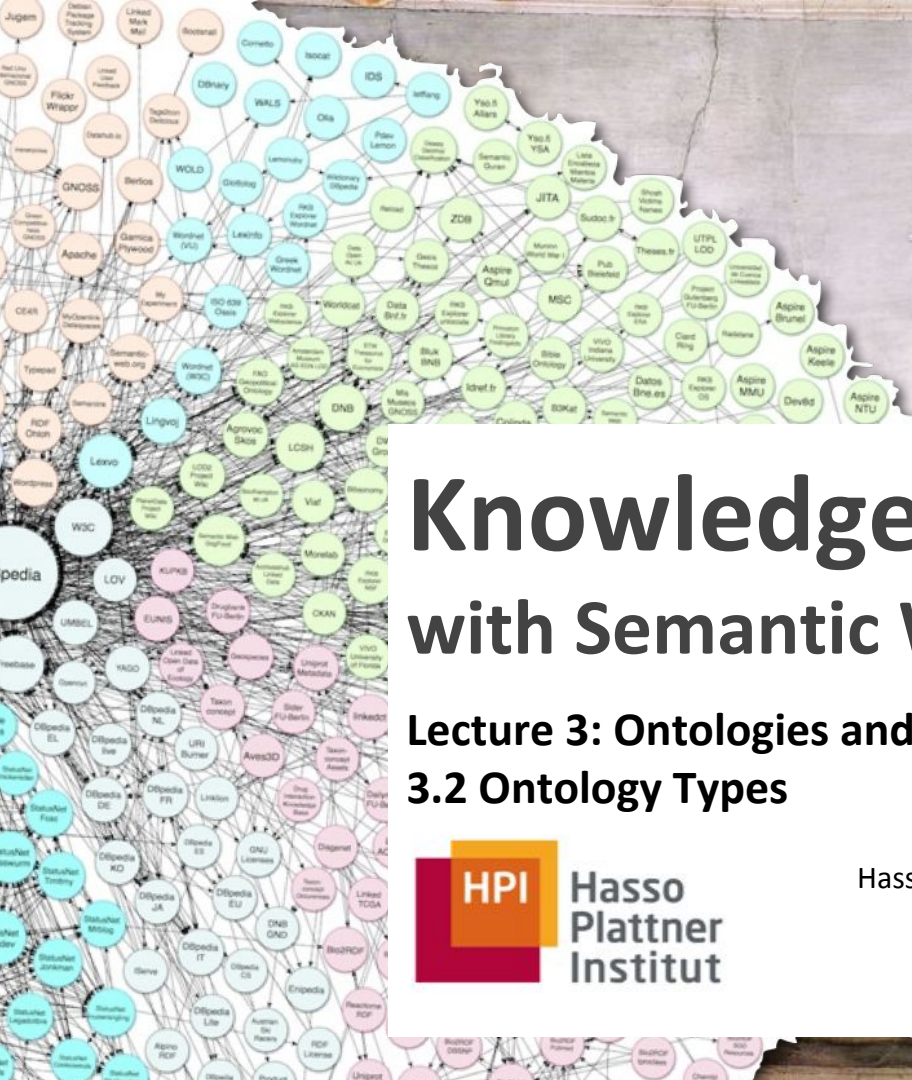


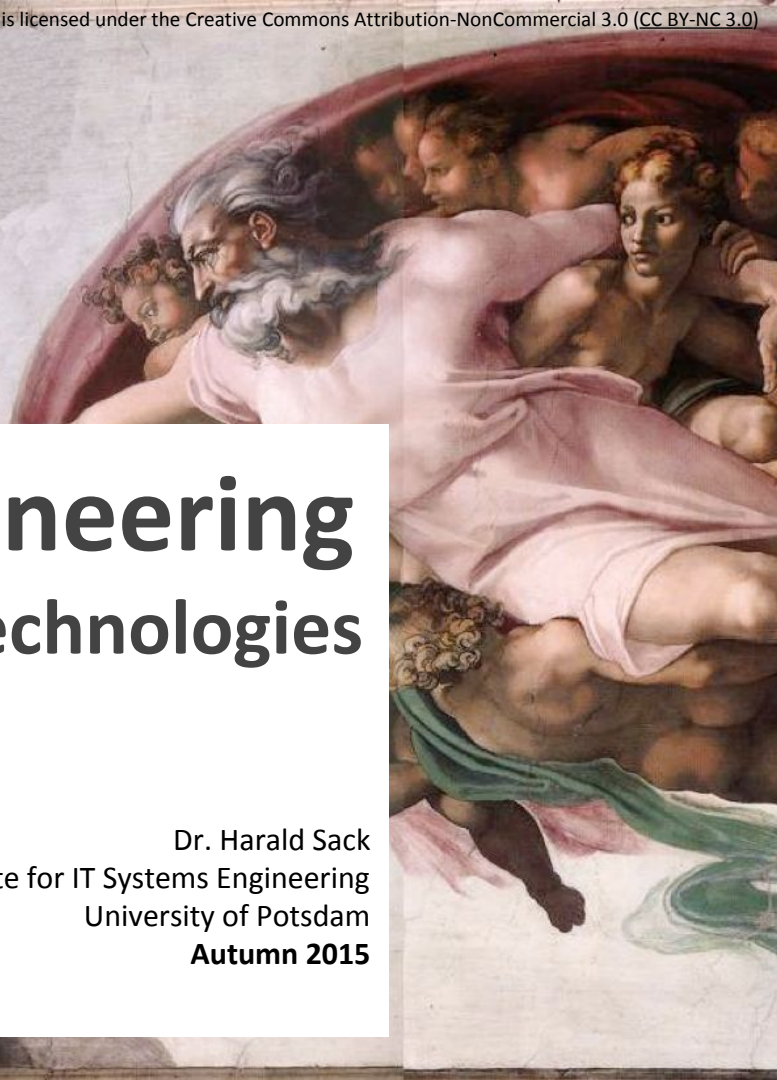


Knowledge Engineering with Semantic Web Technologies

Lecture 3: Ontologies and Logic 3.2 Ontology Types

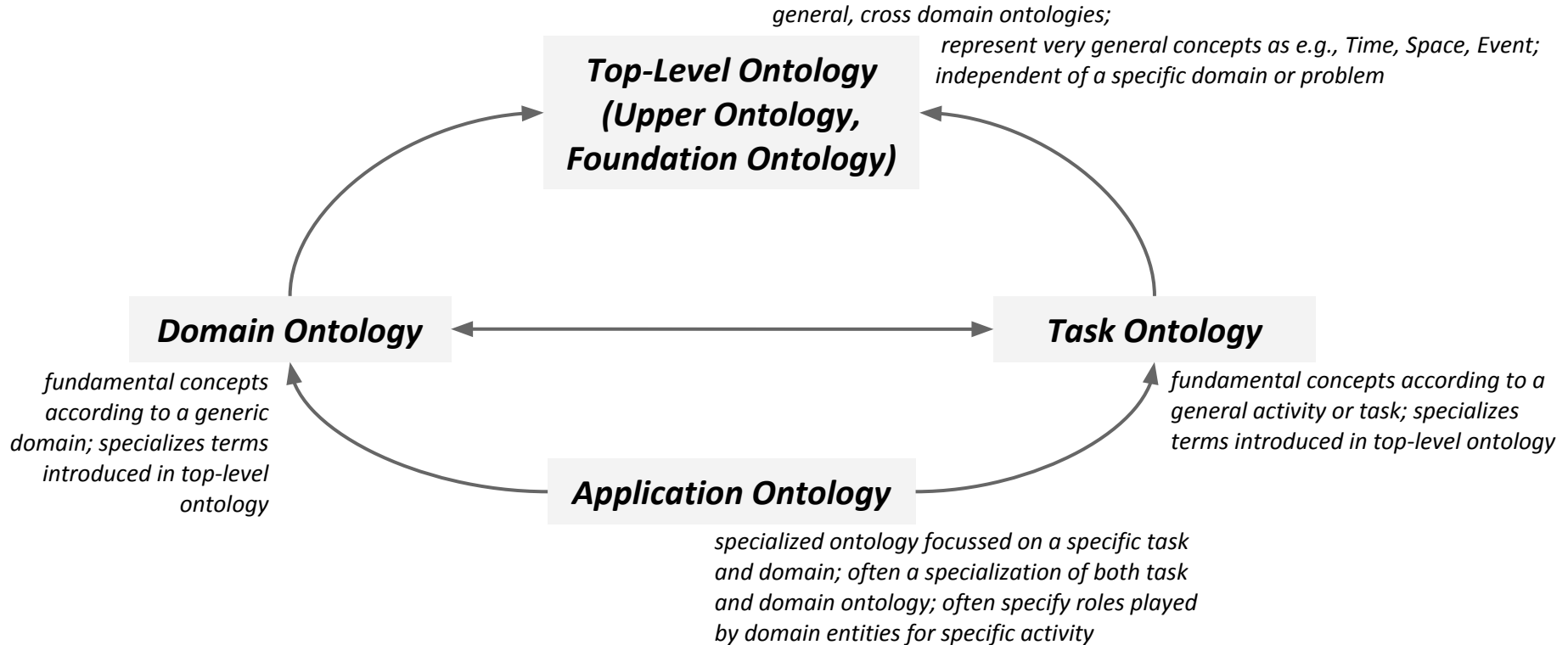


Dr. Harald Sack
Hasso Plattner Institute for IT Systems Engineering
University of Potsdam
Autumn 2015



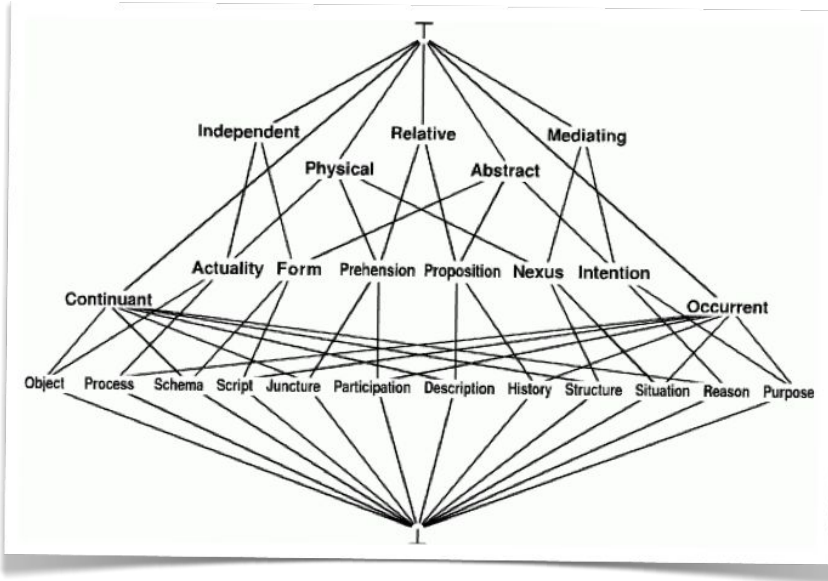
Ontology Types and Categories

according to their level of Generality



(according to Guarino: Formal Ontology in Information Systems, 1998)

KR Ontology



<http://www.jfsowa.com/ontology/kronto.htm>

Example for a Top-Level Ontology: KR Ontology (John F. Sowa)

- based on Alfred North Whithead's **process philosophy** and Charles Sanders Peirce's **semiotic**
- provides a foundation for a systematic characterization of the universe and its expression in human language
- contains 27 concepts
- organized as lattice

Ontology Types and Categories

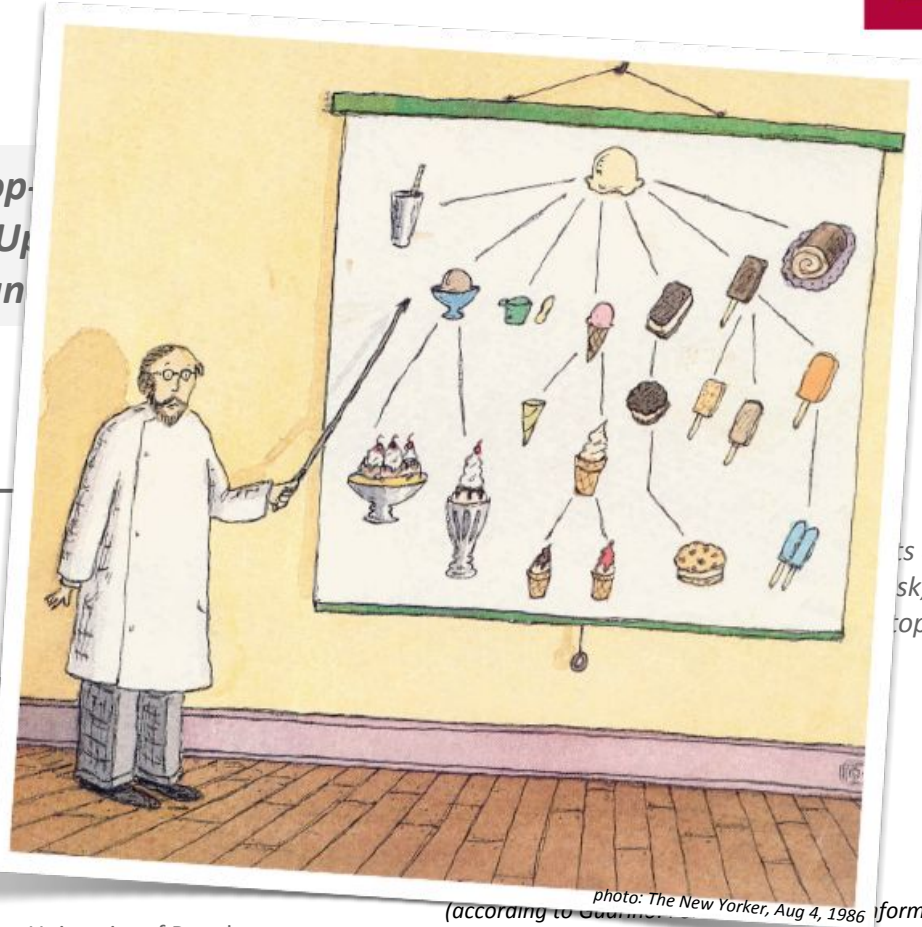
according to their level of Generality

Domain Ontology

fundamental concepts
according to a generic
domain; specializes terms
introduced in top-level
ontology

Top-
(Up
Foun

Ap



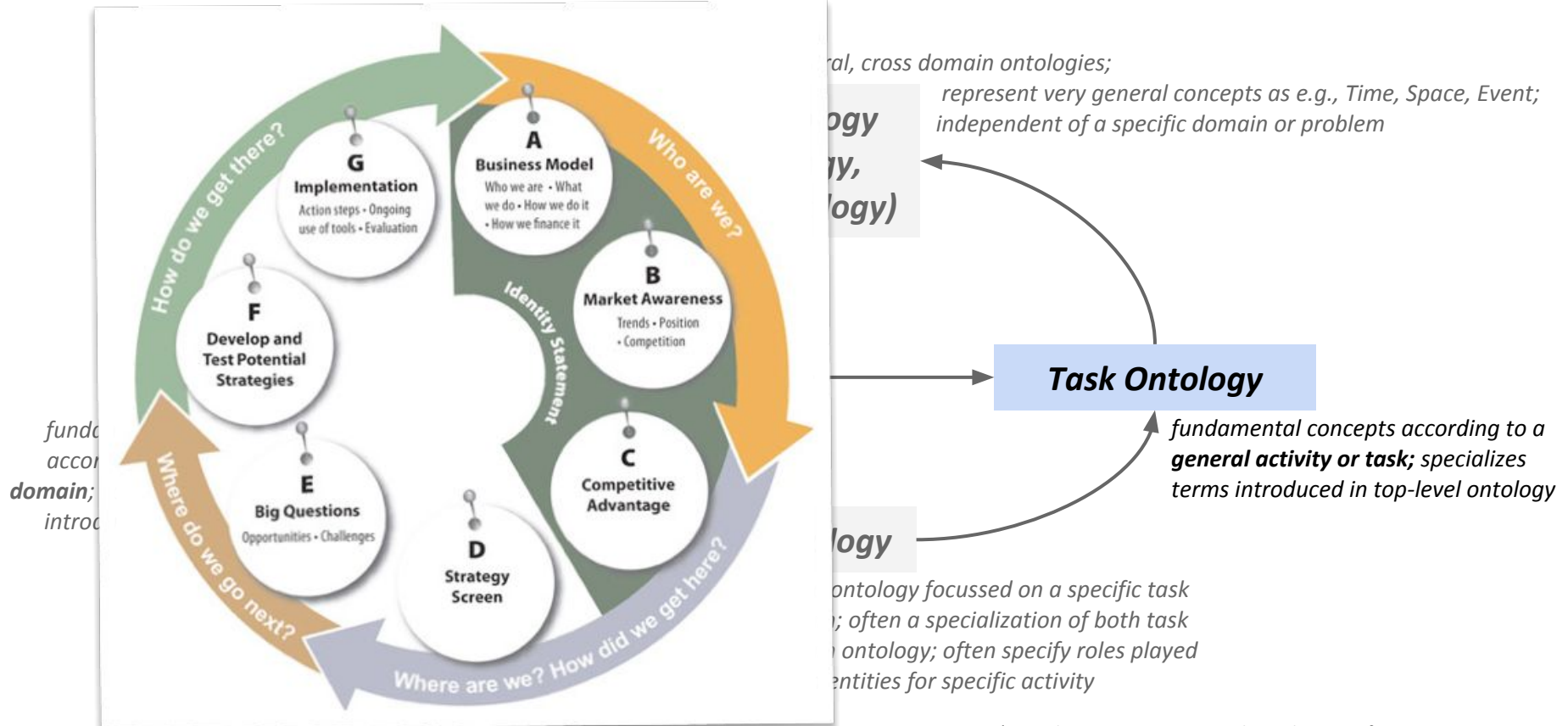
Space, Event;

ts according to a
sk; specializes
top-level ontology

photo: The New Yorker, Aug 4, 1986 information Systems, 1998)

Ontology Types and Categories

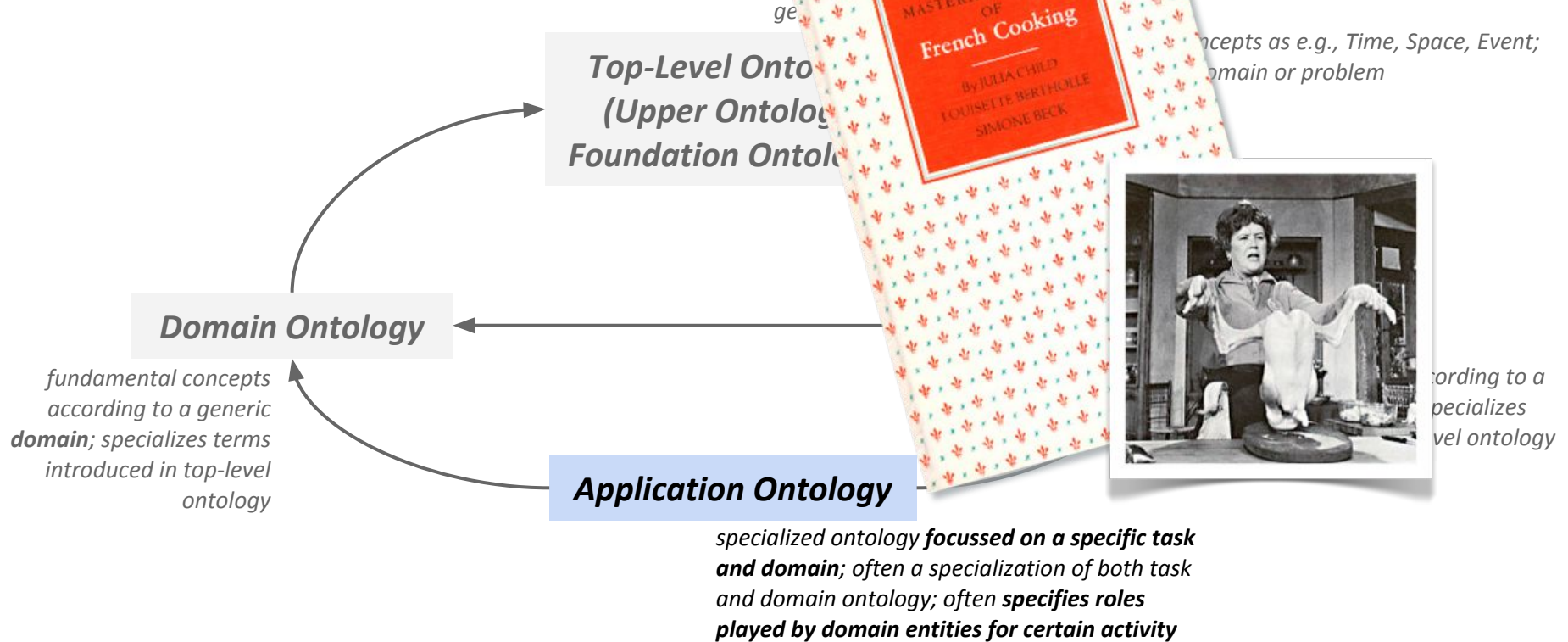
according to their level of Generality



(according to Guarino: Formal Ontology in Information Systems, 1998)

Ontology Types and Categories

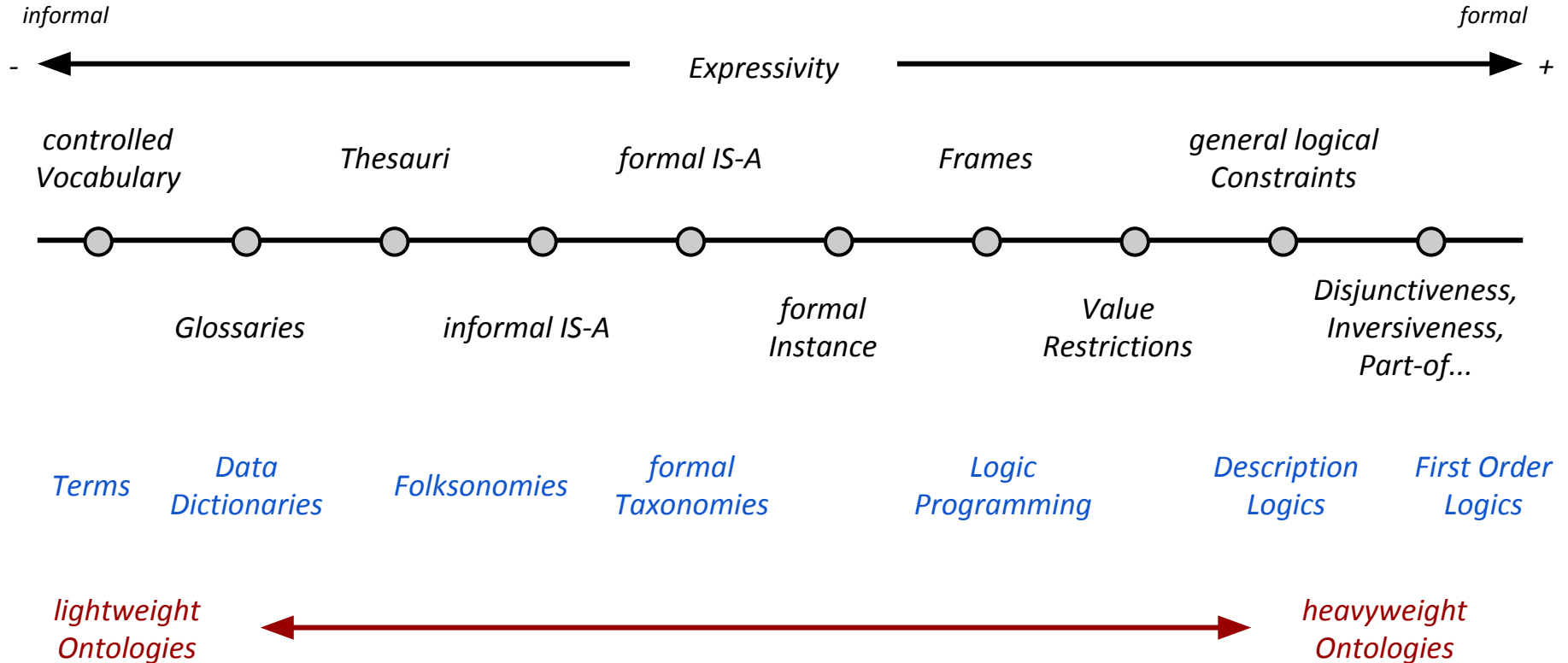
according to their level of Generality



(according to Guarino: Formal Ontology in Information Systems, 1998)

Ontology Types and Categories

according to their level of Semantic Expressivity

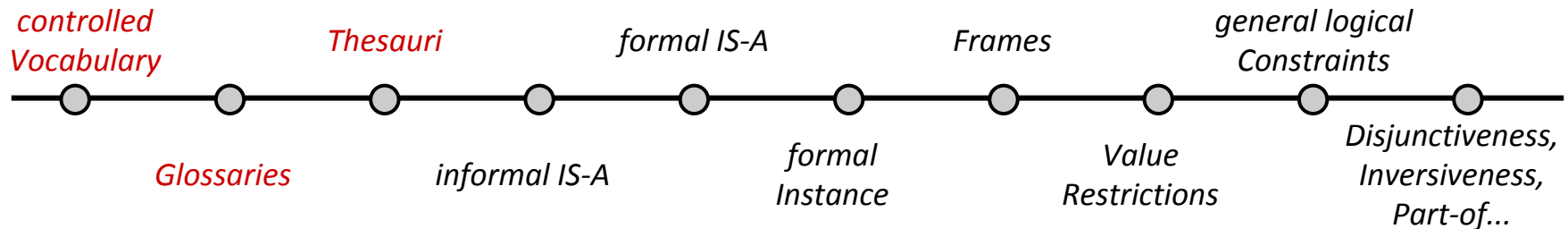


(according to Lassila and McGuinness: The Role of Frame-Based Representation on the Semantic Web, 2001)

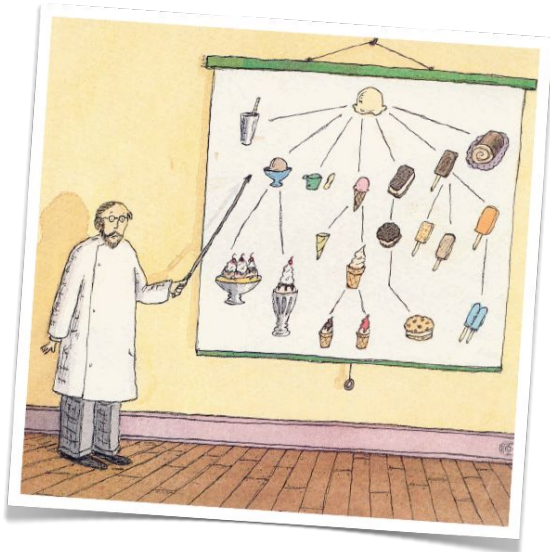
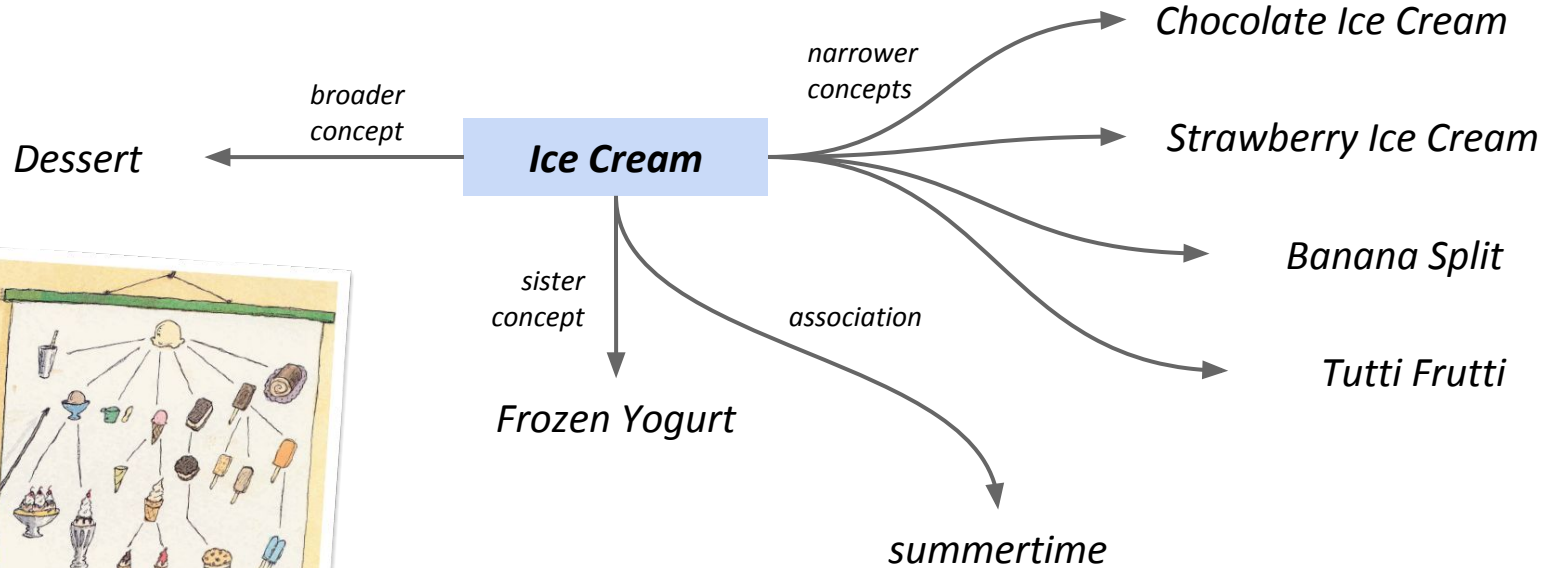
Ontology Types and Categories

according to their level of Semantic Expressivity

- **Controlled Vocabulary:** finite list of terms (e.g. catalogue)
- **Glossary:**
finite list of terms including an informal definition in natural language
- **Thesauri:** [greek. „treasure, treasure house“]
controlled vocabulary, concepts are connected via relations.
 - Equivalency (synonyms)
 - Hierarchies (subclasses, superclasses)
 - Homographs (Homonyms)
 - Associations (similar concepts)



Example of an Thesaurus Entry



WordNet

WordNet Search - 3.1

- [WordNet home page](#) - [Glossary](#) - [Help](#)

Word to search for:

Display Options:

Key: "S:" = Show Synset (semantic) relations, "W:" = Show Word (lexical) relations

Noun

- [S: \(n\)](#) **semantics**
 - [direct hyponym](#) / [full hyponym](#)
 - [S: \(n\)](#) [deixis](#)
 - [S: \(n\)](#) [formal semantics](#)
 - [S: \(n\)](#) [lexical semantics](#)
 - [S: \(n\)](#) [cognitive semantics](#), [conceptual semantics](#), [semasiology](#)
 - [direct hypernym](#) / [inherited hypernym](#) / [sister term](#)
 - [S: \(n\)](#) [linguistics](#)
 - [derivationally related form](#)
- [S: \(n\)](#) **semantics**
 - [direct hypernym](#) / [inherited hypernym](#) / [sister term](#)
 - [S: \(n\)](#) [meaning](#), [substance](#)
 - [S: \(n\)](#) [idea](#), [thought](#)
 - [S: \(n\)](#) [content](#), [cognitive content](#), [mental object](#)
 - [S: \(n\)](#) [cognition](#), [knowledge](#), [noesis](#)
 - [S: \(n\)](#) [psychological feature](#)
 - [S: \(n\)](#) [abstraction](#), [abstract entity](#)
 - [S: \(n\)](#) [entity](#)

WordNet

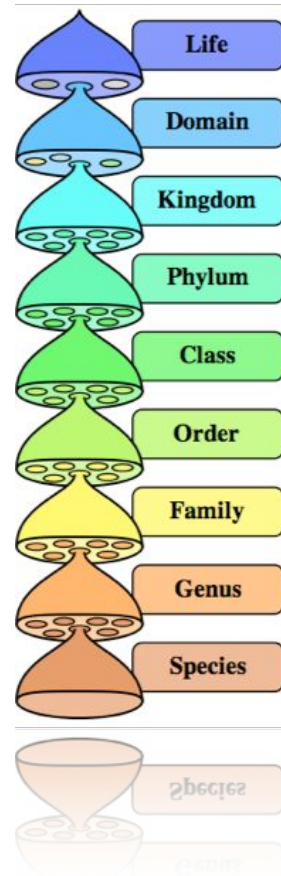
- link-based electronic dictionary with semantic relations
- organized in 117587 „Synsets“, ordered by
 - Nouns (N)
 - Verbs (V)
 - Adjectives (Adj)
 - Adverbs (Av)

<http://wordnetweb.princeton.edu/perl/webwn>

Taxonomies

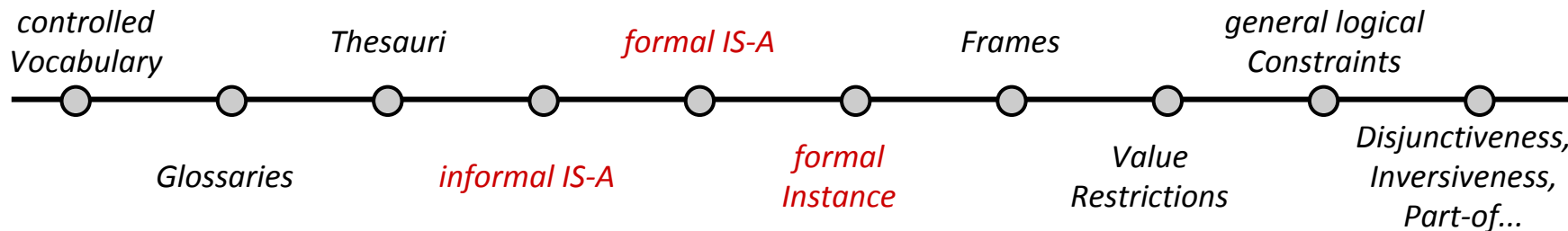
Taxonomy: Definition of a hierarchical system of groups
(from [greek] *τάξις* (*taxis*) = order, arrangement and
νόμος (*nomos*) = law, science) ...

- also **classification schema**, nomenclature, ...
- in science most times classification into (mono-) hierarchical sets (classes, subclasses, ...)
- (also) subject of **biology**:
 - the arrangement of organisms into a classification according to similarities



Taxonomies

- **informal IS-A-Hierarchy:**
explicite hierarchy of classes, subclass relations are not strict
(e.g. index of a library)
- **formal IS-A-Hierarchy:**
explicite hierarchy of classes, subclass relations are strict
- **formal instance:**
explicite class hierarchy, besides strict subclass relations also instance-of
relations are allowed





But beware the Dragons....

Ontologies as Interpretation of Reality

various categories of animals from "a certain chinese encyclopedia"
according to Jorge Luis Borges:

- Those that belong to the emperor
- Embalmed ones
- Those that are trained
- Suckling pigs
- Mermaids (or Sirens)
- Fabulous ones
- Stray dogs
- Those that are included in this classification
- Those that tremble as if they were mad
- Innumerable ones
- Those drawn with a very fine camel hair brush
- Et cetera
- Those that have just broken the flower vase
- Those that, at a distance, resemble flies



Jorge Luis Borges (1899-
1986)

Jorge Luis Borges: The Analytical Language of John Wilkins (1942)



03: The Foundations of Logic

OpenHPI - Course Knowledge Engineering with Semantic Web Technologies

Lecture 3: Ontologies and Logic