

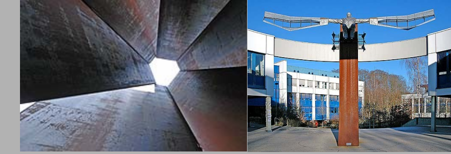

Part II
Methods of AI

Chapter 3
Knowledge and Reasoning

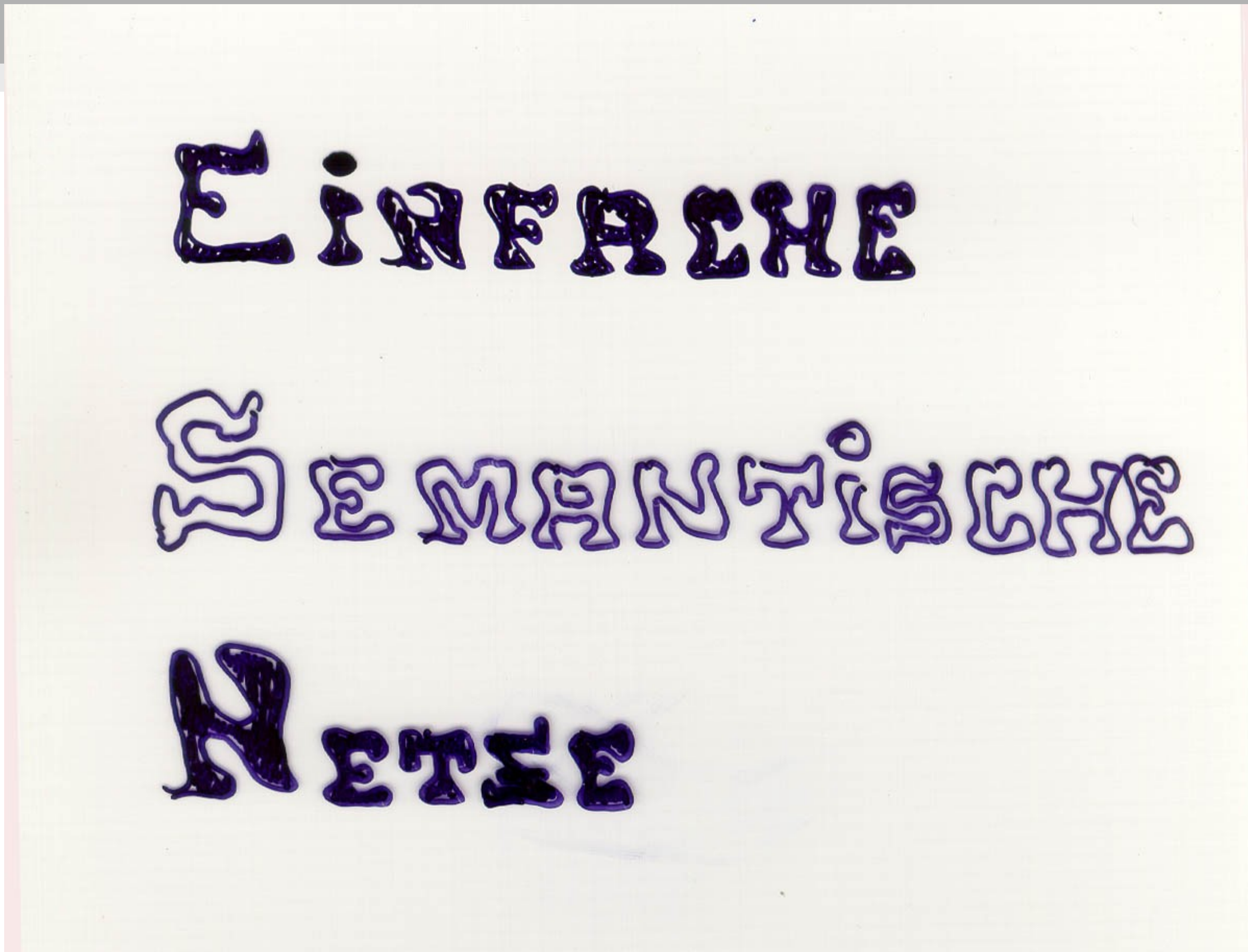
Chapter 3 – Knowledge Representation and Reasoning


3.5 Knowledge Representation

Semantic Networks



Semantic Networks



Simple and Naive Semantic Nets

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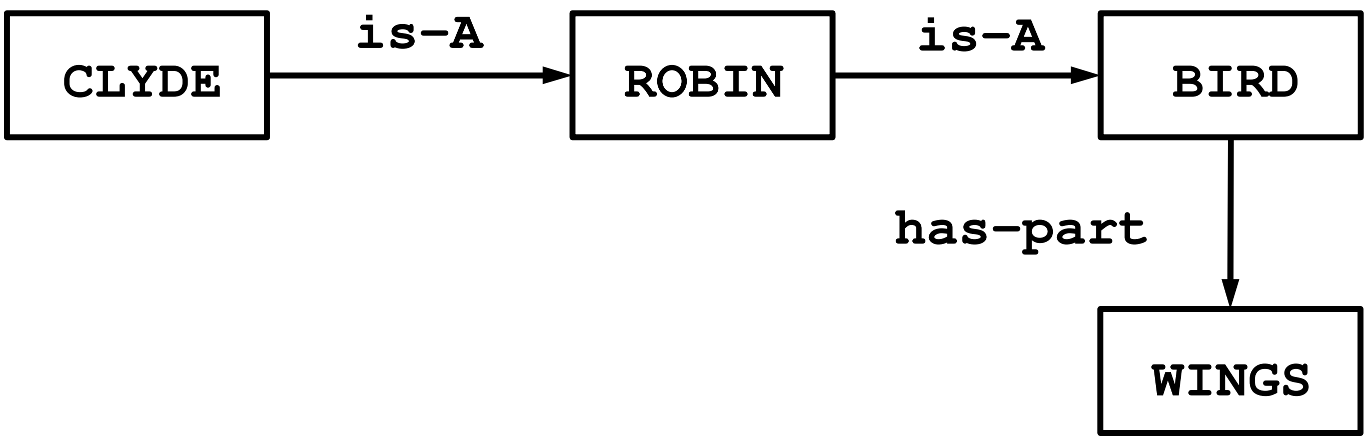
Naive Semantic Networks:
to get started!

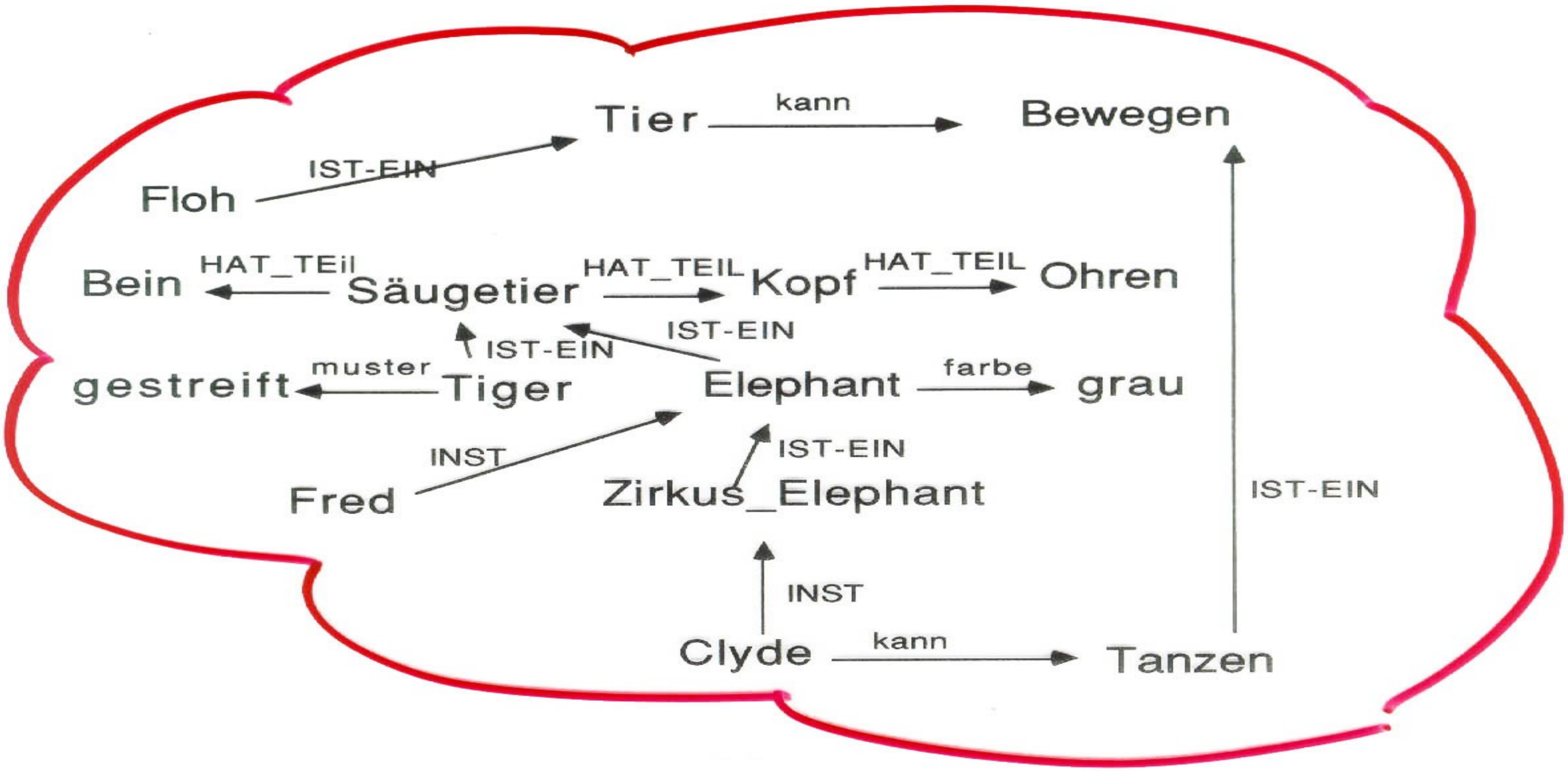
I.

II.

III.



Semantic Nets:
an „unstructured“ Example



PROBLEM-1: Semantics of the SN?

PROBLEM-2: Structure of the SNs ?

Problem-3: Binary relations?

Another famous Example: Winston´s Arch

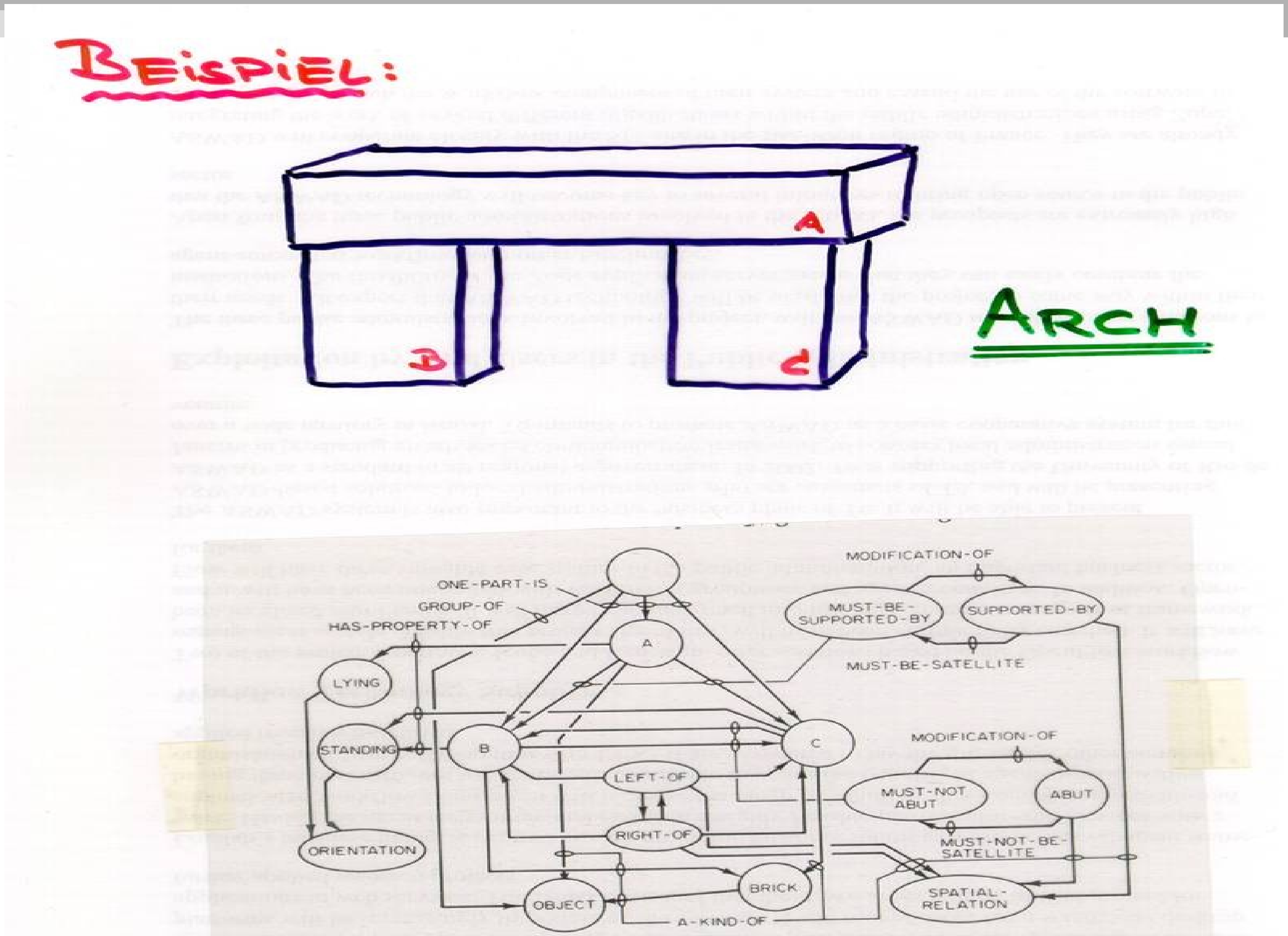


Fig. 5. Structural description of an ARCH. From Winston [1975]. Copyright 1975 by McGraw–Hill, Inc., New York. Used with permission of McGraw–Hill Book Company.

Semantic Networks 1: “Schönfinkeln”

Binary Relations versus Relations with Many Arguments

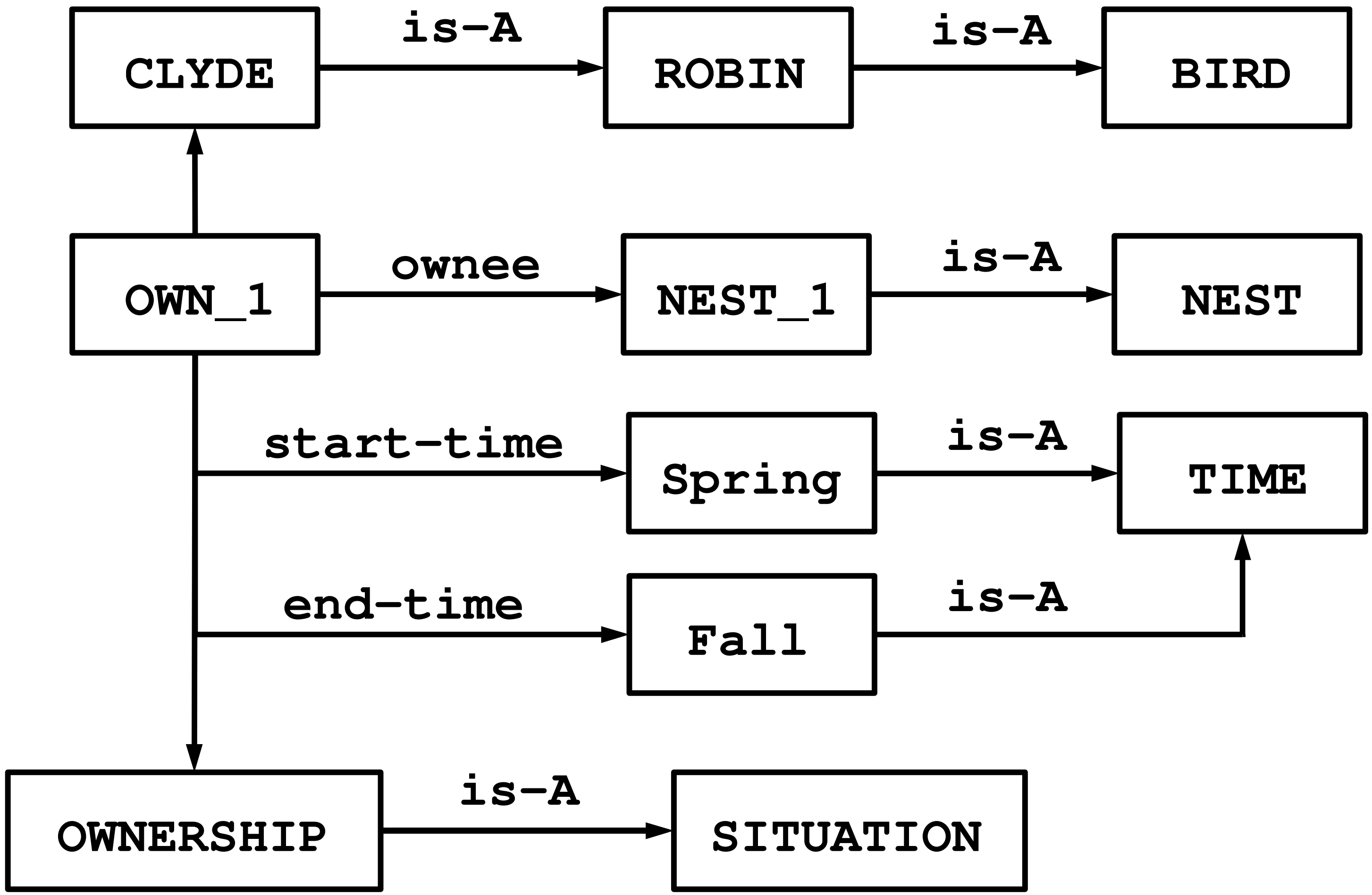
Translation a la Schönfinkel (and other logicians)

TAFEL!

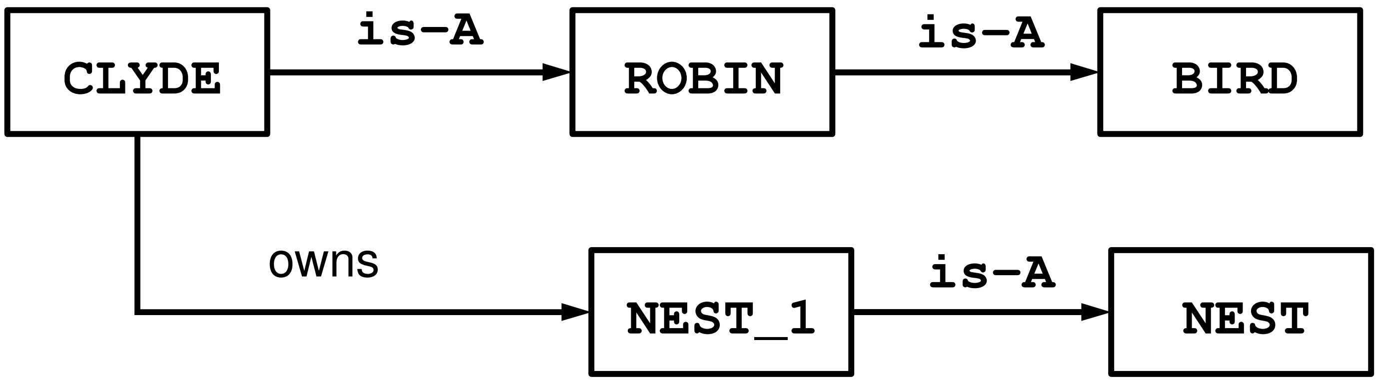
Translates into:

```
Owner(own-1, ... )
Ownee(own-1, ... )
Start(own-1, ... )
End(own-1, ... )
```

Semantic Networks:
An Example for an n-ary Relation



Token-Type Distinction in SN‘s



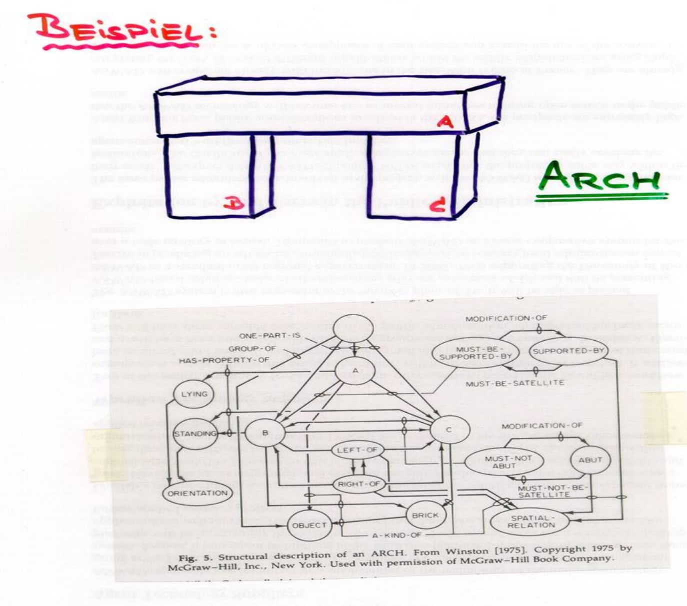
Token: Nest_1
Type: Nest

Nest_1 is of type “Nest”

Semantic Networks: Platon´s World

- Generic Concept
- Individual Concept
- Individual Object:

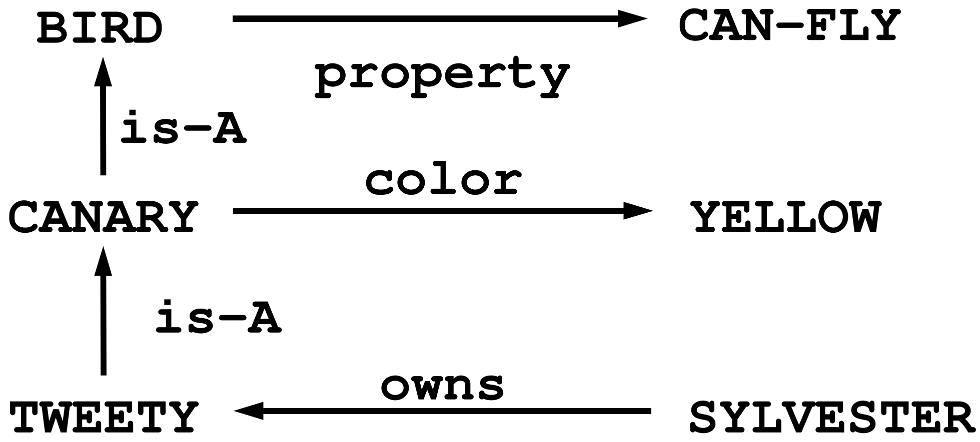
Generic Concept: An Arch



PARIS

An Arc de Triomphe

Inferences with Semantic Nets



⇒ CAN-FLY (CANARY)

⇒ CAN-FLY (TWEETY)

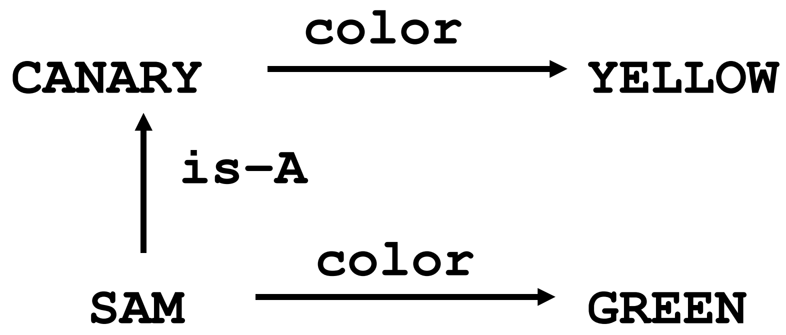
⇒ SYLVESTER owns Something that can fly

⇒ TWEETY is YELLOW

⇒ SYLVESTER owns a CANARY

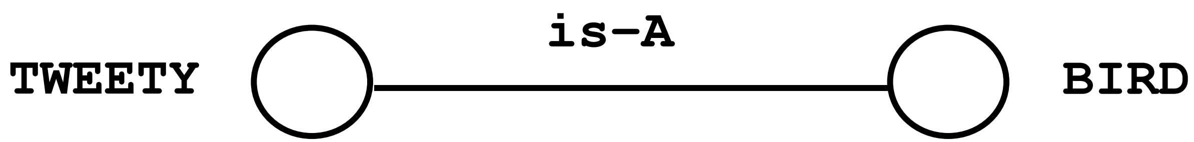
⇒ SYLVESTER owns a BIRD

Contradictions in Semantic Nets



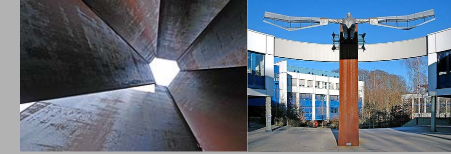
Semantic Networks. Semantics

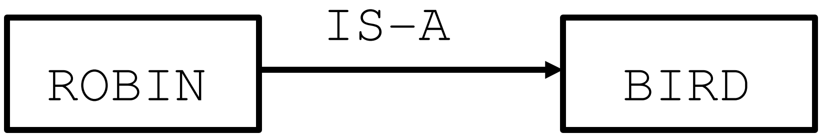
Just a Graphical Representation of the Predicate Calculus ?



Is-A (TWEETY, BIRD)

Naïve Network Theory: Semantics



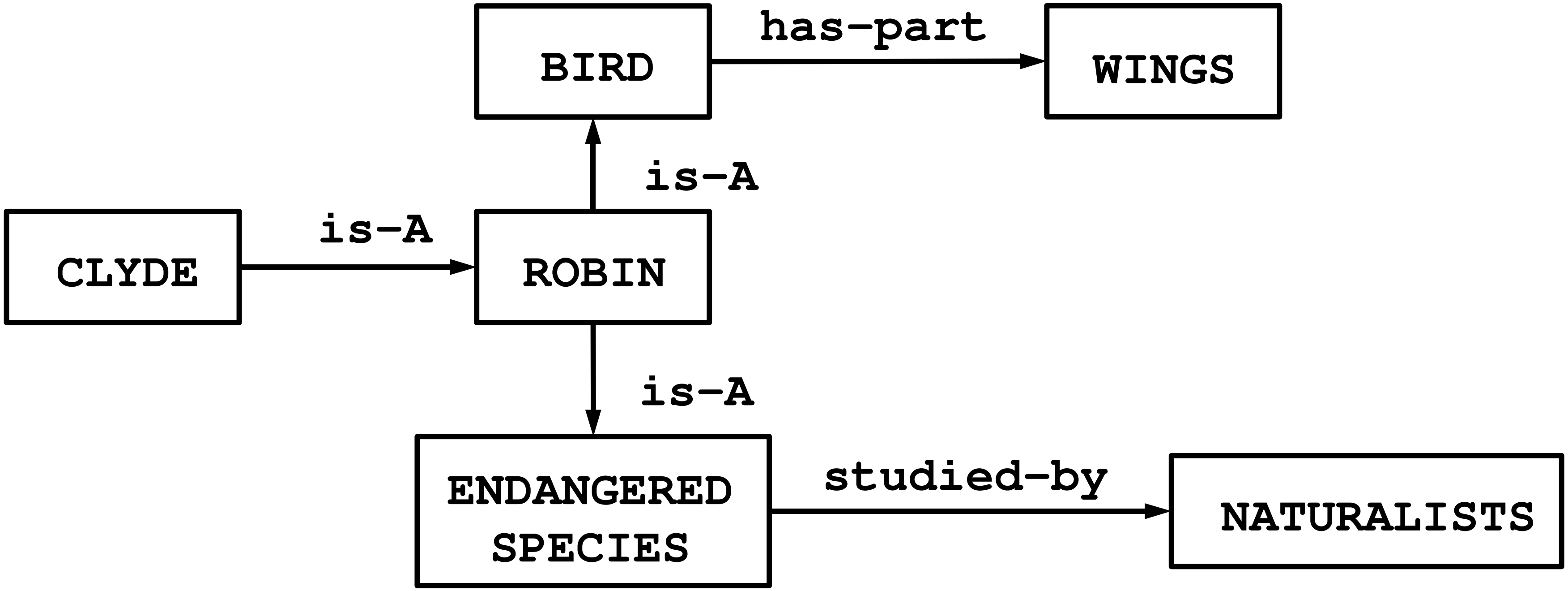


Is-A(ROBIN, BIRD)

<u>LISP</u> **(is-A ROBIN BIRD)**

- **Pidgin English Semantics?**
  - <u>Infix</u>: (ROBIN IS-A BIRD)
  - <u>English</u>: ‚ROBIN is a bird'

Example: Problems of Semantics



has-part(BIRD,WINGS) ⇒ has-part(ROBIN,WINGS)

Property(ENDANGERED SPECIES) ⇒ Property(CLYDE)

Do the naturalists study the special bird CLYDE ?

Nice Properties of Semantic Networks

- Inheritance of Attributes
- Propagation of Parts
- Concept Centered Representation
- Semantic Distance
- Procedural Semantics of SN‘s

BUT: How to get a Declarative (Tarski) or Denotational Semantics of SN‘s?

Semantics

Woods (1975): **„What's in a Link"?**

- **Question:** What is the Semantics of Semantic Networks?
  - The Intuition of the Reader?
  - The LISP-Programs operating on the SN?

compare: the early work on the semantics of programming languages

Levesque & Mylopoulos (1977):

- Procedural Semantics

Cercone & Schubert (1979):

- Translation into First Order Predicate Logic

Distinction of Representational and Conceptual Levels in Semantic Networks


Representational Level	**Primitives**
Implementation	Atoms, Lists Nodes, Pointers
Logical	Statements, Predicates, Logical Operators
Epistemological	Concept Types Inheritance and Structure Relations
Conceptual	Semantic and Conceptual Relations Primitive Objects and Actions
Linguistic	Words and Clauses