



# Introduction to Intelligent Systems

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# 1. In-text Elements

## 1.1 Theorems



## Representation

Choosing a representation

## Aspects of Knowledge representation

### What is a Logic

Non-logical representation

What we've ignored

## Semantic Networks

### Books

### Articles

## 2. Knowledge Representation

### 2.1 Representation

AI agents deal with knowledge(data).

- Facts
- Procedures
- Meaning (relate & define knowledge)

Right representation is crucial

- Early realisation in AI
- Wrong choice can lead to project failure
- Active research area

#### 2.1.1 Choosing a representation

For certain problem solving techniques.

- Best representation already known
- Often a requirement of the technique
- Or a requirement of the programming language(e.g. Prolog)

Representation of:

- Declarative knowledge(what, objects, structure)
- Procedural knowledge(how, actions, performance)

### 2.2 Aspects of Knowledge representation

Syntax:

- Possible (allowed) constructions
- For example: colour(my\_car, red), my\_car(red), red(my\_car), etc.

Semantics:

- What the representation **means** (and how it maps to the real world)
- Example:
  - Colour(my\_car, red) means: "my car is red", "paint my car red", etc.

Requirements for Knowledge Representation languages:

Representation adequacy:

- Should allow for representing all the required knowledge

Infernal adequacy:

Inferential efficiency:

Clear syntax and semantics:

Neutrality:

## 2.3 What is a Logic

A language with concrete rules.

No ambiguity in representation, however there may be errors. Allows for unambiguous communication and processing.

Is very unlike natural languages like e.g. English.

### 2.3.1 Non-logical representation

Logic representation have restrictions and can be hard to work with.

### 2.3.2 What we've ignored

Objects in the world tend to be related to each other.

- Classes, superclasses & subclasses, part / whole hierarchies
- Properties are *inherited* across relationships

The state of the world can change over time.

- Explicit representation of time
- Frame problem: representing the effects of action in logic without having to represent explicitly a large number of intuitive obvious non-effects
- Non-monotonic reasoning

We must reason without complete knowledge

- Closed world assumption

Not all knowledge is "black & white":

- Uncertainty, statistics, fuzzy logic,...

Defaults and exceptions:

Exception for a single object, a property of the object must be set to the (exception) value.

## 2.4 Semantic Networks

Semantic networks are essentially a generalization of inheritance hierarchies.

Each node is an object, class, concept, or event.

Each link is a relationship.

- is-a (the usual subclass or element relationship)
- has-part or part-of
- any other relationship that makes sense in context(e.g. owns thing x)

Semantic networks represent knowledge as a network or graph(easily stored on the computer).

By traversing the network we can find:



- 
- Elephant x likes apples(by inheritance)
  - That certain concepts related in certain ways(e.g. apples and elephants)





## Bibliography

**Books**

**Articles**



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