Worked Example: Veterinary Syndromic Surveillance

Methods and Tools for Modular Ontology Modeling, Part 3

Karl Hammar

The Project

- What is Veterinary Syndromic Surveillance?
- Animal Health Surveillance Ontology, AHSO
- AHSO Purposes:
    - Early warning systems
    - Data integration for reporting to EU agencies
    - Data entry assistance in various support systems
- Development team: 1 core member, 2-3 co-devs, 2-3 hangarounds (all part-time)
- Developer skills: veterinary science, biology, statistics
- Ontology Engineering novices at the outset but learning rapidly
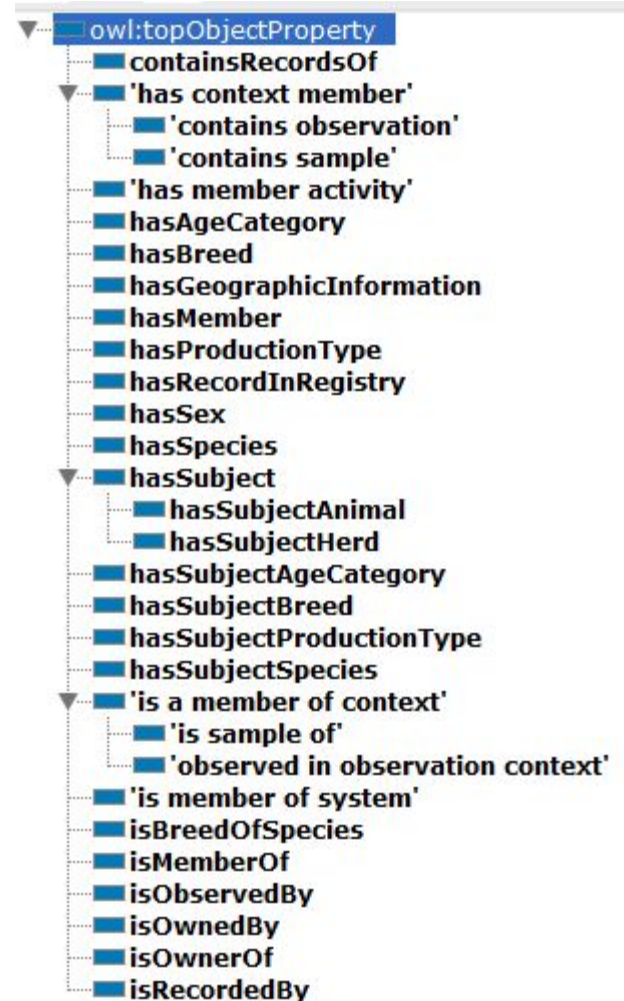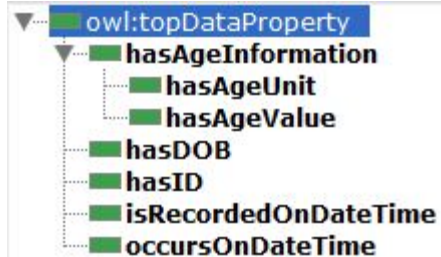
AHSO Development 2015-2018

- Year 1-2:
  - Developing an understanding of tools/technologies/tradeoffs, ontology engineering, building network, finding stakeholders, etc.
  - Studying existing ontologies, their advantages and disadvantages.
  - Prototyping through eXtreme Design workshops.
  - Initial use cases: only in epidemiology.
- Year 3-4:
  - Real ontology development started.
  - Additional national and EU funding obtained, additional use cases developed.
  - eXtreme Design and ODPs used as aids in development but not followed in detail.
  - Karl comes on board to help veterinarians with development work (for both the ontology and tooling to construct/consume it).

AHSO Today

- 37 classes, 31 object properties, 7 datatype properties
- DL expressivity: *ALIF(D)*
  - I.e., base language + inverses + functional properties + datatype properties
- In need of refactoring
  - But work so far has clarified requirements and been useful all the same
- https://github.com/SVA-SE/AHSO
- http://w3id.org/ahso
- https://nandadorea.gitbooks.io/ahso/

owl:Thing
- 'Geographical Information'
- 'Health and surveillance actors'
  - 'Animal owner'
  - Veterinarian
- Observation
  - Birth
  - Death
    - 'Fallen stock'
      - 'Fallen stock destroyed on farm'
      - 'Fallen stock not destroyed on farm'
  - 'Declared movement'
  - 'Pathological examination'
    - 'Ante Mortem Pathological Examination'
    - 'Post Mortem Pathological Examination'
  - Slaughter
    - 'Home slaughter'
  - 'Stillbirth event'
- 'Observation context'
  - Necropsy
  - 'Registered Animal Movement'
  - 'Surveillance activity'
  - 'Surveillance system'
- 'Population unit'
  - Herd
  - Individual
- Registry
  - 'Movement Registry'
- Sample
- 'Zoographical Information'
  - 'Age Category'
  - Breed
  - 'Production Type'
  - Sex
    - Female
    - Male
      - 'Castrated male'
  - Species

owl:topDataProperty
- hasAgeInformation
  - hasAgeUnit
  - hasAgeValue
- hasDOB
- hasID
- isRecordedOnDateTime
- occursOnDateTime

owl:topObjectProperty
- containsRecordsOf
- 'has context member'
  - 'contains observation'
  - 'contains sample'
- 'has member activity'
- hasAgeCategory
- hasBreed
- hasGeographicInformation
- hasMember
- hasProductionType
- hasRecordInRegistry
- hasSex
- hasSpecies
- hasSubject
  - hasSubjectAnimal
  - hasSubjectHerd
- hasSubjectAgeCategory
- hasSubjectBreed
- hasSubjectProductionType
- hasSubjectSpecies
- 'is a member of context'
  - 'is sample of'
  - 'observed in observation context'
- 'is member of system'
- isBreedOfSpecies
- isMemberOf
- isObservedBy
- isOwnedBy
- isOwnerOf
- isRecordedBy

Modelling Issues

- T-box / A-box conflation
- Multi-species Agents
- Observations/Samples/Contexts

T-box / A-box conflation

Symptom: expressing data requires that classes be treated as values.

Causes (?): human "isA" insufficiently formal, not differentiating between subset and set membership. Lack of tree visualisation including members. Projects with unclear use cases. Reuse of existing taxonomies wholesale.

Resolution: Read W3C WG Note *Representing Classes As Property Values* from 2005 (Noy, Uschold, Welty). Consider OWL2 punning if needed.
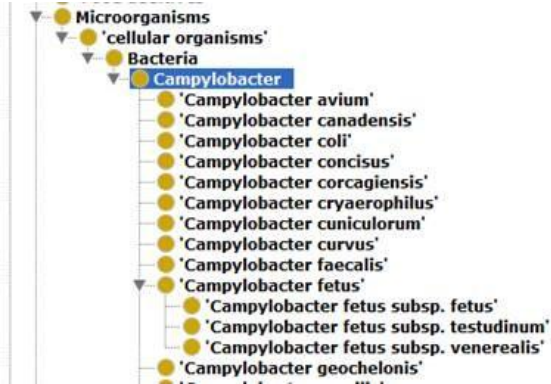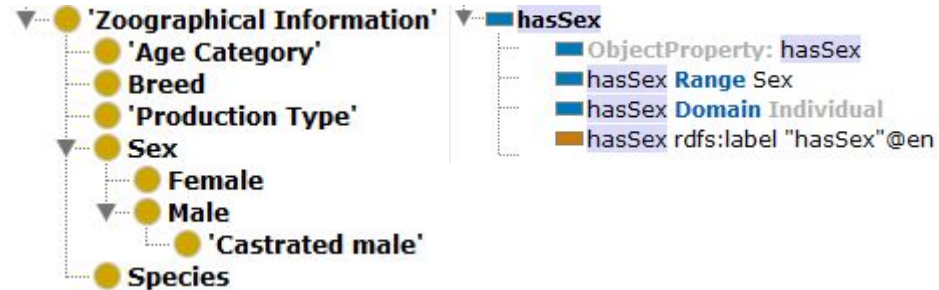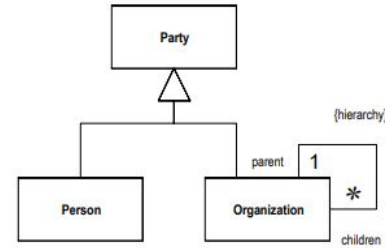
Multi-species Agents

"Population unit" class and subclasses based on Martin Fowler's *Accountability* pattern (from the book Analysis Patterns, <u>highly</u> recommended). *

<u>Question:</u> How do we ensure that herds only contain individuals of the same species?

<u>Answer:</u> We cannot: property chains cannot be used as cardinality restrictions (or be functional)
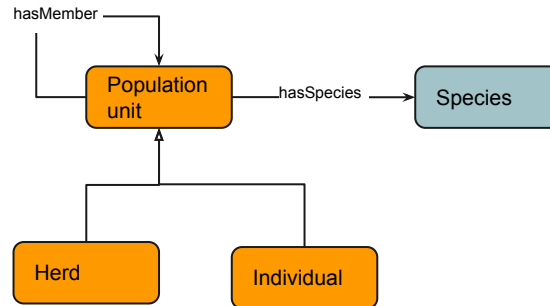
Observations/Samples/Contexts

Goal: representing attributes associated with animals/herds but recorded at some particular observation event.

Solution: Extend on *Observation* pattern (Blomqvist).

Problems: Boundary between *Observation Context* and *Observation* unclear - several object properties shared.

Shared property domain/range definitions incorrect (intersection, not union).
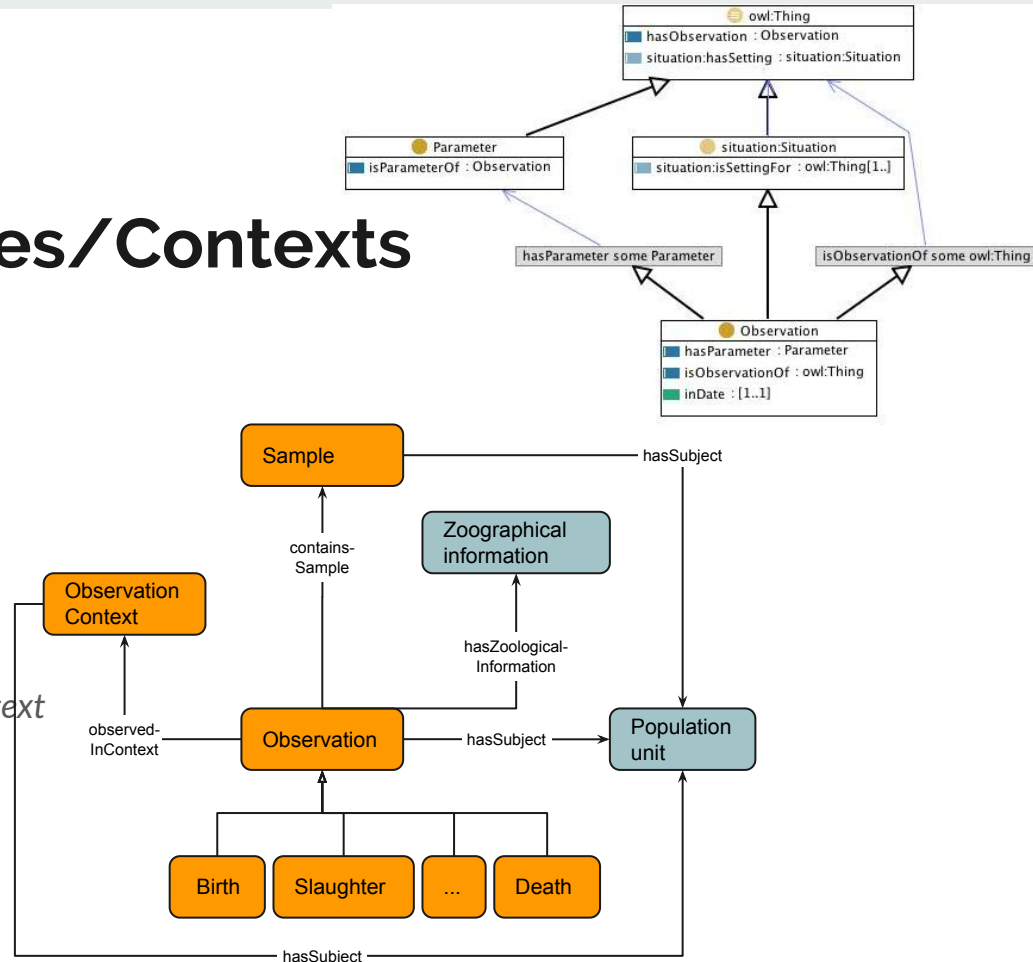
Reflections

- Underlying joint causes of errors:
  - Lack of hierarchy visualisation tooling
  - Lack of modular/folding ontology engineering tooling
  - Focus on formal correctness misses usability and common-sense correctness
  - Unintuitive RDFS domain/range semantics
  - Property chain limitations
- Some of these issues can be improved by better tooling: OPLa, ODPs, Protégé plugins, etc.
- Some require QA processes and user testing.
- Some might require new or modified standards.
- Some are unsolvable.