Sistemas Baseados em Conhecimento
Aula 23

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2017

Exemplos de inferências

Fonte:
Sean Bechofer, University of Manchester
http://mowl-power.cs.man.ac.uk/2009/07/sssw/

Ontologia de Pets

```
ObjectProperty: hasPet
    Range: Animal
    Inverse: isPetOf

Class: Person

Class: Animal

Class: Cat
    SubClassOf: Animal

Class: Dog
    SubClassOf: Animal
```

Cats I

```
Class: PetOwner
    SubClassOf: Person
      that hasPet some Cat
```

1. How many Cats does a PetOwner have?
2. Can a PetOwner have pets which are not Cats?
3. Is owning a Cat enough to recognise a person as a PetOwner?
4. How many Dogs does a PetOwner have?

Cats I

```
Class: PetOwner
    SubClassOf: Person
      that hasPet some Cat
```

1. How many Cats does a PetOwner have? Pelo menos 1
2. Can a PetOwner have pets which are not Cats?
3. Is owning a Cat enough to recognise a person as a PetOwner?
4. How many Dogs does a PetOwner have?

Cats I

```
Class: PetOwner
    SubClassOf: Person
      that hasPet some Cat
```

1. How many Cats does a PetOwner have? Pelo menos 1
2. Can a PetOwner have pets which are not Cats? Não sabemos
3. Is owning a Cat enough to recognise a person as a PetOwner?
4. How many Dogs does a PetOwner have?

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Class: PetOwner
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      that hasPet some Cat
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1. How many Cats does a PetOwner have? Pelo menos 1
2. Can a PetOwner have pets which are not Cats? Não sabemos
3. Is owning a Cat enough to recognise a person as a PetOwner? Não! (subclasse)
4. How many Dogs does a PetOwner have?

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Class: PetOwner
    SubClassOf: Person
      that hasPet some Cat
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1. How many Cats does a PetOwner have? Pelo menos 1
2. Can a PetOwner have pets which are not Cats? Não sabemos
3. Is owning a Cat enough to recognise a person as a PetOwner? Não! (subclasse)
4. How many Dogs does a PetOwner have? Não sabemos

Cats II

```
Class: PetOwner
     EquivalentTo: Person
      that hasPet some Cat
```

1. How many Cats does a PetOwner have?
2. Can a PetOwner have pets which are not Cats?
3. Is owning a Cat enough to recognise a person as a PetOwner?
4. How many Dogs does a PetOwner have?

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```
Class: PetOwner
     EquivalentTo: Person
      that hasPet some Cat
```

1. How many Cats does a PetOwner have? Pelo menos 1
2. Can a PetOwner have pets which are not Cats?
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Class: PetOwner
     EquivalentTo: Person
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1. How many Cats does a PetOwner have? Pelo menos 1
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Class: PetOwner
     EquivalentTo: Person
      that hasPet some Cat
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1. How many Cats does a PetOwner have? Pelo menos 1
2. Can a PetOwner have pets which are not Cats? Não sabemos
3. Is owning a Cat enough to recognise a person as a PetOwner? Sim! (equivalência)
4. How many Dogs does a PetOwner have?

Cats II

```
Class: PetOwner
     EquivalentTo: Person
      that hasPet some Cat
```

1. How many Cats does a PetOwner have? Pelo menos 1
2. Can a PetOwner have pets which are not Cats? Não sabemos
3. Is owning a Cat enough to recognise a person as a PetOwner? Sim! (equivalência)
4. How many Dogs does a PetOwner have? Não sabemos

Fleas I

```
ObjectProperty : hasPet
    Characteristics: transitive

Class: Flea
    SubClassOf: Animal

Class: PetOwner
    SubClassOf: Person
        that hasPet some (Cat that hasPet some Flea)
```

1. How many Cats does a PetOwner have as pets?
2. What animals does a Cat have as pets?
3. What animals does a PetOwner have as pets?

Fleas I

```
ObjectProperty : hasPet
    Characteristics: transitive

Class: Flea
    SubClassOf: Animal

Class: PetOwner
    SubClassOf: Person
        that hasPet some (Cat that hasPet some Flea)
```

1. How many Cats does a PetOwner have as pets? Pelo menos 1
2. What animals does a Cat have as pets?
3. What animals does a PetOwner have as pets?

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ObjectProperty : hasPet
    Characteristics: transitive

Class: Flea
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Class: PetOwner
    SubClassOf: Person
        that hasPet some (Cat that hasPet some Flea)
```

1. How many Cats does a PetOwner have as pets? Pelo menos 1
2. What animals does a Cat have as pets? Não sabemos
3. What animals does a PetOwner have as pets?

Fleas I

```
ObjectProperty : hasPet
    Characteristics: transitive

Class: Flea
    SubClassOf: Animal

Class: PetOwner
    SubClassOf: Person
        that hasPet some (Cat that hasPet some Flea)
```

1. How many Cats does a PetOwner have as pets? Pelo menos 1
2. What animals does a Cat have as pets? Não sabemos
3. What animals does a PetOwner have as pets? Pelo menos 2 (transitividade)

Fleas I

```
ObjectProperty : hasPet
    Characteristics: transitive

Class: Flea
    SubClassOf: Animal

Class: PetOwner
    SubClassOf: Person
        that hasPet some (Cat that hasPet some Flea)
```

4. What happens if I add the restriction hasPet only Cat to the description of PetOwner?

5. Does every Cat that's a pet have a Flea as a pet?

Fleas I

```
ObjectProperty : hasPet
    Characteristics: transitive

Class: Flea
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Class: PetOwner
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        that hasPet some (Cat that hasPet some Flea)
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4. What happens if I add the restriction hasPet only Cat to the description of PetOwner? Nada - porque???

5. Does every Cat that's a pet have a Flea as a pet?

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ObjectProperty : hasPet
    Characteristics: transitive

Class: Flea
    SubClassOf: Animal

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        that hasPet some (Cat that hasPet some Flea)
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4. What happens if I add the restriction hasPet only Cat to the description of PetOwner? Nada - porque??? Falta dizer que Cats e Fleas são disjuntos!
5. Does every Cat that's a pet have a Flea as a pet?

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ObjectProperty : hasPet
    Characteristics: transitive

Class: Flea
    SubClassOf: Animal

Class: PetOwner
    SubClassOf: Person
        that hasPet some (Cat that hasPet some Flea)
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4. What happens if I add the restriction hasPet only Cat to the description of PetOwner? Nada - porque??? Falta dizer que Cats e Fleas são disjuntos!
5. Does every Cat that's a pet have a Flea as a pet? Não!

Fleas I

```
ObjectProperty : hasPet
    Characteristics: transitive

Class: Flea
    SubClassOf: Animal

Class: PetOwner
    SubClassOf: Person
        that hasPet some (Cat that hasPet some Flea)
```

4. What happens if I add the restriction hasPet only Cat to the description of PetOwner? Nada - porque??? Falta dizer que Cats e Fleas são disjuntos!
5. Does every Cat that's a pet have a Flea as a pet? Não! Um dos gatos do PetOwner tem pulga...

Grumpy

```
ObjectProperty: likes
    Characteristics:
        Reflexive

Class: Misanthrope
    EquivalentTo:
        Person
        and (likes only (not (Person)))
```

What do we know about the class Misanthrope, and why?

Grumpy

```
ObjectProperty: likes
    Characteristics:
        Reflexive

Class: Misanthrope
    EquivalentTo:
        Person
        and (likes only (not (Person)))
```

What do we know about the class Misanthrope, and why?

Insatisfatível

SPARQL

SPARQL **P**rotocol **a**nd **R**DF **Q**uery **L**anguage

- Consultas em **RDF**.

SPARQL

SPARQL **P**rotocol **a**nd **R**DF **Q**uery **L**anguage

- Consultas em **RDF**.
- Não faz inferências.

SPARQL

SPARQL **P**rotocol **a**nd **R**DF **Q**uery **L**anguage

- Consultas em **RDF**.
- Não faz inferências.
- Sintaxe Turtle.

Ontologia de Pets

```
ObjectProperty: hasPet
    Range: Animal
    Inverse: isPetOf

Class: Person

Class: Animal

Class: Cat
    SubClassOf: Animal

Class: Dog
    SubClassOf: Animal
```

Ontologia de Pets

```
ObjectProperty: hasPet
    Range: Animal
    Inverse: isPetOf

Class: Person
```

Quais são as subclasses de Animal?

```
Class: Animal

Class: Cat
    SubClassOf: Animal

Class: Dog
    SubClassOf: Animal
```

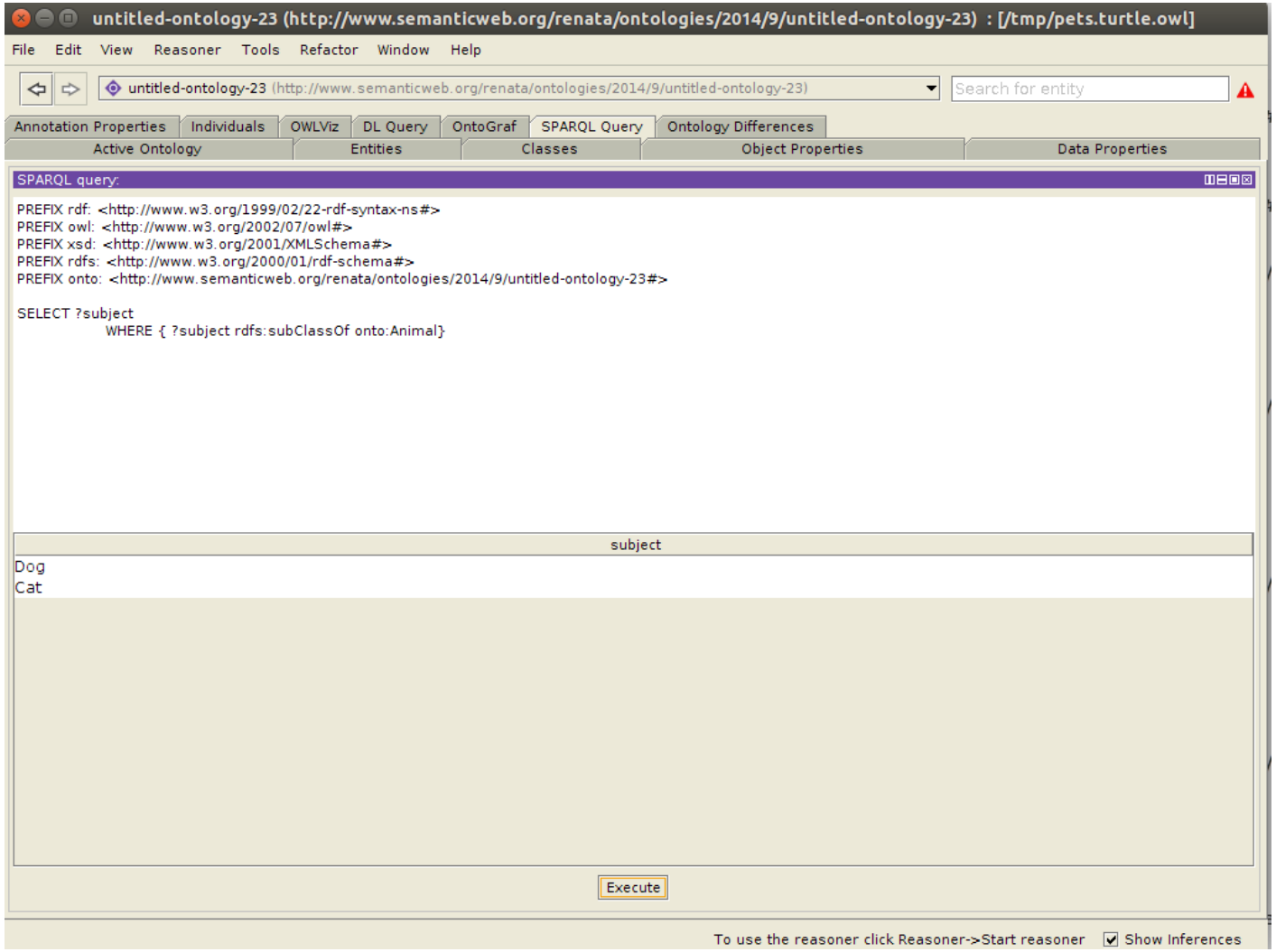
Ontologia de Pets

```
ObjectProperty: hasPet
    Range: Animal
    Inverse: isPetOf

Class: Person

Class: Animal

Class: Cat
    SubClassOf: Animal

Class: Dog
    SubClassOf: Animal
```

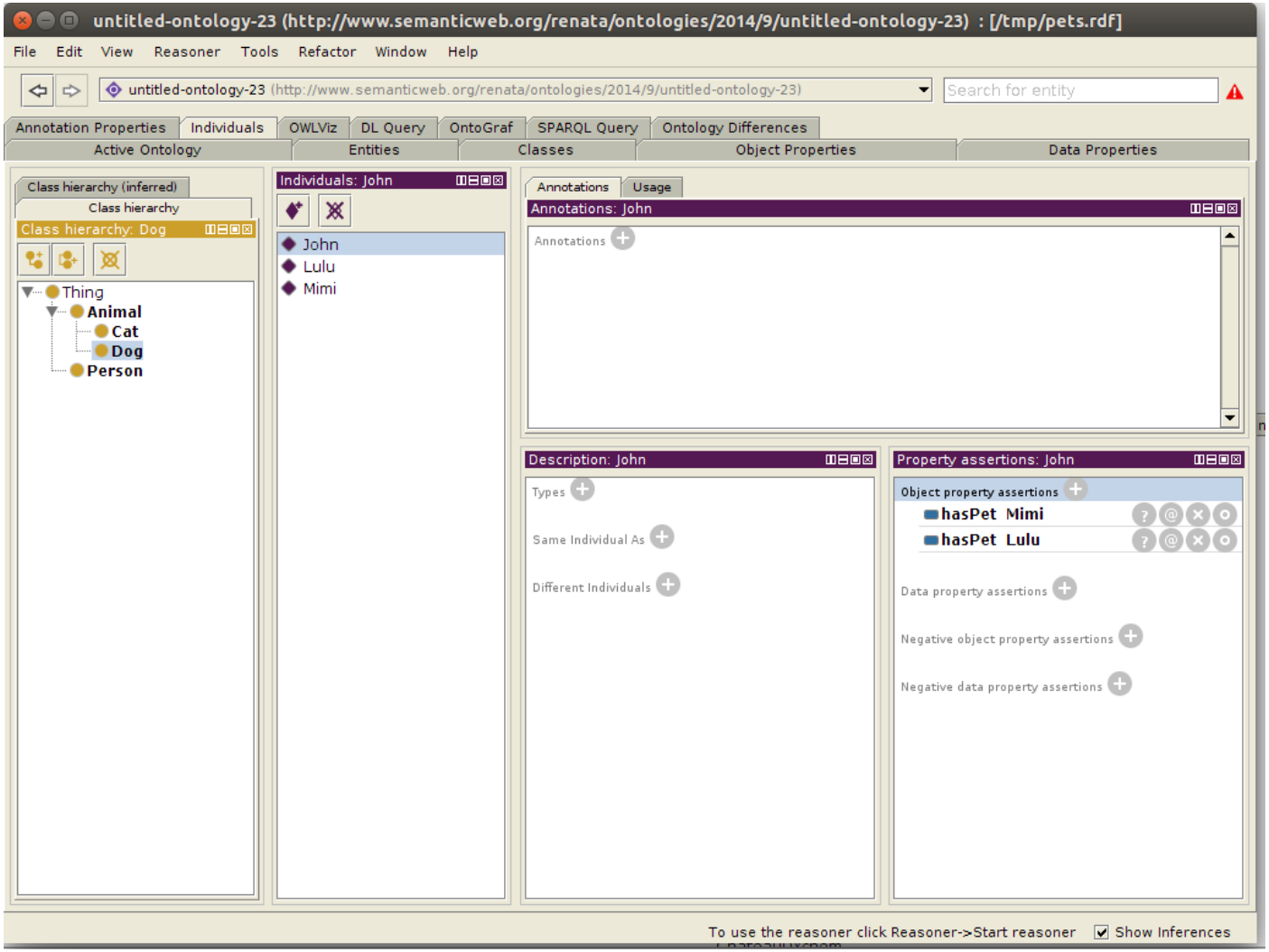
Quais são as subclasses de Animal?

```
SELECT ?subject
  WHERE {?subject rdfs:subClassOf onto:Animal}
```

Consulta no Protégé



Ontologia de Pets - ABox



Ontologia de Pets - ABox

```
Individual: Mimi
      type: Cat

Individual: Lulu
      type: Dog

Individual: John
      type: Person
      hasPet: Mimi
      hasPet: Lulu
```

Ontologia de Pets - ABox

```
Individual: Mimi
      type: Cat

Individual: Lulu
      type: Dog

Individual: John
      type: Person
      hasPet: Mimi
      hasPet: Lulu
```

Que animais John tem?

Ontologia de Pets - ABox

```
Individual: Mimi
      type: Cat

Individual: Lulu
      type: Dog

Individual: John
      type: Person
      hasPet: Mimi
      hasPet: Lulu
```

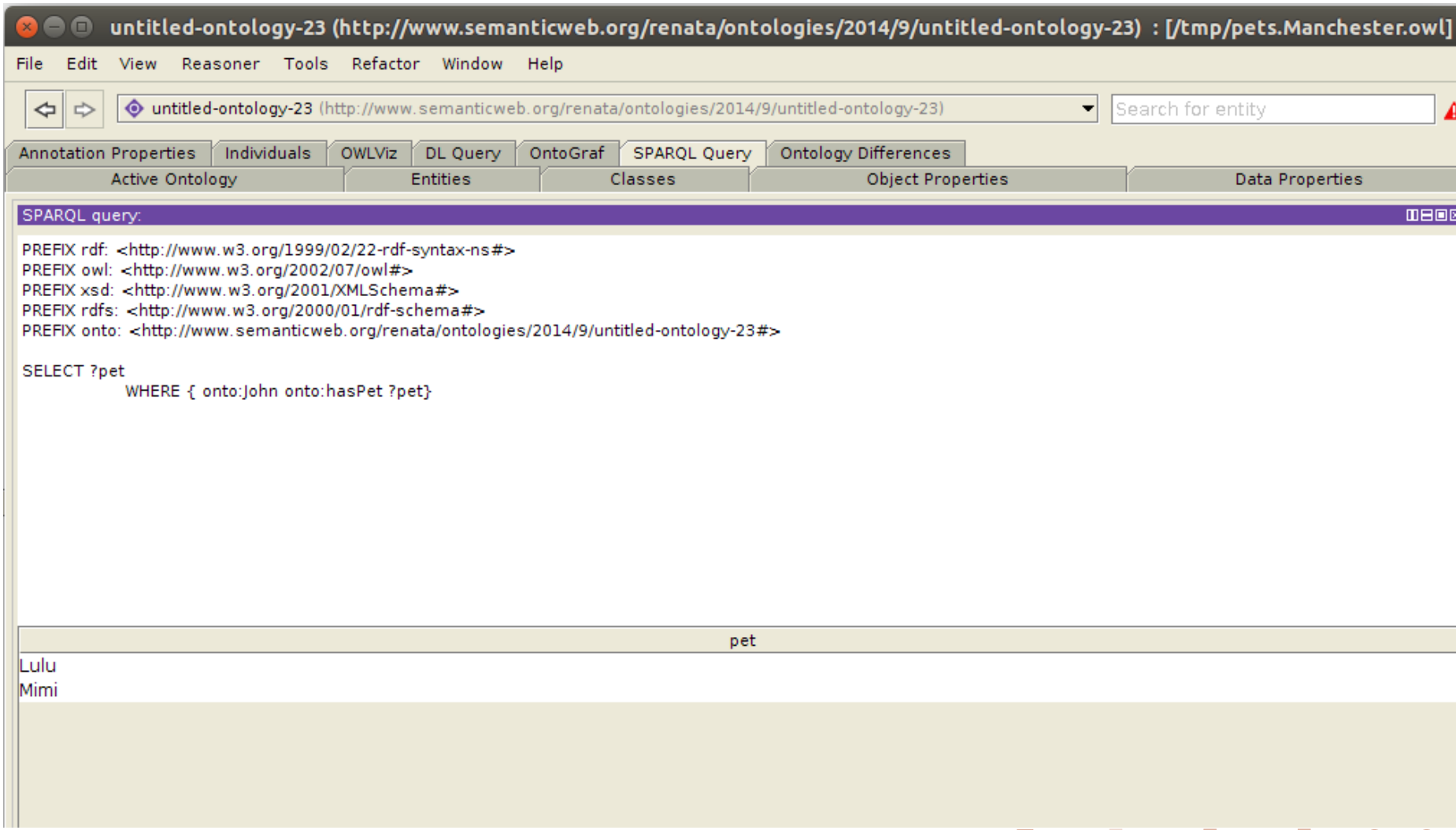
Que animais John tem?

```
SELECT ?pet
 WHERE {onto:John  onto:hasPet ?pet}
```

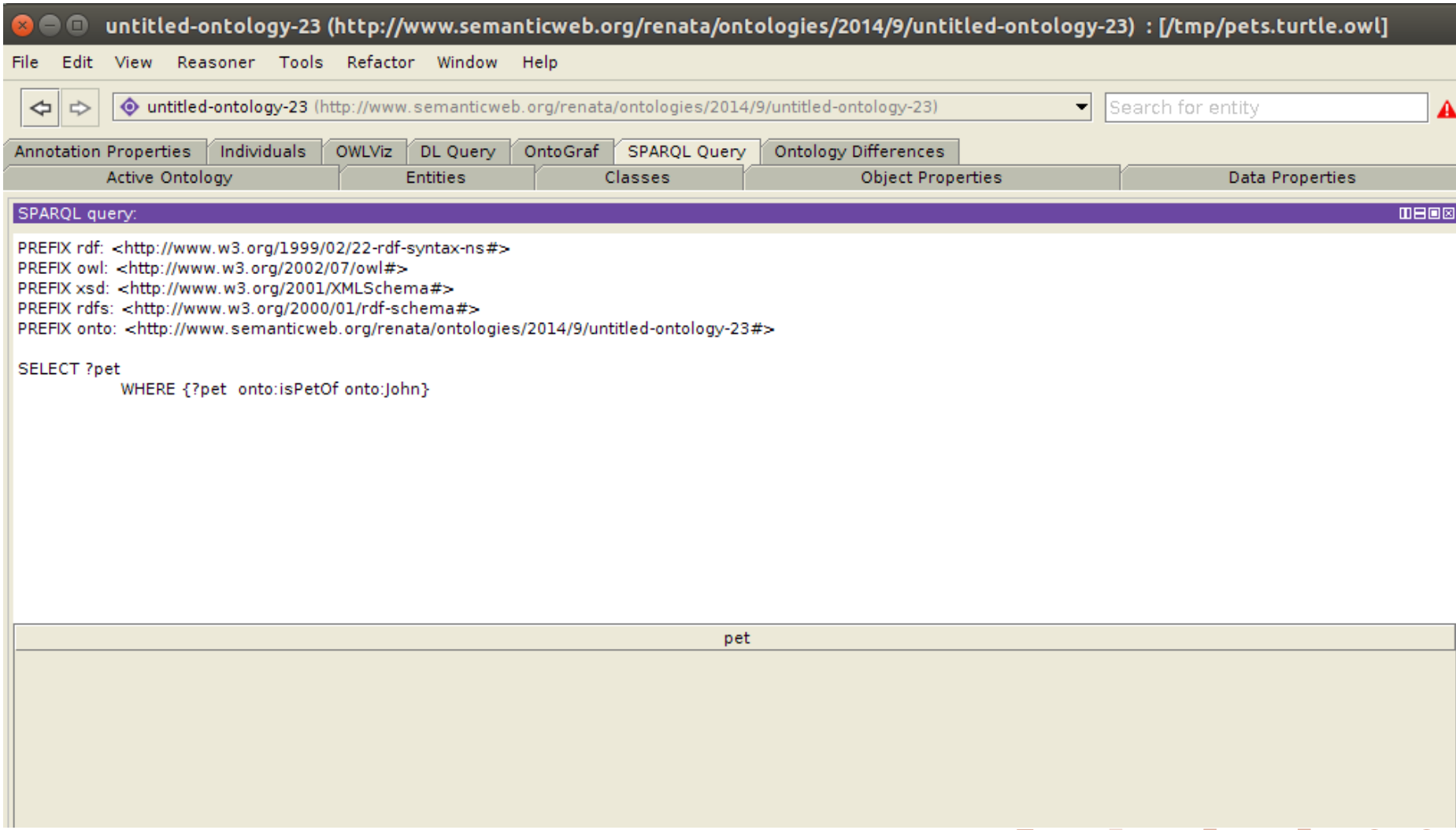
ou

```
SELECT ?pet
 WHERE {?pet  onto:isPetOf onto:John}
```

John hasPets...



But who isPetOf John?



SPARQL não faz inferências!!!

- Ligar o mecânismo de inferência (Reasoner) no Protégé.

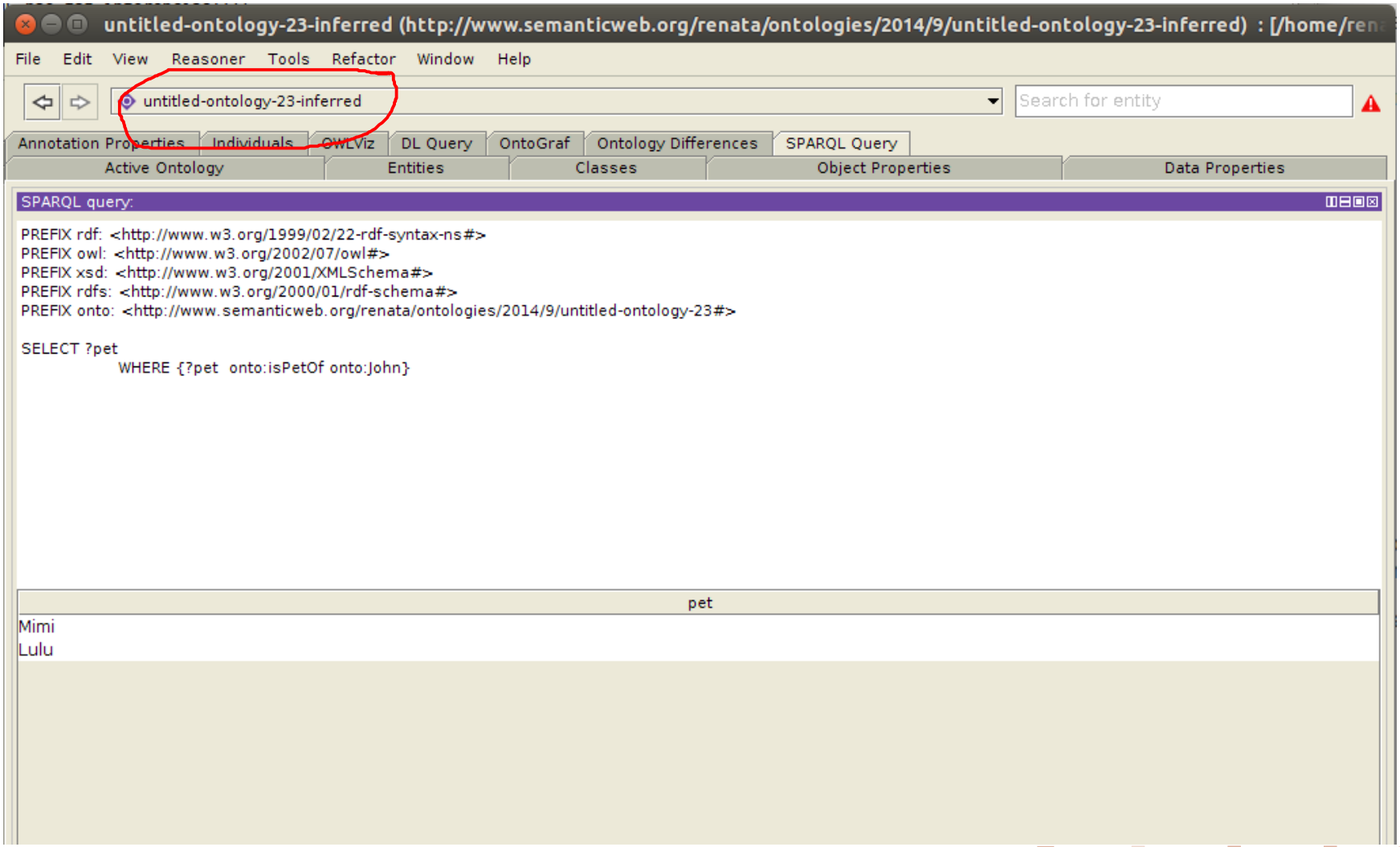
SPARQL não faz inferências!!!

- Ligar o mecânismo de inferência (Reasoner) no Protégé.
- Exportar ontologia inferida: escolher exportar todos os axiomas, incluindo os originais (asserted)

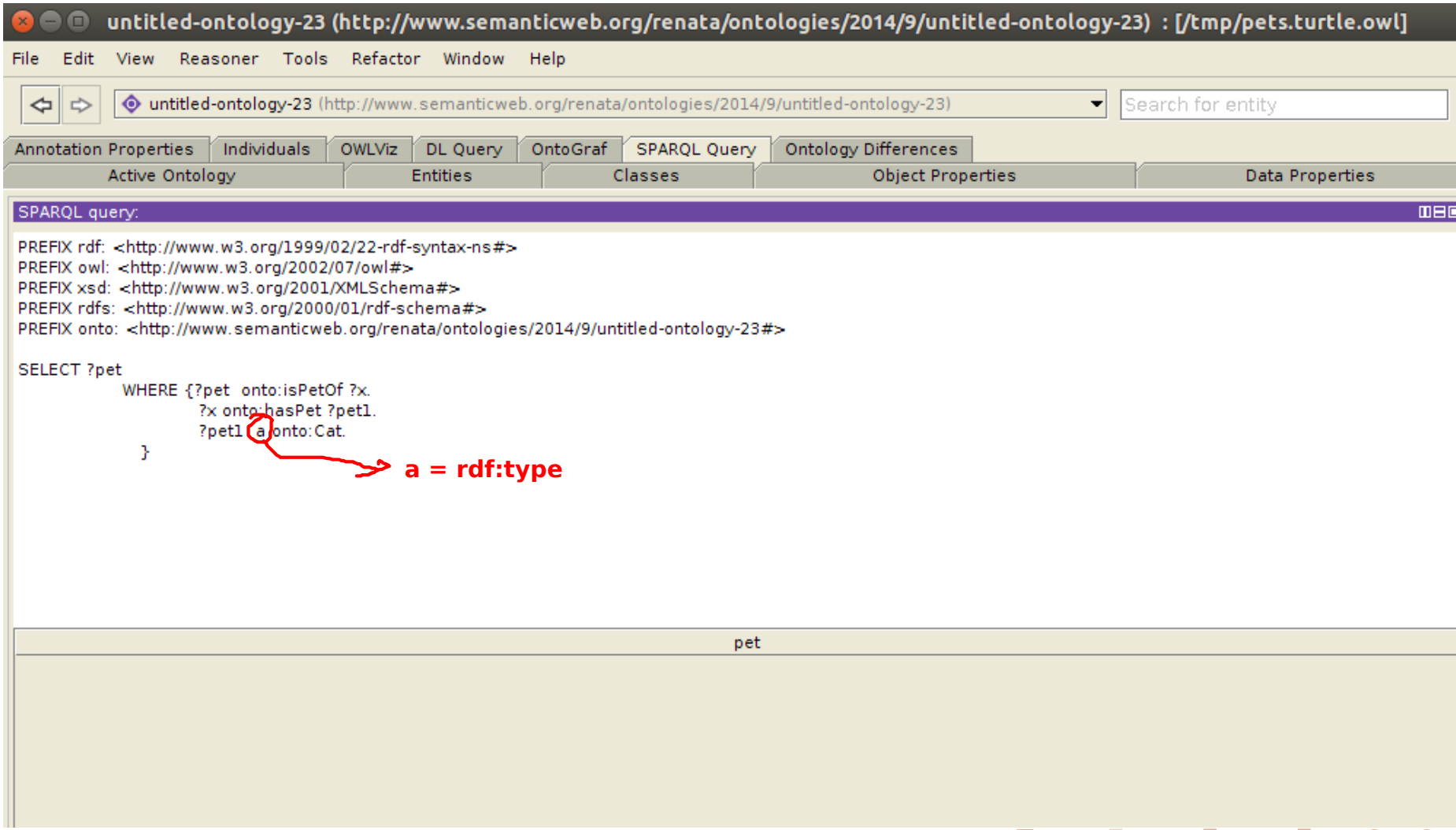
SPARQL não faz inferências!!!

- Ligar o mecânismo de inferência (Reasoner) no Protégé.
- Exportar ontologia inferida: escolher exportar todos os axiomas, incluindo os originais (asserted)
- Usar a nova ontologia para fazer as consultas.

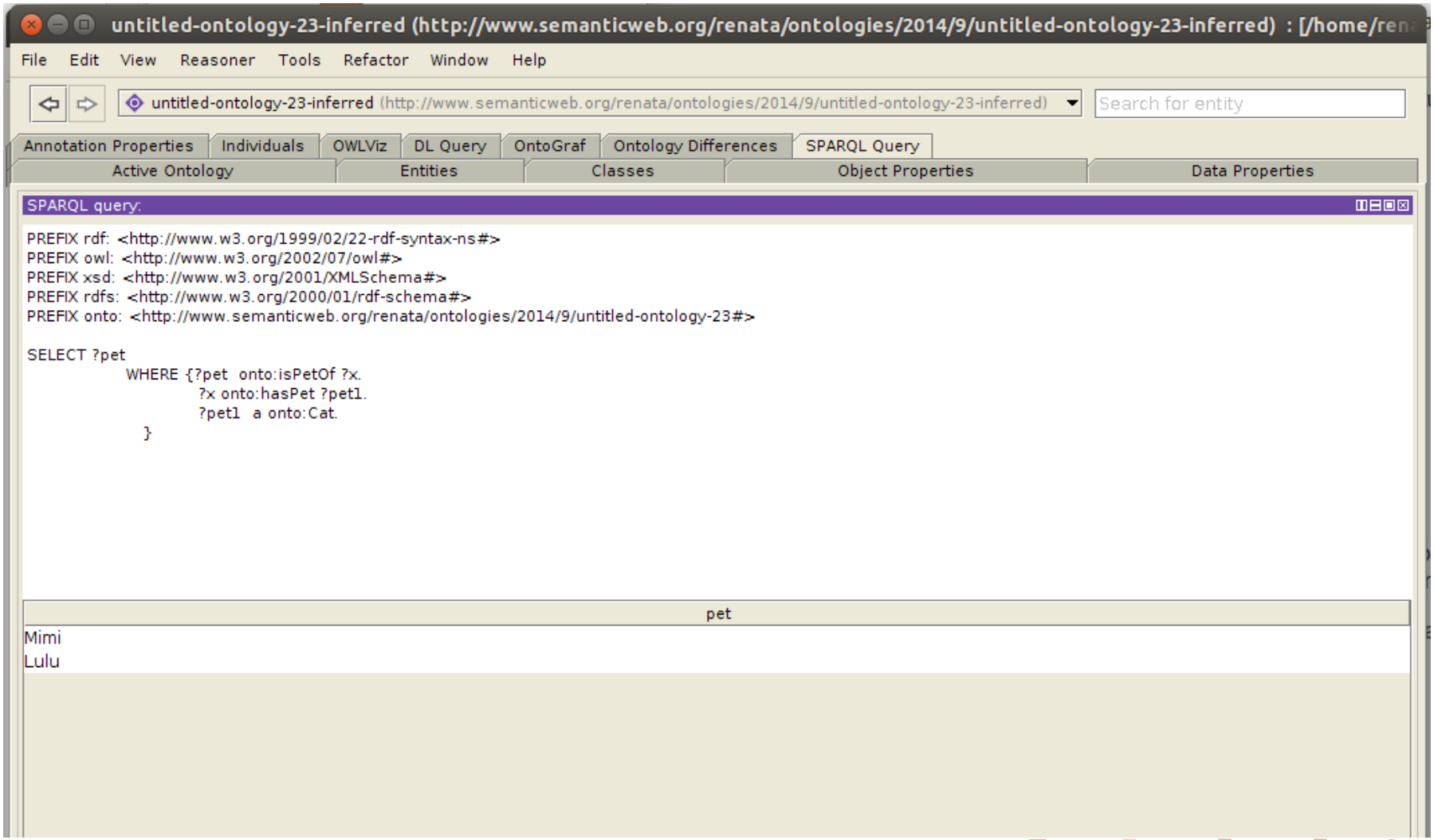
Mimi e Lulu arePetsOf John



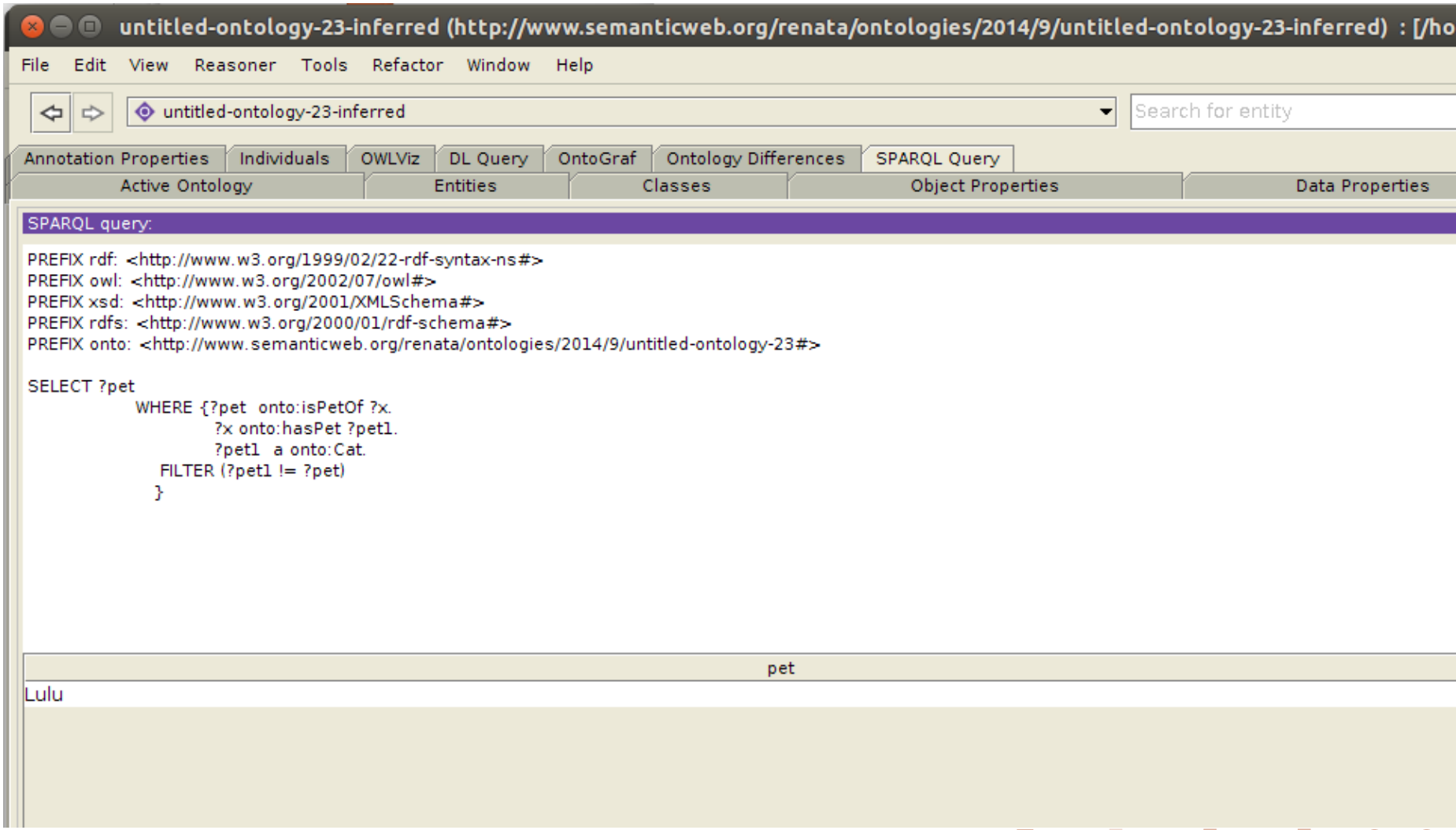
Consultas Compostas



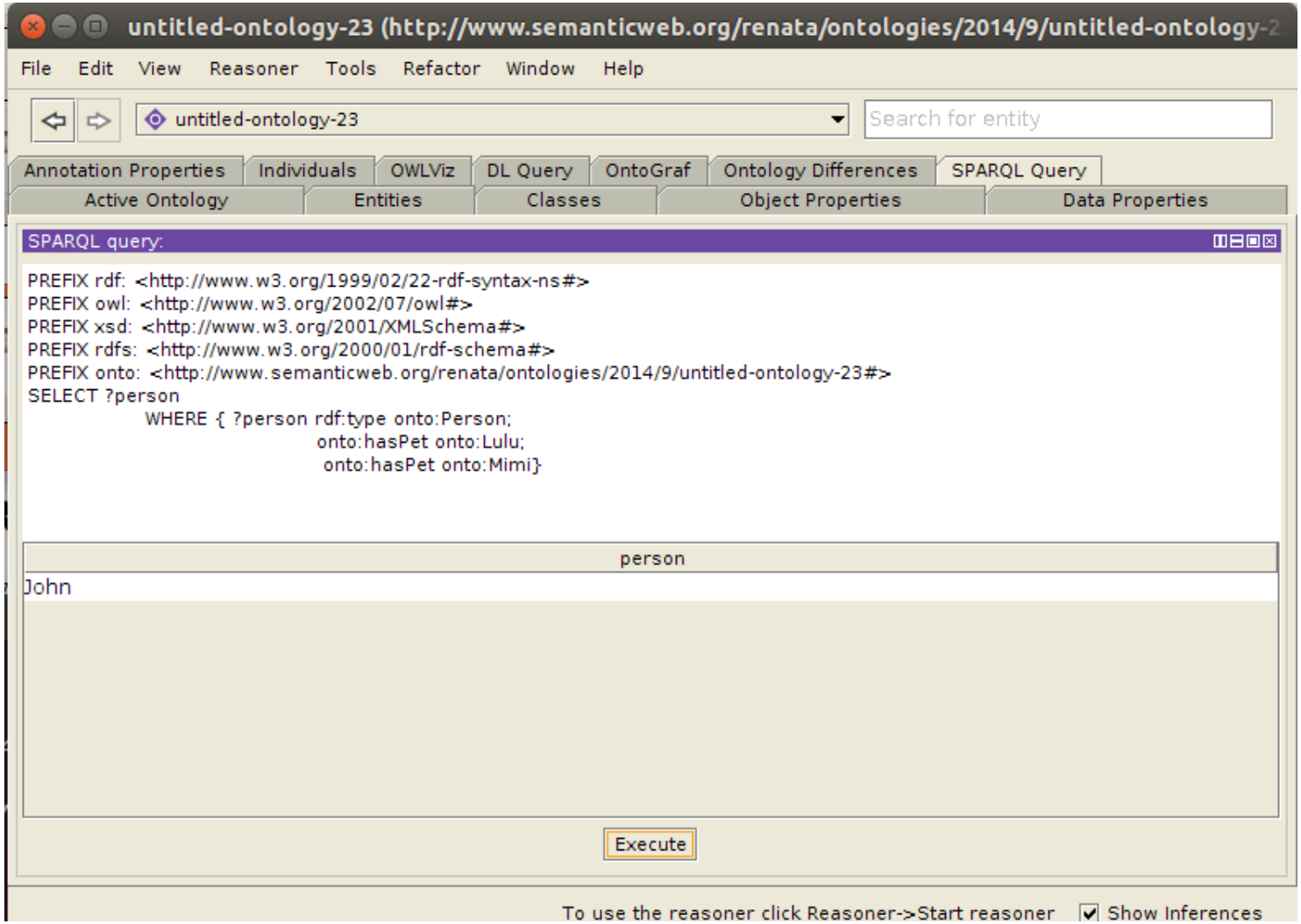
Consultas Compostas



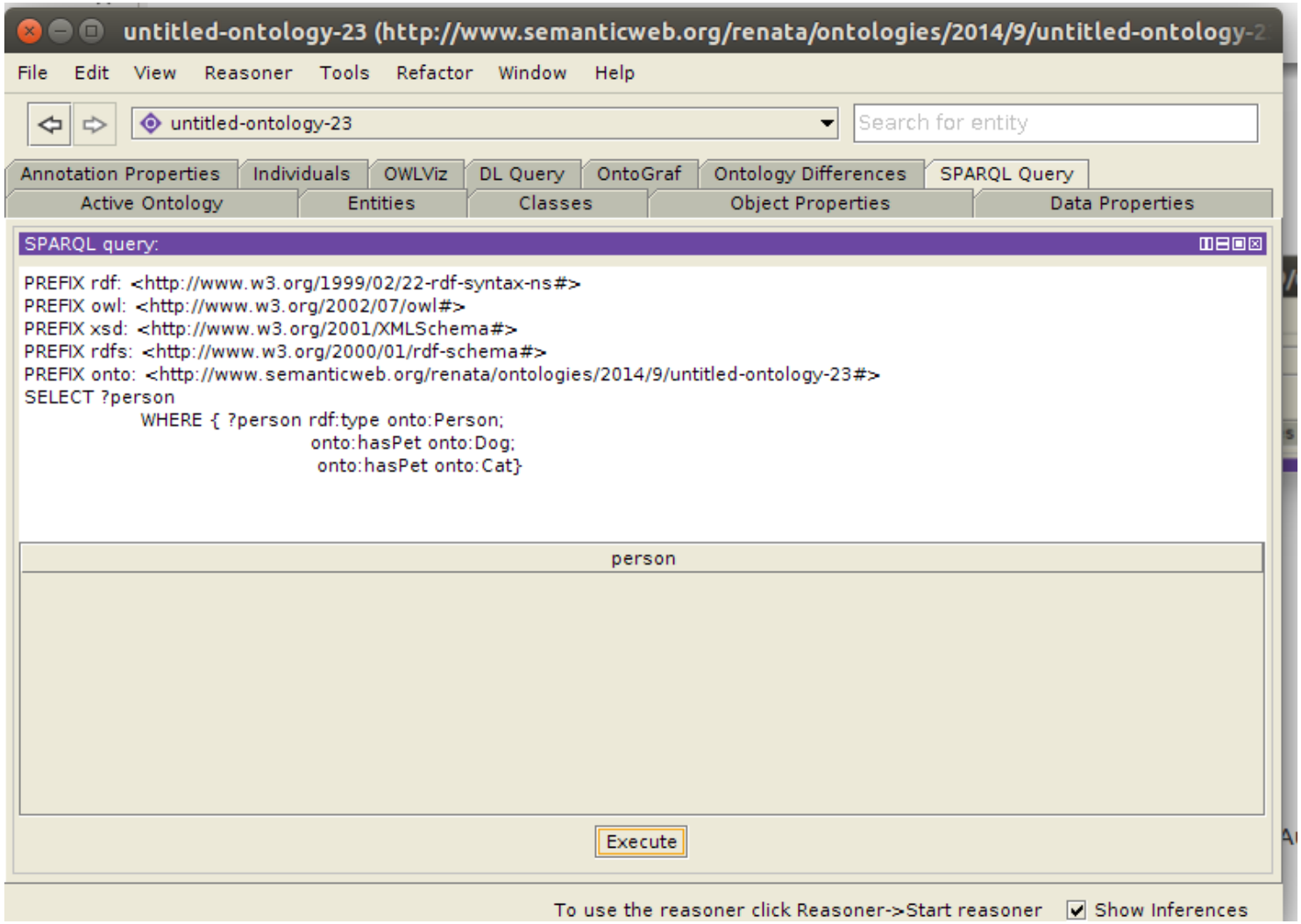
Filtros


untitled-ontology-23-inferred (http://www.semanticweb.org/renata/ontologies/2014/9/untitled-ontology-23-inferred) : [/ho
File Edit View Reasoner Tools Refactor Window Help
untitled-ontology-23-inferred
Search for entity
Annotation Properties Individuals OWLViz DL Query OntoGraf Ontology Differences SPARQL Query
Active Ontology Entities Classes Object Properties Data Properties
SPARQL query:
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX onto: <http://www.semanticweb.org/renata/ontologies/2014/9/untitled-ontology-23#>
SELECT ?pet
WHERE {?pet onto:isPetOf ?x.
?x onto:hasPet ?pet1.
?pet1 a onto:Cat.
FILTER (?pet1 != ?pet)
}
pet
Lulu

Consultas Compostas ;



Por que não funciona?



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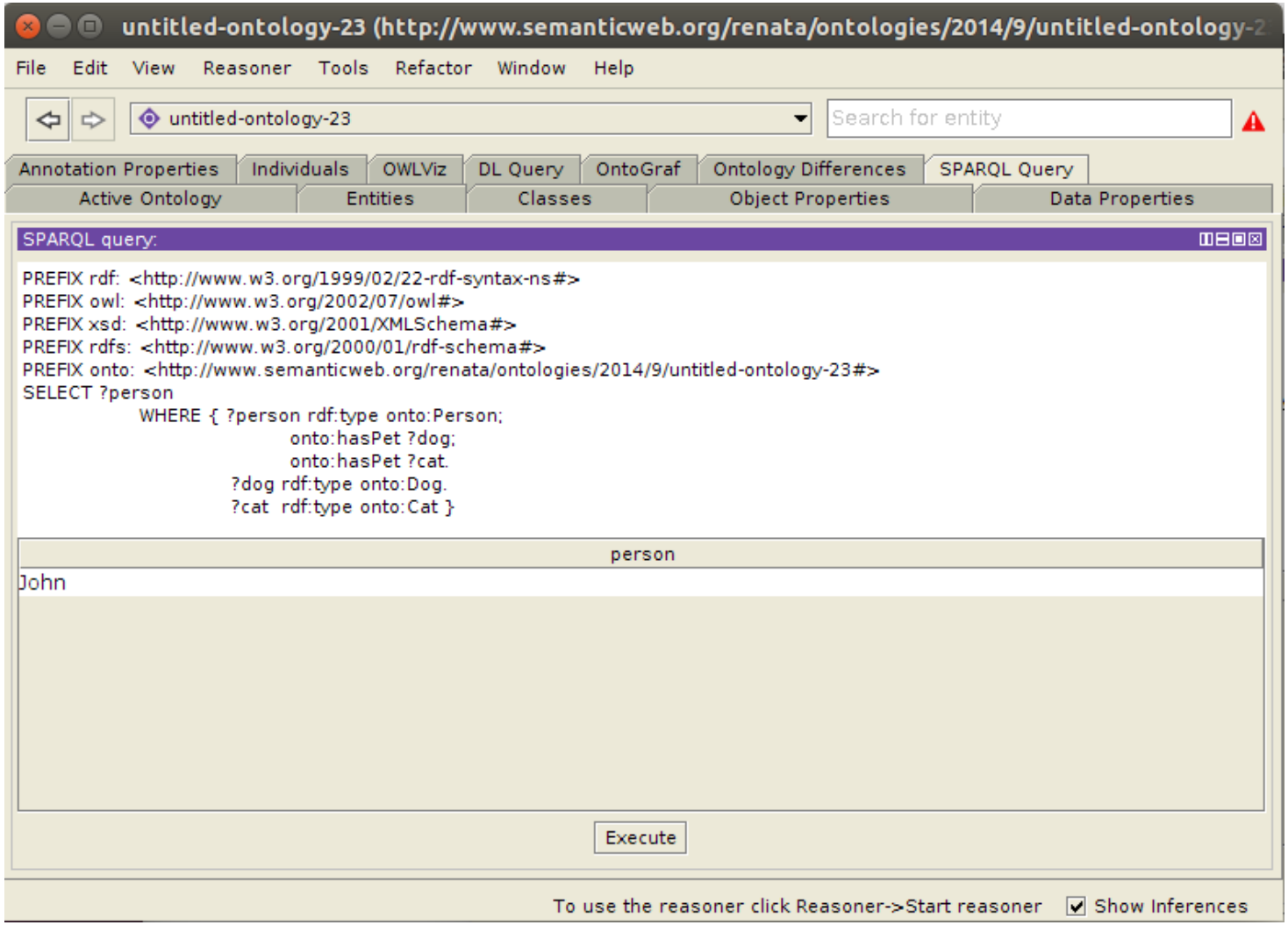
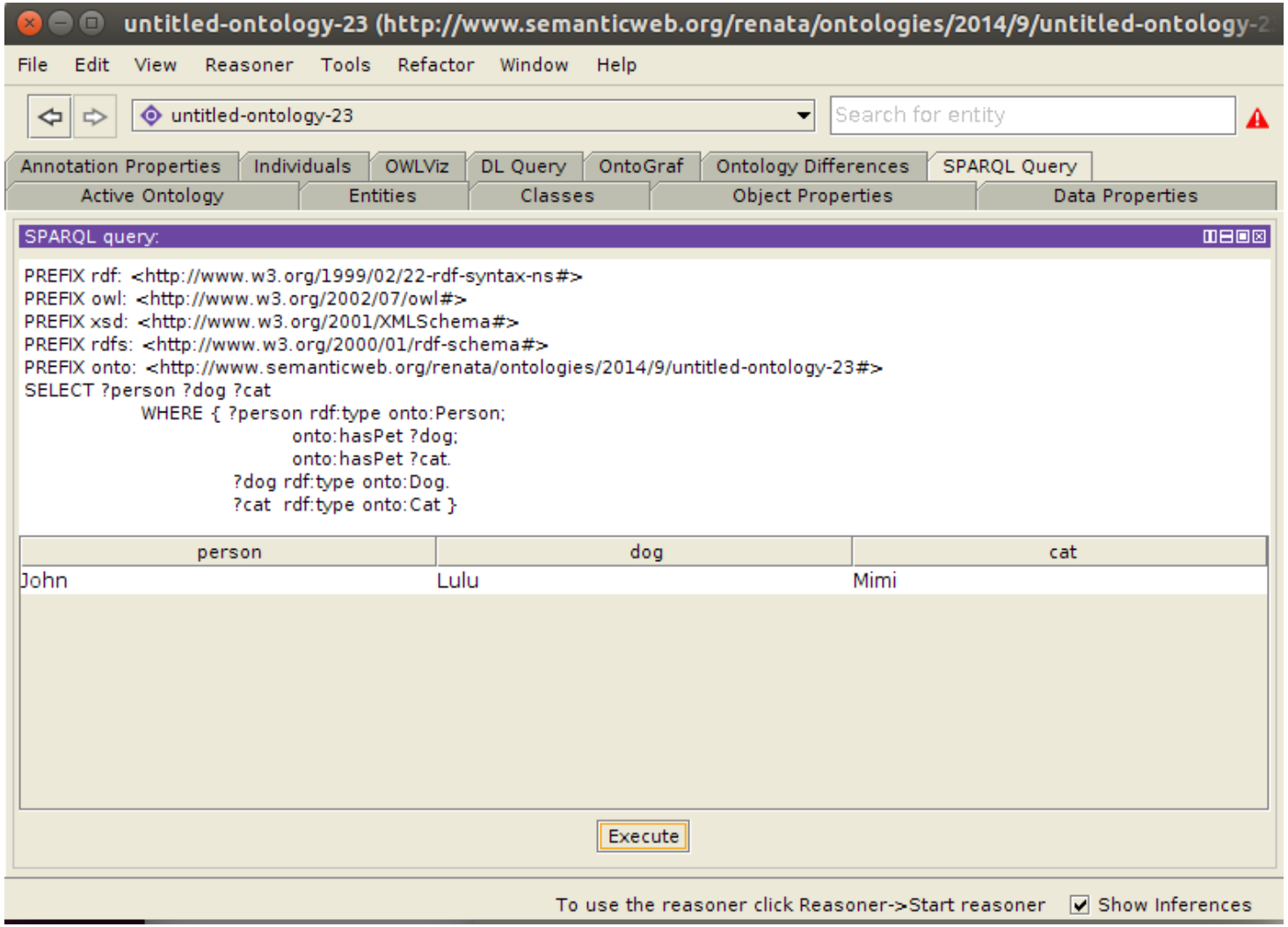


Mais de uma variável



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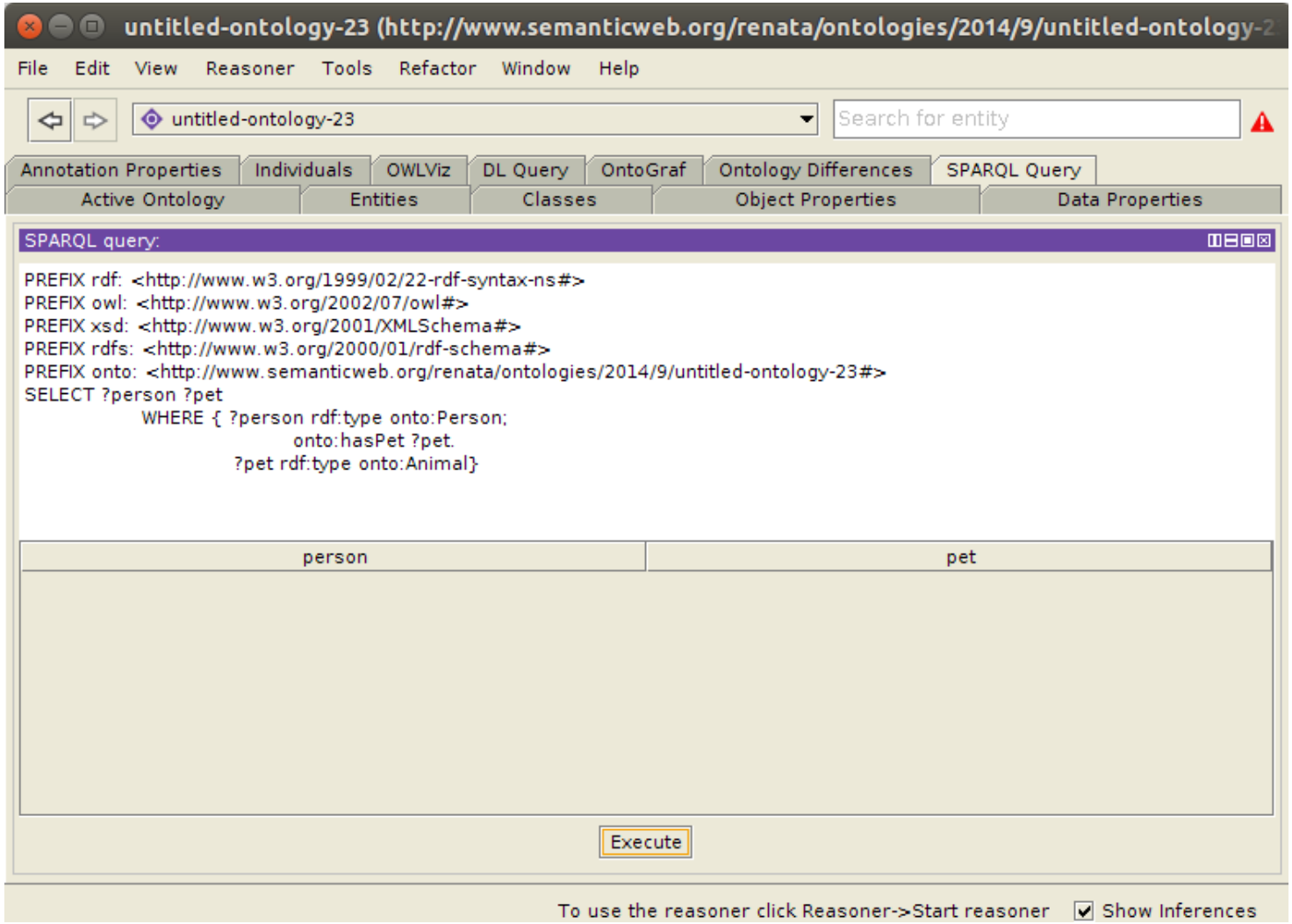
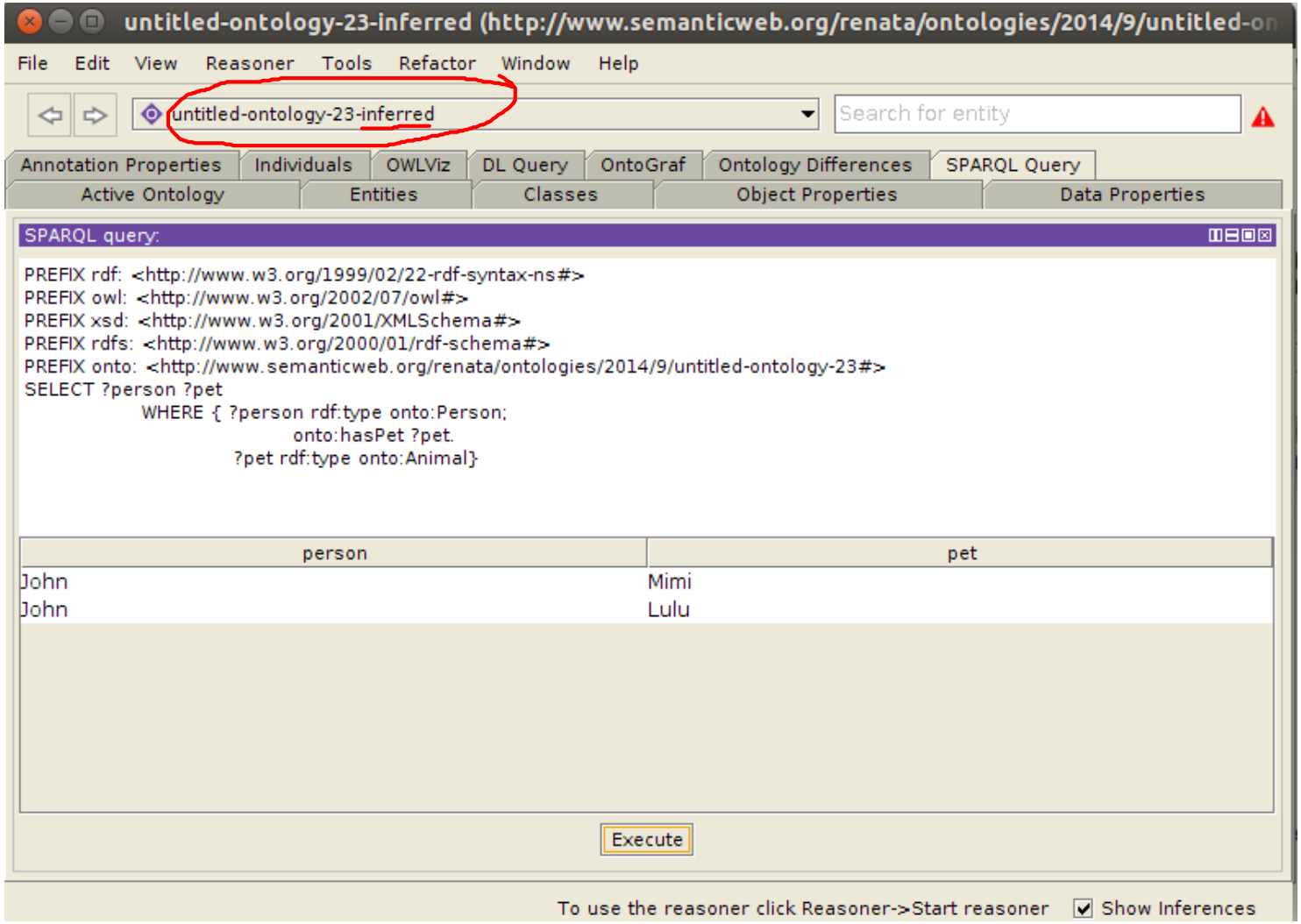


:-)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Search for entity
Annotation Properties Individuals OWLViz DL Query OntoGraf Ontology Differences SPARQL Query
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SPARQL query:
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX onto: <http://www.semanticweb.org/renata/ontologies/2014/9/untitled-ontology-23#>
SELECT ?person ?pet
WHERE { ?person rdf:type onto:Person;
onto:hasPet ?pet.
?pet rdf:type onto:Animal}
person
pet
John
Mimi
John
Lulu
Execute
To use the reasoner click Reasoner->Start reasoner
Show Inferences