Formal ontologies vs. triple based KR gap or convergence?

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DL Ontologies (OWL-DL)
- formal axioms
- universal truths
- set semantics
- clear commitment
- Tbox-Abox partition
- instance-level rels
- "in-built" DL reasoning
- "Top down"
- "something goes"

SPO-Triples (RDF)
- informal graphs
- assertions (any)
- shallow semantics
- unclear commitm.
- puns
- unrestricted rels
- Reasoning by hand crafted rules
- "Bottom up"
- "anything goes"

- RDF(S) syntax (not obligatory)
- restriction to binary relations
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... bridging the gap?
Equivalences RDF - OWL?

- English: "Trondheim is part of Norway"
  RDF: <Trondheim; part-of; Norway>
  OWL: Trondheim part-of Norway

- English: "The thumb is part of the hand"
  RDF: <Thumb; part-of; Hand>
  OWL: Thumb subClassOf part-of some Hand

- If has-part is inverse of part-of:
  RDF: < Norway; has-part; Trondheim >
  OWL: Norway has-part Trondheim
  RDF: <Hand; has-part; Thumb>
  OWL: Hand subClassOf has-part some Thumb
Equivalences RDF - OWL?

• English: "Aspirin treats headache"
  RDF: <Aspirin; treats; Headache>
  OWL: ???

• Ambiguity 1:
  "aspirin molecule" or "portion of aspirin"

• Ambiguity 2:
  "every aspirin treats some headache"?
  "every headache is treated by some aspirin"?
  "every aspirin has the potentiality to treat headache"?
  "the relation 'treats' obtains only between the types 'aspirin' and 'headache'"?
Basic problem

• RDF has a very weak formal semantics. It facilitates the encoding of statements with (hidden) ambiguities.

• OWL has a strict formal semantics. It does not allow to work around ambiguities. Consequence:
  – Risk of creating wrong axioms such as:
    * Aspirin subclassOf treats some Headache
  – Difficulty of represent the intended meaning in case of default or dispositional statements, e.g.
    Aspirin subclassOf bearerOf some
    (Disposition and hasRealization only
      (TreatingProcess and hasParticipant some Headache))
  – Ontology << Knowledge Representation !!
Enriching expressiveness of Triple Stores?

Description Logics (OWL-DL)

SPO-Triples (RDF)
Enriching expressiveness of Triple Stores?
Possible strategies

• Test whether an entity is a class or an individual:
  – if S or O in an rdfs:subclassOf statement -> Class
  – if O in a rdf:type statement -> Class
  – if S in a rdf:type statement -> Individual

• Make difference between formal relations and material relations:
  – formal relations: typically "all-some" pattern, e.g. part-of
  – material relations: processes, e.g. activates, binds

• Bring quantification inside RDF predicates <S; P; O>
  If S and O are classes and P is a formal relation then:
  <S ; P_AS; O> equivalent to  S subclassOf P some O

• Inverse relations only if S and O are individuals

• If S is and individual then O is an individual (with the exception of P = \{an rdfs:subclassOf; rdf:type, ...\}