

Human memory and structured objects

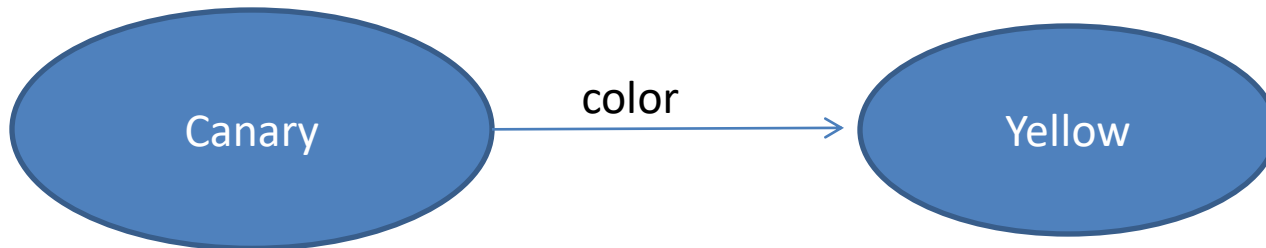
- Our knowledge representation encodes what is significant about an event. Omits many of the unimportant details. Why?
- Initial memory for an event contains verbal and visual details most details forgotten within one minute.
- People's memory often better for expected rather than un expected events.

- New information is not just passively encoded but interacts with existing knowledge.
- Knowledge is interconnected , structured and organized around a basic set of concepts and relationships

- Three types of structured object:
- 1-Semantic Nets – heavy influence from psychology proposed as a model of human memory.
- 2-Frames – joint influence of AI and psychology much of the detail worked out in A.I.
- 3-Scripts-based on the psychological concept of schema and then implemented in A.I, as scripts

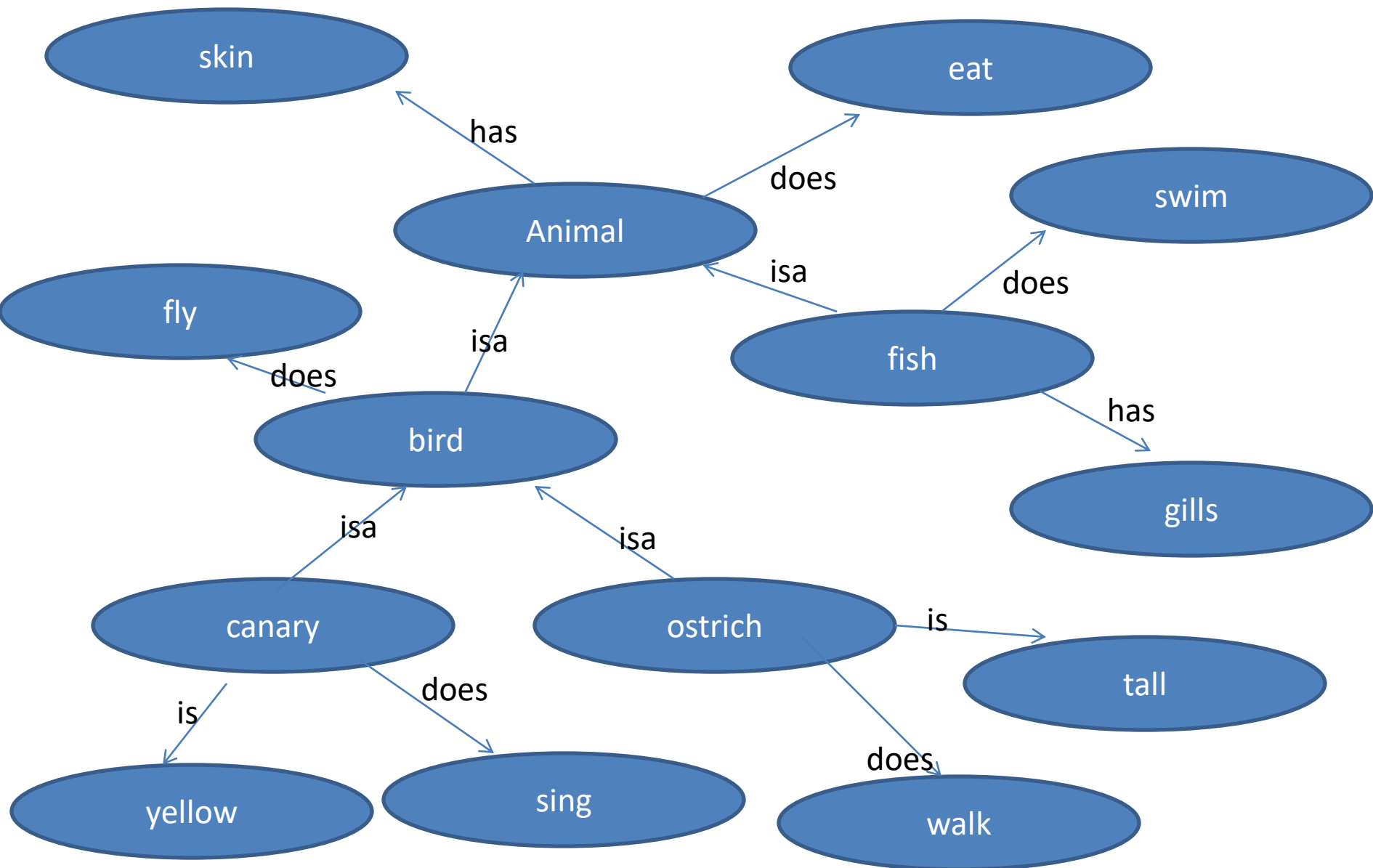
Semantic Networks

- Nodes represent items or concepts
- Arcs represent relationships between nodes.
- Node and arcs labeled to show the particular concept / relationship that they represent



Semantic networks also implement inheritance

A taxonomic Tree



- Collins & Quillian (1969).
- Simple items of information represented by 2 nodes and connecting arc
- eg. A fish has gills
- Implicit information can be deduced because of the special nature of the isa link
- e.g. does a canary fly? A canary is a bird and a bird flies

- Note that we don't have to include the "canary does fly" link explicitly.
- Inheritance is possible, this allows a node's properties to be passed on to subordinate nodes.
- E.g. An ostrich has skin

Reasoning in semantic Nets

- Network serves as data
- Reasoning proceeds by traversing arcs in net to identify complex relationships between nodes .
- Techniques –graph theory
 - intersection search :- activate all arcs connected to one node & all arcs connected to another Nodes connected to these arcs are themselves activated , and so on.
 - Eventually , all paths between two original nodes found; this shows all relations encoded in net that link these nodes.

Advantages of Semantic Nets

- Relationships and inferences are made explicit
Can be used to give explanations.
- Reasonably efficient as information need only be stored once at the highest level of abstraction. hence easy to update and maintain

Problems with Semantic Nets

- Picking the right set of nodes & links. Once committed, its hard to introduce new primitives.
- Hard to express quantification in basic networks
 - e.g. some birds fly
 - e.g. All the birds sing some songs, some of the birds sing all of the songs.
- Intentional concepts are hard to express
 - e.g. Tim believed that tom thought the lecture was fun.

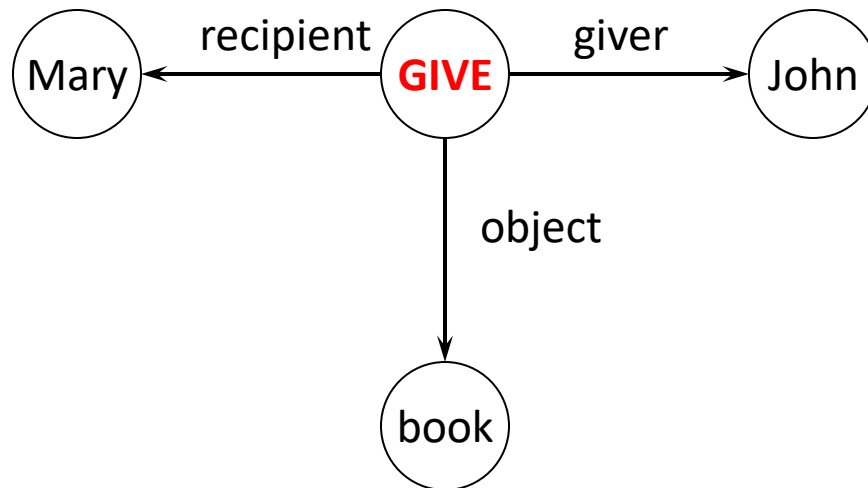
- This led to construction of representational units with more structure than simple nodes and links.

Semantics Nets in prolog

- We use an `isa(type , parent)` predicate to indicate that `type` is a member of `parent` and `hasprop(obj , property, value)` predicate represent property relations.
- `isa(canary, bird).`
- `isa(ostrich, bird).`
- `isa(bird, animal).`
- `isa(fish, animal).`
- `hasprop(canary , color, yellow).`
- `hasprop(bird , travel, fly).`
- `hasprop(ostrich , travel, walk).`

Non-binary relations

- We can represent the generic *give* event as a relation involving three things:
- Example: Merry gives the book to John
 - A giver
 - A recipient
 - An object

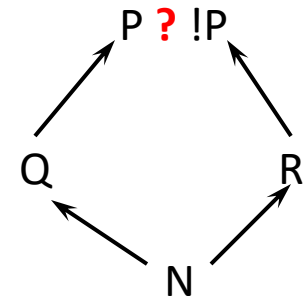
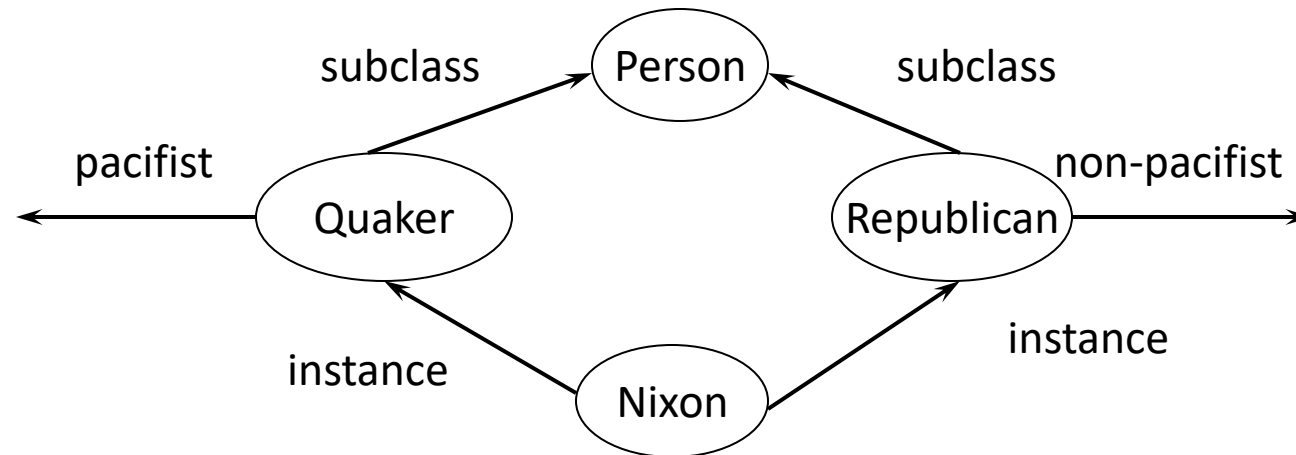


Multiple Inheritance

- A node can have any number of superclasses that contain it, enabling a node to inherit properties from multiple *parent* nodes and their ancestors in the network. It can cause conflicting inheritance.

Nixon Diamond

(two contradictory inferences from the same data)



Structured knowledge representations

- Frames or schemas ,scripts focus on more complex, structured units of knowledge than the simple node
- They are often more explicit ,expressive and efficient than simple networks.
- Often used for expected or stereo typical events , what did you expect when you walked into the lecture today?

Frames

- Developed by Marvin Minsky (1975).
- An extension to semantic nets. Nodes are replaced by structured groups of information called frames.
- Internal structure of frame is a type of slot and filler structure, representing properties (slot) and their (filler).
- Frames can represent classes of entities (class frames) such as a class of students or specific entities (instance frames) such as marvin
- Frames are hierarchically ordered and so share many of the benefits of semantic networks.

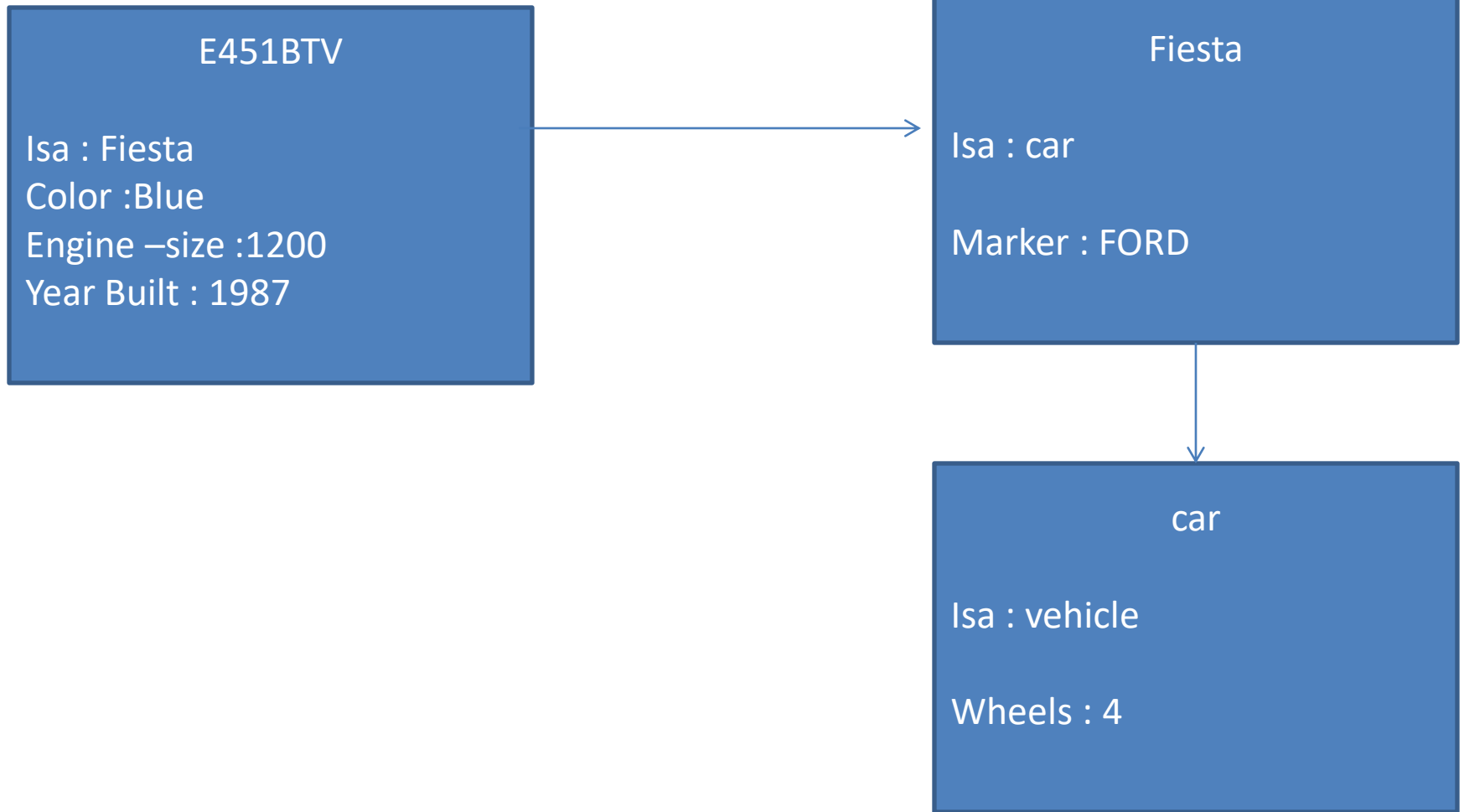
A frame for a book is given below.

Slots	Fillers
publisher	Thomson
title	Expert Systems
author	Giarratano
edition	Third
year	1998
pages	600

Frames can represent either generic or frame. Following is the example for generic frame.

Slot	Fillers
name	computer
specialization_of	a_kind_of machine
types	(desktop, laptop, mainframe, super) if-added: Procedure ADD_COMPUTER
speed	default: faster if-needed: Procedure FIND_SPEED
location	(home, office, mobile)
under_warranty	(yes, no)

Reasoning in frames – A car example



Inheritance

- Multiple inheritance allows frames to inherit from more than one source.

FORD

Isa : car
Color :Blue
Elegant :low
reliability : low

Small car

Isa : car
Cost : Low
Speed :Low

Fiesta

Isa : Small car , FORD

Inheritance

- Similar to Object-Oriented programming paradigm

