EASE Ontologies

Hands-On (last minute)

What is an Ontology?

- Set of logical statements („axioms“ / „assertions“)
- Formulated in some formal ontology language
- Knowledge base for declarative memory
  - What is a X?
  - How do X and Y relate?
- Can be reasoned about
- Careful: Reasoning can be computationally expensive

Reasoning Example I

1. Every European city is a place
2. Bremen is a European city

=> Bremen is a place

Reasoning Example II

1. European citizen = human that lives in a European city
2. Bremen is a European city
3. Anna is a human
4. Anna lives in Bremen

=> Anna is a European citizen

Reasoning Example III

1. Every European citizen is European or has a visa
2. Every European is a Human
3. VisaOwner = has a visa
4. Every VisaOwner is a Human

=> Every European citizen is a Human

Reasoning Example IV

1. Every European citizen is European or has a visa
2. Danny is a European citizen
3. Danny is not European and does not have a visa

=> **Error!**

OWL

- Web Ontology Language
- W3C Standard to define Ontologies
- Standard for most formal ontologies

- TBox – Knowledge about classes of things (*classes*)
- RBox – Knowledge about their relations (*object properties*)
- ABox – Knowledge about class instances (*individuals*)

OWL Axioms

TBox – Knowledge about classes of things („classes“)
RBox – Knowledge about their relations („object properties“)
ABox – Knowledge about class instances („individuals“)

Box	Assertion Name	Semantic	Example
TBox	SubClass Of	Every C is a D	Every Dog is an Animal
TBox	Equivalent To	Every C is a D and vice-versa	Every Town is a City and vice-versa
ABox	Type	a is a C	OlafScholz is a Chancellor
ABox	Object property	r(a,b)	Donald loves Daisy
RBox	SubPropertyOf (Chain)	r(x,y) and s(y,z), then t(x,z)	momOf(x,y) & sisterOf(y,z) => auntOf(x,z)
…	…	…	…

Let´s replace simple classes (C,D) by more complex ones!

Syntax (in Protégé)	Semantic	Example
C and D	Objects with both the class C and D	Flower and Red
Not(C)	Objects that are not of class C	not(Human)
C or D	Objects with any of the classes C and D	Dog or Cat
r some C	Objects that are related to some object of class C via r	loves some Human
…	…	…

We can even nest these for complex assertions, e.g.:

Looser = human and not(hasWon some Price)

Reasoning Example V

Syntax (in Protégé)	Example
C and D	Flower and Red
Not(C)	not(Human)
C or D	Dog or Cat
r some C	loves some Human

1. Every child loves chocolate
2. Cool child = loves chocolate and spinach
3. Mom`s Blattspinat is a Spinach
4. Tim is a child and loves Mom`s Blattspinat

=> Tim is a Cool Child

Box	Assertion Name	Semantic	Example
TBox	SubClass Of	Every C is a D	Every Dog is an Animal
TBox	Equivalent To	Every C is a D & vice-versa	Every Town is a City and vice-versa
ABox	Type	a is a C	OlafScholz is a Chancellor
ABox	Object property	r(a,b)	Donald loves Daisy
RBox	SubPropertyOf	r(x,y) and s(y,z), then t(x,z)	momOf(x,y) & sisterOf(y,z) => auntOf(x,z)

Reasoning Example VI

Syntax (in Protégé)	Example
C and D	Flower and Red
Not(C)	not(Human)
C or D	Dog or Cat
r some C	loves some Human

1. Errol lives in Mexico City
2. Mexico City is the capital of Mexico
3. Whoever lives in a capital of a country is a citizen of that

=> Errol is a citizen of Mexico

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TBox	SubClass Of	Every C is a D	Every Dog is an Animal
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ABox	Type	a is a C	OlafScholz is a Chancellor
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RBox	SubPropertyOf	r(x,y) and s(y,z), then t(x,z)	momOf(x,y) & sisterOf(y,z) => auntOf(x,z)

Your turn!

Go through the reasoning examples I-IV and replicate them in Protégé.

- Download: https://protege.stanford.edu/

- You already know everything about OWL & Protégé?
  - Visit https://github.com/ease-crc/soma
  - Clone or Download as Zip
  - Open owl/SOMA-ALL.owl in Protege

SOMA

- **SO**cio-physical **M**odel of **A**ctivities
- Main Ontology of EASE
- Common vocabulary for all components
- Declarative Memory of Knowrob (minus dynamic ABox)
- Vocabulary of Episodic Memory (NEEMs)

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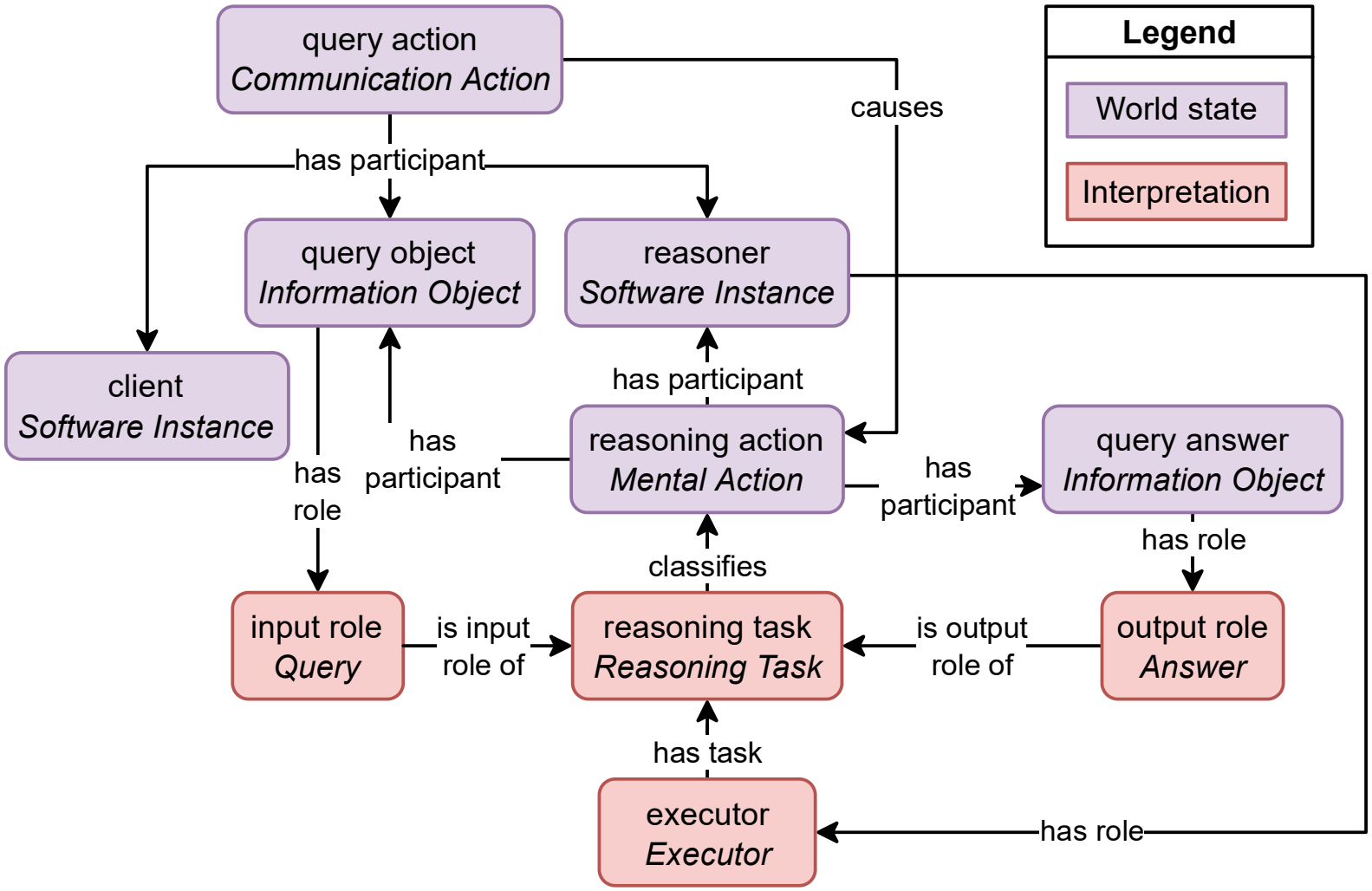
SOMA

Seperates physical events with the interpretation thereof



Explore SOMA a bit

IN PROTÉGÉ, SEARCH FOR TASK AND VISIT THE *TAXONOMY*

WHAT MENTAL TASKS ARE THERE?

DO YOU UNDERSTAND THE COMMENTS?