

## Modelling the World Logically

- Why we need logic?



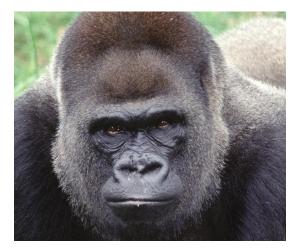
## How to model real world objects?

- Things, or data
- Database
- How data are modelled in database?
- Knowledge representation
- Now try this!



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### **Case Study**













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## How can machine understand?

Canid  $\sqsubseteq$  Mammal Dog  $\sqsubseteq$  Canid Fox  $\sqsubseteq$  Canid Wolf  $\sqsubseteq$  Canid

Human ⊑ Hominin

Felid ⊑ Mammal

Cat ⊑ Felid

 $\mathsf{Lion} \sqsubseteq \mathsf{Felid}$ 

Tiger ⊑ Felid

Human  $\sqsubseteq$  Primate



#### How about now?

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#### **Domesticated?**



## Can machine understand now?

Dog ⊑ ∃hasBodyPart.Leg

Cat ⊑ ∃hasBodyPart.Wisker

Cat ⊑ ∃hasBodyPart.Leg

Human ⊑ ∃hasBodyPart.Leg

Cat  $\sqsubseteq \exists$ hasStatus.DomesticatedStatus



# **Other situations?**

• What if you have a pet cat, called Bob?

Cat(Bob)

 How can a machine know your pet Bob is not a gorilla?

 $\mathsf{Cat} \sqcap \mathsf{Gorilla} \sqsubseteq \bot$ 

• How about when Bob is a kitten?

Kitten  $\equiv$  Cat  $\sqcap$  Young



## **Knowledge representation**

- KR is hard
  - Experts
  - Consistence
  - Sharable
  - Semantics
  - Large

- KR is useful
  - Find hidden information
  - Theorem proving
  - SNOMED CT NHS Digital
  - Artificial Intelligence



Digital SNOMED CT Browser		Release: United Kingdom Edition 20181001 - Perspective: Full - About - SNOMED
© SNOMED International 2017 v1.36.4 - Hosted and maintained by NHS Digital		
Taxonomy Search Favorites Refset		Concept Details
Taxonomy	O C	Concept Details 💿 🌣
Inferred view 👻 Descendants Count: Off 👻		Summary Details Diagram Expression Refsets Members References
<ul> <li>SNOMED CT Concept</li> <li>Body structure (body structure)</li> <li>Clinical finding (finding)</li> <li>Environment or geographical location (environment / location)</li> <li>Event (event)</li> <li>Observable entity (observable entity)</li> <li>Organism (organism)</li> <li>Pharmaceutical / biologic product (product)</li> <li>Physical force (physical force)</li> <li>Physical object (physical object)</li> <li>Procedure (procedure)</li> <li>Qualifier value (qualifier value)</li> <li>Record artifact (record artifact)</li> <li>Situation with explicit context (situation)</li> <li>Social context (social concept)</li> <li>Special concept (special concept)</li> <li>Specimen (specimen)</li> <li>Staging and scales (staging scale)</li> <li>Substance (substance)</li> </ul>		Classification Map          Parents <ul> <li>SNOMED CT Concept (SNOMED RT+CTV3)</li> <li>Clinical finding             <li>Clinical finding             <li>Clinical finding (finding)             <li>Clinical finding (finding)             <li>Clinical finding (finding)             <li>Clinical finding             <li>Clinical finding             <li>Clinical finding             <li>Clinical finding             <li>Clinical finding             <li>Clinical finding             </li> <li>Clinical finding             <li>Clinical finding             </li> </li></li></li></li></li></li></li></li></li></li></li></ul>



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