topi.link:
The Northern/Southern Ontology

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Abstract

The Linked Geodesy Research Project *topi.link* combines geodesy and Linked Data research questions. Using the Academic Meta Tool (AMT), we have a **little minion**, which addresses the task of inferencing vague graph data. *topi.link* will give access to the AMT world using toponyms as a graph-based vague topology for these toponyms. This paper demonstrates a very simple example how to model a north/south ontology using AMT.

Key words: Linked Data; Semantic Reasoning; Vagueness; Conceptual Modeling.

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1 Introduction

This example ontology aims the question how to model *relative toponym relations* using the *Academic Meta Tool*[1] and Linked Data technologies as well as the degree of connection (vagueness). What kind of inferences will result, if we do some reasoning using the AMT JavaScript[2] reasoner? This ontology will help to answer this question. Let us start with a simple imagination: Imagine, we have two Places A and B and we know that A is in the north of B with 70% (Fig. 1) and *south* is the inverse of *north* - how will Place C related to A, if B has a degree of connection of about 60% to Place C (Fig. 2)?
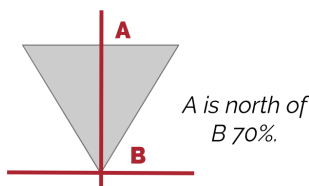

Fig. 1. Research Question, Florian Thiery [CC BY 4.0]

Fig. 2. Research Question, Florian Thiery [CC BY 4.0]

2 Prefixes

The following *prefixes* are defined:

```
1 @prefix topi: <http://topi.link/ontology/northsouth#> .
2 @prefix amt: <http://academic-meta-tool.xyz/vocab#> .
3 @prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
4 @prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

3 Academic Meta Tool Scheme

The used ontology refers to the *Academic Meta Tool Vocabulary* (Penny Edition)[3]. An excerpt:

```
1 amt:Concept rdfs:subClassOf rdfs:Class .
2 amt:Role rdfs:subClassOf rdf:Property .
3 amt:Axiom rdfs:subclassOf rdfs:Class .
4 amt:InferenceAxiom rdfs:subClassOf amt:Axiom .
5 amt:IntegrityAxiom rdfs:subClassOf amt:Axiom .
6 amt:RoleChainAxiom rdfs:subClassOf amt:InferenceAxiom .
7 amt:InverseAxiom rdfs:subClassOf amt:InferenceAxiom .
8 amt:DisjointAxiom rdfs:subClassOf amt:IntegrityAxiom .
9 amt:SelfDisjointAxiom rdfs:subClassOf amt:IntegrityAxiom .
10 amt:Logic rdfs:subClassOf rdfs:Class .
11 amt:LukasiewiczLogic rdf:type amt:Logic .
12 amt:ProductLogic rdf:type amt:Logic .
13 amt:GoedelLogic rdf:type amt:Logic .
```

4 The Northern and Southern Places Ontology

The *Northern and Southern Places Ontology*[4] is defined to show how AMT may help to answer the question shown in section 1. The following sections will explain how it works!

5 Concepts and Roles

In our example, we specified one AMT *concept* (Fig. 3), the general concept of a geographic feature, here the *Place*:

```
1 topi:Place rdf:type amt:Concept .
2 topi:Place rdfs:label "Place" .
3 topi:Place amt:placeholder "placename" .
```


Fig. 3. Concepts, Florian Thiery [CC BY 4.0]

For demonstrating purposes we introduce also two AMT *roles* (Fig. 3), *northOf* and *southOf* for connecting place nodes with an edge:

```
1 topi:northOf rdf:type amt:Role .
2 topi:northOf rdfs:label "is in the north of" .
3 topi:northOf rdfs:domain topi:Place .
4 topi:northOf rdfs:range topi:Place .
5 topi:southOf rdf:type amt:Role .
6 topi:southOf rdfs:label "is in the south of" .
7 topi:southOf rdfs:domain topi:Place .
8 topi:southOf rdfs:range topi:Place .
```
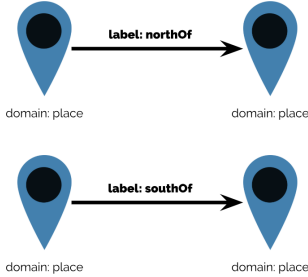

Fig. 4. Roles, Florian Thiery [CC BY 4.0]

6 Axioms

We also introduce *axioms* to enable reasoning via the AMT JavaScript framework. In this example, we use two types of axioms, the *Role-Chain-Axiom* (Fig. 6) and the *Inverse-Axiom* (Fig. 5). Starting with the simple one, as we all know, *north* is the *inverse* of *south*. In a formal AMT way, the **antecedent** is *northOf*/*southOf* and the **inverse** is the opposite role:

```
1 topi:Axiom03 rdf:type amt:InverseAxiom .
2 topi:Axiom03 amt:antecedent topi:northOf .
3 topi:Axiom03 amt:inverse topi:southOf .
4 topi:Axiom04 rdf:type amt:InverseAxiom .
5 topi:Axiom04 amt:antecedent topi:southOf .
6 topi:Axiom04 amt:inverse topi:northOf .
```

To create role chain *inferences* we use the *AMT Role-Chain-Axiom* where **antecedent1** is *northOf* or
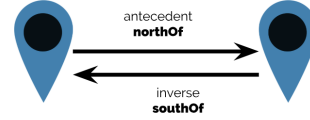

Fig. 5. Inverse-Axiom, Florian Thiery [CC BY 4.0]

southOf and the **antecedent2** will be the same. In our simple example the **consequent** will be also the same, here using the **logic** *ProductLogic*.

```
1 topi:Axiom01 rdf:type amt:RoleChainAxiom .
2 topi:Axiom01 amt:antecedent1 topi:northOf .
3 topi:Axiom01 amt:antecedent2 topi:northOf .
4 topi:Axiom01 amt:consequent topi:northOf .
5 topi:Axiom01 amt:logic amt:ProductLogic .
6 topi:Axiom02 rdf:type amt:RoleChainAxiom .
7 topi:Axiom02 amt:antecedent1 topi:southOf .
8 topi:Axiom02 amt:antecedent2 topi:southOf .
9 topi:Axiom02 amt:consequent topi:southOf .
10 topi:Axiom02 amt:logic amt:ProductLogic .
```
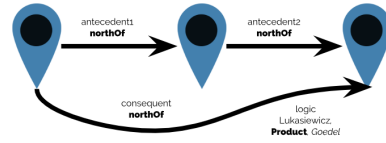

Fig. 6. Role-Chain-Axiom, Florian Thiery [CC BY 4.0]

Acknowledgements

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