

# Knowledge Graphs

## Lecture 1 - Knowledge Graphs in the Web of Data

### 1.1 Data, Information, and Knowledge

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# Knowledge Graphs

## Lecture 1: Knowledge Graphs in the Web of Data

1.1 Data, Information, and Knowledge

1.2 How to Represent Knowledge?

1.3 The Art of Understanding

1.4 Towards a Universal Knowledge Representation

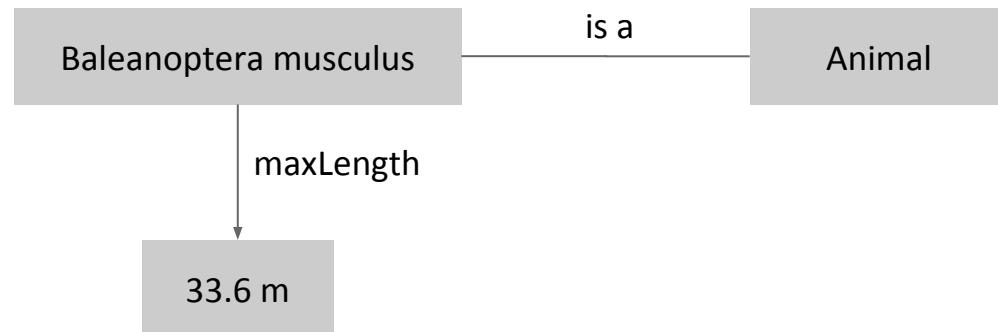
1.5 The Semantic Web

1.6 Linked Data and the Web of Data

33.6

33.6 m

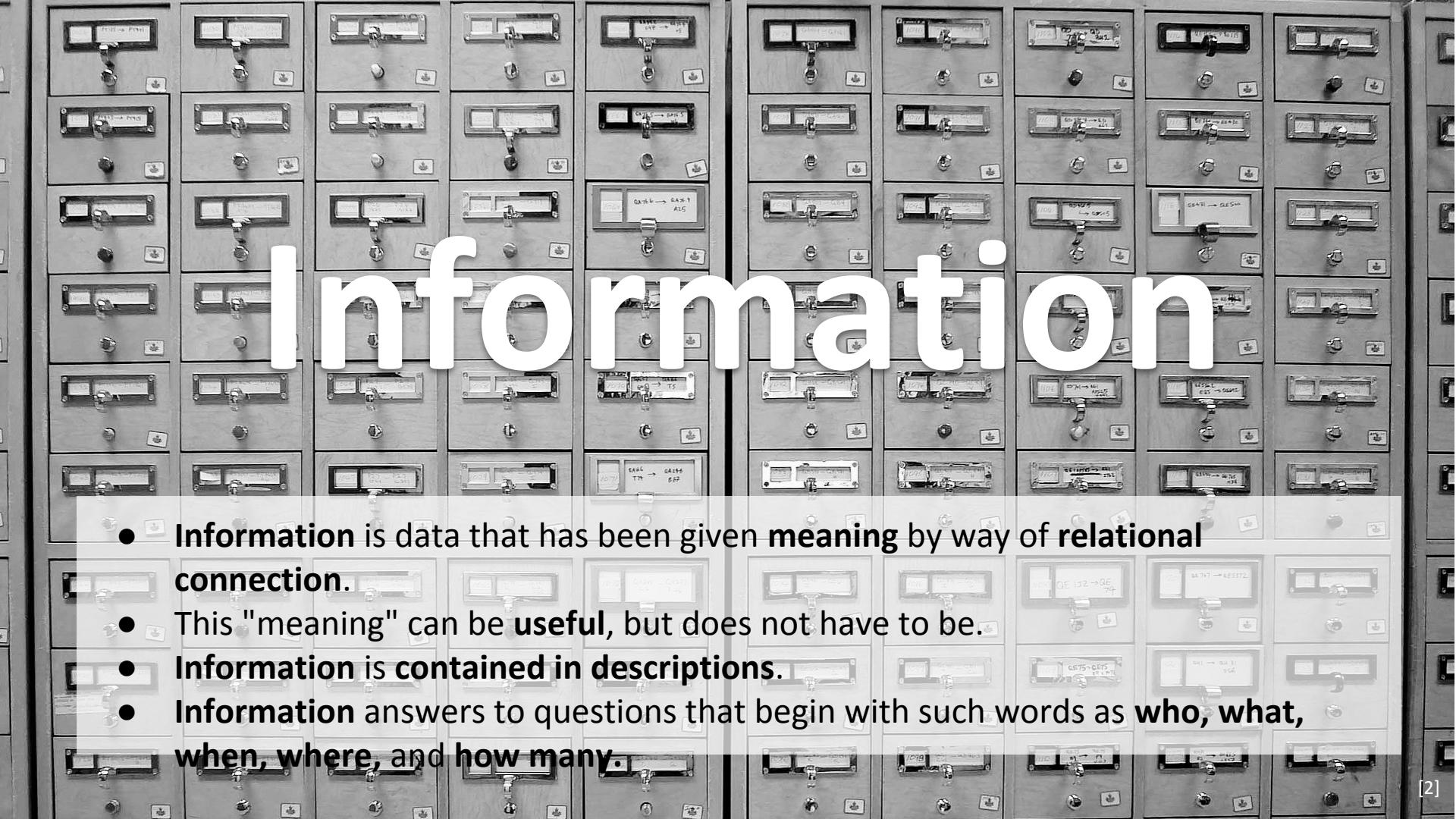
33.6m



$BaleanopteraMusculus \sqsubseteq Animal \sqcap \forall maxLength.\leq 33.6$

# Data

- Data is raw.
- It simply exists and has no significance beyond its existence (in and of itself).
- It can exist in any form, usable or not.



# Information

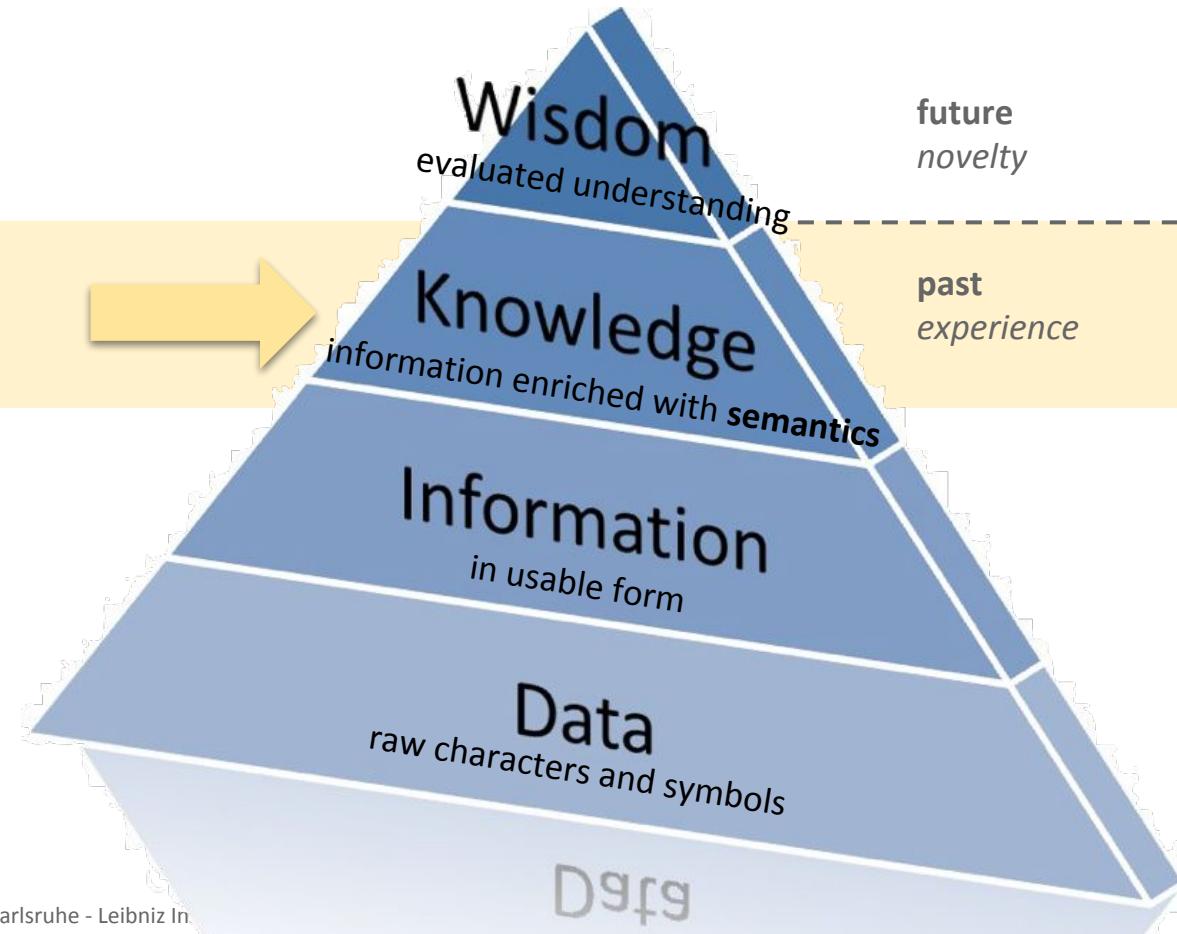
- **Information** is data that has been given **meaning** by way of **relational connection**.
- This "meaning" can be **useful**, but does not have to be.
- **Information** is contained in **descriptions**.
- **Information** answers to questions that begin with such words as **who, what, when, where, and how many**.

# Knowledge

- **Knowledge** is the appropriate collection of information, such that its intent is to be useful.
  - **Wisdom** is the ability to make sound judgments and decisions.
  - **Understanding** is a continuum that leads from data, through information and knowledge, and ultimately to wisdom.

# Data transforms to information by convention, information to knowledge by cognition, and knowledge to wisdom by contemplation.

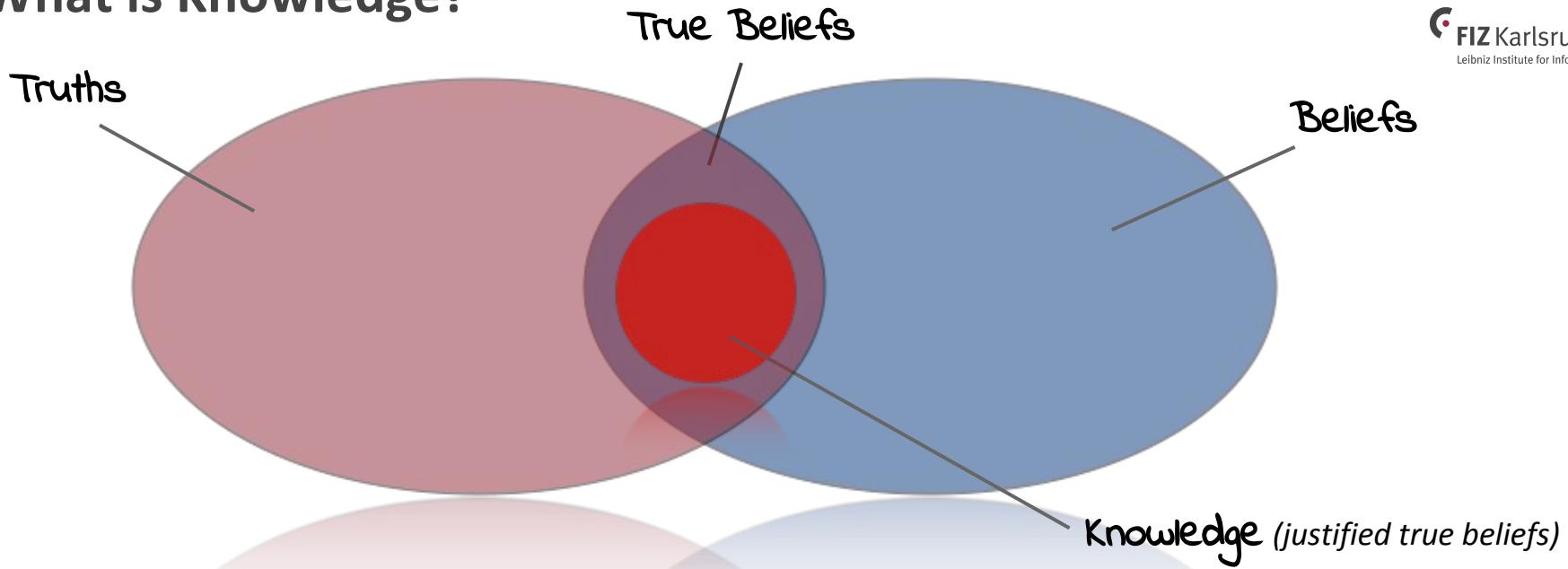
# From Data to Knowledge



DIKW Pyramid, Ackoff 1989

# What is Knowledge?

# What is Knowledge?

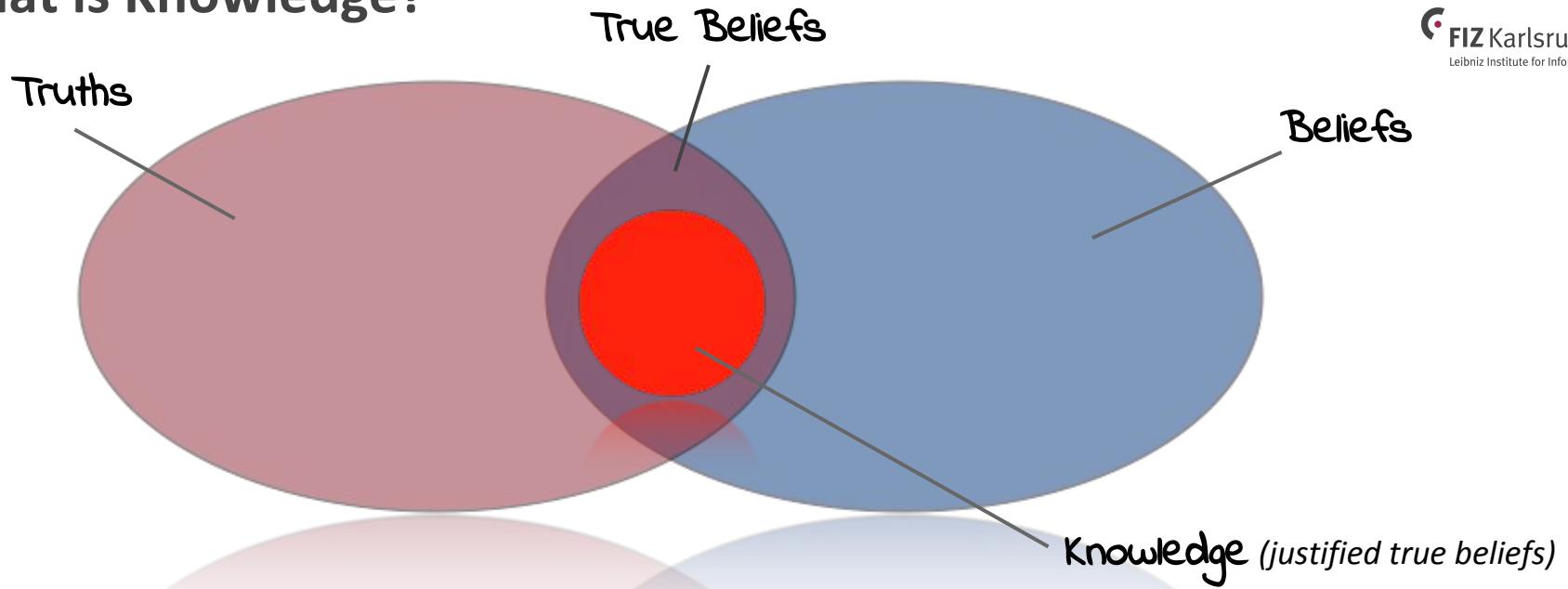


The Tripartite **Analysis of Knowledge**:  $S$  knows that  $p$  iff

- $p$  is true;
- $S$  believes that  $p$ ;
- $S$  is justified in believing that  $p$ .

[The Analysis of Knowledge](#), Stanford Encyclopedia of Philosophy, 2001.

# What is Knowledge?



Traditional Definition: „*Knowledge is a justified subset of all true beliefs*“

To represent knowledge, we need a formal knowledge representation = **Ontologies**

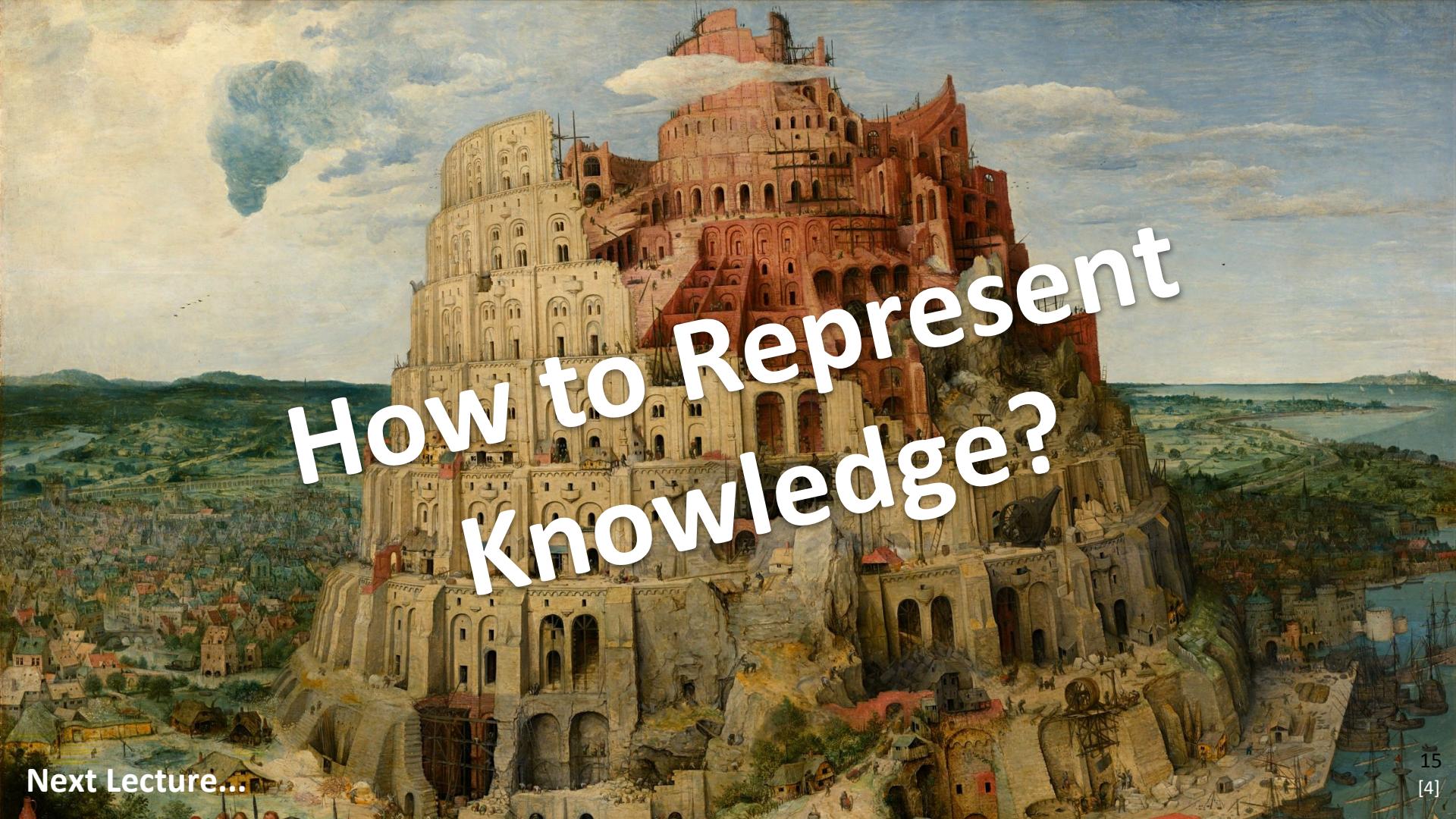


„People can't share knowledge if they don't speak a common language“

Thomas Davenport (1997)

## ...to speak a common Language:

- common symbols and concepts (**Syntax**)
- agreement about their meaning (**Semantics**)
- classification of concepts (**Taxonomy**)
- associations and relations of concepts (**Thesauri**)
- rules and knowledge about which relations are allowed and make sense (**Ontologies**)

A detailed oil painting by Pieter Bruegel the Elder, depicting the Tower of Babel. The central focus is a massive, multi-tiered structure under construction, rising from a rocky cliff. The tower is built of stone and features numerous arched windows and doorways. Scaffolding and wooden walkways are visible on the upper levels. In the background, a city with many smaller buildings stretches across a valley, leading to a distant sea. The sky is filled with clouds, and a large, dark, billowing cloud or smoke is visible on the left side.

# How to Represent Knowledge?

Next Lecture...

# Knowledge Graphs

## 1. Knowledge Graphs in the Web of Data / 1.1 Data, Information, and Knowledge

### Picture References:

- [1] Matrix Computer Screen, <https://pixabay.com/illustrations/matrix-code-computer-pc-data-356024/>
- [2] UBC Library Card Catalog, Paul Joseph, cc-by-2.0,  
[https://commons.wikimedia.org/wiki/File:2009\\_3544505541\\_card\\_catalog.jpg](https://commons.wikimedia.org/wiki/File:2009_3544505541_card_catalog.jpg)
- [3] Tree of knowledge based on the French Encyclopedie from 1780,  
[https://commons.wikimedia.org/wiki/File:Essai\\_d%27une\\_distribution\\_g%C3%A9n%C3%A9alogique\\_des\\_sciences\\_et\\_des\\_arts\\_principaux,\\_1780.jpg](https://commons.wikimedia.org/wiki/File:Essai_d%27une_distribution_g%C3%A9n%C3%A9alogique_des_sciences_et_des_arts_principaux,_1780.jpg)
- [4] Pieter Bruegel the Elder, The Tower of Babel (1563)  
[https://commons.wikimedia.org/wiki/File:Pieter\\_Bruegel\\_the\\_Elder\\_-\\_The\\_Tower\\_of\\_Babel\\_\(Vienna\)\\_-\\_Google\\_Art\\_Project.jpg](https://commons.wikimedia.org/wiki/File:Pieter_Bruegel_the_Elder_-_The_Tower_of_Babel_(Vienna)_-_Google_Art_Project.jpg)