Ontologien

Eine sehr allgemeine Einführung

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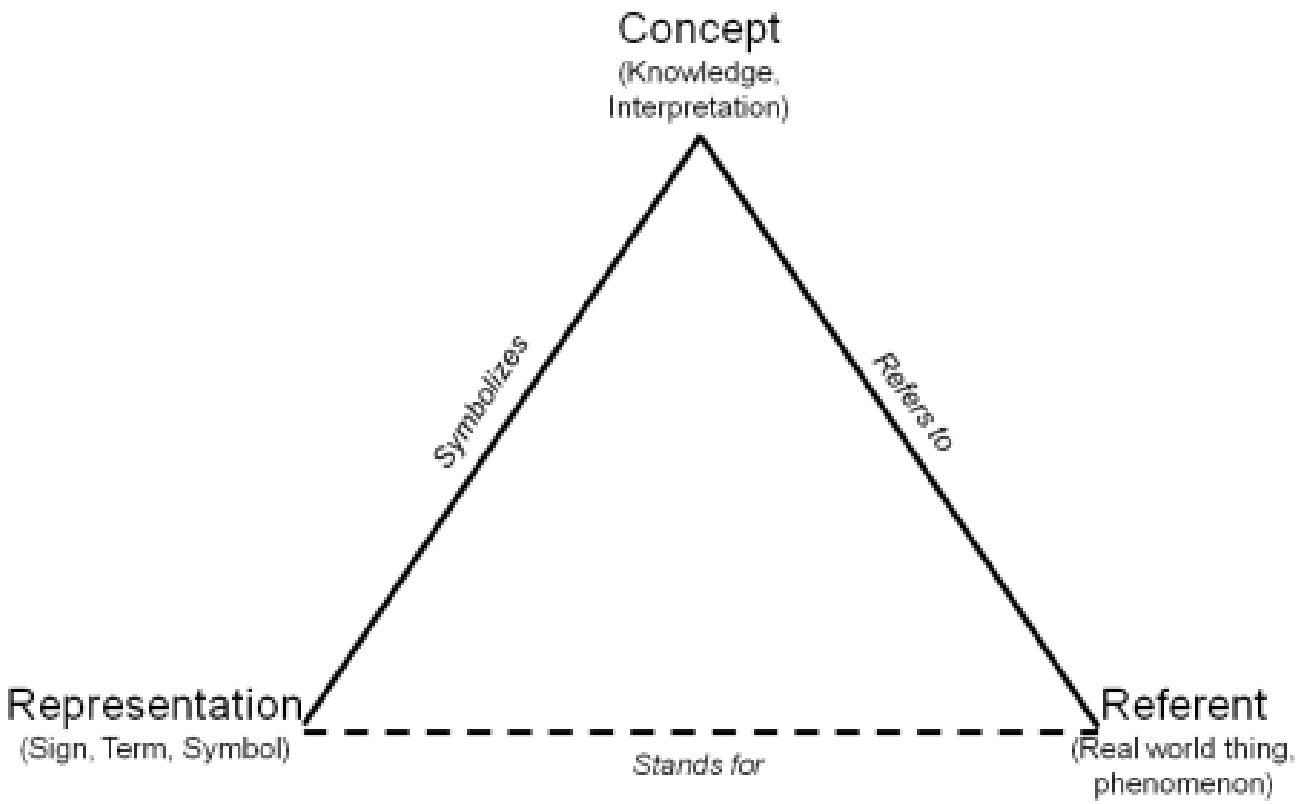
Was ist eine Ontologie? (in der Informatik)

An ontology is a formal, explicit specification of a shared conceptualization.

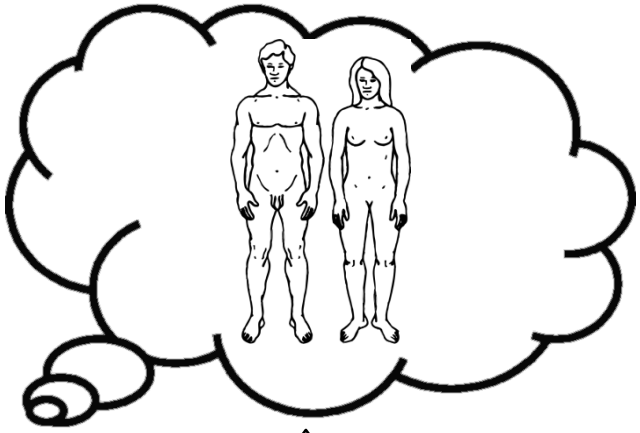
[Studer et al., 1998], Gruber

Semiotisches Dreieck



Quelle: http://activeknowledgemodeling.com/2010/12/17/enterprise-ontologies-%E2%80%93-the-holy-grail-or-the-emperor%E2%80%99s-new-clothes/

Semiotisches Dreieck



belebt, sterblich, auf zwei Beinen gehend, ungefiedert, vernunftbegabt, ...

"Mensch"

Was ist eine Ontologie? (in der Informatik)

Ontologien in der Informatik sind meist sprachlich gefasste und formal geordnete Darstellungen einer ***Menge von Begrifflichkeiten und der zwischen ihnen bestehenden Beziehungen in einem bestimmten Gegenstandsbereich****. Sie werden dazu genutzt, „Wissen" in digitalisierter und formaler Form zwischen Anwendungsprogrammen und Diensten auszutauschen. Wissen umfasst dabei sowohl Allgemeinwissen als auch Wissen über sehr spezielle Themengebiete und Vorgänge.*

Ontologien enthalten ***Inferenz- und Integritätsregeln****, also Regeln zu Schlussfolgerungen und zur Gewährleistung deren Gültigkeit.*

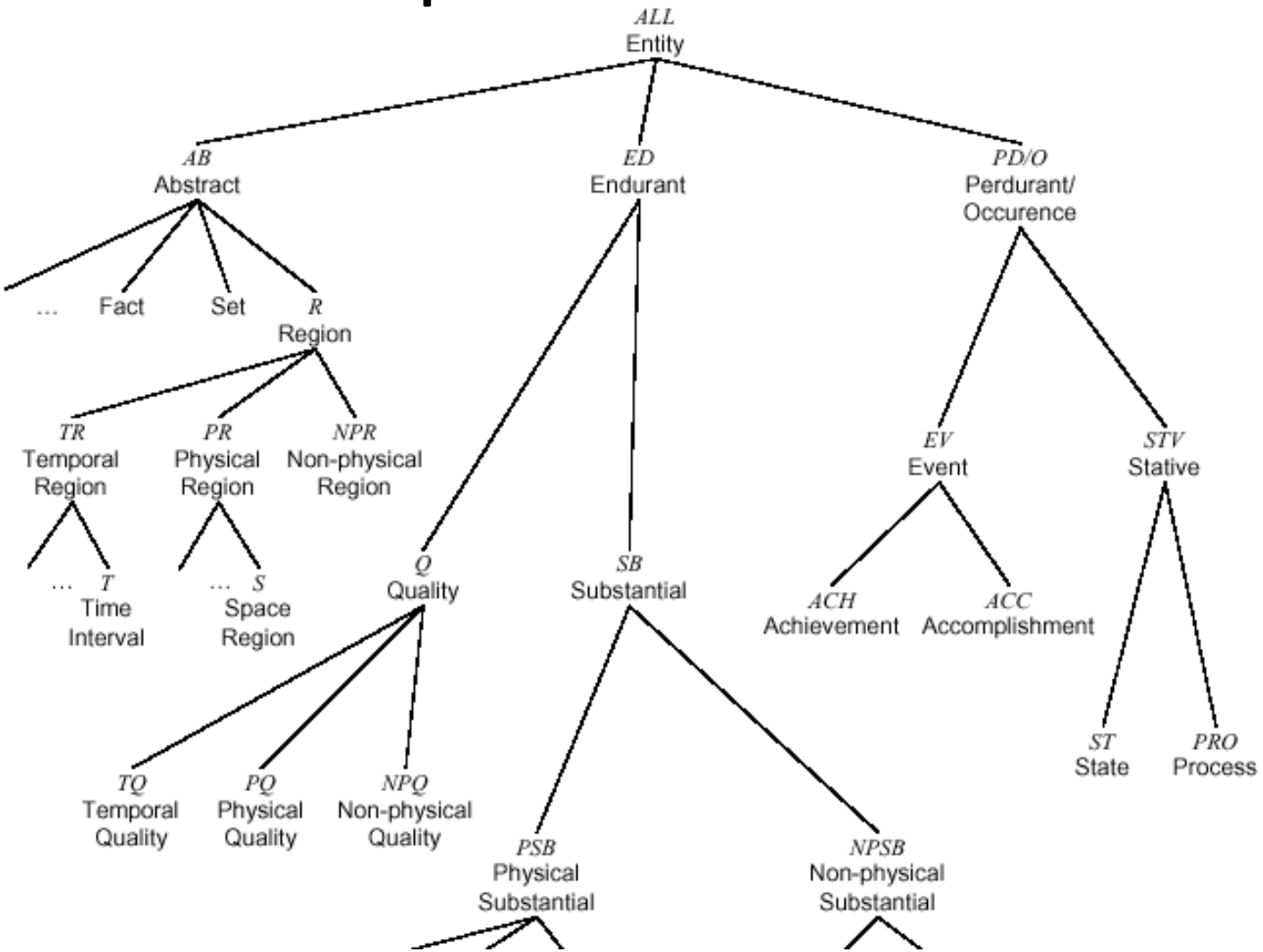
http://de.wikipedia.org/wiki/Ontologie_(Informatik)

Was ist die Ontologie in der Philosophie?

Die Ontologie ... ist eine Disziplin der **theoretischen Philosophie**. In der Ontologie geht es in einer allgemeinen Begriffsverwendung um **Grundstrukturen der Realität**. Dieser Gegenstandsbereich ist weitgehend deckungsgleich mit dem, was nach traditioneller Terminologie „allgemeine Metaphysik“ genannt wird. Dabei wird etwa **eine Systematik grundlegender Typen von Entitäten** (Gegenstände, Eigenschaften, Prozesse) und ihrer strukturellen Beziehungen diskutiert.

Upper Ontologies am Beispiel von DOLCE

Upper Ontologies sind die Schnittstellen zwischen der Ontologie (Philosophie) und der Informatik



Warum Ontologien im Web?

People can't share knowledge if they don't speak a common language."

[Tom Davenport, Lawrence Prusak: Working Knowledge]

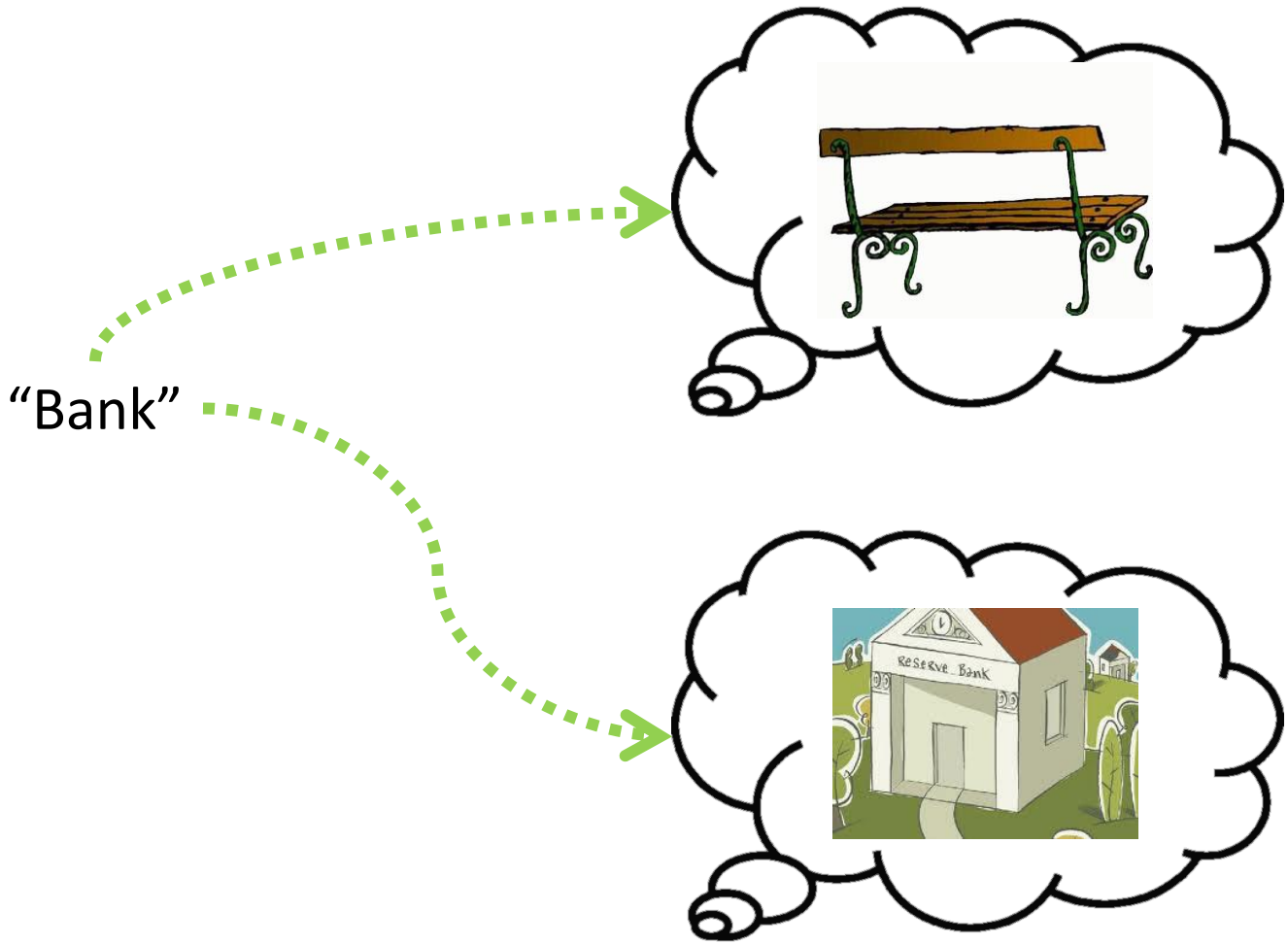
Sprache ist mehrdeutig

Synonyme: Eine Bedeutung, mehrere Wörter

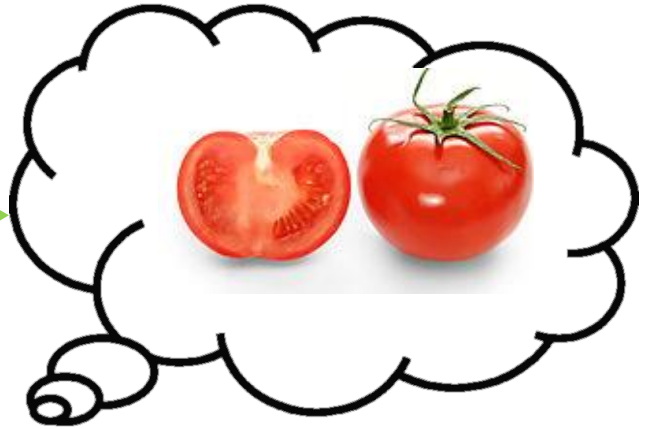
Homonyme: Ein Wort, mehrere Bedeutungen

Am Schwierigsten zu erkennen: teilweise gemeinsames Verständnis, Abweichungen im Detail

Homonyme



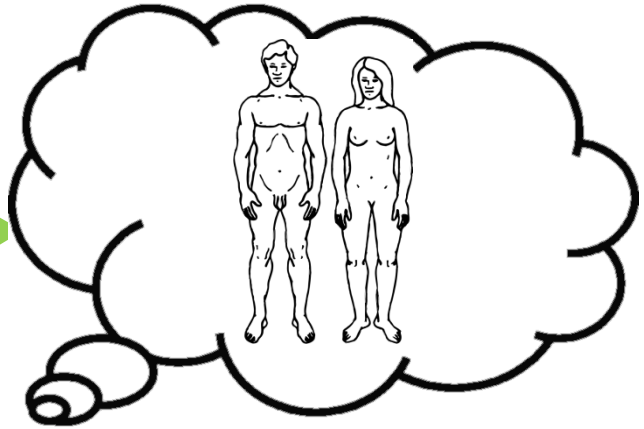
Synonyme



“Tomate”

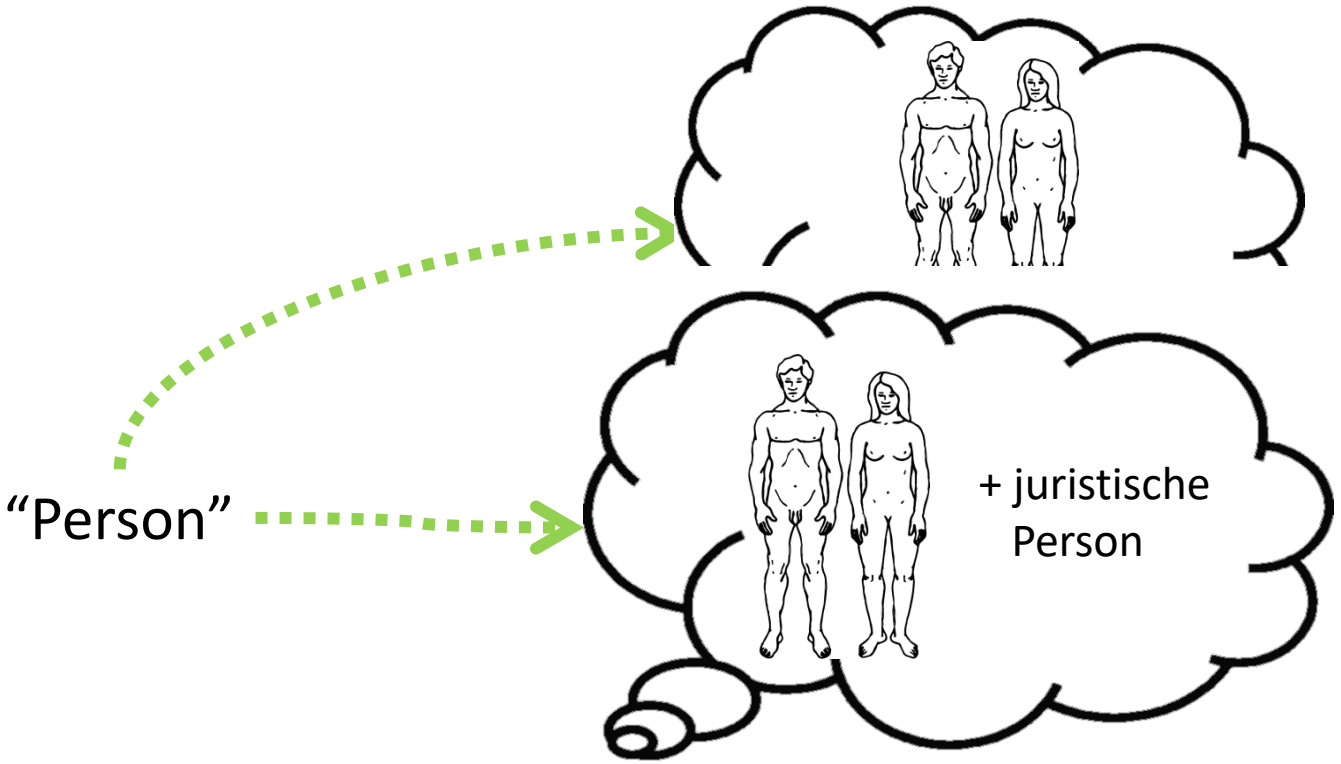
“Paradeiser”

Abweichungen in Bedeutung, überlappende Bedeutung



“Person”

Abweichungen in Bedeutung, überlappende Bedeutung



Warum Ontologien im Web?

- Grundlage für Daten- und Wissensaustausch
- Ontologien sind
  - gemeinsames Vokabular
  - Sicherstellung, dass alle das Gleiche unter den verwendeten Begriffen verstehen
- Automatisierung (Reasoning Tasks)
  - Ableiten von implizitem Wissen
  - Erkennen von Widersprüchen
  - Ermitteln von Begriffshierarchien

Ontologie-Sprachen für das Web

- RDF(S)
  - nur für einfache Vokabulare
  - nicht ausdruckstark genug
- Web Ontology Language (OWL und OWL 2)
  - basiert auf Beschreibungslogiken
  - verschiedene Dialekte
- F-Logic
  - basiert auf Regeln, Datalog/Prolog
  - großen Einfluss auf Rule Interchange Format (RIF)

Grundbausteine von Ontologien

Semantische Modellierung
(Klassen, Properties, Instanzen)

\+ Zusätzliche Einschränkungen und Regeln

\+ Begriffsdefinitionen

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OWL Reasoning Tasks

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OVERVIEW

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- These slides explain the two kinds of reasoning tasks which are to be carried out manually (in the exam), how to visualize the results, and how to check the results using Protégé
  - Subsumption Checking
    - given an ontology and a set of classes from this ontology, find the semantic relationship (subclass-of $\sqsubseteq$, superclass-of $\sqsupseteq$, equivalent-to $\equiv$, disjoint-with $\sqsubseteq\neg$, or none) for each pair of classes
  - Instance Checking
    - given an ontology and a set of individuals and a set of classes from this ontology find out for each <individual,class>-pair whether the individual is definitely a member of (+), may be a member of (?), or is definitely not a member (-) of the class

SUBSUMPTION CHECKING

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Class: **Young**

Class: **Person**

Class: **Female**

Class: **Male**
DisjointWith: Female

Class: **Woman**
EquivalentTo: Female and Person

Class: **Man**
EquivalentTo: Male and Person

Class: **YoungPerson**
EquivalentTo: Person and Young

Class: **YoungWoman**
EquivalentTo: Woman and Young

Task: Find the pairwise semantic relationships of classes Woman, Man, YoungWoman, Person, and YoungPerson.

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⊑ SubClassOf ≡ EquivalentTo ⊒ SuperClassOf ⊑¬ DisjointWith	YoungPerson	Person	YoungWoman	Man	Woman
Woman					
Man					
YoungWoman					
Person					
YoungPerson					

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Woman		⊑	⊒	⊑¬	≡
Man		⊑	⊑¬	≡	
YoungWoman	⊑	⊑	≡		
Person	⊒	≡			
YoungPerson	≡				

CHECK RESULTS IN PROTÉGÉ

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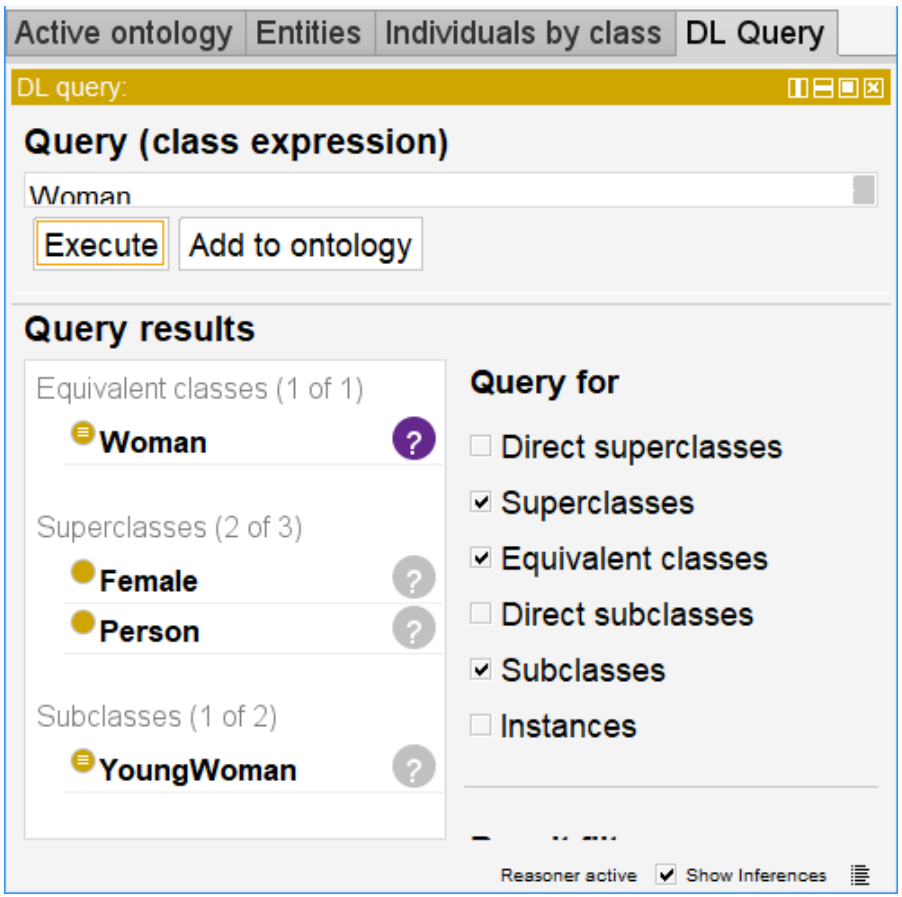

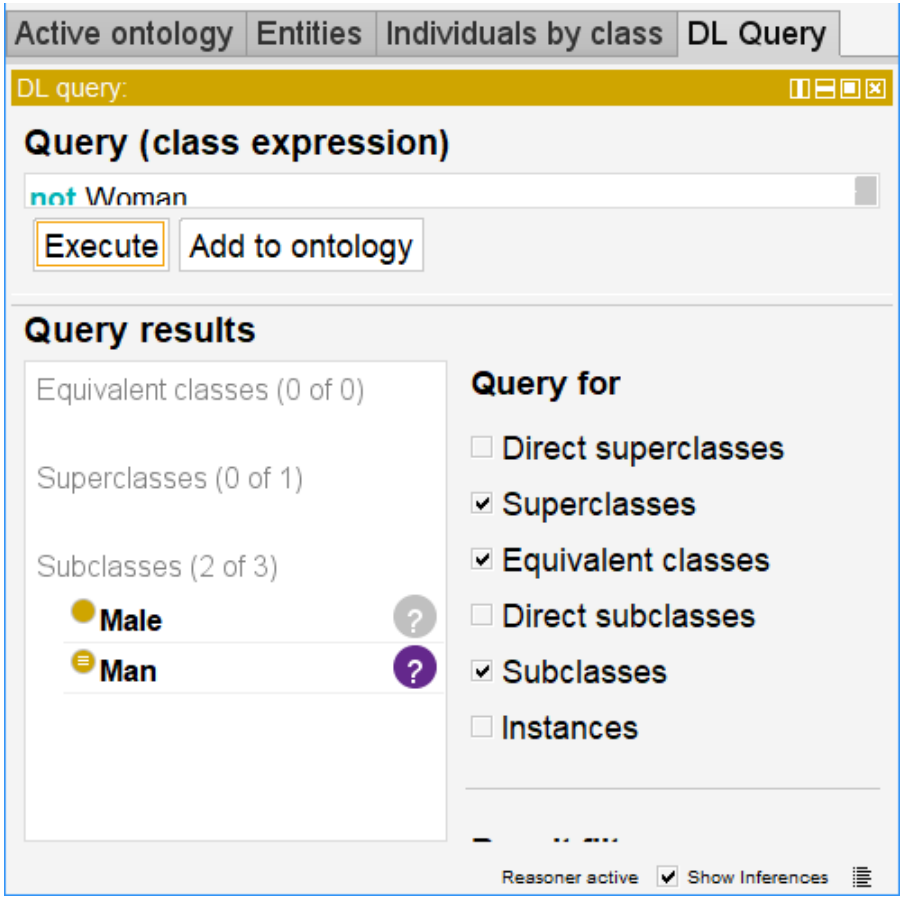

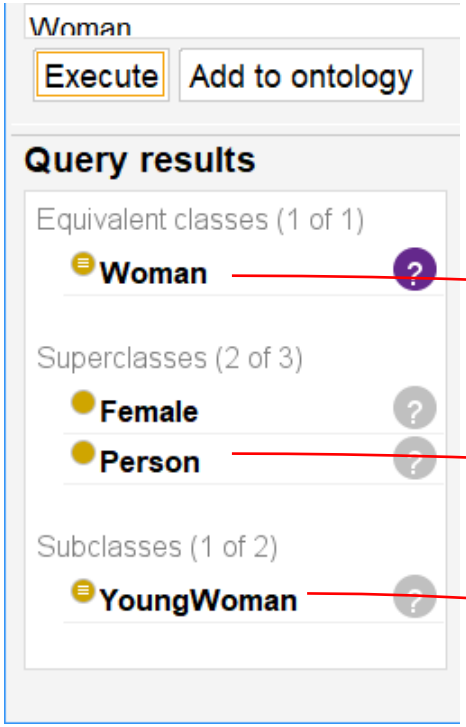

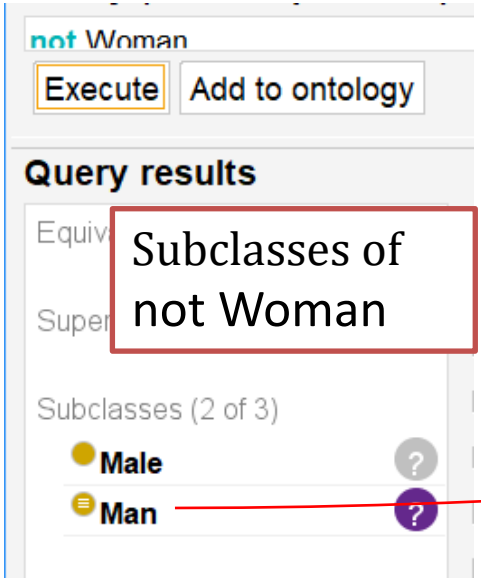

	YoungPerson	Person	YoungWoman	Man	Woman
Woman		⊑	⊒	⊑¬	≡
Man		⊑	⊑¬	≡	
YoungWoman	⊑	⊑	≡		
Person	⊒	≡			
YoungPerson	≡				

INSTANCE CHECKING

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Individual: Hermione
Types: YoungWoman

Individual: Fang
Types: Male

Individual: Harry
Types: Male, Person, Young

Task: for individuals **Harry**, **Hermione** and **Fang** and classes **YoungPerson**, **Person**, **YoungWoman**, **Man**, **Woman** find out of which class which individual is instance of, may be an instance of, or definitely is not an instance of

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\+ is instance of

– is definitely not an instance of

? may be an instance of

	YoungPerson	Person	YoungWoman	Man	Woman
Hermione					
Fang					
Harry					

INSTANCE CHECKING

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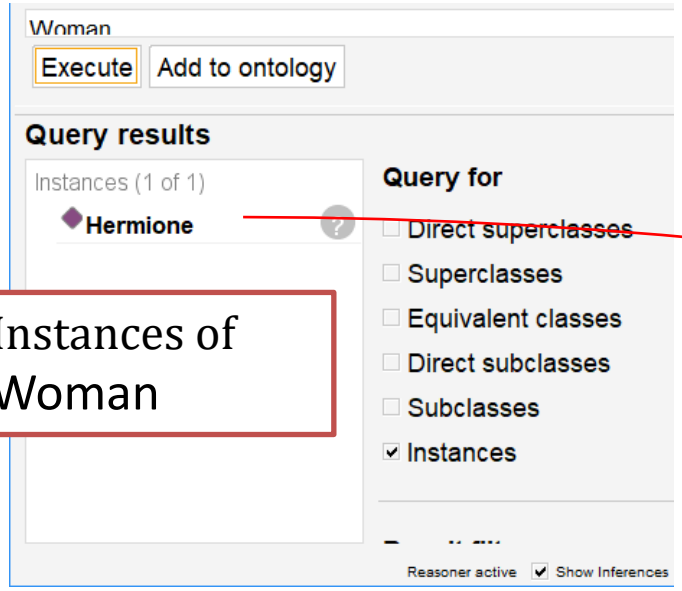
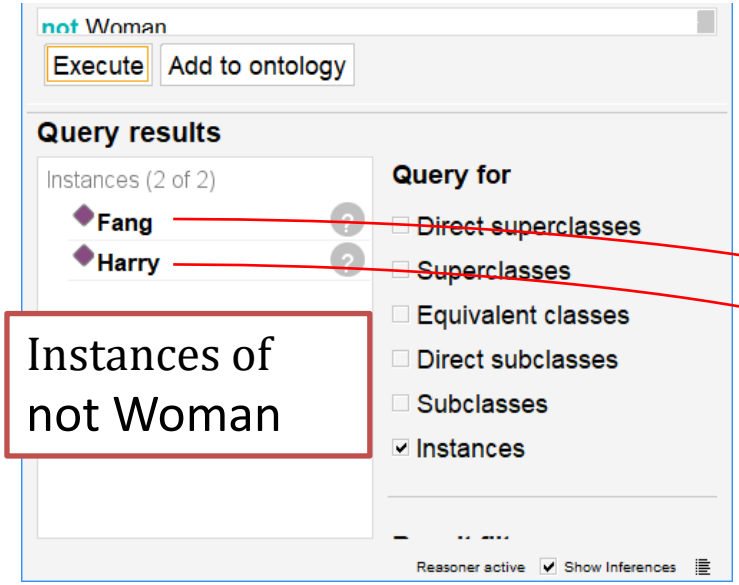
\+ is instance of
– is definitely not an instance of
? may be an instance of

	YoungPerson	Person	YoungWoman	Man	Woman
Hermione	+	+	+	–	+
Fang	?	?	–	?	–
Harry	+	+	–	+	–



Instances of Woman



Instances of not Woman

\+ is instance of

– is definitely not an instance of

? may be an instance of

	YoungPerson	Person	YoungWoman	Man	Woman
Hermione	+	+	+	–	+
Fang	?	?	–	?	–
Harry	+	+	–	+	–