



# Intelligent Information Systems

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Lecture Notes: Module 6



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# Semantic Networks

## Module 6

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# Background

# Structuralism

**Structuralism is the approach to describe, conceptualize and understand the world that emphasizes mutual relationships between entities rather than their individual and independent existence.**

**Structural semantics considers a language as a relational structure. The semantic field of a word in this structure is defined as a set of relations of this word with other words.**

# Psychologists and Librarians

**Quillian (1968), Anderson & Rower (1973), Norman & Rumelhart (1975) considered semantic networks models of human memory.**

**The meaning of a word (term) is defined by means of a set of relations that binds this word with other words.**

**Note that this approach had earlier been applied in dictionaries, thesauri, and encyclopedias. Today, this approach was developed into hyperlinks.**



# Semantic Networks

# No Standard

**There is no widely accepted unified definition of semantic networks, therefore, there is no standard regarding semantic networks either.**

**Hence, there is no means available to define semantics of semantic networks!**

**The meaning given to a semantic network is determined by procedures operating on the network.**



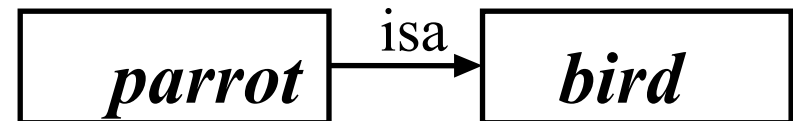
# Semantic Net Components, ISA

A semantic net is a graph made of nodes connected by edges (archs). Nodes and edges can be labeled. The main relationship (connection) is the **relation of taxonomy ISA** (hierarchical heritage).

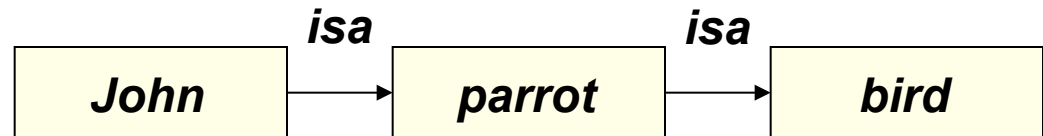


***All parrots are birds***

We can add:



***John is a parrot***

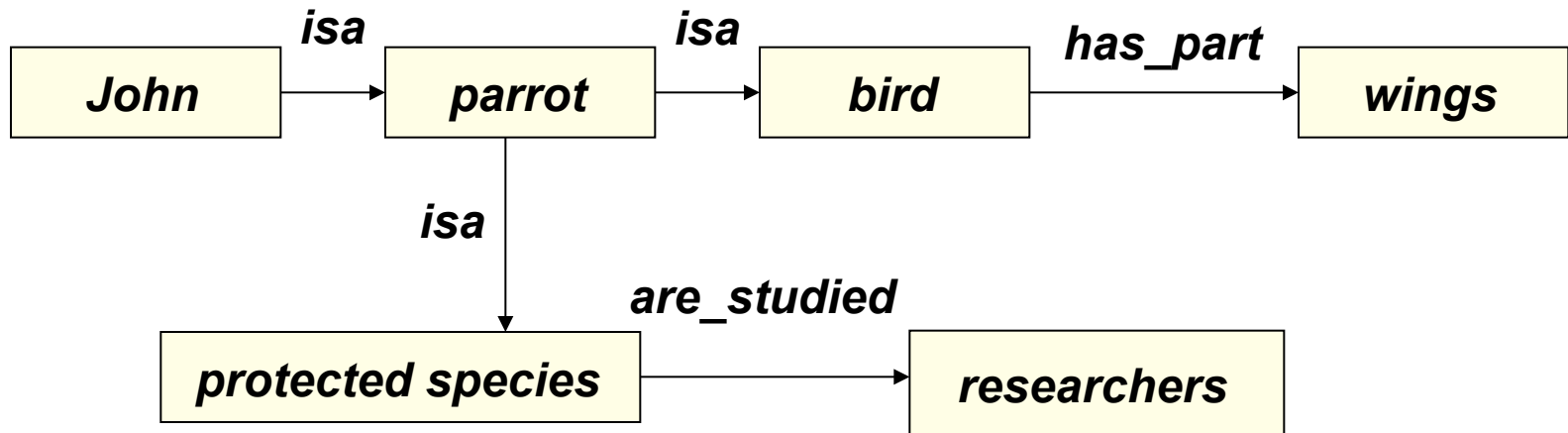


Immediate deduction is then feasible (along the edges):

***John is a parrot, parrot is a bird, then John is a bird.***

# Inference Traps

In addition to taxonomy, relations that describe properties of entities are necessary e.g. *has\_part*.



**Note that an inference leads to the conclusion that researchers study John, which might not be necessarily true!**

# Problems & Questions

**This unexpected result is caused by the fact that our network does not distinguish classes of entities from instances. Woods (1975), Stefik (1980) and other attempted to resolve this problem.**

**Unfortunately, there are more problems and questions, e.g. what does a node represent, how to represent time, ideas, convictions, incomplete information, how to define heritage rules?**

# Quering

# Reasoning

**A semantic network is an information system.**

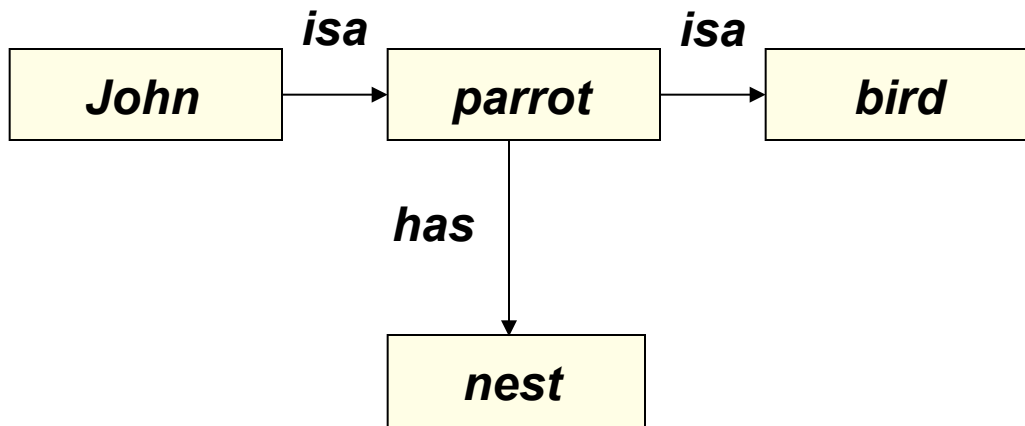
**For most information systems based on semantic networks reasoning works as follows:**

- 1. The query is translated into a semantic network using the same notation as the system being queried.**
- 2. The query is matched with the system being queried.**

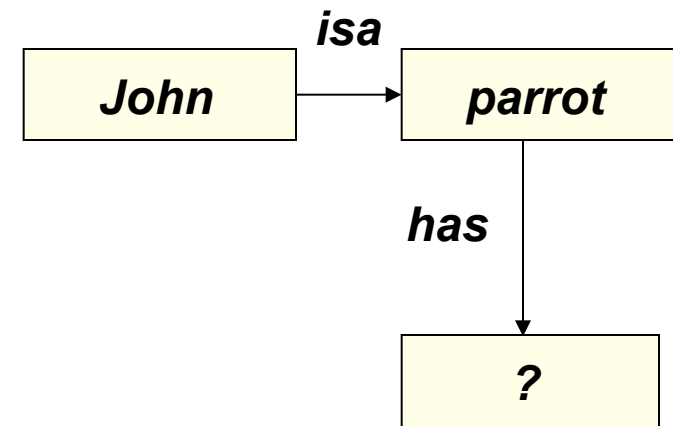
# Example of Query Answering

**Query: *What does John have?***

**Information System**



**Query**



If matching does not succeed then the answer is that :  
***John has nothing.***

# Areas of Applications

- Machine translation.
- Conceptual description of information systems to be designed.
- **Understanding of a natural language.**
- Recognition and understanding of speech.
- **Building natural language interfaces to databases.**
- Construction of question answering systems (e.g. SIR).
- **Setting up knowledge sets for robots.**

**Note: Semantic networks have often been studied along with Minsky's frames.**

# Recommended Readings:

- Brachman R. J., "On the epistemological status of semantic networks" [in:] Findler, 1979.
- Findler, Nicholas V., [ed.] "Associative Networks: Representation and Use of Knowledge by Computers", Academic Press, New York, 1979.
- Lehmann F., [ed.] "Semantic Networks in Artificial Intelligence", Pergamon Press, Oxford, 1992
- Levesque, H., Mylopoulos J., "A procedural semantics for semantic networks", [in:] Findler, 1979.
- Sowa J. F., [ed.] "Principles of Semantic Networks: Explorations in the Representation of Knowledge", Morgan Kaufmann Publishers, San Mateo, CA, 1991.



[http://en.wikipedia.org/wiki/Semantic\\_network](http://en.wikipedia.org/wiki/Semantic_network)





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DEVELOPMENT PROGRAMME



# Thank you!



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