# Combining SHACL and Ontologies

**TECHNISCHE UNIVERSITÄT WIEN**

Anouk Michelle Oudshoorn

Institute of Logic and Computation

LogiCS

Supervised by
**Magdalena Ortiz**

## 1. Problem

**OWL** and **SHACL** are two prominent W3C standards for handling RDF data on the Web.

**OWL**
- reason with implicit knowledge
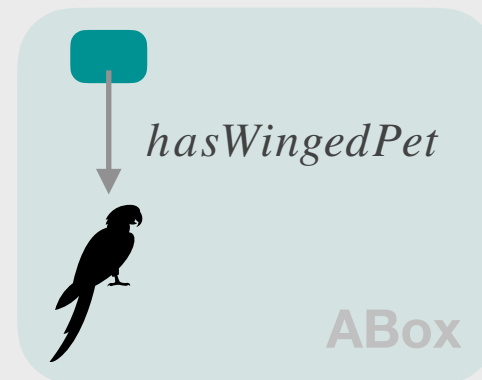- open-world assumption: not all true data must be present

**SHACL**
- check correctness of data
- closed-world assumption: if the information is not there, it is not true

- combination mentioned in SHACL specification
- feels natural: validation of data with implicit knowledge
- challenging: how to combine open- and closed-world?

$PetOwnerShape \leftarrow \exists hasPet$



$hasWingedPet$

**ABox**

$hasWingedPet \sqsubseteq hasPet$

$\exists hasWingedPet^- \sqsubseteq Bird$

…

**DL-Lite$_R$** **TBox**

Does [ ] has the shape of a pet owner?

## Problem Statement

*What happens when we combine SHACL and OWL? Can we define working semantics for meaningful fragments? What is the complexity of these semantics? What can we say about containment of SHACL when we have ontologies?*

$HorseShape \leftarrow \exists hasParent . HorseShape \wedge \neg \exists hasParent . (Donkey \vee Zebra)$
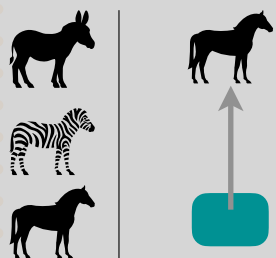
$HorseShape \leftarrow Horse$

**Non-monotonicity**: adding more facts can change validation result - checking over all possible models is not a good idea!
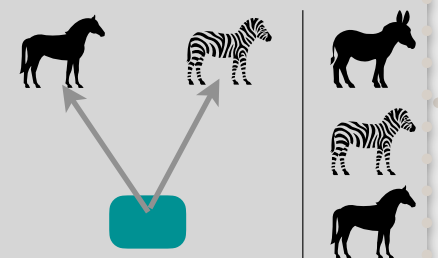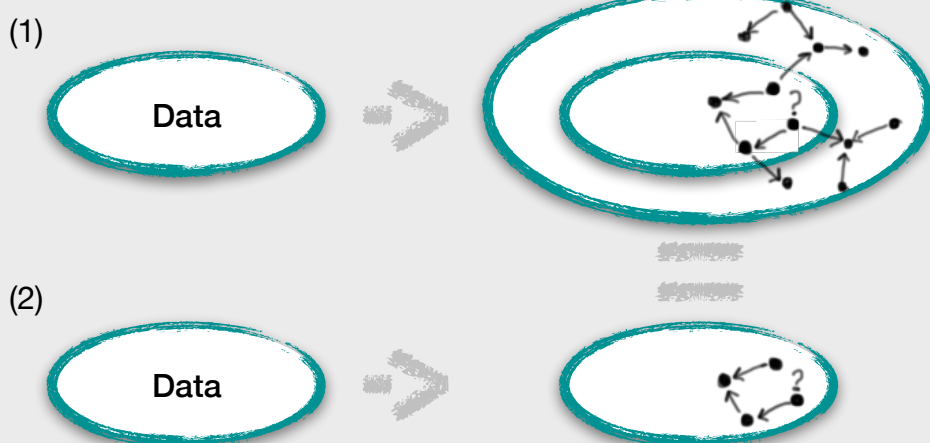
## 2. First Results

(1) We translated original data and ontological knowledge (DL-Lite) into an **austere canonical model**, then checked constraints there.

(2) Rewriting the constraints with the ontological knowledge such that they can be directly applied on the original data.

(1)

**Data**

(2)

**Data**

Validating data with stratified, simplified constraints under ontological knowledge (DL-Lite) is **EXPTIME-complete** in combined complexity.

## 3. Future Research

Extend our rewriting, to capture:

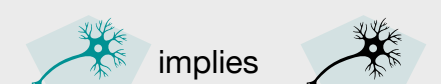- complex path expressions
- counting paths

Work with more expressive Description Logics:

$\mathcal{ELHI}, Horn\text{-}\mathcal{SHIQ}, …$

What to do with SHACL with unstratified negation?

Deciding containment in fragments of SHACL with ontologies:

Given [ ] and [ ] sets of constraints, then

[ ] implies [ ]

Particularly hard to find decidable fragment: two kinds of recursion involved.