COMP318: Ontology based Information Systems

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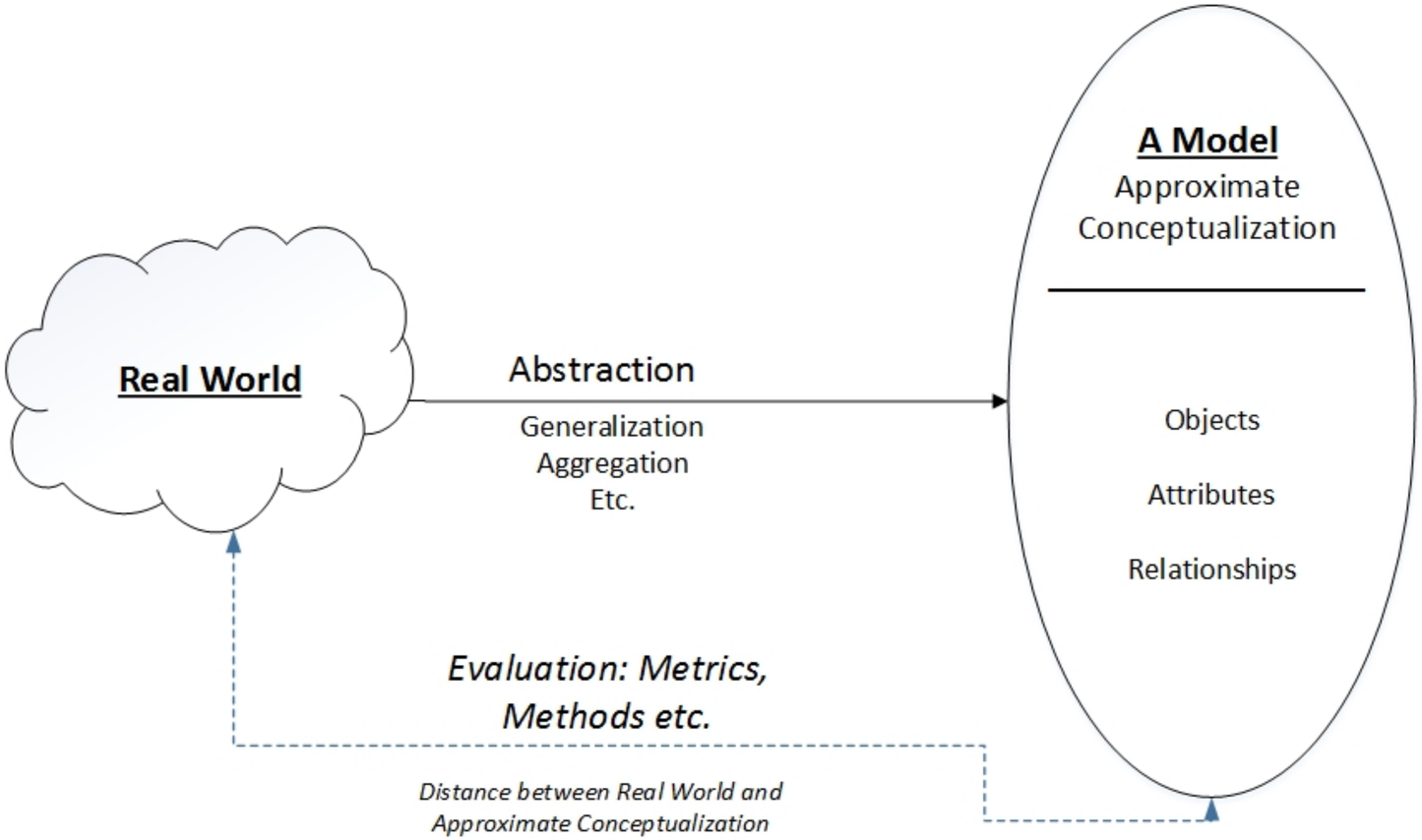
Where were we

- Ontology engineering
  - Ontology 101

Ontology evaluation

- The process of **deciding the quality of an ontology**
  - Two activities: **ontology verification** and **validation**
- **Ontology verification:** checks the encoding of the specification
  - detects errors, as e.g. circular, class hierarchies, redundant axioms, inconsistent naming schemes etc.
  - confirms that the ontology has been built according to certain specified ontology quality criteria
- **Ontology validation:** checks whether the meaning of the definitions matches with the conceptualisation the ontology is meant to specify
  - the goal is to show that the world model is compliant with the formal model

Ontology evaluation



from Hlomani & Stacey: Approaches, methods, metrics, measures and subjectivity in ontology evaluation, ACM 2014

Ontology evaluation criteria

- **Accuracy**:
  - Do axioms comply to knowledge elicited from the users?
  - Does the ontology capture and represents aspects of the real world correctly?
- **Adaptability**:
  - Does the ontology offer the conceptual foundation for a range of anticipated tasks?
  - Can the ontology be extended and specialised without the need to remove axioms (*monotonically*)?
  - Does the ontology comply to procedures for extension, integration, and adaptation?
- **Clarity**:
  - Does the ontology communicate effectively the intended meaning of the defined terms?
  - Are the definitions objective and independent of context?
  - Does the ontology use definitions or (partial) descriptions?
  - Are the definitions documented?
  - Is the ontology understandable?

Ontology evaluation criteria

- **Completeness**:
  - Is the domain of interest appropriately covered?
  - Are competency questions defined and can the ontology answer them?
  - Does the ontology include all relevant concepts and their lexical representations?
- **Computational efficiency**:
  - How easy and successfully can reasoners process the ontology?
  - How fast can the standard reasoning processes (satisfiability, instance classification, etc.) be applied to the ontology?
- **Conciseness**:
  - Does the ontology include irrelevant axioms?
  - Does the ontology specify the weakest theory possible and define only essential terms?
  - How weak are the assumptions regarding the ontology's underlying philosophical theory about reality?

Ontology evaluation criteria

- **Consistency**:
  - Do the axioms lead to contradictions (logical consistency)?
  - Are formal and informal description of the ontology consistent?
  - Are any representation choices made purely for the convenience of notation or representation?
  - Does the translation from the knowledge level to the encoding show a minimal encoding bias?
- **Organisational Fitness**:
  - Is the ontology easily deployed within the organization?
  - Do tools within the organization put constraints on the ontology?
  - Does the ontology meet legal requirements

Measures for ontology evaluation

- Direct measurement of the criteria in the previous slides is difficult, however …

- **Ontology Correctness**
  - **Accuracy**, e.g. using **precision** (total number correctly defined concepts over whole knowledge defined in ontology) and **recall** (total number correctly defined concepts over all knowledge that should be defined)
  - **Completeness**, e.g. using coverage of encoded axioms and axioms in specification
  - **Consistency**, e.g. count terms with inconsistent meaning

- **Ontology Quality**
  - **Computational Efficiency**, e.g. through size
  - **Adaptability**, e.g. via coupling (number of external classes referenced) and cohesion (number of root, leaf, avg. inheritance depth, etc.)
  - **Clarity**, e.g. number of word senses