INF5020
Philosophy of Information:

Ontology

THIS SESSION – *The goal*

History:
- We first talked about computation, complexity and looked at several definitions of information.
- Later, we also tried to understand information within the context of data, knowledge, communication and language.
- We attempted to get a feel of the relation between computing and information processing.

Goal:
- We want to understand what everybody seems to be talking about in relation to information systems, knowledge or information representation etc.: ONTOLOGY
- We will also try to understand the uses of Ontology in contrast with Epistemology.
- We will also introduce the discussion on what information storage/retrieval is as contrasted with data storage/retrieval

- Ontology is a branch of philosophy (as Epistemology and Axiology, which we shall look at briefly later, are)

- Ontology "… is the science of what is, of the kinds and structures of objects, properties, events, processes, and relations in every area of reality."

- Sometimes Ontology is used in its broader sense, including not only what exists but what may or can exist as well.

> Barry Smith, "Ontology" (Chapter 11) in Luciano Floridi (Ed.), The Blackwell Guide to Philosophy of Computing and Information, Blackwell Publishing 2004
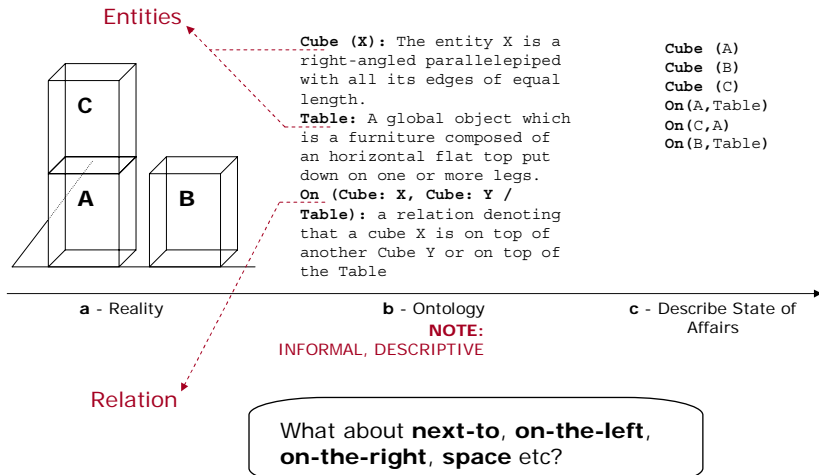

- "Ontology seeks to provide a <u>definitive and exhaustive classification</u> of entities in all spheres of being."
- "The classification … should be definitive in the sense that it can serve as an answer to such questions as:
    - Q_1: What classes of entities are needed for a complete description and explanation of al the goings-on in the universe?
    - Q_2: What classes of entities are needed to give a account of what makes true all truths?"
- "It should be exhaustive in the sense that all types of entities should be included in the classification, including also the types of relations by which entities are tied together."

> Barry Smith, "Ontology" (Chapter 11) in Luciano Floridi (Ed.), The Blackwell Guide to Philosophy of Computing and Information, Blackwell Publishing 2004

Ontology – *A tiny example*

Entities

C

A B

Cube (X): The entity X is a right-angled parallelepiped with all its edges of equal length.
Table: A global object which is a furniture composed of an horizontal flat top put down on one or more legs.
On (Cube: X, Cube: Y / Table): a relation denoting that a cube X is on top of another Cube Y or on top of the Table

Cube (A)
Cube (B)
Cube (C)
On(A,Table)
On(C,A)
On(B,Table)

a - Reality   **b** - Ontology   **c** - Describe State of Affairs
                         NOTE:
                         INFORMAL, DESCRIPTIVE

Relation

What about **next-to**, **on-the-left**, **on-the-right**, **space** etc?

Ontology – *Various schools in Ontology*

SUBSTANTIALISM

Ontology as a substance- or thing- (or continuant-) based discipline.

ADEQUATISM (classify)

Seeking a taxonomy of the entities in reality at all levels of aggregation.

— **vs.** —

FLUXISM

Ontology centered on events or processes (or occurrents).

— **vs.** —

FLUXISM (reduce)

Seeking to establish the ultimate furniture of the universe.

Barry Smith, "Ontology" (Chapter 11) in Luciano Floridi (Ed.), The Blackwell Guide to Philosophy of Computing and Information, Blackwell Publishing 2004

- **ADEQUATISM** is often the choice in information systems (IS), because:
  - Adequatist taxonomies are comparable to scientific taxonomies
  - Adequatism transcends the dichotomy between substantialism and fluxism: it accepts categories of both continuants and occurrents.
  - Ontology (from the point of view of adequatism) is a descriptive enterprise.

- NOTE: Adequatism is distinct from other sciences both in its radical generality and because it seeks not predication and explanation but rather taxonomy and description.

> Barry Smith, "Ontology" (Chapter 11) in Luciano Floridi (Ed.),
> The Blackwell Guide to Philosophy of Computing and
> Information, Blackwell Publishing 2004

- **The Tower-of-Babel problem:**

"As more diverse groups are involved in sharing and translating even more diverse varieties of information, the problems standing in the way of putting this information together within a single system increase geometrically. Methods must be found to resolve the terminological and conceptual incompatibilities which then inevitably arise.

Initially, such incompatibilities were resolved on a case-by-case basis. Gradually, however, it was recognized that the provision, once and for all, of a common reference ontology – a shared taxonomy of entities – might provide significant advantages…, and the term "ontology" came to be used by information scientists to describe the construction of a canonical description of this sort."

> Barry Smith, "Ontology" (Chapter 11) in Luciano Floridi (Ed.),
> The Blackwell Guide to Philosophy of Computing and
> Information, Blackwell Publishing 2004

Some keywords:

- Ontology = Dictionary of Terms (DOTS)
- Formulated in a common (canonical) syntax
- Containing commonly accepted definitions
- Designed to yield <u>a lexical/taxonomical framework for knowledge representation</u>,
- Can be shared across IS communities (basically any other communities as well)

Barry Smith, "Ontology" (Chapter 11) in Luciano Floridi (Ed.), The Blackwell Guide to Philosophy of Computing and Information, Blackwell Publishing 2004

Huh? Why not information representation?

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Some problems:

- Constructing a single "universal" and shared ontology is difficult
- Typically, many will contribute with smaller ontologies
- Typically, many will have different opinions, values, political systems, rights, beliefs etc.,
- Thus, building an ontology from smaller ones difficult, because "sharing" is difficult

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Ontology vs. ontology – *An important clarification #1*

Note:

- In the previous slide, note that Ontology is demoted to ontology with a little "o"

- The big-o Ontology is a branch of philosophy and doesn't cover what we are talking about when we say things like "constructing an ontology"

- The little-o ontology is used to mark the distinction: We are talking about something reified into a list-of-things of sorts, where the list and the entries in the list have certain structural/relational properties etc.

Ontology vs. ontology – *An important clarification #2*

But:

- The little-o ontology is also a misnomer, really:

  It creates confusion (cognitive noise) due to the semantic overloading of the term Ontology

- What we're talking about is an ontological dictionary or an ontological thesaurus, or – most appropriate – an ontological (not database but) information base.

Yes! That's the reason for the mess!

Ontology vs. ontology – *An important clarification #3*

Info-base vs. knowledge-base:

- An ontological <u>information</u> base is of course with respect to our definitions of information and knowledge.

- An information base would popularly be called a knowledge base today, …

  … but we've agreed that information is external to the mind whereas knowledge is internal, …

  …so we can't really construct a knowledge-base but only an information base.

Axioms, postulates, definitions have their consequences!

Ontology vs. ontology – *An important clarification #4*

Onto-base:

- An ontological <u>information</u> base is what we will refer to as an <u>onto-base</u>.

- Note that "information" is not explicit in the term so that it can refer to an ontological knowledge base as well (avoiding disagreement, since it takes so much of valuable attention away from other relevant issues).

- NOTE AGAIN:
  An onto-base is not any info-base or knowledge-base: it is an <u>ontologically constructed</u> info-base.

Ontology is not the "thing" we're constructing but the theory we <u>ground</u> our approach (of constructing info-bases) in!

One possible solution to the "sharing" problem:
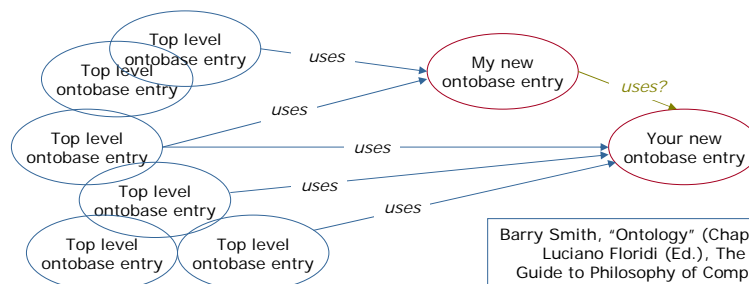**Upper ontology or top-level ontology.**

- Constructing a single universal and shared ontology is difficult, but we can attempt to build "... a **top-level ontology**, which would confine itself to the specification of such highly general (domain-independent) categories as: time, space, inherence, instantiation, identity, measure, quantity, functional dependence, process event, attribute, boundary, an so on."

- See for example the "IEEE Standard **Upper Ontology** Working Group (SUO WG) at http://suo.ieee.org.

> Barry Smith, "Ontology" (Chapter 11) in Luciano Floridi (Ed.), The Blackwell Guide to Philosophy of Computing and Information, Blackwell Publishing 2004

Use of upper ontologies or top-level ontology:

- Why would upper ontologies or a top-level ontology resolve the problem of sharing ontologies?
- The idea is that any "local" ontology can then be defined in terms of a single shared top-level ontology.
- In other words, every entry in my onto-base and in your onto-base can be boiled down to entries in the top-level onto-base!
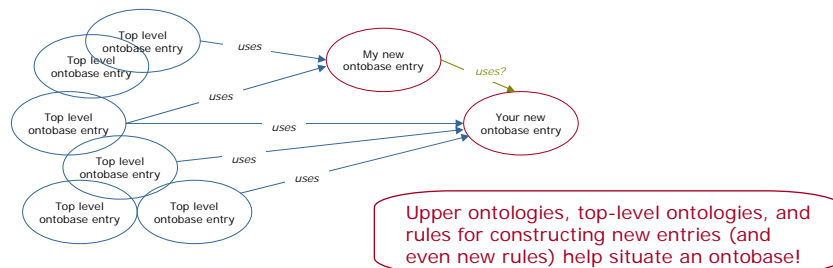

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Situated nature of ontologies:

- All knowledge, all planes are "situated": They change and adapt to the context, the situation.
- This is valid of any ontology as well.
- Thus, ontologies have to be evolvable, changeable, re-constructible (to some extent) in run-time or "use-time".

Upper ontologies, top-level ontologies, and rules for constructing new entries (and even new rules) help situate an ontobase!

Ontology engineering:

- There are many solutions, at least directions, but:

  - How to go about constructing a first-cut ontology, how to refine it etc. are still amongst open issues.

    (DISCUSS)

  - How to structure entries, the level of formalism (how to be descriptive to the human and prescriptive to the machine etc.) are also discussed

    (DISCUSS)

NEXT TIME:
Weber's Ontology of Information Systems

ANY QUESTIONS SO FAR?