Ontology Authoring
Inspired by Dialogue

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Ontology Authoring

• Importance of correct and complete authoring of ontologies. Domain experts often have little expertise with logic.

• Authors often misunderstand the meaning of the different logical constructs, and fail to anticipate the logical conclusions that follow from them (Rector et al 2004, Dzabor et al 2006).

• Most ontology authoring is carried out using Protégé, which hides some aspects of the logic and provides an easy “point and click” interface.
Towards Human-oriented Authoring

- Controlled natural languages (CNLs) have been developed to express OWL concepts and axioms (Power 2012, Denaux et al 2014, ...)
- A CNL parser can be embedded in an authoring interface. In theory, a CNL means that an author only needs to understand NL, not logic.
- A sequence of commands using a CNL ("add X, delete Y, ...") gives rise to a kind of dialogue...

The “What if...?” project: How we can exploit/adapt techniques from natural language dialogue systems to make such dialogues more natural and useful?
What is natural dialogue like?

(How does one design a dialogue system?)
Some characteristics of NL dialogue systems

1. Use of corpus analysis to determine relevant speech acts/dialogue moves and transitions between them.

2. Use of feedback and mixed initiative.

3. Consideration of user goals and cooperative interaction.
1. Corpus analysis

- We instrumented Protégé to record mouse clicks and other actions.
- We used eye tracking to record sequences of fixations within the interface.
- We investigated sequences of actions (Vigo et al, CHI 2015)
Transitions
Larger patterns

Exploration, editing and reasoning activities
2. Mixed initiative

• Although the user is the domain expert, the system understands logic and reasoning better.
• Feedback: implications of actions of the user
• BUT in any sufficiently powerful logic, there are infinitely many new facts that are true when an axiom is added!
• So there is a content selection problem (as in NLG) (Parvizi et al, KEOD 2014).
Ways of choosing content

- **Syntax driven:**
  - Our reasoner produces all entailments of particular forms, with a coverage extending that of (Denaux et al 2012).
  - Remove subsumptions by negations.
  - Choose axioms with maximal signature sets.

- **Logic driven:**
  - Treat subsumptions of/by unsatisfiable classes specially
  - Choose more specific subsumptions over less specific ones

- **Discourse driven:**
  - Choose axioms that mention classes appearing recently in the dialogue?
  - Exploit possible more complex dialogue structures in terms of determining “focus of attention”?

- **Pragmatics driven:**
  - Choose axioms relevant to the user’s goals (see next…)?
3. Goals and Cooperativeness

- Selection of feedback should depend on the user’s goals that are not yet achieved.

- Goals of ontology authors – to produce ontologies that can answer competency questions, e.g.
  - What culinary roles does a given potato have?
  - Which bodies in the solar system are planets?

  But (as long as the vocabulary is there) these questions can be asked at any point in ontology authoring – can’t directly tell whether the goals are achieved or not!
Exploiting Presuppositions

- CQs have natural language presuppositions
  - "What X are Y?" presupposes that some X are Y and some X are not Y (Levinson 1983, Zuber 1983)
- The user can be told if a presupposition is currently violated (Ren et al, ESWC 2014). E.g:

CQ: Which processes implement a given algorithm?

Example possible violations:
- No process could possibly implement an algorithm (satisfiability test)
- Currently no process can be inferred to implement an algorithm
- Every process currently implements all algorithms
Where we are: interface
Where next?

• Evaluation with users
• Integration
  o Speech acts and larger dialogue structures – compatibility of our interface with the empirical findings
  o CNL for competency questions
  o More serious experimentation with entailment selection heuristics
  o “What if...?” questions and associated interactions
Answering “What if…?” Questions

“What if …?” involves a combination of:

1. Checkpoint/backup/undo mechanism
2. Feedback on actions (“what has…?”)

embedded within a dialogue framework.....