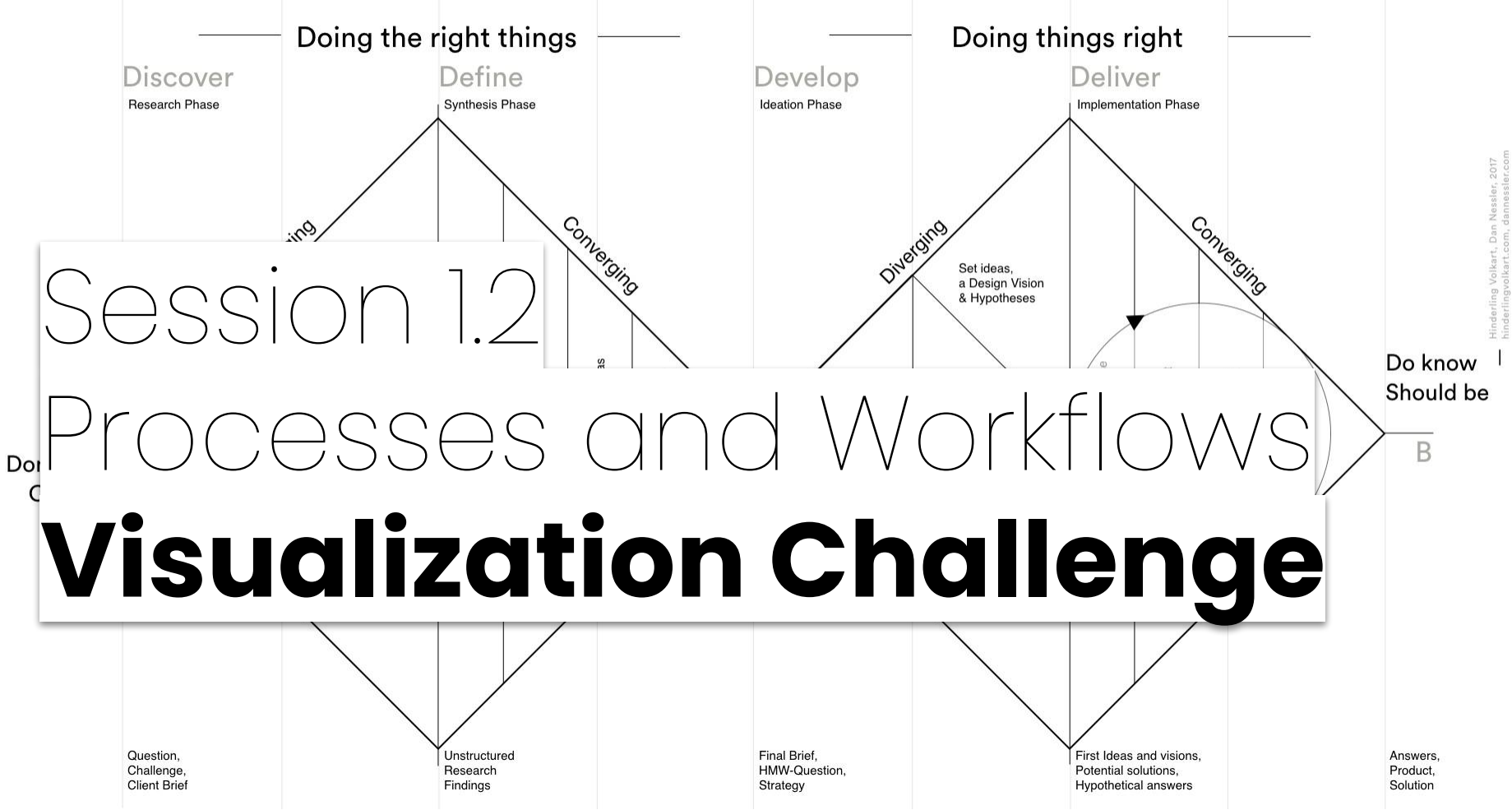
Test
- User-centered **evaluation**



Session 1.2
Processes and Workflows
Visualization Challenge

Online Course
Data Visualization for Professionals

THE UNIVERSITY of EDINBURGH

Benjamin Bach

May 2022

http://benjbach.me

https://datavis-online.github.io

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Encoding: designer

Decoding: user

1 **Data**

What is my data?
Which data type?
Ordinal / numerical / categorical?

2 **Visual Mapping**

What is my visual representation?
Which visual variables am I using?
How am I encoding my data?

3 **Rendering**

What is my medium?
monoscopic/stereoscopic?
Tangiblity?
Print / digical?

View

4 **Perceiving**

What does it show?
Where is big, medium, small?
How do things compare?
What relationships exist?

5 **Interpreting**

What does it mean?
What does color mean?
Wha does 'up 'mean?
What do these patterns show?

6 **Comprehending**

What does it mean for me?
What shall I do now?
Is this all true?
What do I learn?

Data Visualization Challenge

Data	

Data Visualization Challenge

Data	Message & Insights

Data Visualization Challenge

Data	**Message & Insights**
Audience	

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

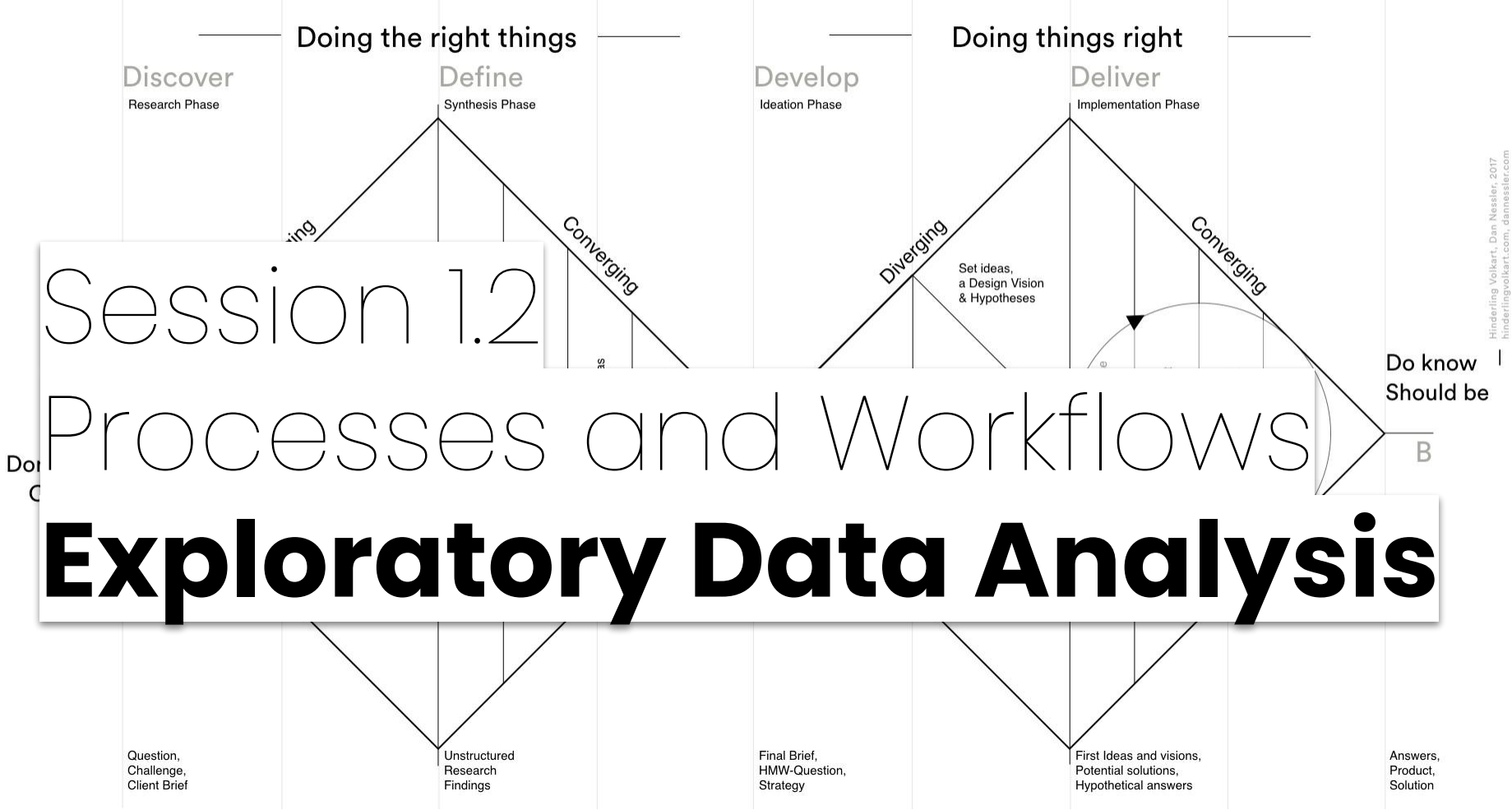
- Who is my audience?
- Why do they care?
- What do they know?

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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Processes and Workflows

Exploratory Data Analysis

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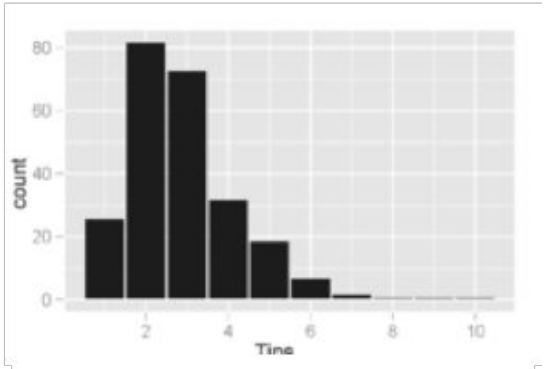
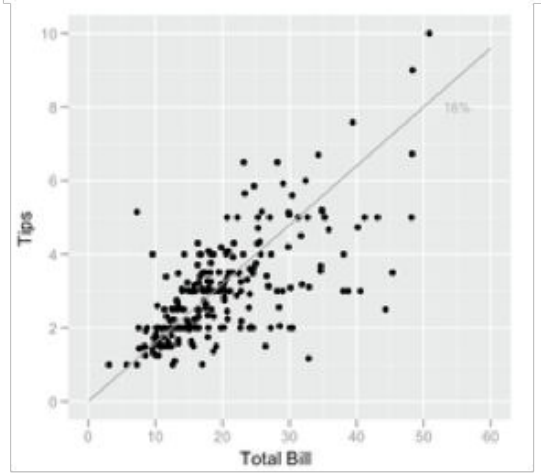
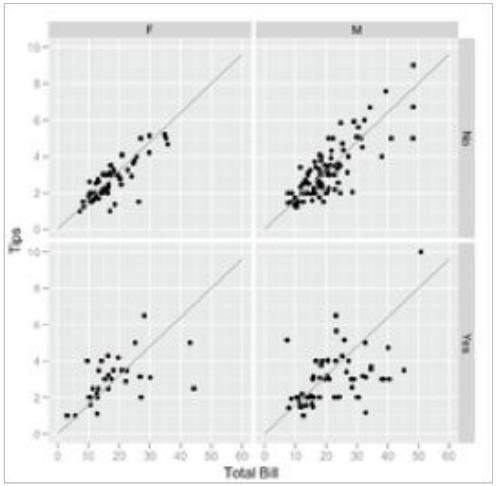
John W. Tukey

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

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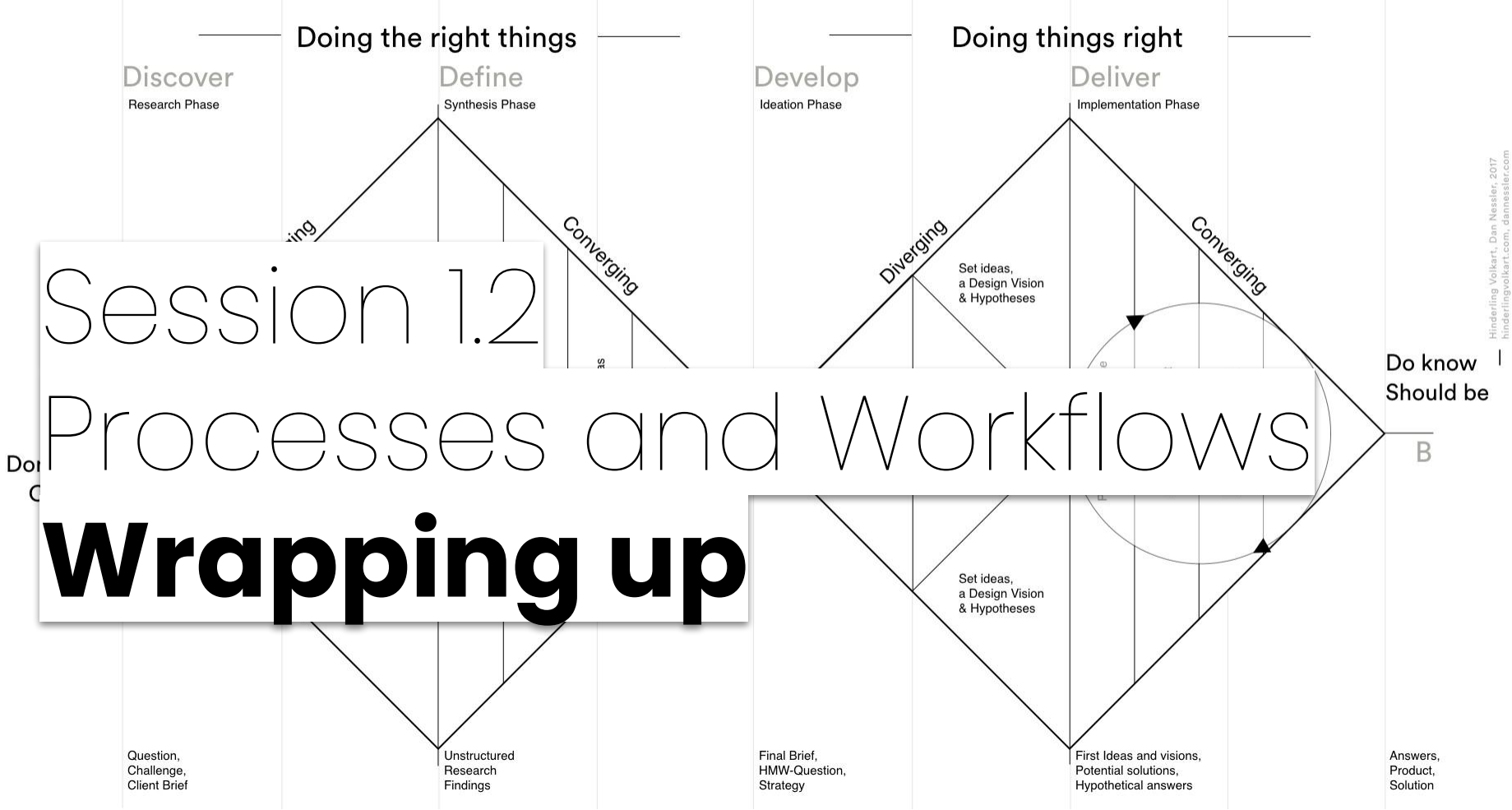

Session 1.2
Processes and Workflows
Wrapping up

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Wrap-up

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2. Many **processes** you will use visualization:
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