ECOR

European Centre for
Ontological Research

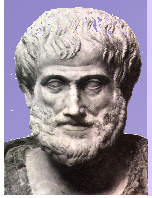
UNIVERSITÄT DES SAARLANDES

Terminology and Ontology in Semantic Interoperability of Electronic Health Records

Dr. W. Ceusters

European Centre for Ontological Research

Saarland University



ECOR
European Centre for Ontological Research

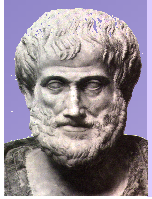
UNIVERSITÄT DES SAARLANDES

Semantic Interoperability

- Working definition:
  - Two information systems are semantically interoperable if and only if each can carry out the tasks for which it was designed using data and information taken from the other as seemlessly as using its own data and information.

system: Any organized assembly of resources and procedures united and regulated by interaction or interdependence to accomplish a set of specific functions.

information system: a system, whether automated or manual, that comprises people, machines, and/or methods organized to collect, process, transmit, and disseminate data that represent user information.



ECOR

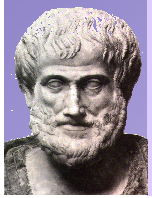
European Centre for Ontological Research

UNIVERSITÄT DES SAARLANDES

Essential components

- **People**: ph… …ients, healthc…
- **Mac…**
- **Data** …)
- **Procedu…**

Communication & Interpretation



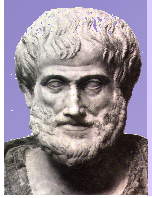
ECOR

European Centre for Ontological Research

UNIVERSITÄT DES SAARLANDES

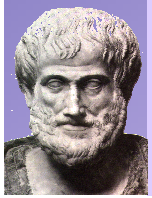
Terminology

- A theory concerned with those aspects of the nature and the functions of language which permit the efficient representation and transmission of items of knowledge (J. Sager)
- Precise and appropriate terminologies provide important facilities for human communication (J. Gamper)



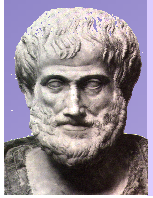
Ontology

- An ontology is a representation of some pre-existing domain of reality which
  - (1) reflects the properties of the objects within its domain in such a way that there obtains a systematic correlation between reality and the representation itself,
  - (2) is intelligible to a domain expert
  - (3) is formalized in a way that allows it to support automatic information processing



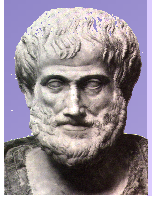
A division of labour

- Terminology:
  - Communication amongst humans
  - Communication between human and machine
- Ontology:
  - Representation of “reality” inside a machine
  - Communication amongst machines
  - Interpretation by machines



Today's biggest problem: a confusion between "terminology" and "ontology"

- The conditions to be agreed upon when to use a certain term to denote an entity, are often different than the conditions which make an entity what it is.
  - Trees would still be different from rabbits if there were no humans to agree on how these things should be called.
- "ontos" means "being". The link with reality tends to be forgotten: one concentrates on the models instead of on the reality.



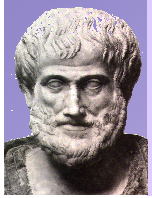
ECOR

European Centre for Ontological Research

UNIVERSITÄT DES SAARLANDES

Concept based terminology

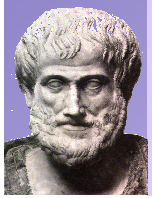
- “concept” as the core element for organising terms
- Concept system: organisation of concepts by means of generic and associative relationships
  - The concept *tool* is more generic than the concept *hammer*
  - The concept *hammer* is associated with the concept *nail*.



A gradual shift in meaning

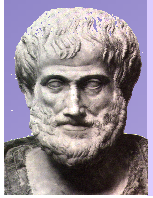
- ISO-1087 (1990) **concept**: *a unit of thought constituted through abstraction on the basis of properties common to a set of objects.*

- ISO-1087 (2000) **concept**: *a unit of knowledge created by a unique combination of characteristics.* Characteristic itself is defined as: *an abstraction of a property of an object or of a set of objects.*



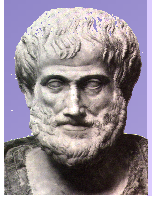
A refinement of relationships but at the wrong level

- Only associative relationships can hold between concepts à la ISO-1987 in 1990.
- Both associative and generic relationships can hold between concepts à la ISO-1987 in 2000.
- A partonomy relationship can hold for the 2000-definition, but here the meaning is different than partonomy at the level of the real world entities.



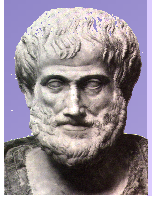
And then the abundance of false promisses and beliefs

- XML
- Description Logics
- RDF(s)
- UML
- OWL
- ... What's next ???



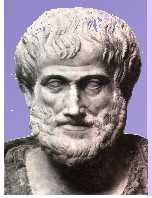
Some results

- Cranky models and definitions in ISO and European standards
  - Latest example: “meta-data repositories”
    - Total confusion about data, what they represent, and how to obtain them
- “Pragmatic” solutions that violate basic common sense:
  - HL7-RIM
    - A document is an act
    - Confusion between acts and statements about acts
    - Person(quantity = 100) has-part Person(quantity = 60; sex = female)



What to do about it ? (1)

- Research:
  - Revision of the appropriatness of concept-based terminology for our purposes
  - Relationship between models and that part of reality that the models want to represent
  - Adequacy of current tools and languages for representation
  - Boundaries between terminology and ontology and the place of each in semantic interoperability in healthcare



What to do about it ? (2)

- Training and awareness
  - Make people more critical wrt terminology and ontology promisses
    - What is needed must be based on needs, not on the popularity of a new concept
    - But in a system, it's not just your own needs, it is each component's needs !
  - Towards "an ontology of ontologies"
    - First description
    - Then quality criteria