ELECTRONIC PUBLISHING
AND DIGITAL STORYTELLING
Lesson 5

DATA SENSE MAKING

TABLE OF CONTENTS

01 FROM DATA TO WISDOM

02 STAGES OF INFORMATION VISUALISATION

03 TYPES OF DATA EXPLORATION

04 HANDS-ON

ELECTRONIC PUBLISHING
AND DIGITAL STORYTELLING
Lesson 5

FROM DATA TO WISDOM

REMINDER OF DATA SCIENCE OBJECTIVES

Get insights from data

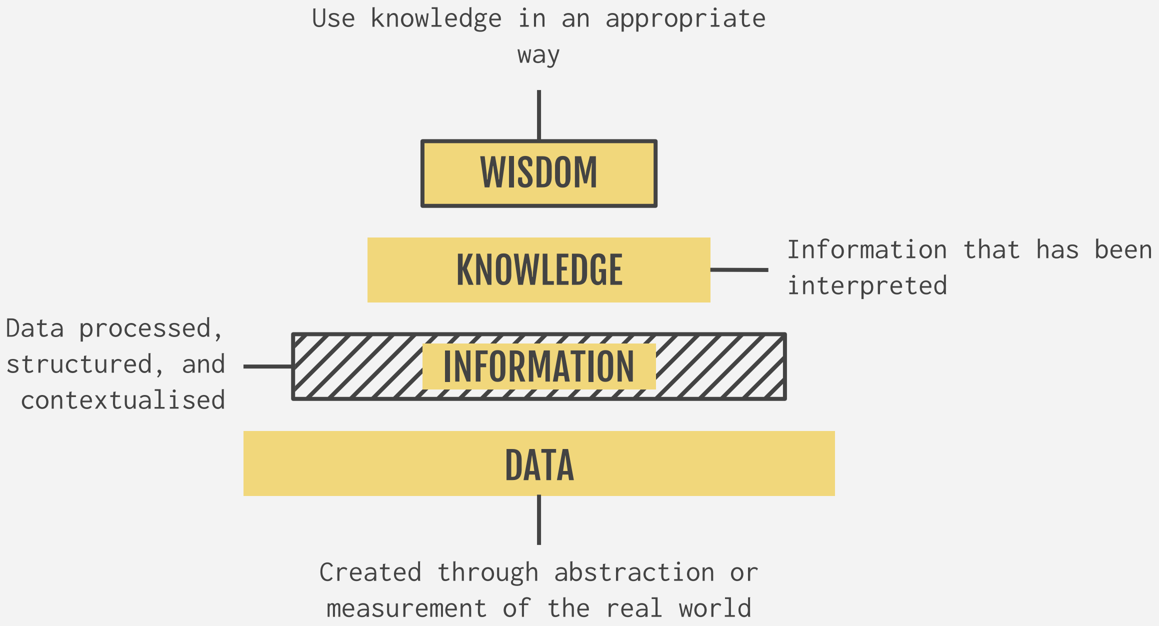
Improve understanding of data

Make informed decisions

DIKW PYRAMID

Where is the Life we have lost in living?
Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?

T.S. Eliot, The rock, 1934.



Use knowledge in an appropriate way

WISDOM

KNOWLEDGE

Information that has been interpreted

Data processed, structured, and contextualised

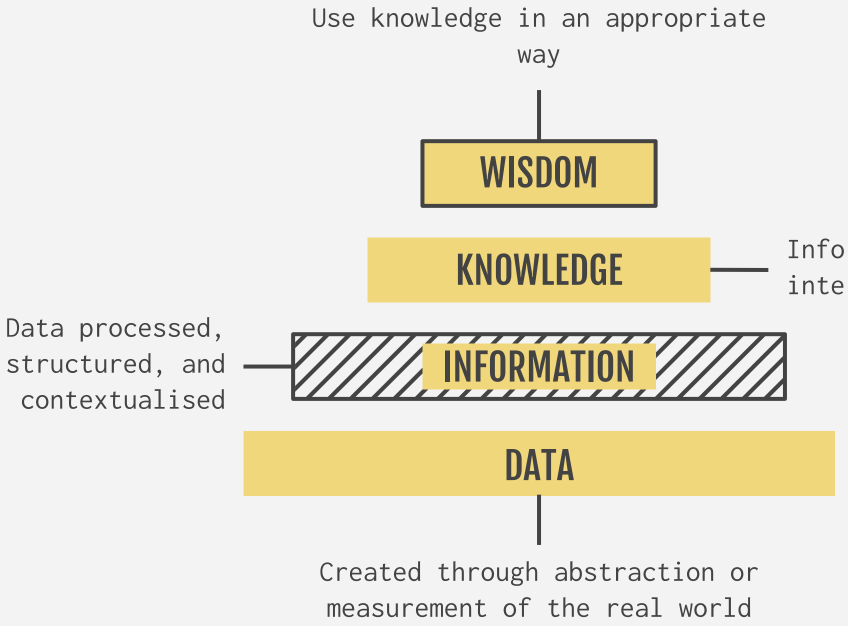
INFORMATION

DATA

Created through abstraction or measurement of the real world

DIKW PYRAMID

The length is **directly proportional** to the amount of data processed and **inverse proportional** to the informative results.



Use knowledge in an appropriate way

WISDOM

KNOWLEDGE

Information that has been interpreted

Data processed, structured, and contextualised

INFORMATION

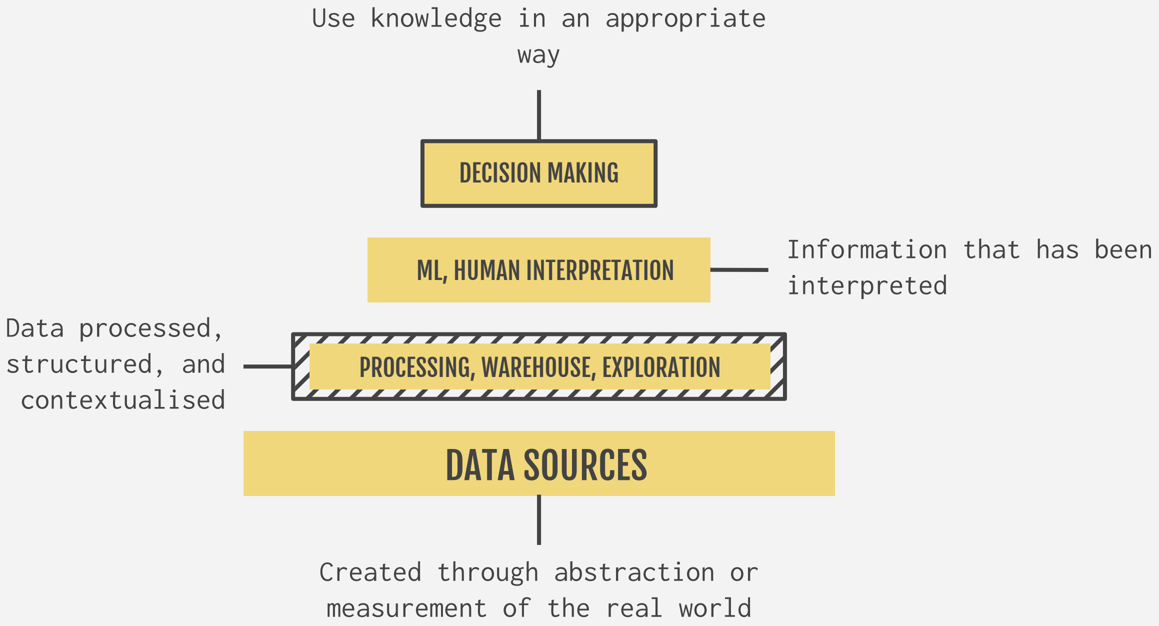
DATA

Created through abstraction or measurement of the real world

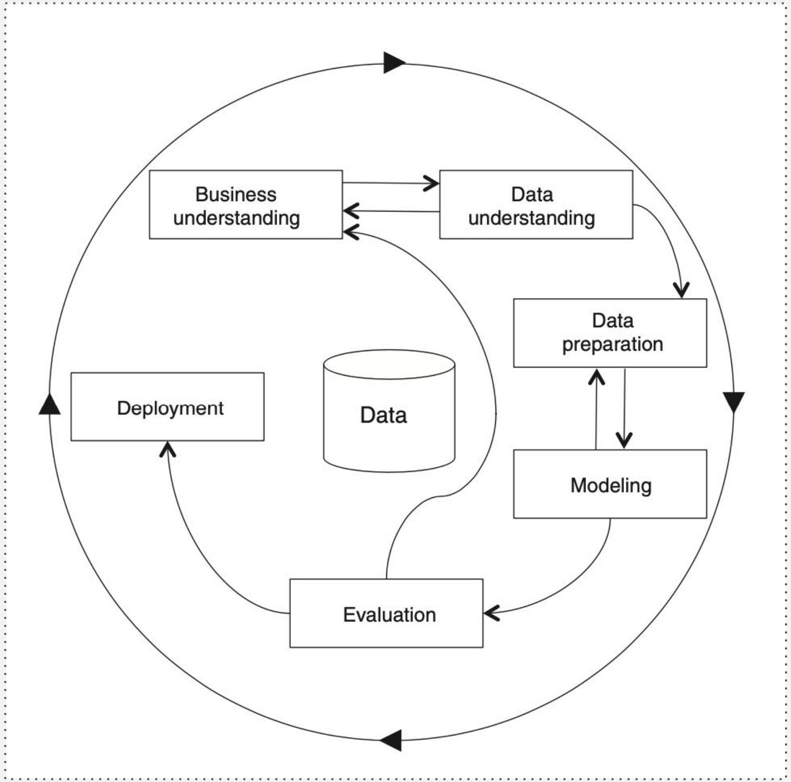
DATA SCIENCE PYRAMID

The DIKW pyramid corresponds to **data science activities**.

Developers usually spend most of the time in the first two stages, and less in the top two stages.


Use knowledge in an appropriate way
DECISION MAKING
ML, HUMAN INTERPRETATION
Information that has been interpreted
Data processed, structured, and contextualised
PROCESSING, WAREHOUSE, EXPLORATION
DATA SOURCES
Created through abstraction or measurement of the real world

CRISP-DM PROCESS

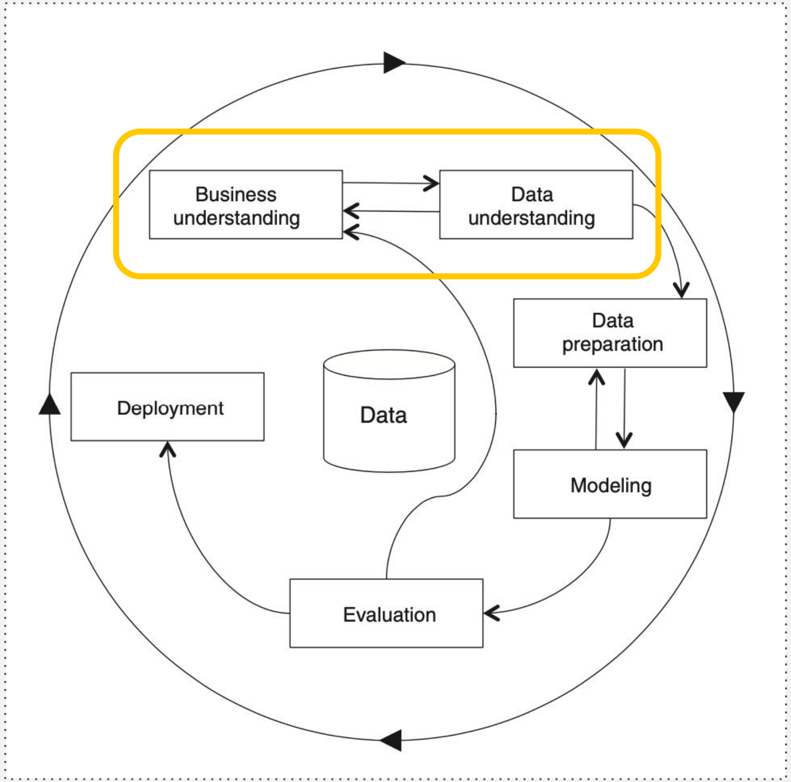


Data science activities are part of an iterative life-cycle.

One of the most used models for describing the data mining process is called **Cross Industry Standard Process for Data Mining**.

It is independent from any software or data analysis technique.

CRISP-DM PROCESS

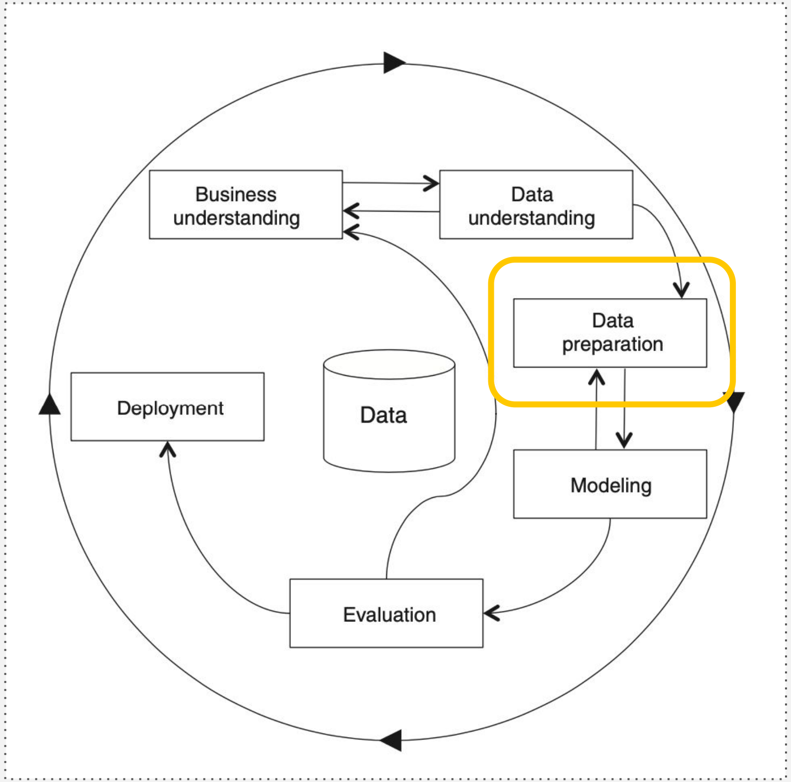


In **Business understanding and data understanding** developers define the goals of the project according to the needs of the commissioner.

Include **identification of a problem** and **data exploration** (to see if adequate data are available).

If there are data, the process proceeds. If there are no data are available developers choose another problem to tackle.

CRISP-DM PROCESS

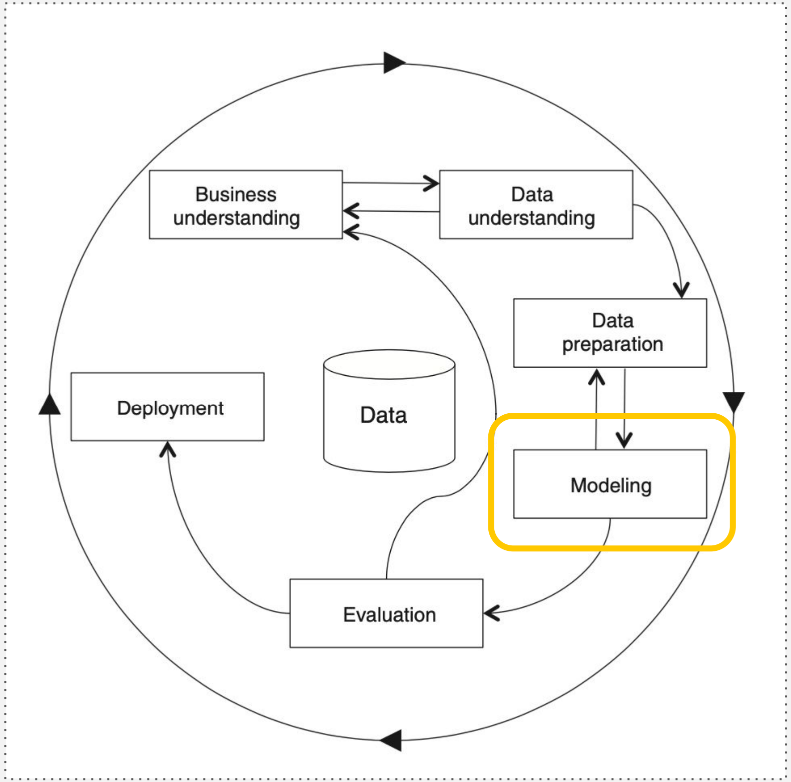


In **Data preparation**, developers **create the dataset** for the analysis.

It may require to **integrate several** data sources, where inconsistencies must be resolved.
Data are mapped, merged, and moved to a dataset for data analysis purposes. This process is called **ETL** (extraction, transformation and load)

Secondly, **data-quality** checks are performed.

CRISP-DM PROCESS



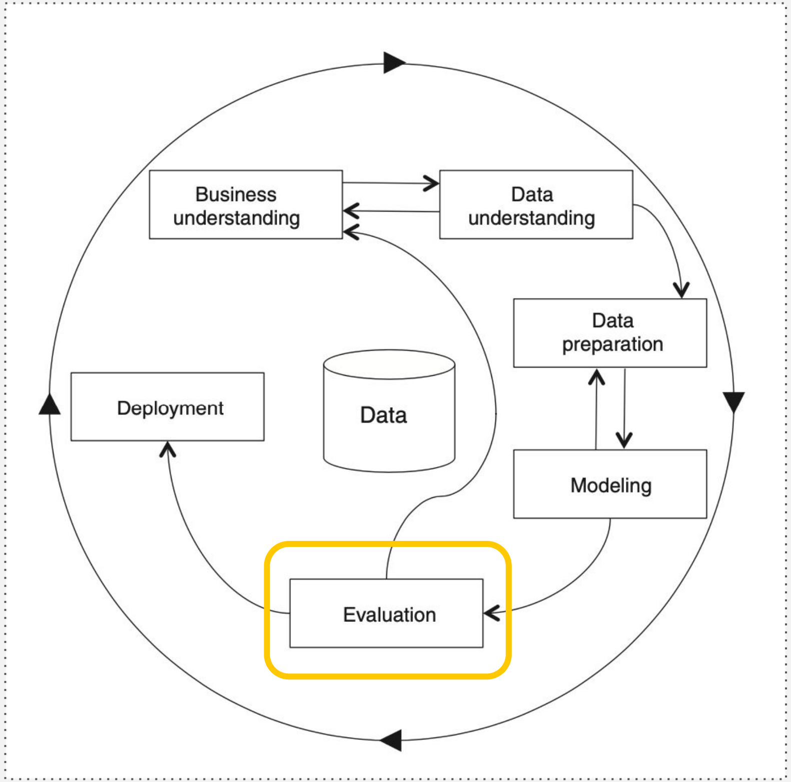
In **modeling**, automatic algorithms are applied to extract patterns of interest and to create a model that encodes such patterns.

Usually, **Machine Learning** methods are here applied to understand which algorithm better fits the data and helps to extract the patterns.

A model can also be a **decision tree**.

DISCLAIMER *In this course we will use less sophisticated methods for the analysis, but the process still applies.*

CRISP-DM PROCESS

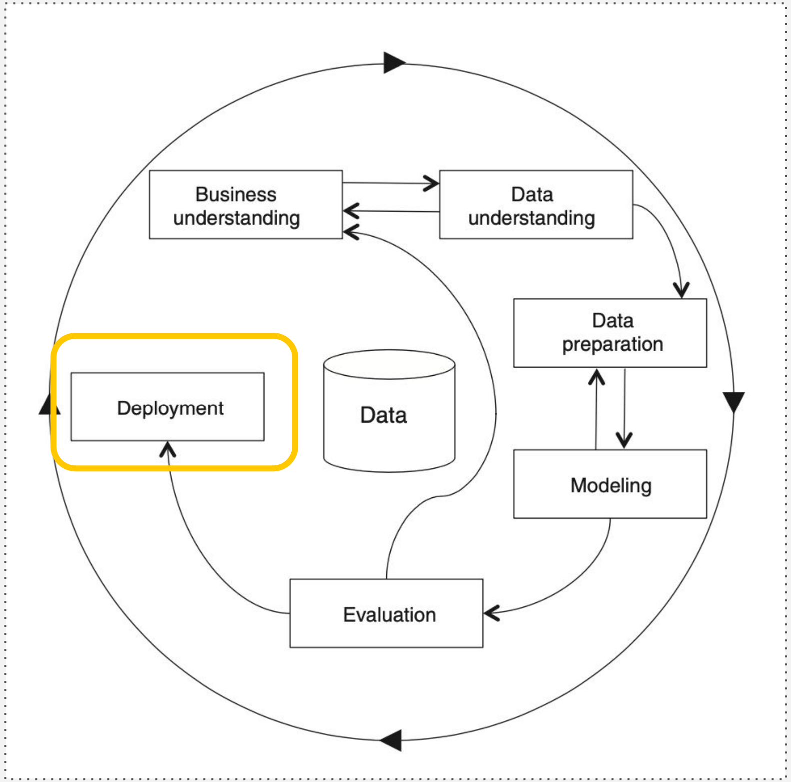


In the **evaluation**, developers test their model with respect to the initial goals.

Are the objectives achieved? What is missing? What can be done better?

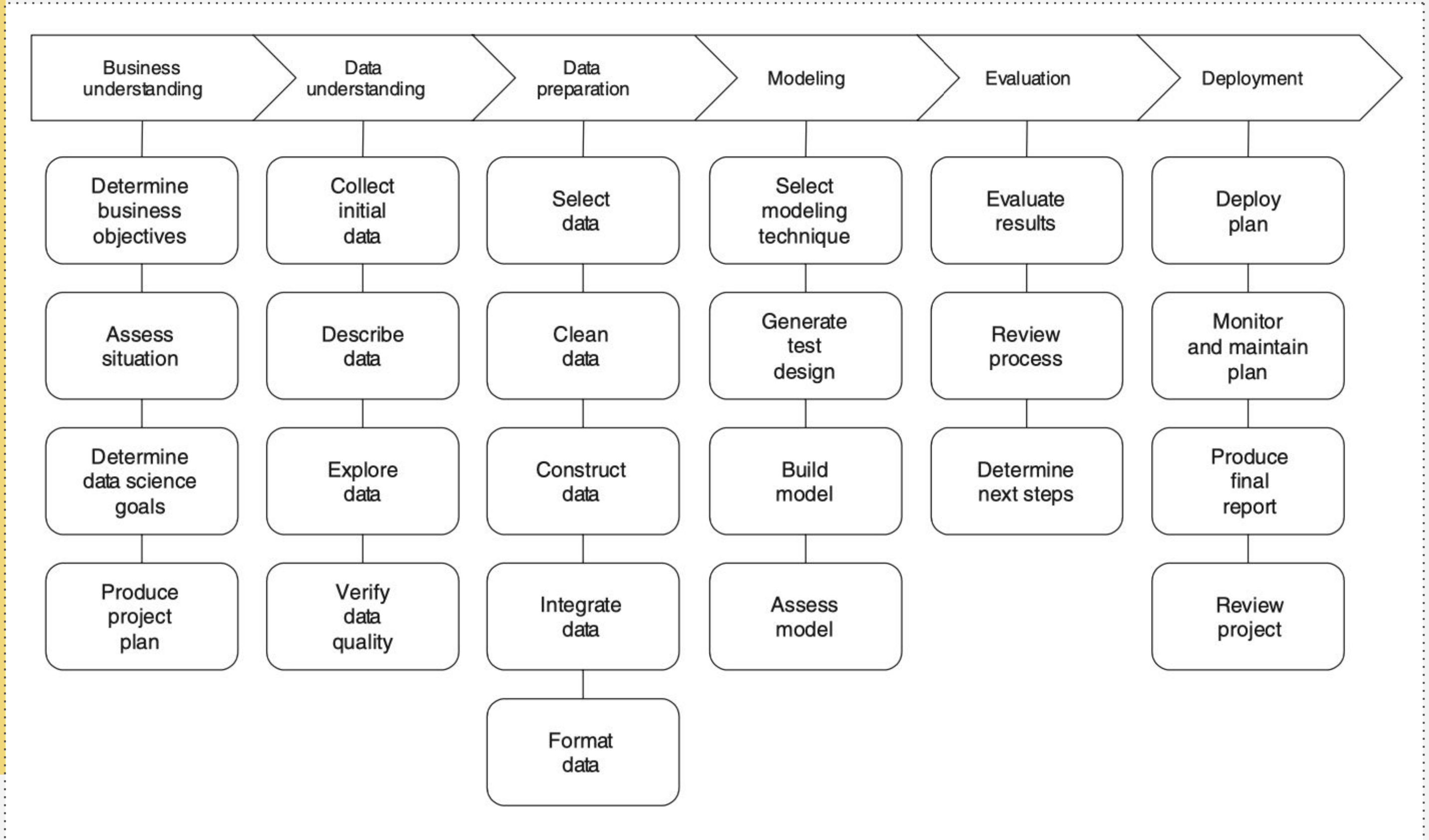
CRISP-DM PROCESS

In the **deployment**, developers study how to integrate their results in the original infrastructure of the commissioner.



Here the activities in detail.

CRISP-DM PROCESS



Business understanding	Data understanding	Data preparation	Modeling	Evaluation	Deployment
Determine business objectives	Collect initial data	Select data	Select modeling technique	Evaluate results	Deploy plan
Assess situation	Describe data	Clean data	Generate test design	Review process	Monitor and maintain plan
Determine data science goals	Explore data	Construct data	Build model	Determine next steps	Produce final report
Produce project plan	Verify data quality	Integrate data	Assess model		Review project
		Format data			

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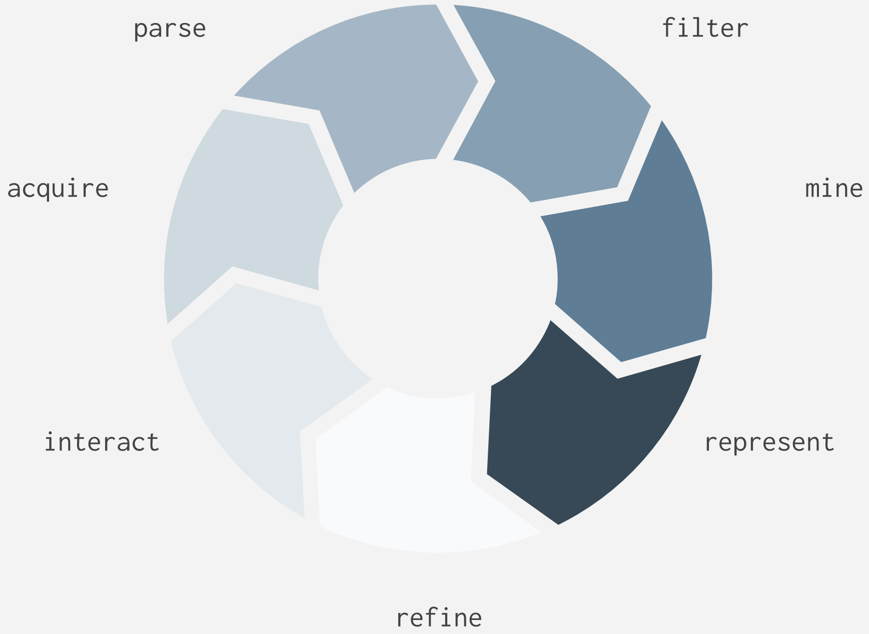
AND DIGITAL STORYTELLING
Lesson 5

STAGES OF INFORMATION VISUALISATION

Fry, B. Visualizing Data. O’Reilly

THE SEVEN STAGES OF INFORMATION VISUALISATION



Fry, B. Visualizing Data. O'Reilly

ACQUIRE DATA

ARTchives

We start from the RDF dump of the ARTchives project, which includes information about art historians, their collections, research topics, and related cultural institutions.

Always start with **existing data** and discover what is the **added value** of the dataset (e.g. find relevant information that characterise it, find patterns in data).

PRELIMINARIES

ARTchives

The dataset is meant to facilitate historiographical research.

It’s rather small (25-30 records).

Includes Wikidata and local terms.

Ask some preliminary **questions**:

- Who created the dataset and why?
- How big is it?
- What do fields mean?

Get familiar with a few records.

DEFINE ATTRIBUTES FOR THE ANALYSIS

Select the number of (dependent or independent) data attributes that you want to work on.

Univariate. A single variable studied against other independent variables.

Bivariate. Two dependent variables studied against other independent variables.

Trivariate. Three dependent variables studied against other independent variables.

Multivariate. Multiple dependent variables studied against other independent variables.

ARTchives

Example Univariate: the distribution of the property **birthplace**. How many historians are annotated with that property?

PARSE DATA

After you acquire the data, these need to be parsed—changed into a format that tags each part of the data with its intended use.

ARTchives

The data are parsed via python library RDFLib, which allows us to manipulate graph data.

FILTER AND MINE DATA

ARTchives

To answer specific questions we may need to **filter** some data out, e.g. data about historians' birthplaces.

In order to use python libraries for data analysis and visualisation we need to **convert** filtered data into other formats, e.g. a table.

After you transform the raw data into a more suitable format, you can perform operations such as **filtering, sorting, re-organising** so that patterns can be easily identified.

This step involves math, statistics, and data mining.

REPRESENT DATA

This step determines the basic form that a set of data will take. Some data sets are shown as lists, others are structured like trees, and so forth.

How you choose to represent the data can influence the very first step (what data you **acquire**) and the third step (what particular pieces you **extract**).

ARTchives

The use some python libraries for plotting information and get some new insight from the data we have.

REFINE DATA

Graphic design methods are used to clarify the representation by calling more attention to particular data.

ARTchives

After interpreting the visualizations we will tweak them to highlight most meaningful insights.

INTERACT WITH DATA

Interaction means **letting the user control or explore the data**. Interaction might cover things like selecting a subset of the data or changing the viewpoint.

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AND DIGITAL STORYTELLING
Lesson 5

TYPES OF DATA EXPLORATION

Borner & Polley, Visual insights. MIT Press. 2014

LEVELS OF ANALYSIS

STATISTICAL

TEMPORAL

GEOSPATIAL

Profiling (at micro-meso-macro level)

WHEN: evolution of variables over time variable

WHERE: trajectories and space dimension of variables

LEVELS OF ANALYSIS

TOPICAL	NETWORK
WHAT: analysis of categorical variables	**WITH WHOM**: relations between data points

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AND DIGITAL STORYTELLING
Lesson 5

HANDS-ON

WHAT'S THE PLAN?
SET UP YOUR PROJECT!

Install Jupyter notebook locally and create the notebook for your python code

CREATE A JUPYTER NOTEBOOK

First steps to answer a research question via data visualisation

DATA ACQUISITION / PARSING / FILTERING

Install and use some python libraries for **exploring** data

DATA REPRESENTATION

INSTALL AND LAUNCH JUPYTER NOTEBOOK

Instructions: https://jupyter.org/install

In the shell run:

```
pip install notebook
```

Then, in the shell, move to the folder where your code is (e.g. **cd Desktop/dhdk_epds/tutorials/**) and run:

```
jupyter notebook
```

CREATE A JUPYTER NOTEBOOK

When the browser opens let's explore together what is there and **let's create your first Python file**.

Top-right menu: New > Python 3

- Rename the file
- Have a look at the editor menu
- Create cells and define the type of content (markdown or code)
- Basics of markdown
- Example of python code
- Run

In case of massive problems installing Jupyter notebook go to: https://deepnote.com/project/3a40744d-d8a2-4282-9f77-e2802b99d592
Top-left Menu: Add files > New notebook
The interface is slightly different but the basics are the same!

INSTALL PYTHON LIBRARIES

Pandas

```
pip install pandas

pip install pandas_profiling
```

Seaborn

```
pip install seaborn
```

MOVE TO THE TUTORIAL

Open the course repository on the browser
https://github.com/marilenadaquino/epds
Go to the folder tutorials/
and open in the browser the file called
dataviz_tutorial.ipynb

HOMEWORK

Create your first Jupyter notebook and submit it in a week!

https://forms.gle/EeyyG5cStdNpUfAp9

In this Jupyter notebook you’ll have to:

- Acquire / Parse / Filter ARTchives data in order to answer the following question:

  What are the most referenced people in ARTchives archival collections?

- Represent the data in a bar chart

THANKS

Does anyone have any questions?

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github