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.

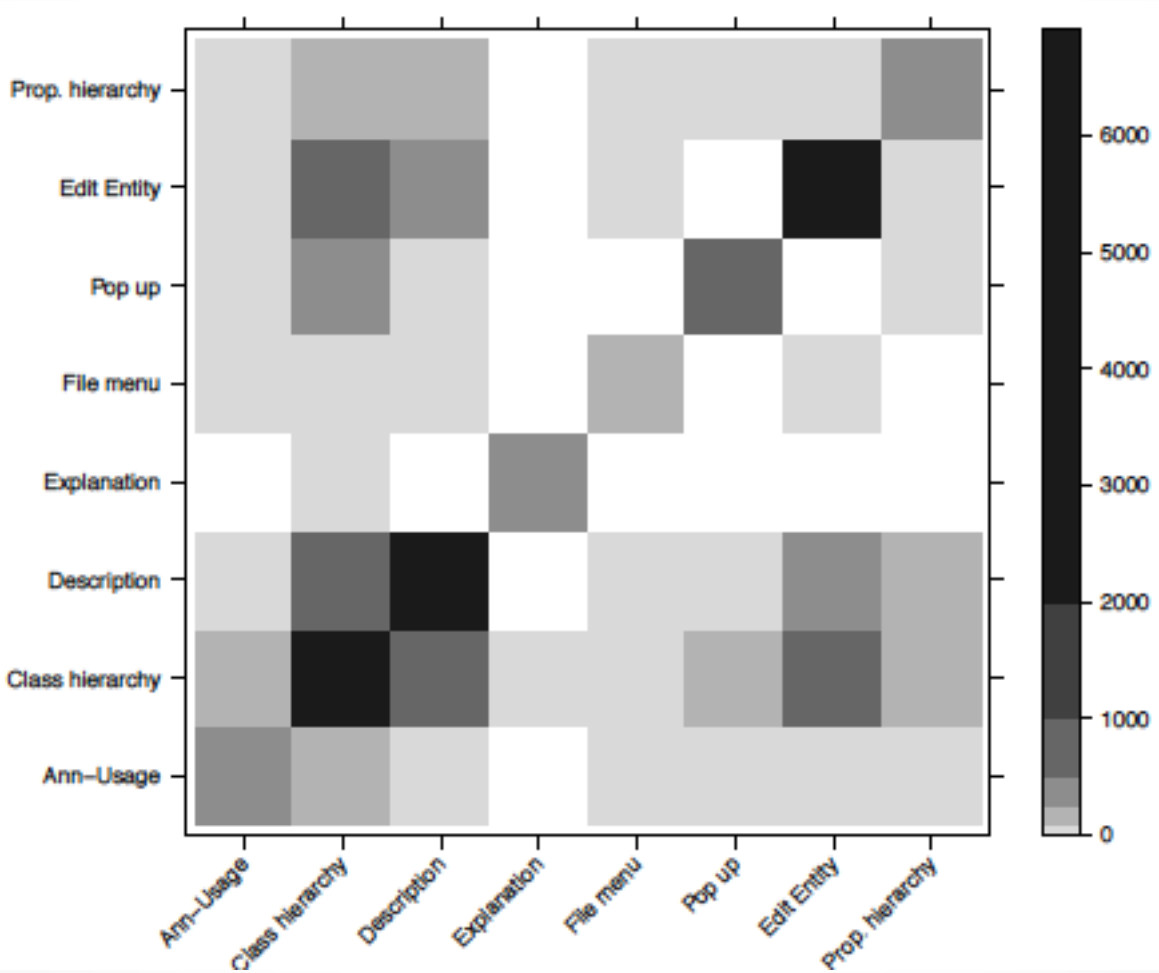
2. Use of feedback and mixed initiative.

3. Consideration of user goals and cooperative interaction.

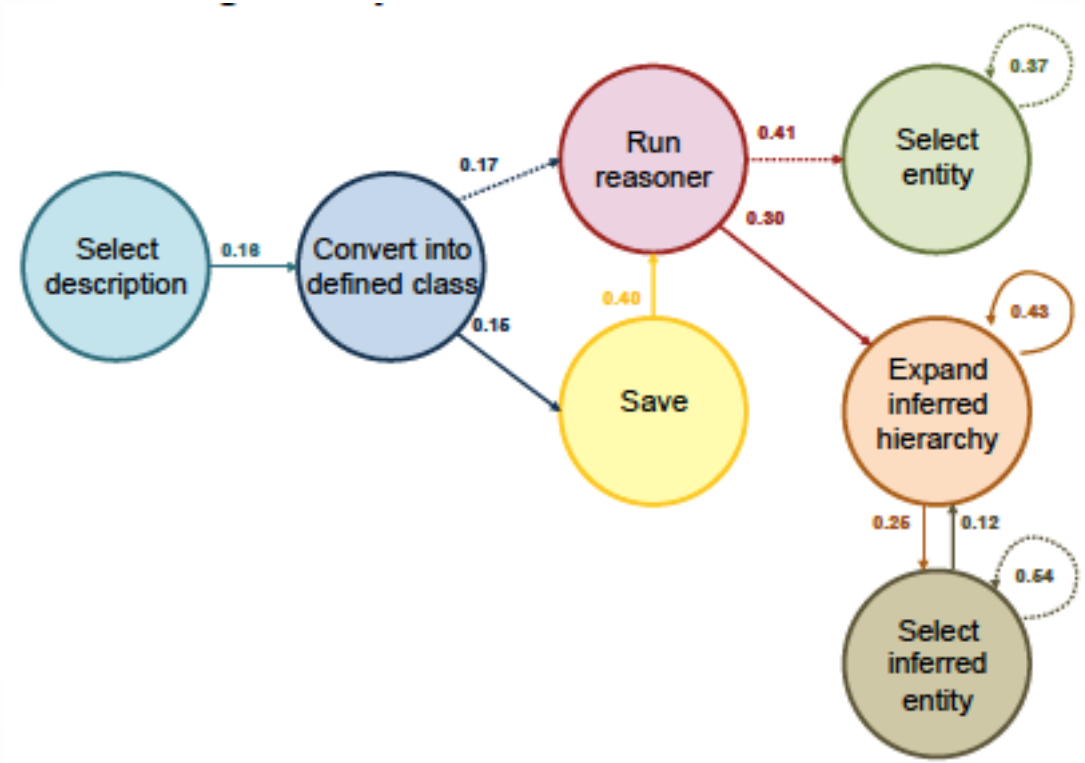
1. Corpus analysis

- 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 unsatosfiable 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

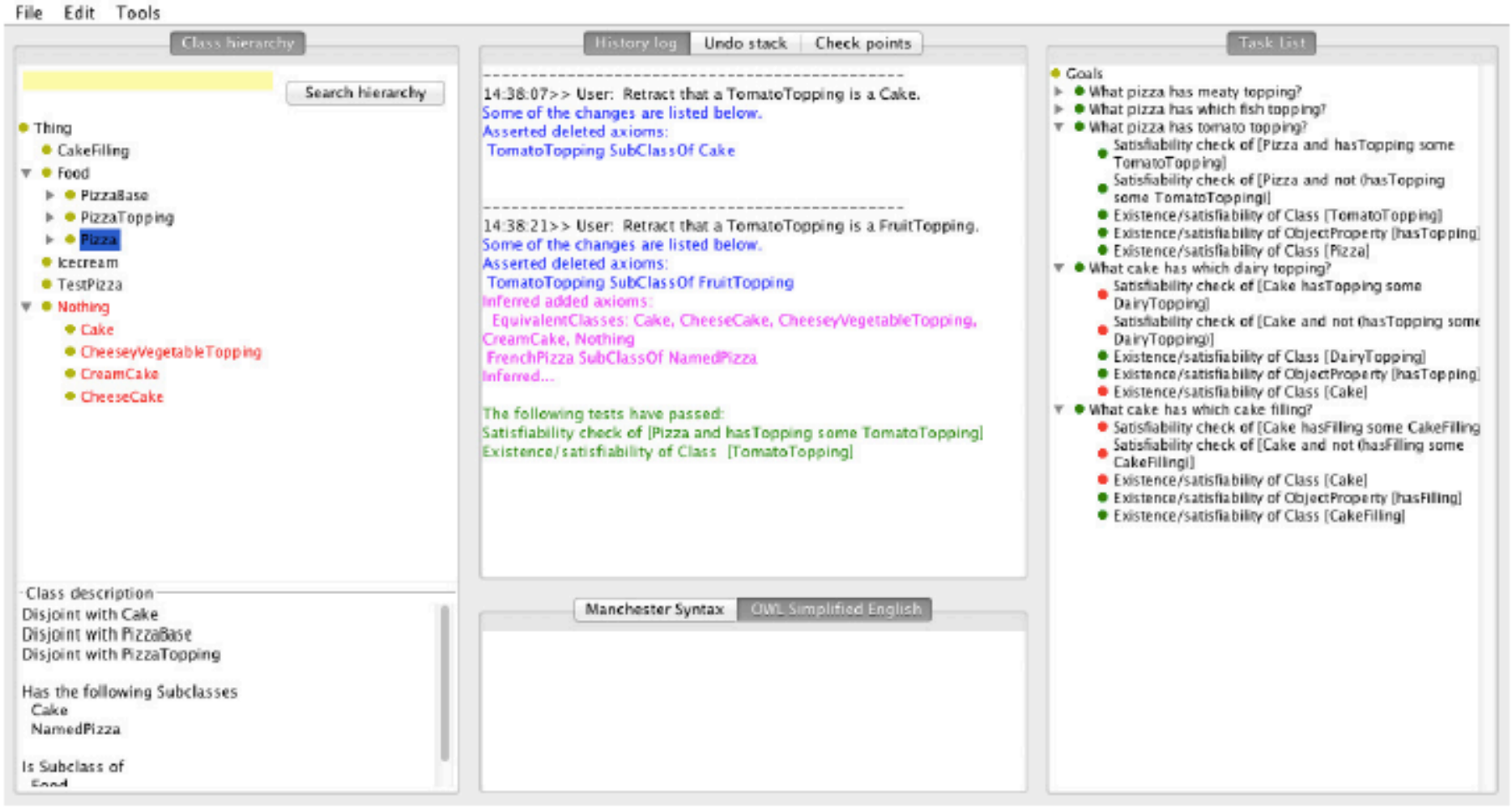
- CQs have natural language presuppositions
  - "What X are Y?" presupposes that some X are Y and some X are not Y (Levinson 1983, Zuber 1983)
- The user can be told if a presupposition is currently violated (Ren et al, ESWC 2014). E.g:

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
  - Speech acts and larger dialogue structures – compatibility of our interface with the empirical findings
  - CNL for competency questions
  - More serious experimentation with entailment selection heuristics
  - "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…..