Animal Ontology

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The aim of this project is to create an ontology based on the animal kingdom. For this, we chose the broad definition of the animal kingdom, and include also plants. We define the classes associated to the ontology so that we include the main characteristics of animals and plants, as well as their reproduction means and their movement properties. We are then able to infer on the class of an instance we choose to create. We chose to create this ontology because it is a quite well posed problem and it is as simple to verify its correctness. We will implement this ontology in Protégé, which is a tool allowing the user to easily create an ontology.

1 Domain Problem

The main idea of the ontology we created is to help a biologist to classify animals and plants. The Biologist in question uses a cutting edge camera system coupled with computer vision, which allows the computer program to extract characteristics from the individuals that are present on the images. The Biologist is quite lazy and does not want to infer on the category of the individual knowing its features. Indeed, that would take too much time and that is why we decided to create an Ontology to help this biologist classify the individuals as seen by the cameras.

2 MIRO – Minimum Information for Reporting of an Ontology

1. **Ontology name**: Animal Ontology (AO), v1.0, Animal kingdom Ontology, v1.0
2. **Ontology owners**: Karl Nalpas, karl.nalpas@ensta-paristech.fr ; Thales L. Raveli, thales.raveli@gmail.com
3. **Git repository link**: https://github.com/animalontology/Report
4. **Need**: As explained in the brief introduction, the Ontology developed is useful for our Biologist.
5. **Knowledge acquisition methodology**: The knowledge was acquired through several internet websites collecting animal kingdom classification examples, such as http://biology.homeomagnet.com/animal-kingdom-classification/
6. **Target audience**: More broadly, the ontology is addressed to anyone who wishes to know the class of a certain animal/plant according to key observed features.
7. **Development environment**: The ontology was developed using *Protégé*.
8. **Development environment**:We have classified only 15% of all the living organisms, therefore our ontology could be used to accelerate the process. You may find further problems in the next link : https://www.desertusa.com/desert-activity/classified-plants-animals.html

3 Class Definition

3.1 Classes

In this section, we will explain the choices we made in terms of the classes and subclasses we decided to implement. We chose to make it simple for the user, as the latin names are sometimes difficult to understand, therefore we simplified the real classes associated with the animal kingdom, but the ontology can easily be updated and developed. For educational purposes, we therefore decided to only implement two main classes for living beings : plants and animals.

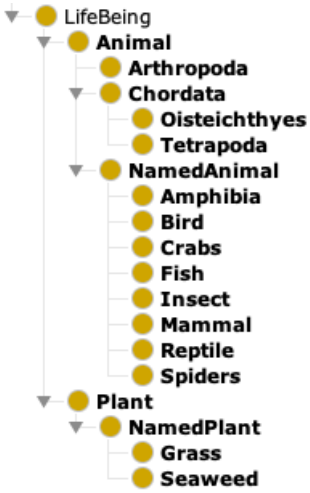

Figure 1: LifeBeing class

We then define a characteristics class, which allows us to classify features that are going the determine the type of living being. In this class, we define for example the reproduction type of the living being, as well as its movement type and its source of energy. In the next figure, we display the characteristics class.

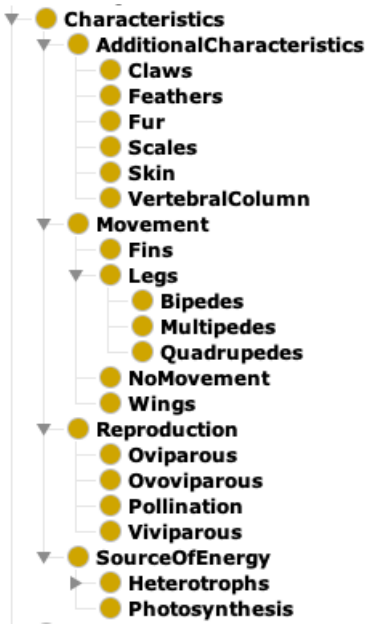

Figure 2: Characteristics class

On the next figure, we display a zoom on the source of energy of the living being.

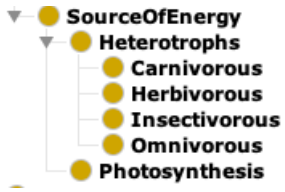

Figure 3: Source of Energy zoom

Finally, we define the habitat of the living being.

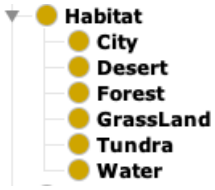

Figure 4: Habitat class

3.2 Properties

In this section, the different properties are defined. They will be used to create the logic linking the different classes. For example, we have the *isHomeTo* property, which will be used to link the living being to a certain habitat.

Figure 5: Habitat class

Now let us take as an example the Arthropoda class, representing the insects. In this class we see that the instance does not live in the water, that it moves with legs or with wings, and that it does not have a solid spine. Also, the insects do not have photosynthesis as a source of energy. All these logical assertions are represented for Arhropoda in the next illustration.

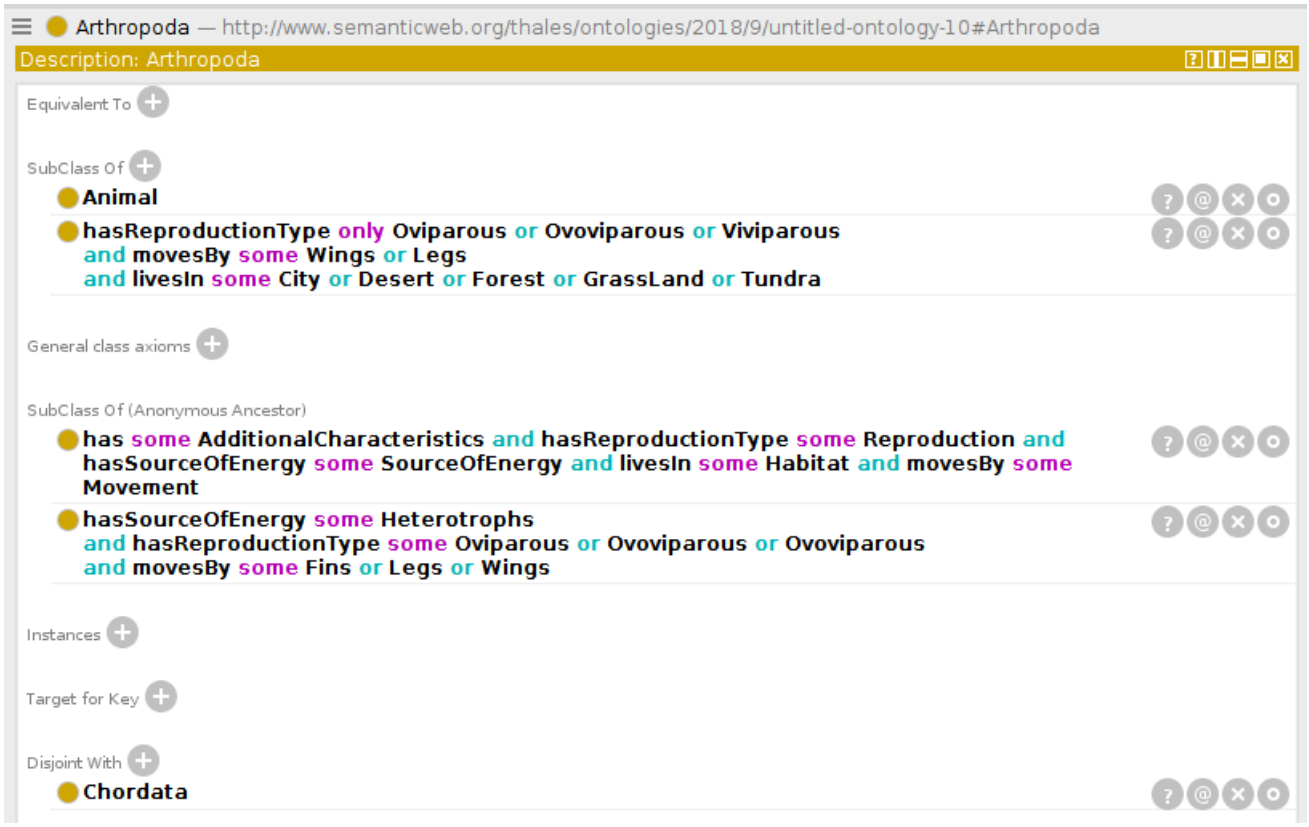

Figure 6: Arthropoda description

4 Testing of the Ontology

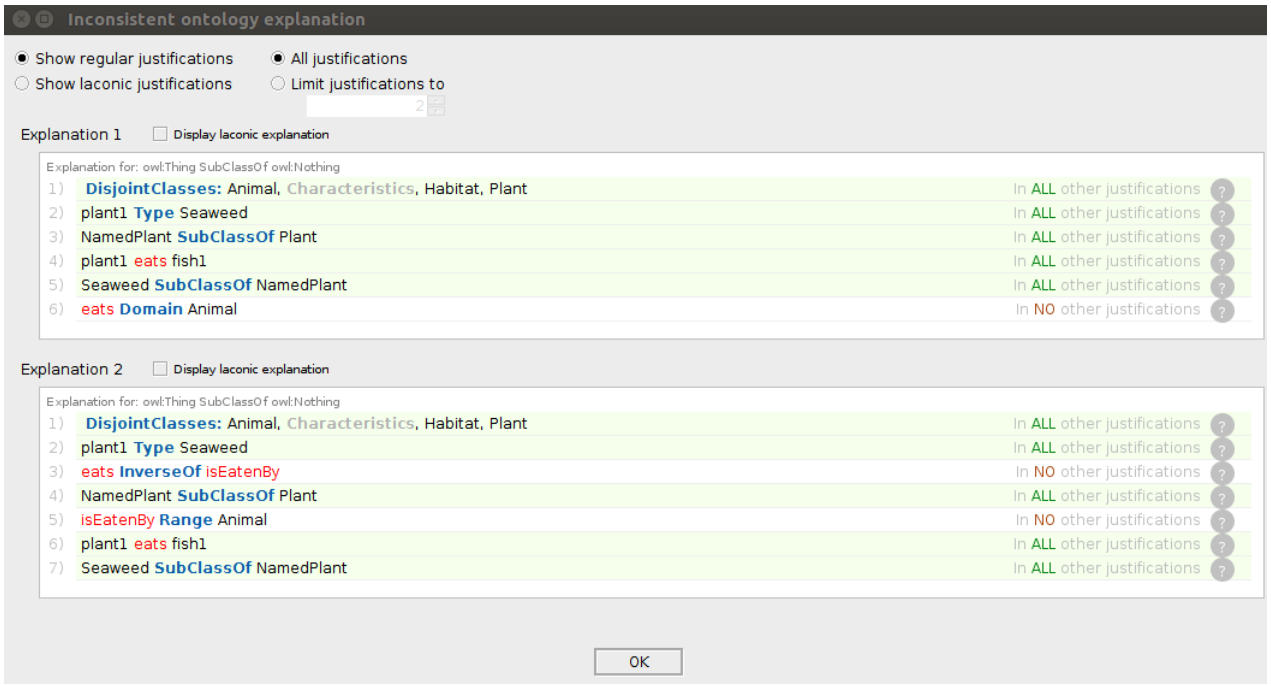

Figure 7: Arthropoda description

In figure 7, we created two instances of the classes fish and seaweed, and tried to make the seaweed eat the fish. The interpreter tells us why this is not possible, so the ontology is inconsistent, which

is what we wanted to prove that it works well.

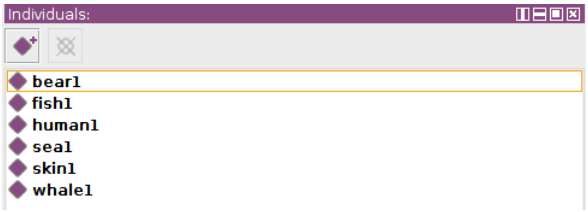

Figure 8: Arthropoda description

After deleting the example of the fish and the seaweed, we also created some other tests that did not made our ontology inconsistent. In figure 8, we can see the individuals created. We created a *bear1* that eats a *fish1*; a *human1* that has *skin1*; a *whale1* that is a mammal and lives in *sea1*, that is an instance of Water. All of those examples were consistent, and we could create many others based on animal species and their characteristics.

5 Conclusion

The ontology we created can now be used to test the relationships between the different class instances of the animal kingdom. During this project we defined classes and subclasses to organize the relationships between living beings as well as their characteristics. After that, we defined the properties and described the classes, so that we can link the different elements of our ontology. The biologist can now test his knowledge of the surrounding environment without having to remember the classes of living beings.

Appendix A Other representations of the Ontology

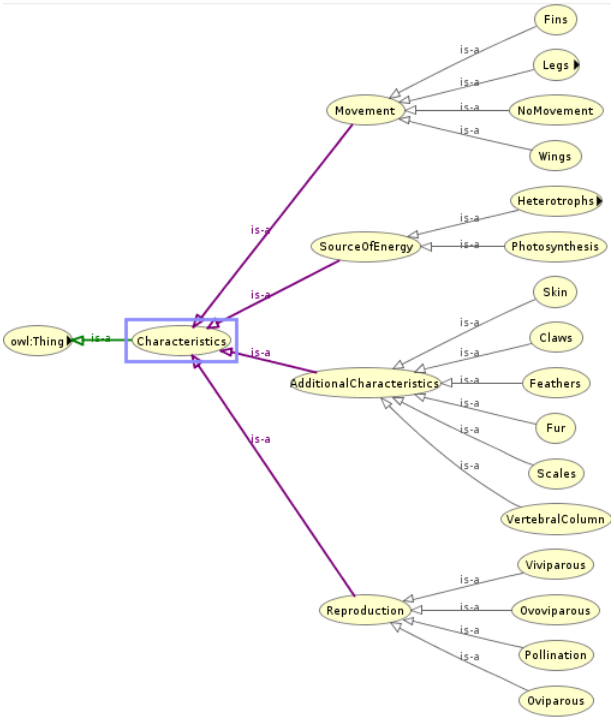

Figure 9: Characteristics Class

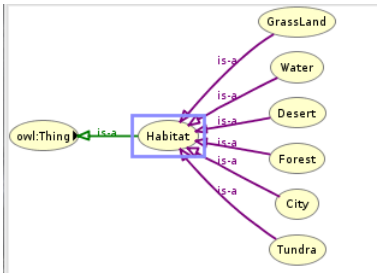

Figure 10: Habitat Class

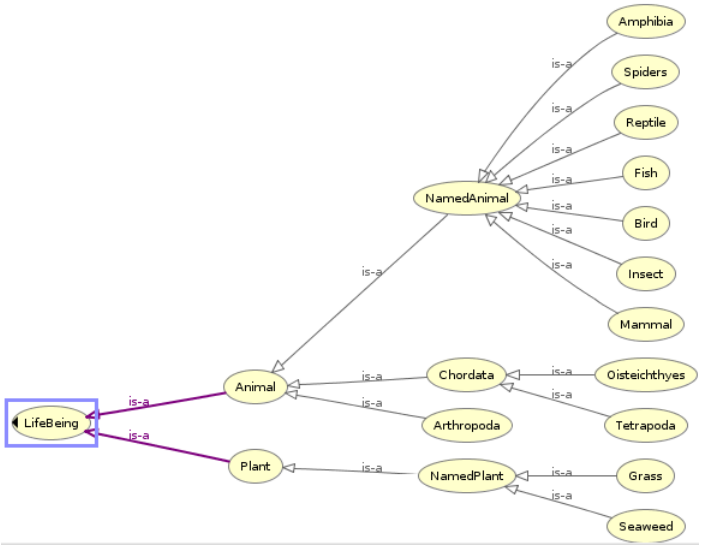

Figure 11: Life Being Class