

Ontology Evolution Using Belief Change and the AGM Theory

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Belief Change for Ontology Evolution¹

Motivation

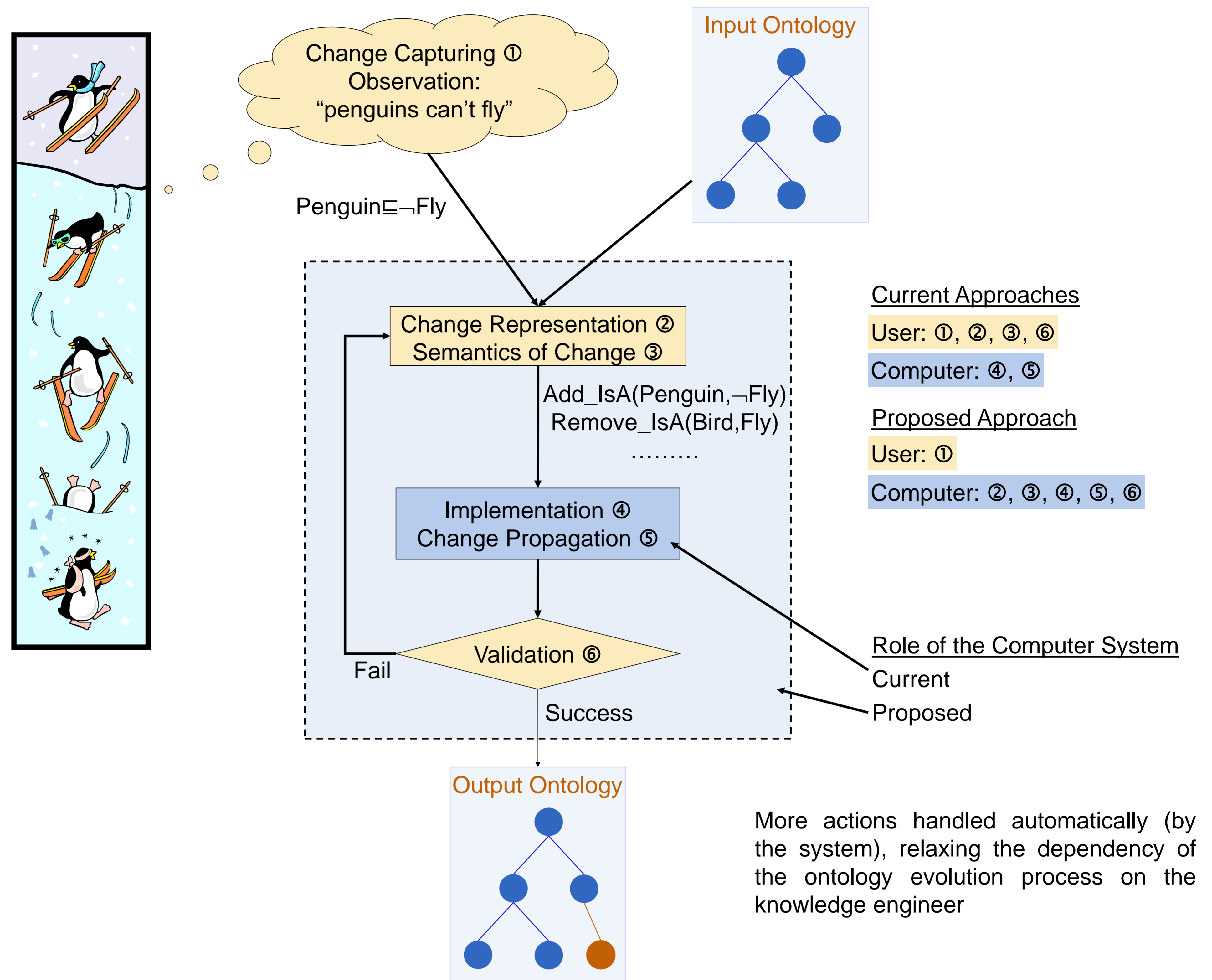
- Lack of adequate formalizations
- Manual execution
- Too many operators to consider

Our Approach (Key Ideas)

- Proposed a novel, automatic and more formal approach to ontology evolution based on and inspired by belief change
- Studied belief change formalisms, principles, ideas and techniques under the prism of ontology evolution

Main Results

- Adequate formalisms provided by belief change and Tarski's logical model
- Belief change is automatic: relevant ideas, intuitions, techniques and models are useful
- 4 operations only (revision, contraction, update, erasure)



Generalization of the AGM Theory^{2,3}

Motivation

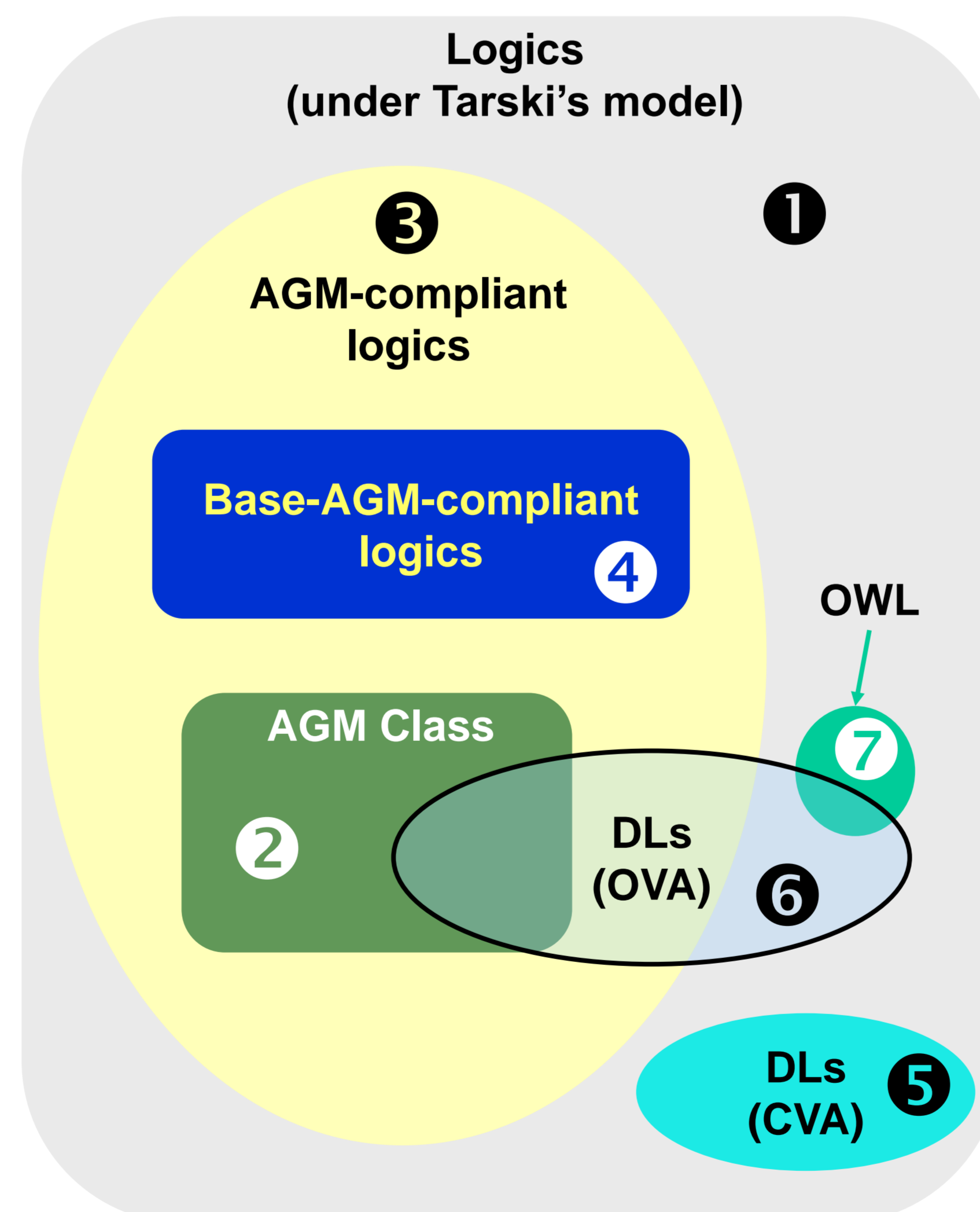
- The above model is very abstract; we need a more concrete approach

Our Approach (Key Ideas)

- AGM theory is the most influential approach in belief change; DLs and OWL are the most useful formalisms for the representation of ontologies
- Dropped the AGM assumptions: our work is applicable to all logics under Tarski's model
- Generalized the AGM theory of contraction and the AGM postulates

Main Results

- Evaluation of the feasibility of applying the AGM theory in all logics under Tarski's model (AGM-compliance)
- Connection with foundational operators
- Study and development of specialized conditions and heuristics regarding the AGM-compliance of DLs and OWL
- Theoretical foundations that allow the development of more concrete approaches



- ①: Logics that can be described by an $\langle L, Cn \rangle$ pair, under Tarski's model
- ②: Logics that satisfy the AGM assumptions
- ③: Logics allowing the definition of a contraction operator satisfying the basic AGM postulates (3 characterizations)
- ④: Logics allowing the application of the AGM model in belief base (foundational) operators (2 characterizations)
- ⑤: DLs, Closed Vocabulary Assumption (CVA)
- ⑥: DLs, Open Vocabulary Assumption (OVA)
- ⑦: Web Ontology Language (OWL), all flavors

Partial List of Description Logics (area ⑥)

AGM-compliant DLs	Non-AGM-compliant DLs
<ul style="list-style-type: none"> ✓ $ALCO_{\neg, \cap, \cup}$ ✓ $ALC_{\neg, \cap, \cup}$ with no Abox ✓ $ALCO$ with no axioms involving role terms ✓ ALC with empty Abox and no axioms involving role terms ✓ All DLs with more operators than the above DLs 	<ul style="list-style-type: none"> ✓ SH, SHI, SHIN, SHOIN, SHOIN(D), SHOIN⁺, SHOIN⁺(D), SHIQ, SHIF, SHIF(D), SHIF⁺, SHIF⁺(D) ✓ FL_0, FL^- with role axioms ✓ All DLs between ALH and ALHCIOQ ✓ All flavors of OWL with annotations ✓ OWL DL, OWL Lite without annotations

More details on this work can be found at:

- [1] G. Flouris, D. Plexousakis, G. Antoniou, Evolving Ontology Evolution, to appear in SOFSEM-06.
- [2] G. Flouris, D. Plexousakis, G. Antoniou, Generalizing the AGM Postulates: Preliminary Results and Applications, NMR-04.
- [3] G. Flouris, D. Plexousakis, G. Antoniou, On Applying the AGM theory to DLs and OWL, ISWC-05.