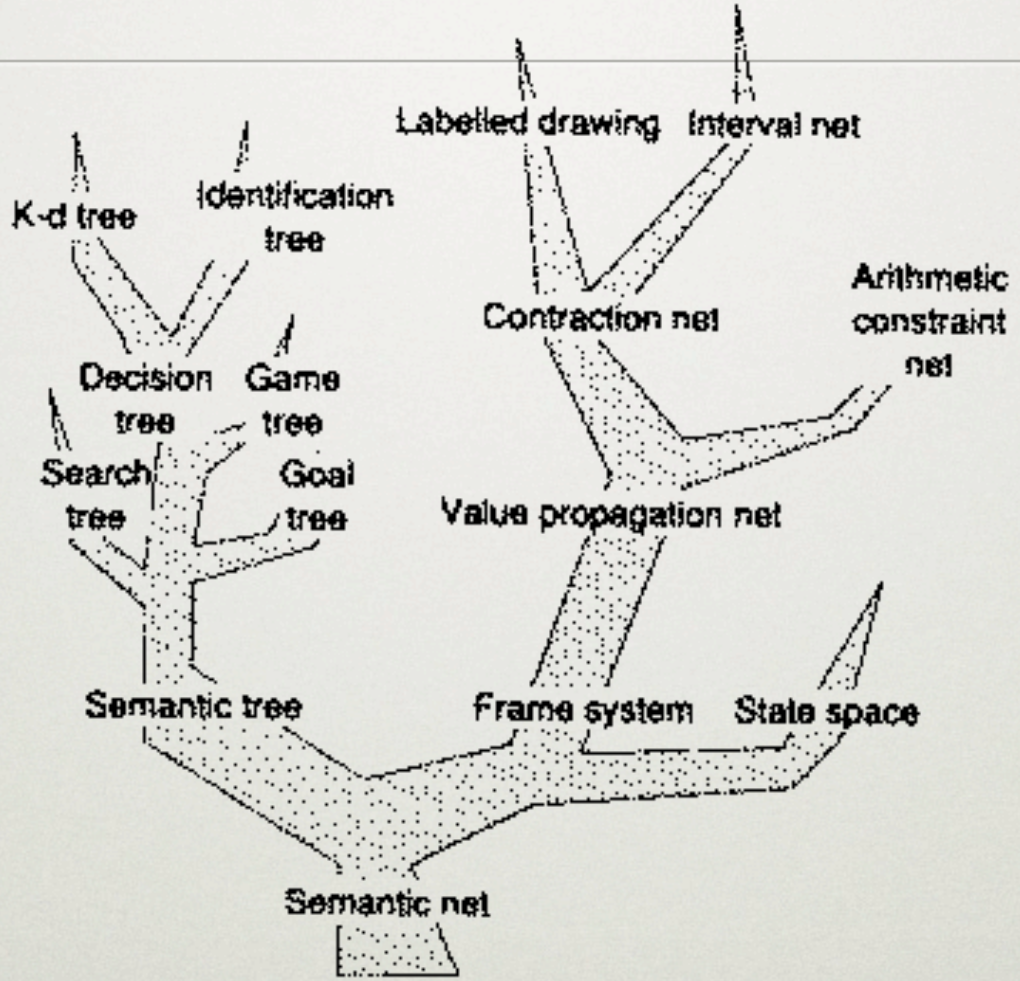
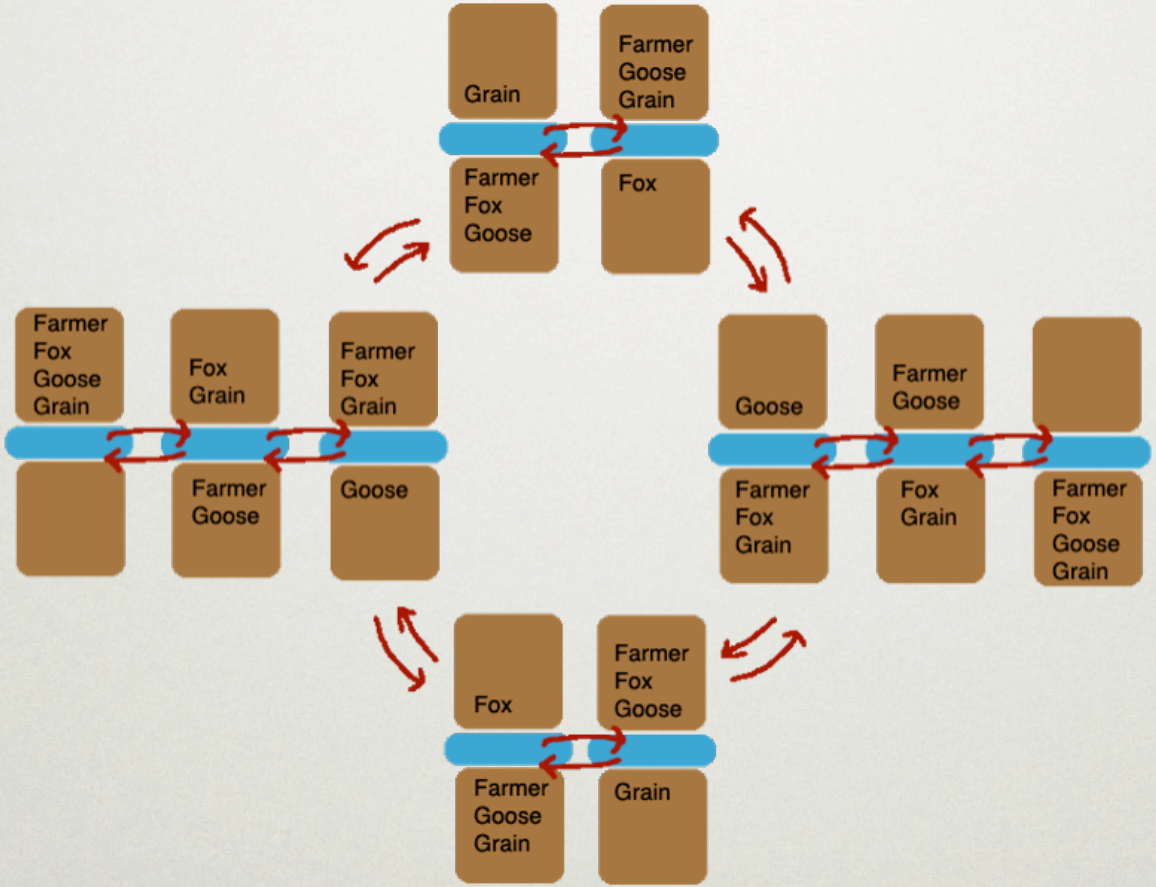
Semantic Networks

M. Anthony Kapolka III
CS 340 AI Fall 2011
Wilkes University

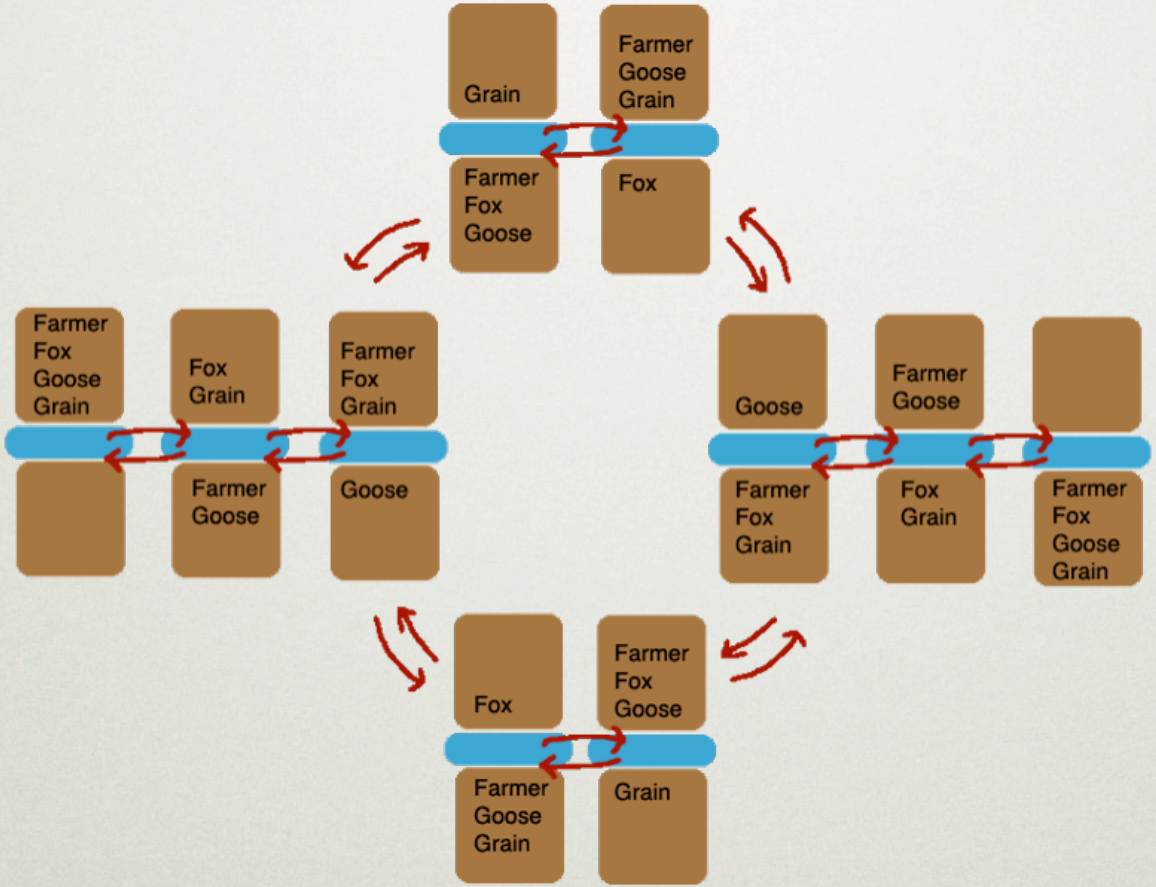
Ubiquitous


Labelled drawing
Interval net
K-d tree
Identification tree
Contraction net
Arithmetic constraint net
Decision tree
Game tree
Search tree
Goal tree
Value propagation net
Semantic tree
Frame system
State space
Semantic net

Farmer Fox Goose Grain



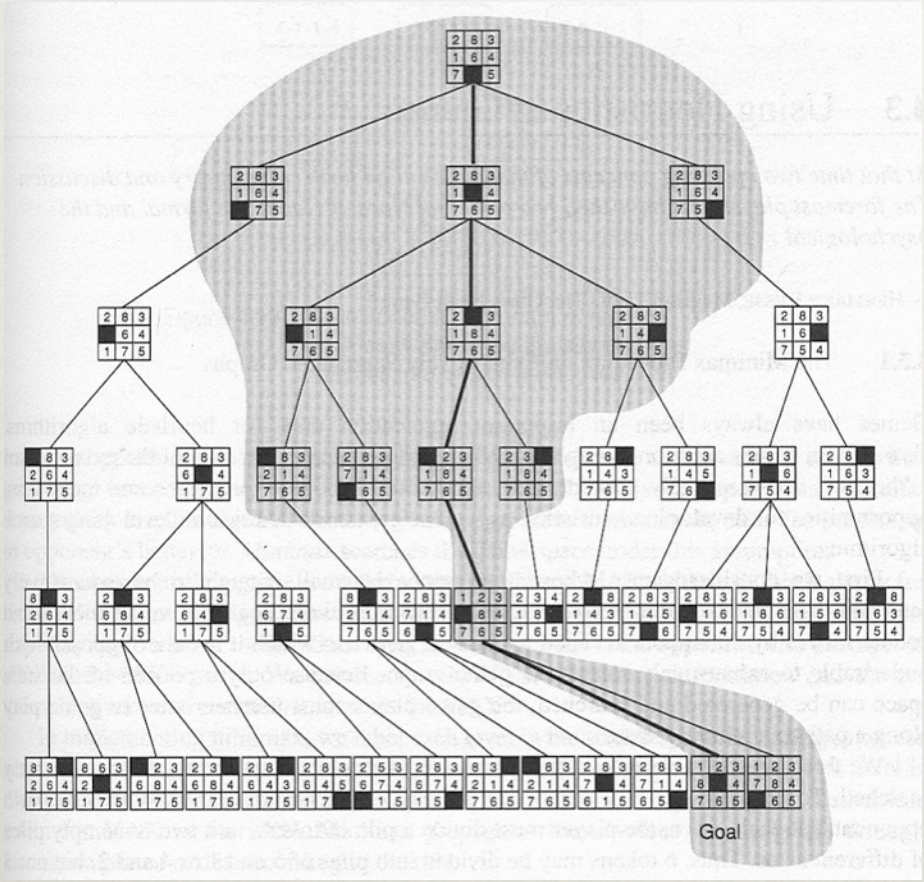
Farmer Fox Goose Grain



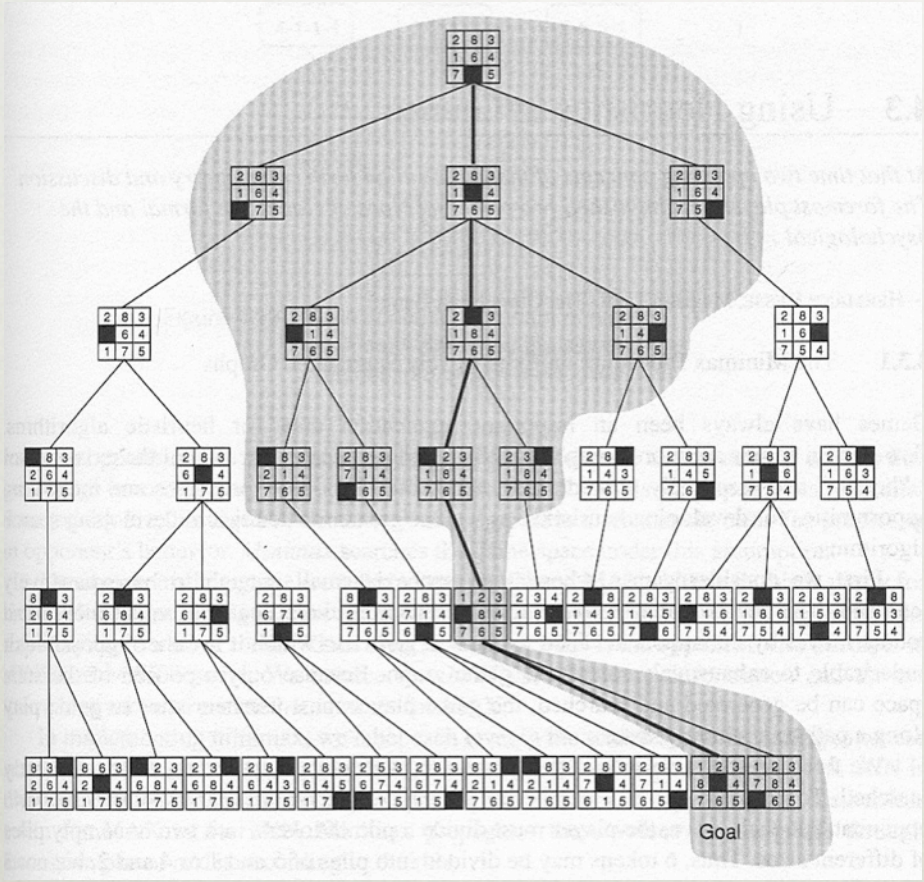
Nodes

Edges

8-Puzzle

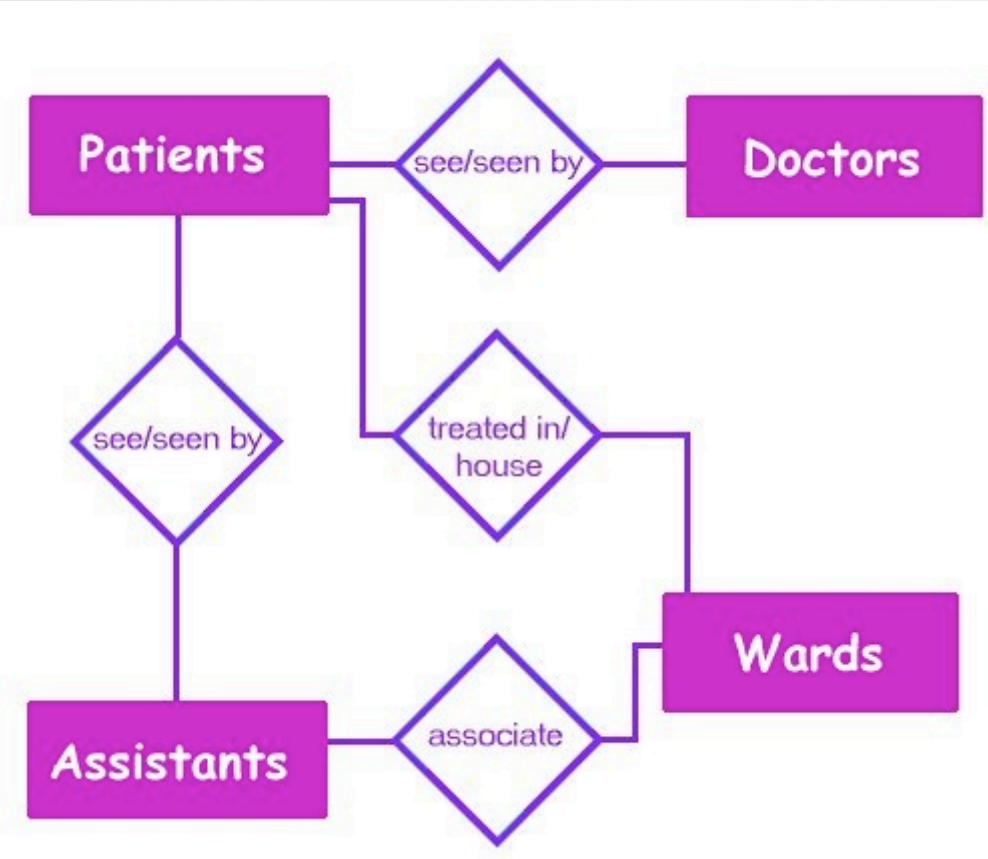


8-Puzzle



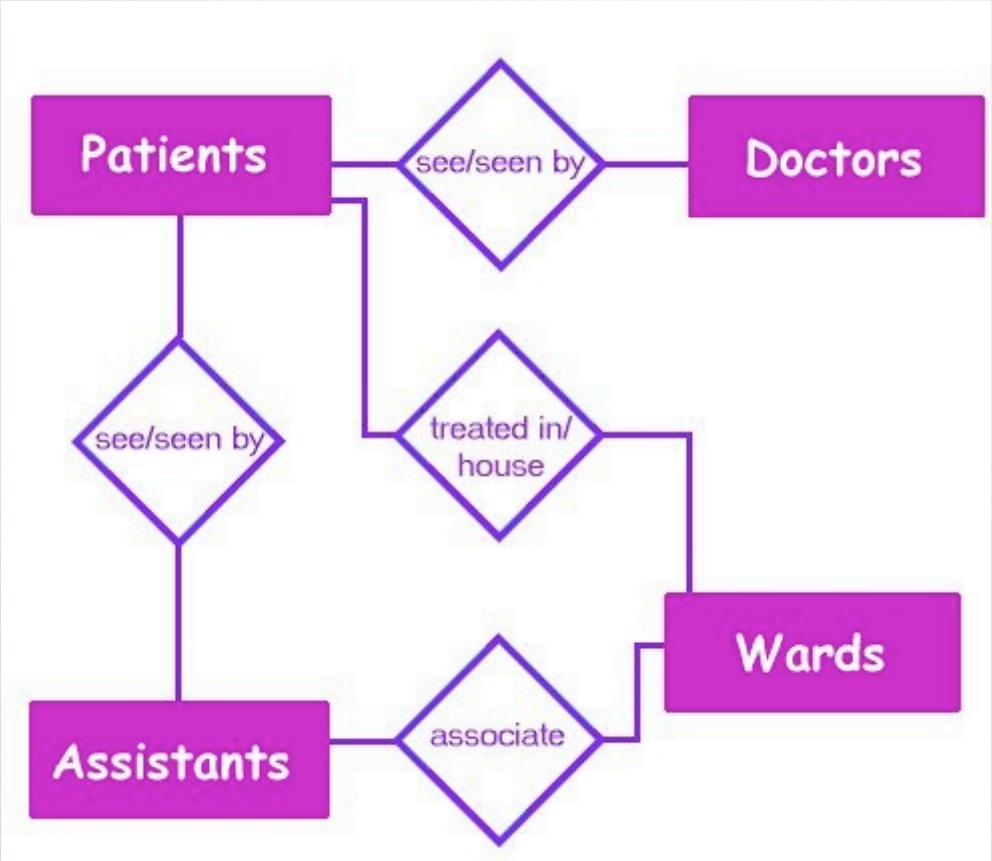
Nodes
Edges

ER Diagrams



[www.umsl.edu/~sauter/analysis/er/er_intro.html]

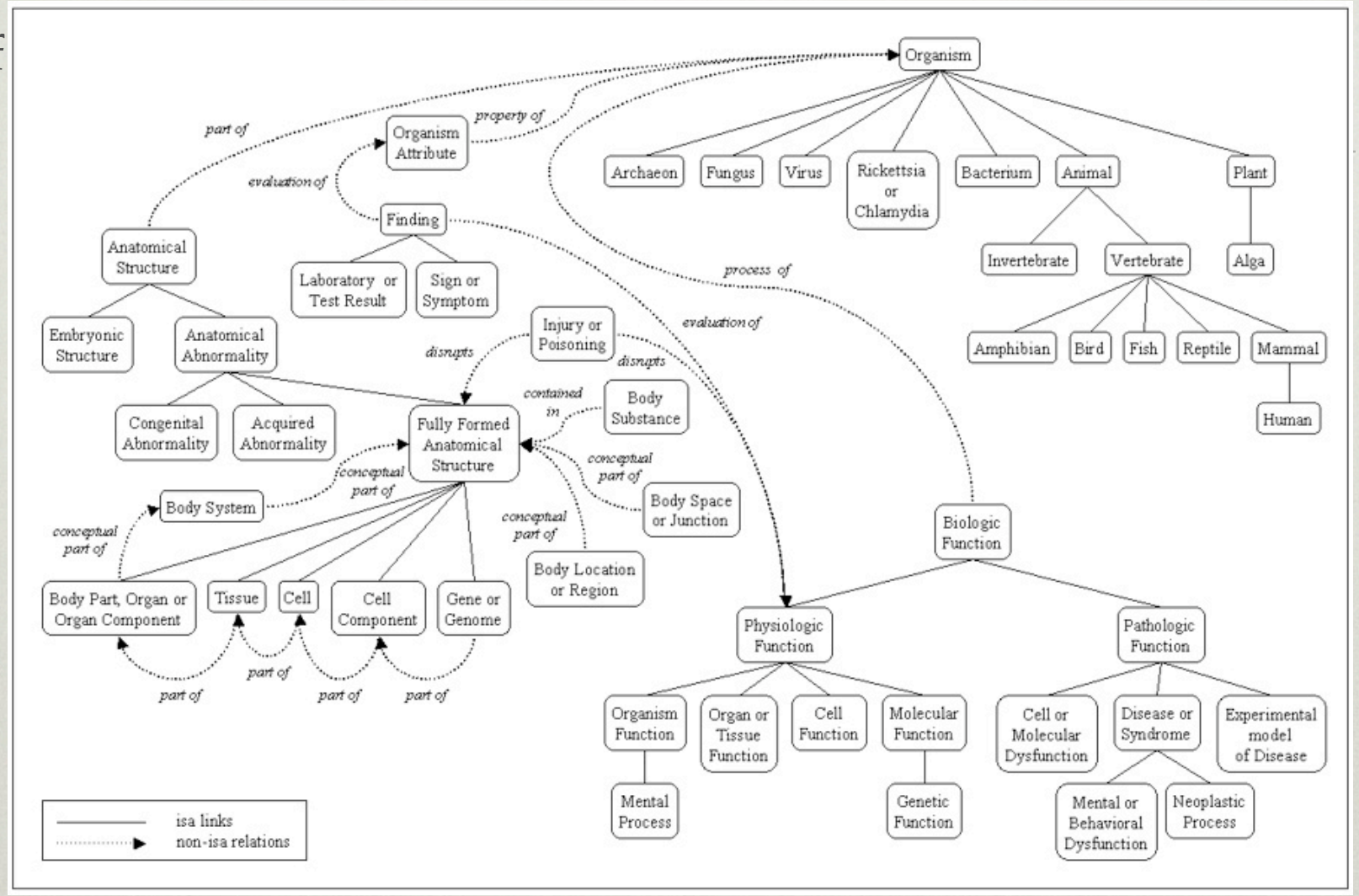
ER Diagrams



Nodes
Edges

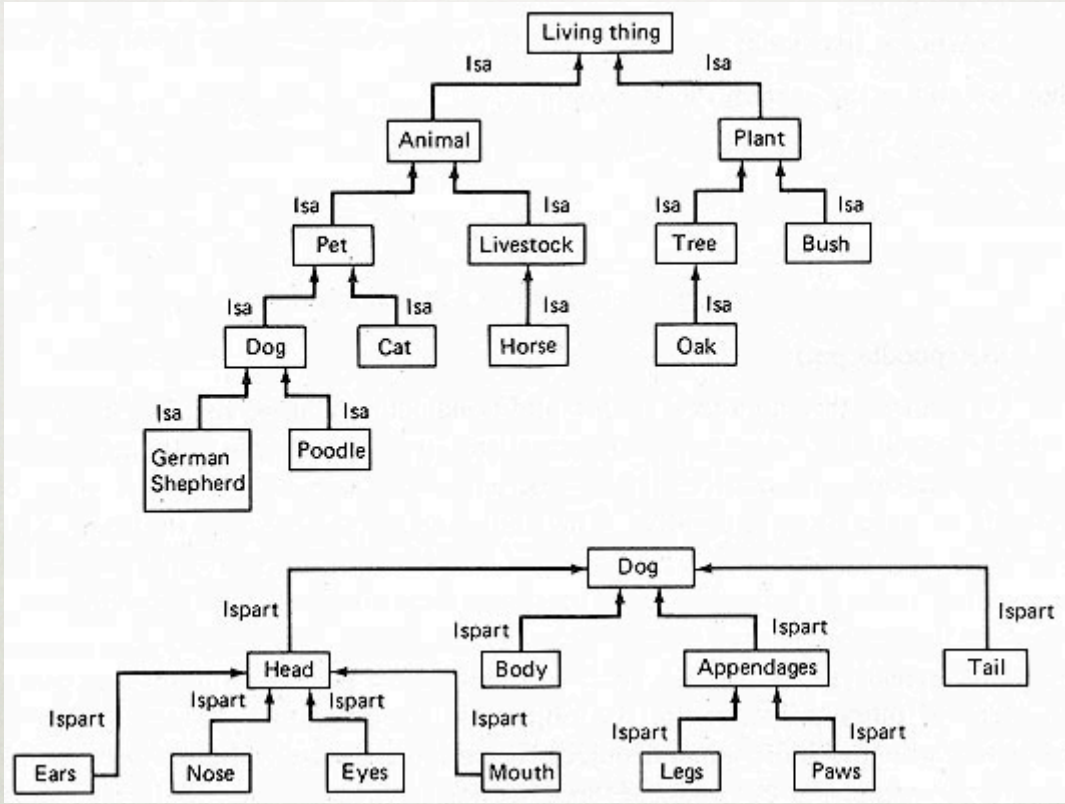
[www.umsl.edu/~sauter/analysis/er/er_intro.html]

Part of MeSH



[www.nlm.nih.gov/research/umls/sndoc_figure.GIF]

IS-A, IS-PART Hierarchies



[Rich 1991]

True or False?

True or False?

- A canary is a canary.

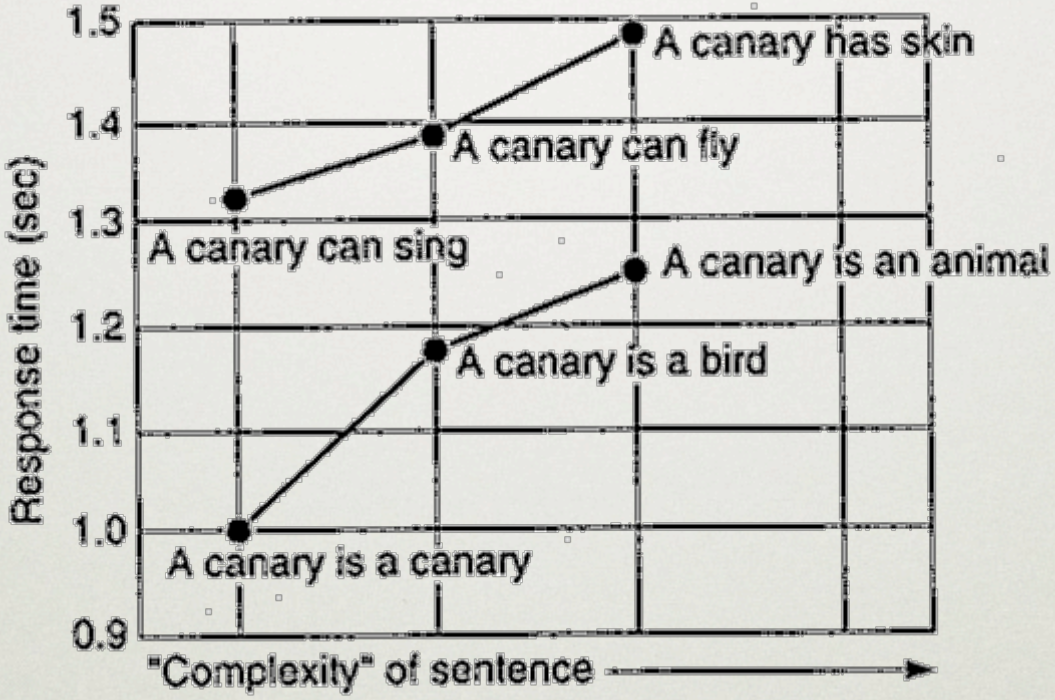
True or False?

- A canary can sing.

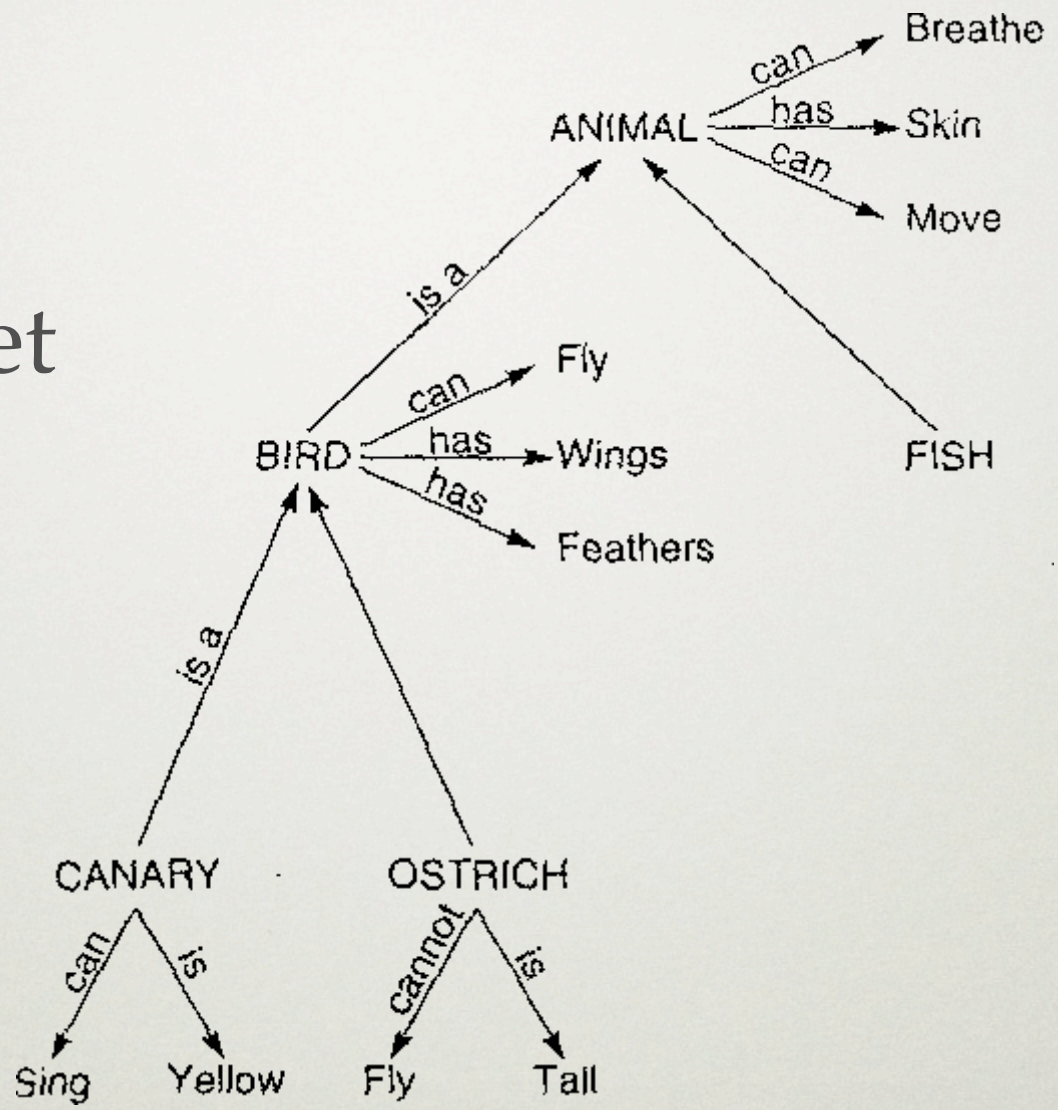
True or False?

- A canary has skin.

Response Time vs. Semantic Complexity



Postulated Semantic Net



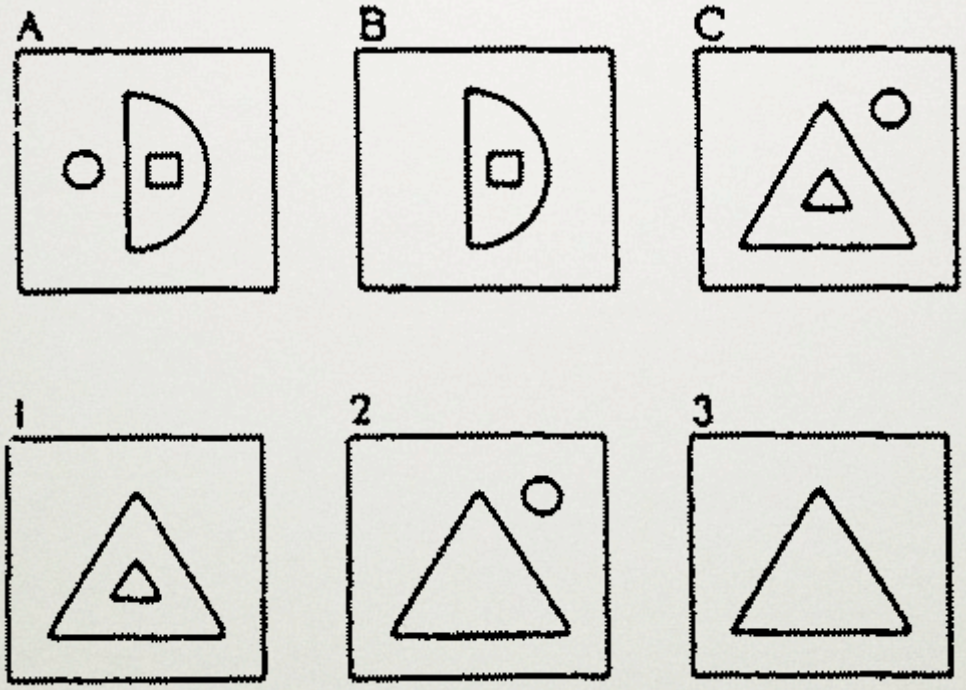
Semantic Networks

- Represent knowledge as a graph
- Vertices represent facts (concepts)
- Edges represent relationships between concepts
- meaning of vertices (nodes) & edges (links)
- operations on semantic network

Example Applications

- Analogy Problems
- Feature Extraction
  - represent images as a semantic net
- Feature Evaluation
  - determine what links have changed

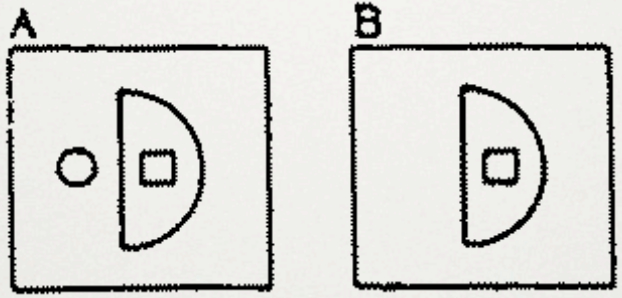
A : B :: C : ?

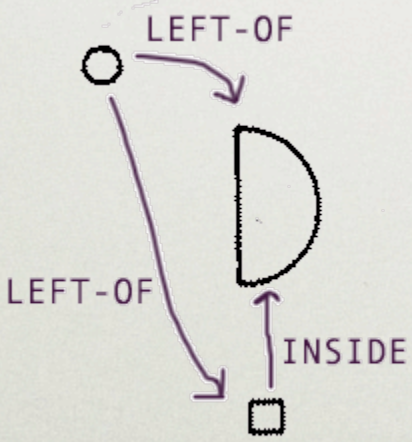


Analogy Program

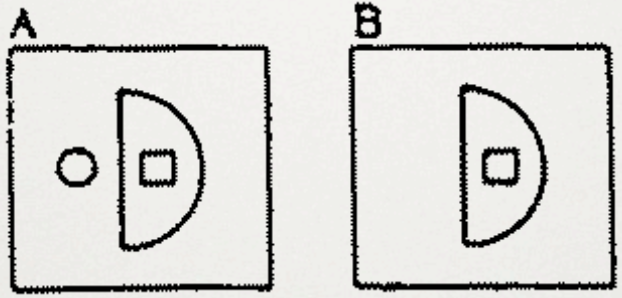
- Used graphic techniques to identify objects and relations
  - e.g. odd # lines crossed, inside
    even # lines crossed, outside
  - e.g. compute center, compare X Y coordinate for above/below/left/right
- Used similarity metric to compare two semantic nets

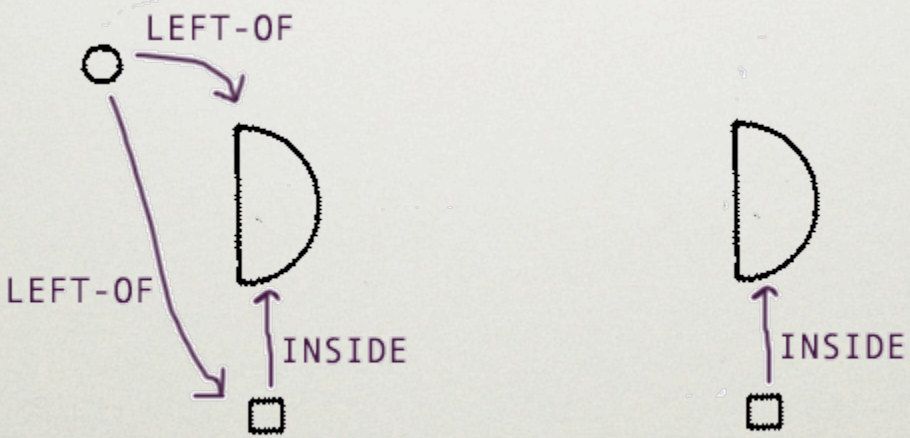
Look at A : B



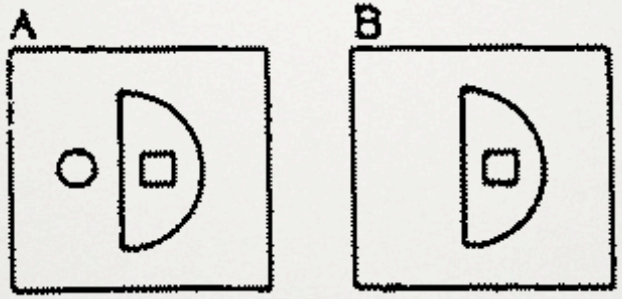


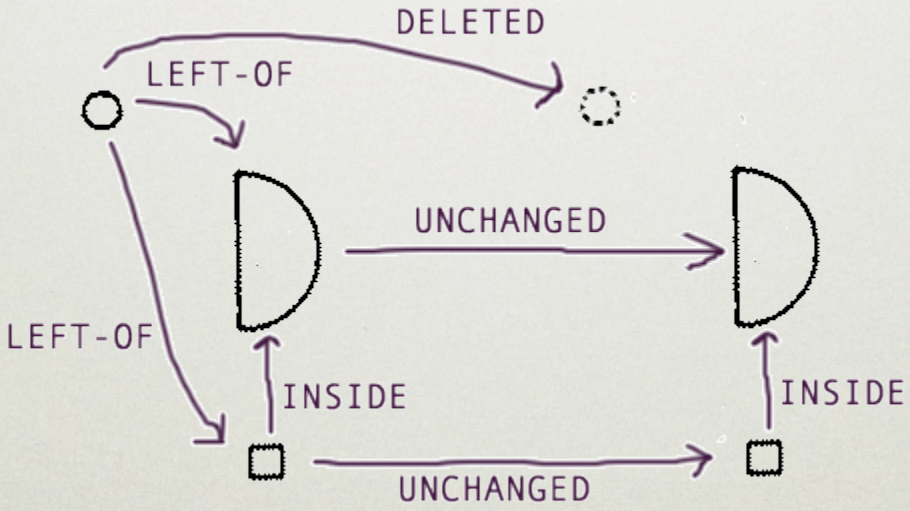
Look at A : B



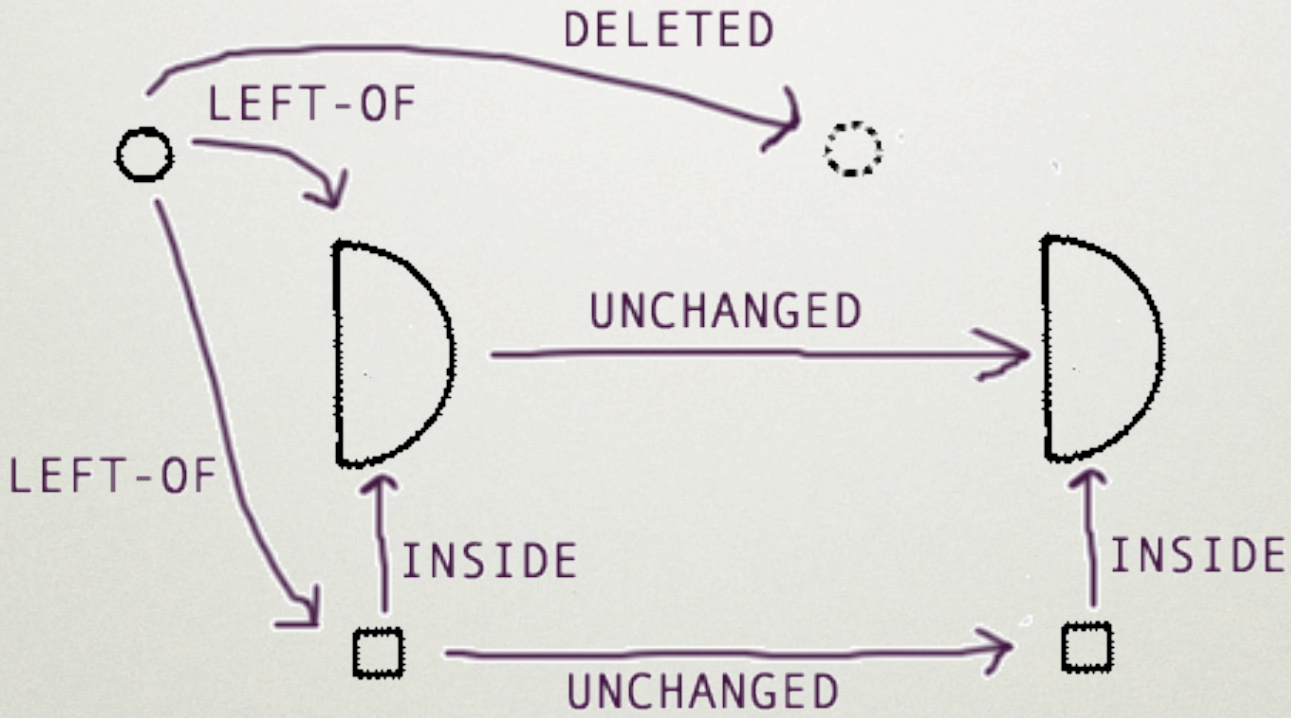


Look at A : B

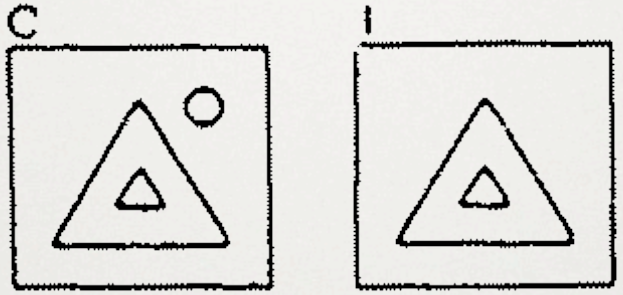

A
B

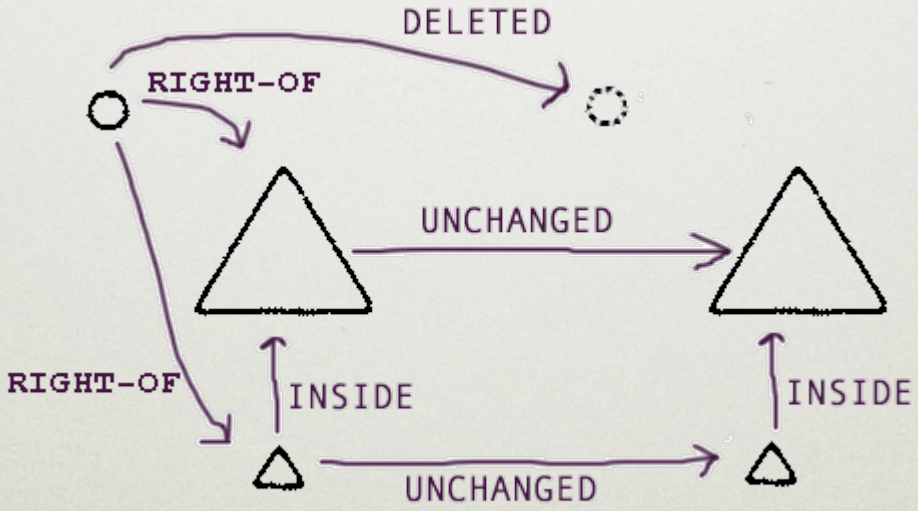

DELETED
LEFT-OF
UNCHANGED
LEFT-OF
INSIDE
INSIDE
UNCHANGED

Semantic Network

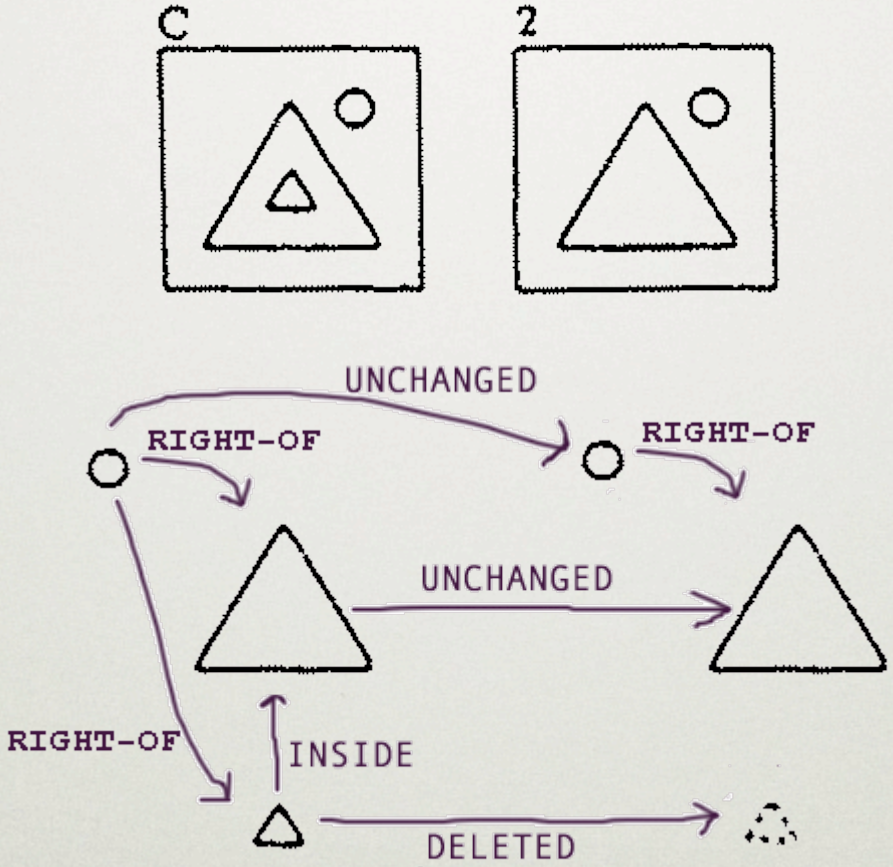


C : 1

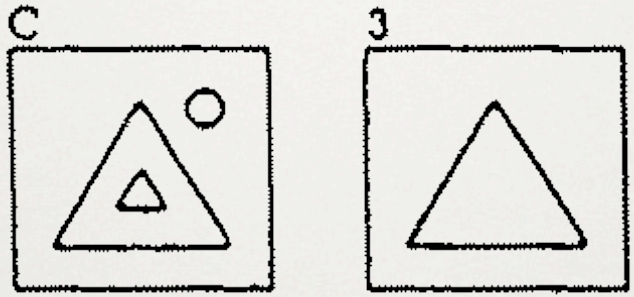

C
I

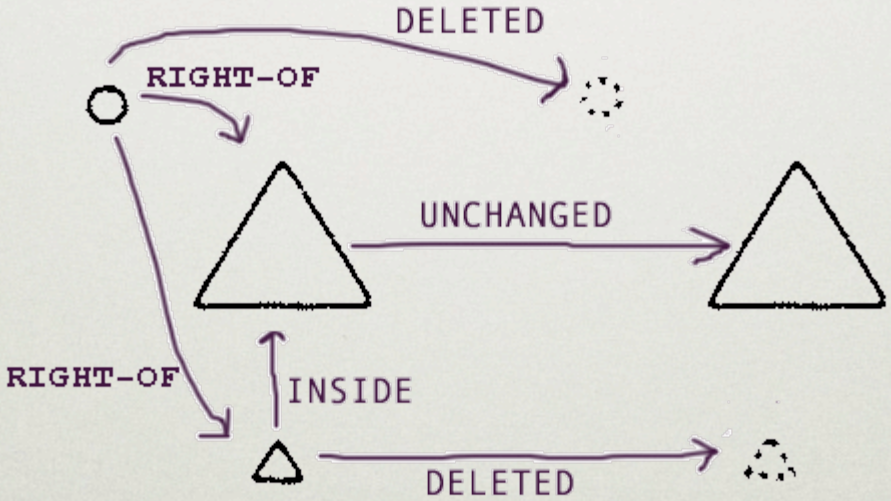

DELETED
RIGHT-OF
UNCHANGED
RIGHT-OF
INSIDE
INSIDE
UNCHANGED

C : 2

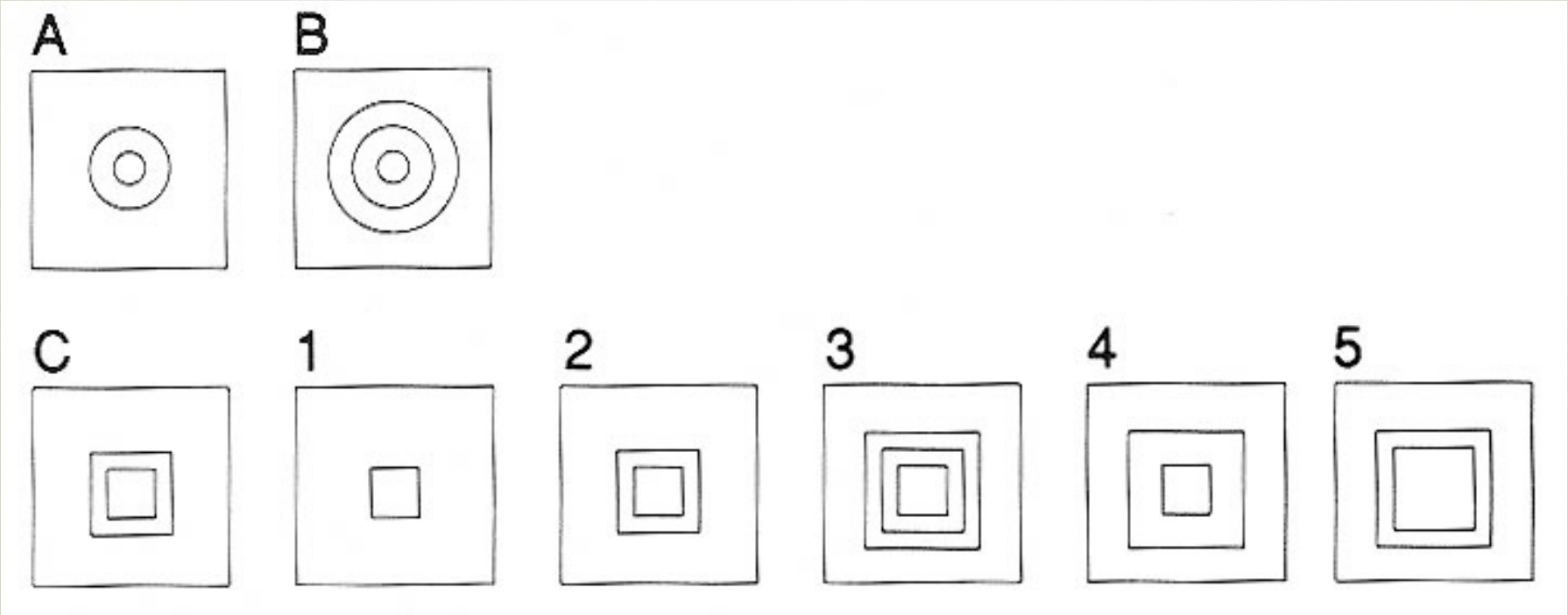

C
2
UNCHANGED
RIGHT-OF
RIGHT-OF
UNCHANGED
RIGHT-OF
INSIDE
DELETED

C : 3

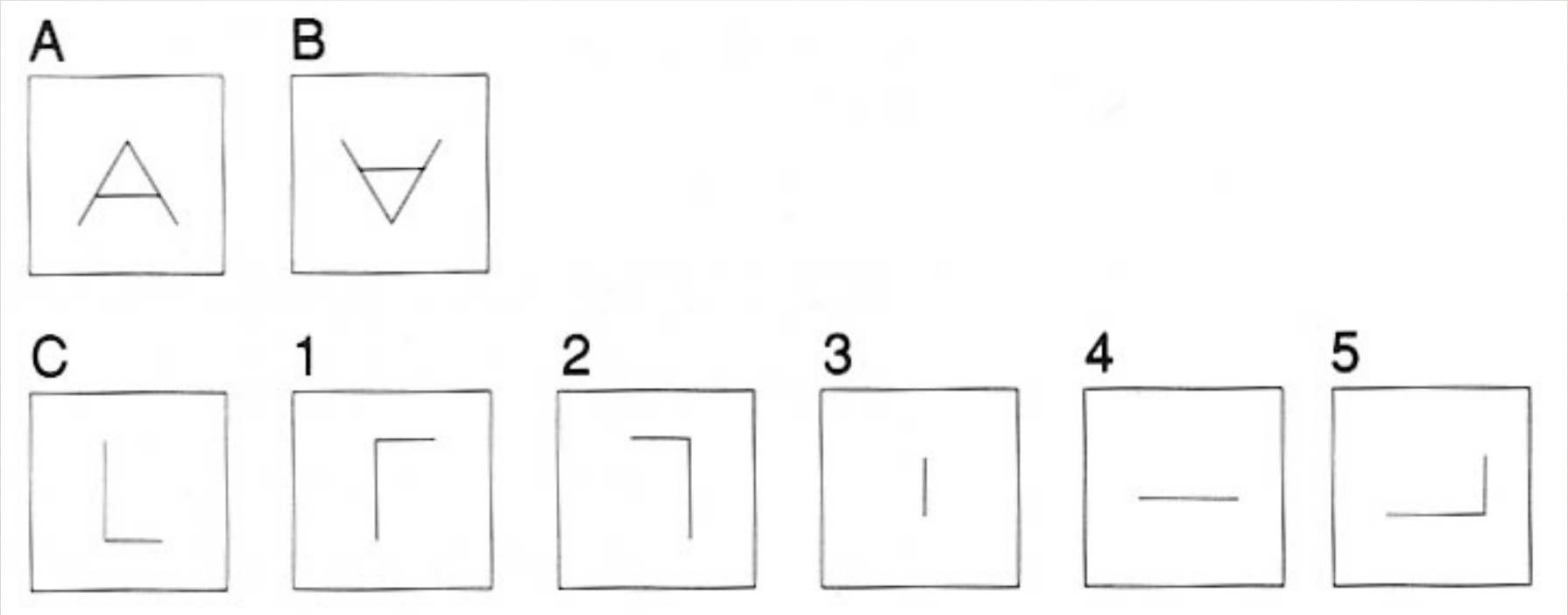




Could answer Questions like:



Could answer Questions like:



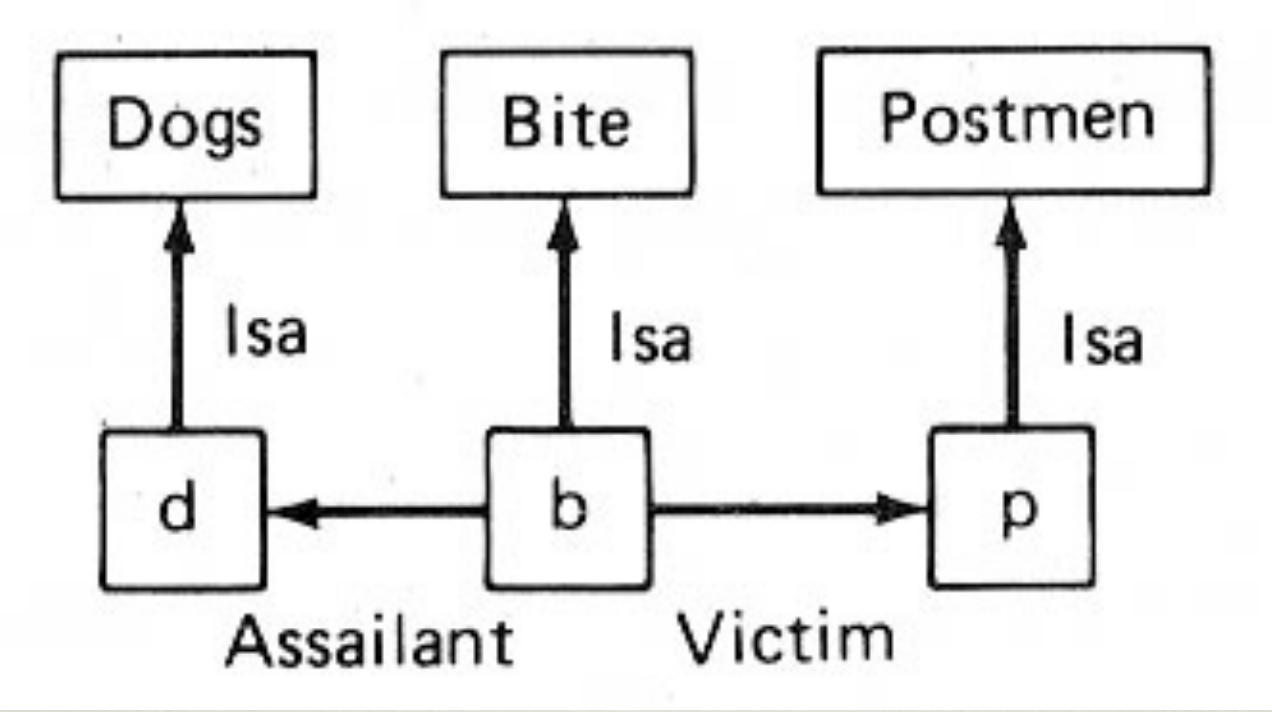
Real Life Problems

Real Life Problems

Or maybe?

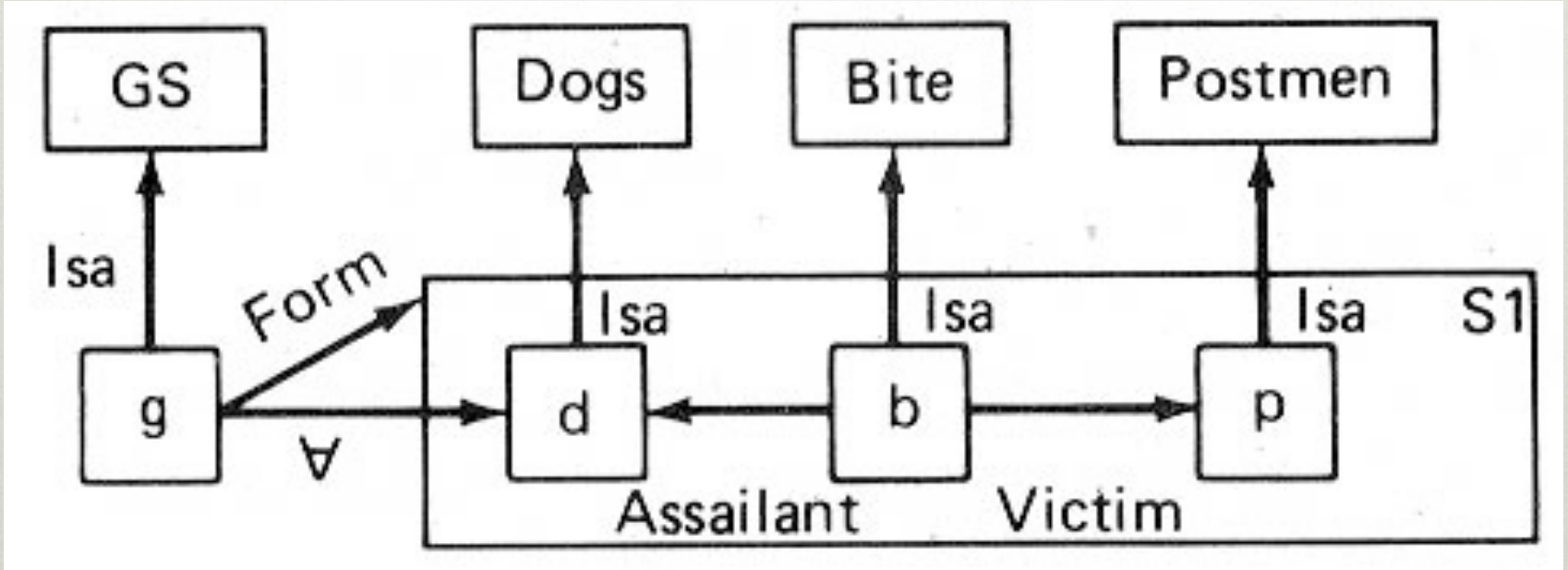
Or maybe?

A Simple Sentence



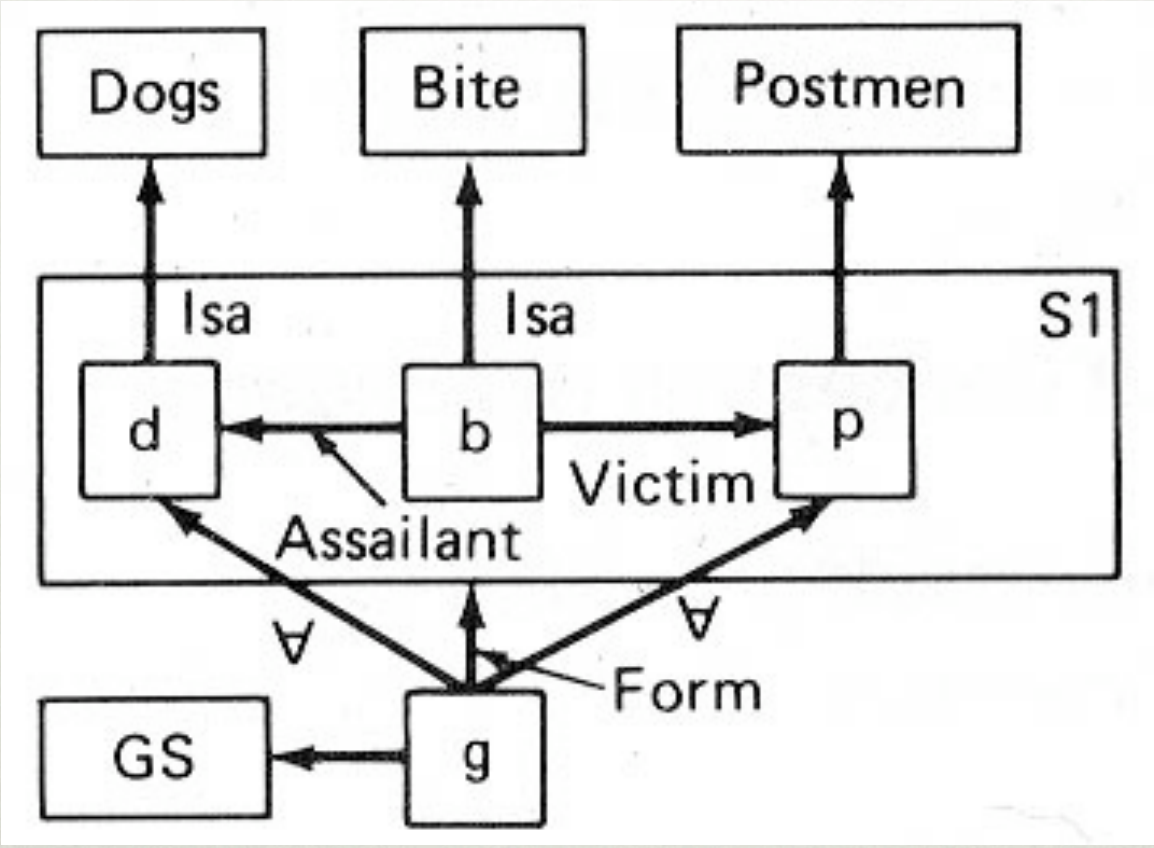
[Rich 1991]

Another Sentence



[Rich 1991]

Sentence Three

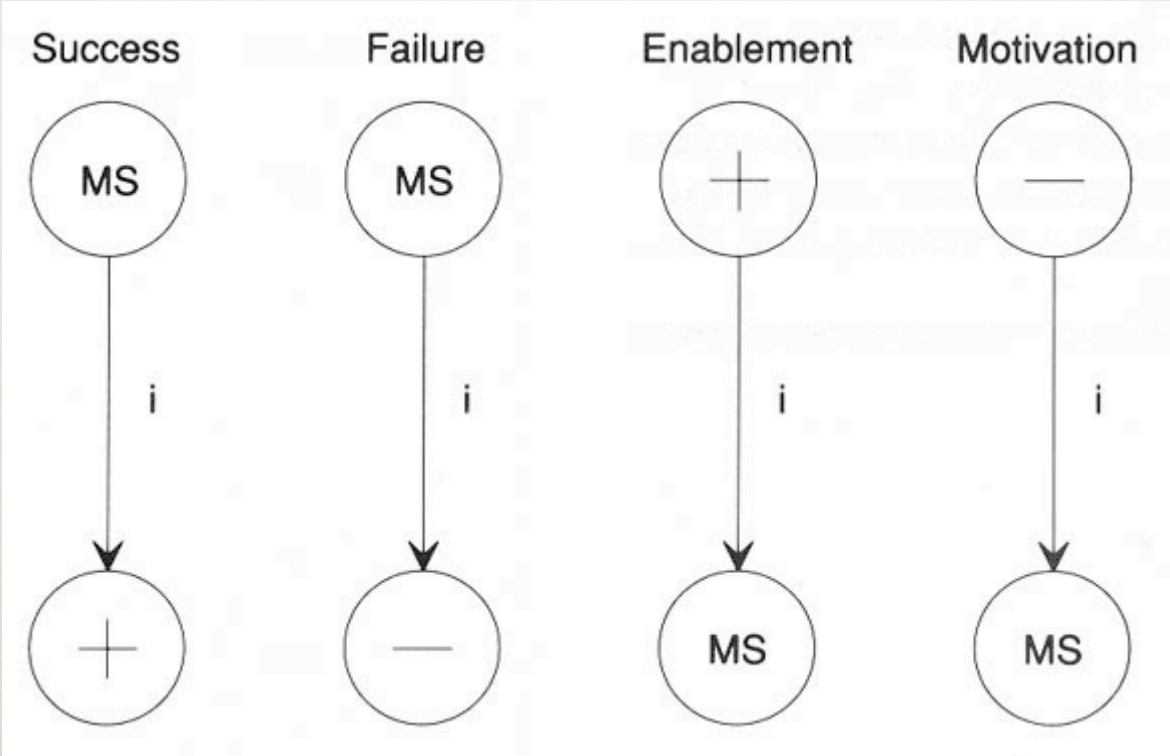


[Rich 1991]

"Plot Units"

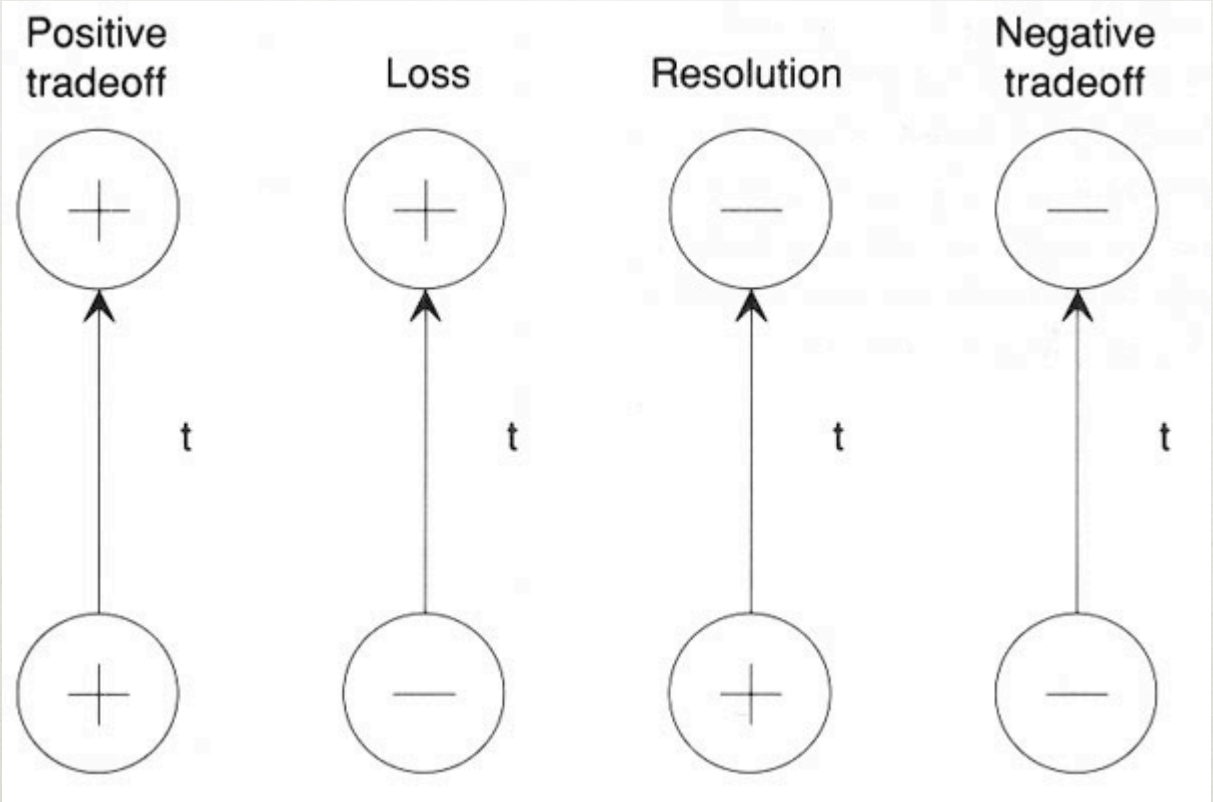
- Goal is to summarize a story.
- Story represented by a semantic net
- Nodes are
  + (positive) **-** (negative) or **MS** (neutral)
- (Causal) Links are
  i (initiates) **t** (terminates) or **c** (corefers)

Example Plots



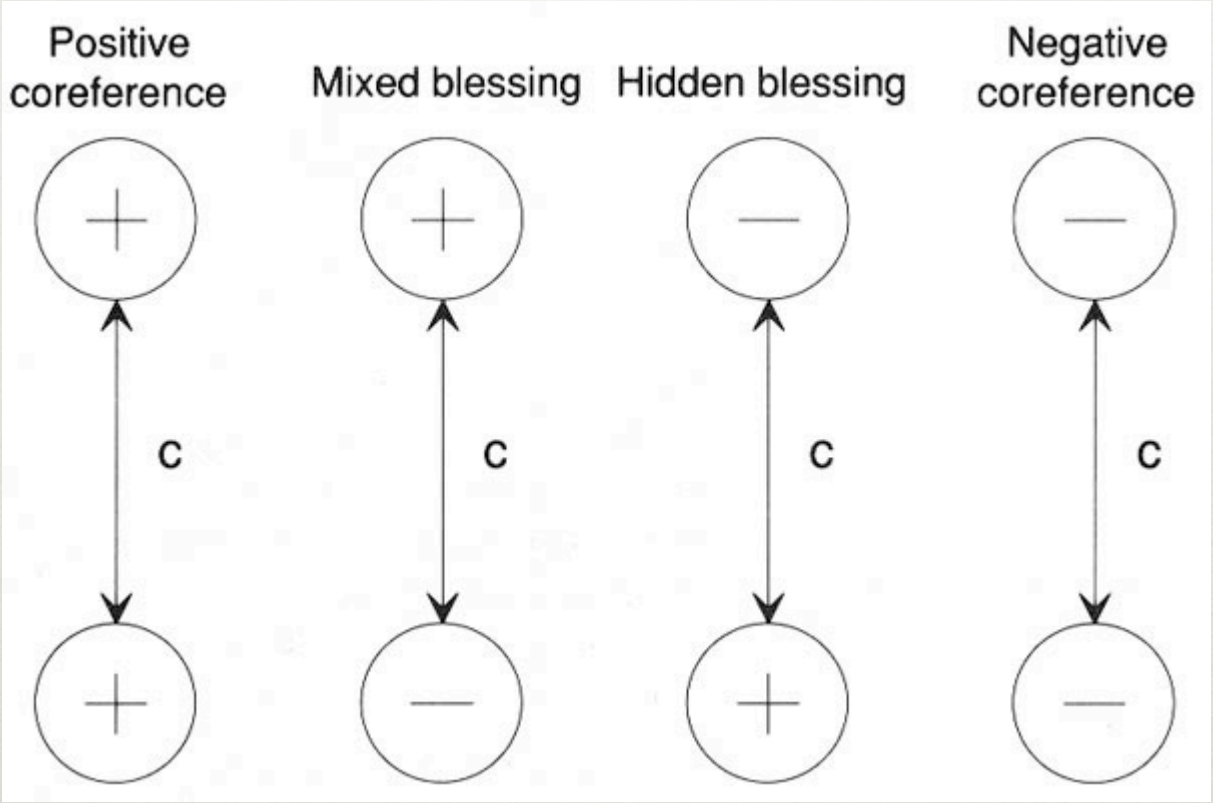
[Winston 1992]

More Plots



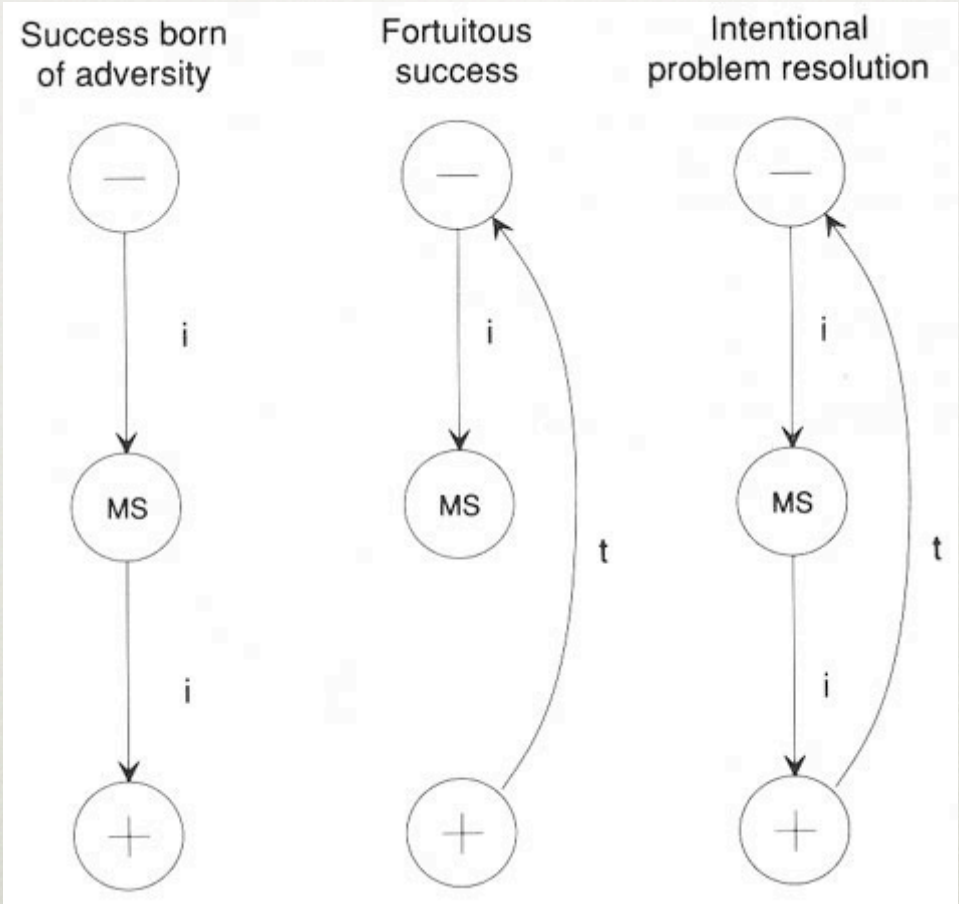
[Winston 1992]

And More Plots



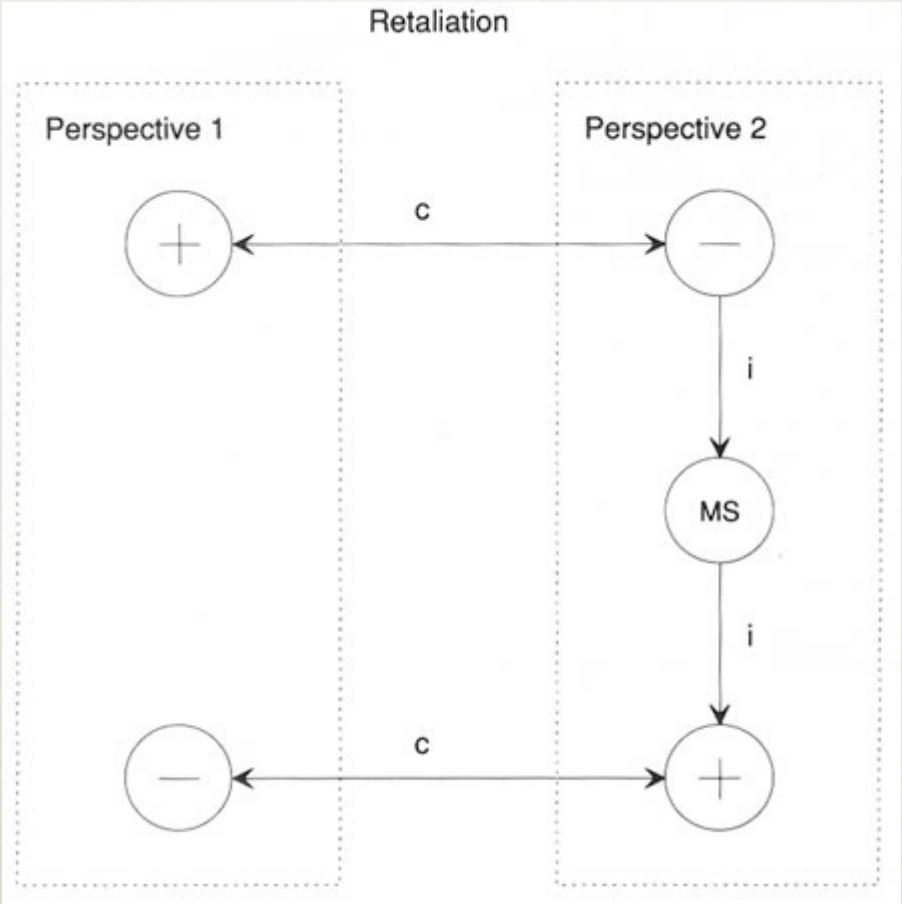
[Winston 1992]

Higher-Level Units



[Winston 1992]

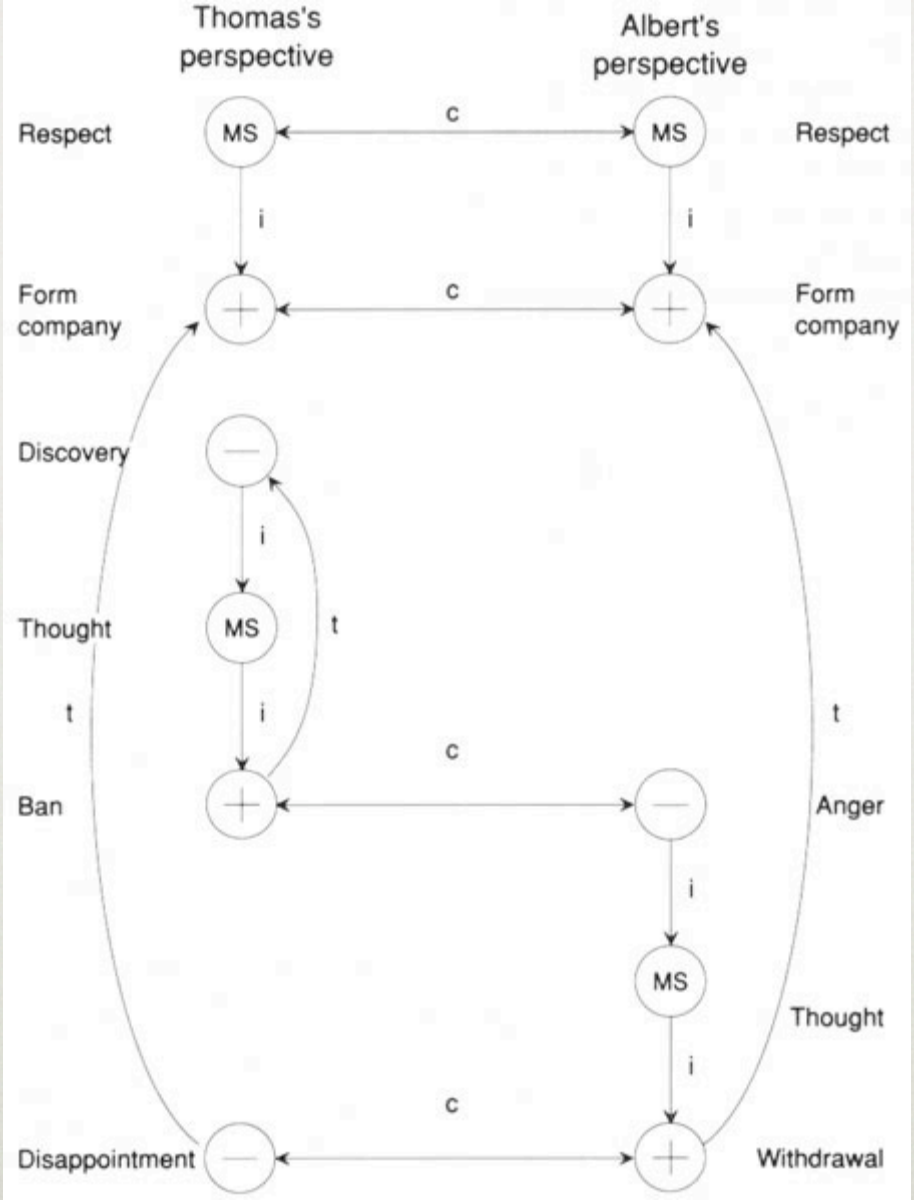
Multiple Perspective



[Winston 1992]

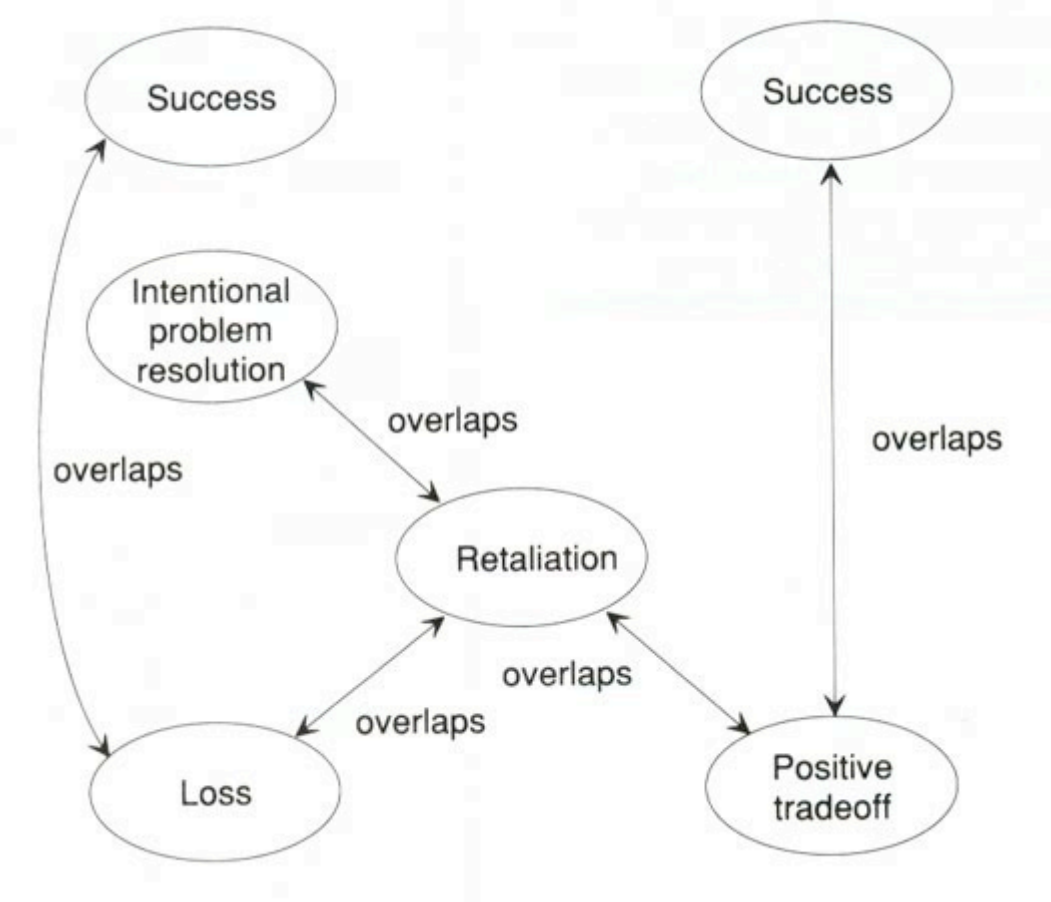
Thomas And Albert

Thomas and Albert respected each other's judgment and decided to form a company together. Thomas learned Albert was notoriously absentminded, whereupon he insisted Albert have nothing to do with the company's finances. This angered Albert so much that he backed out of their agreement, hoping Thomas would be disappointed.



[Winston 1992]

Abstracted Story



[Winston 1992]

Summary

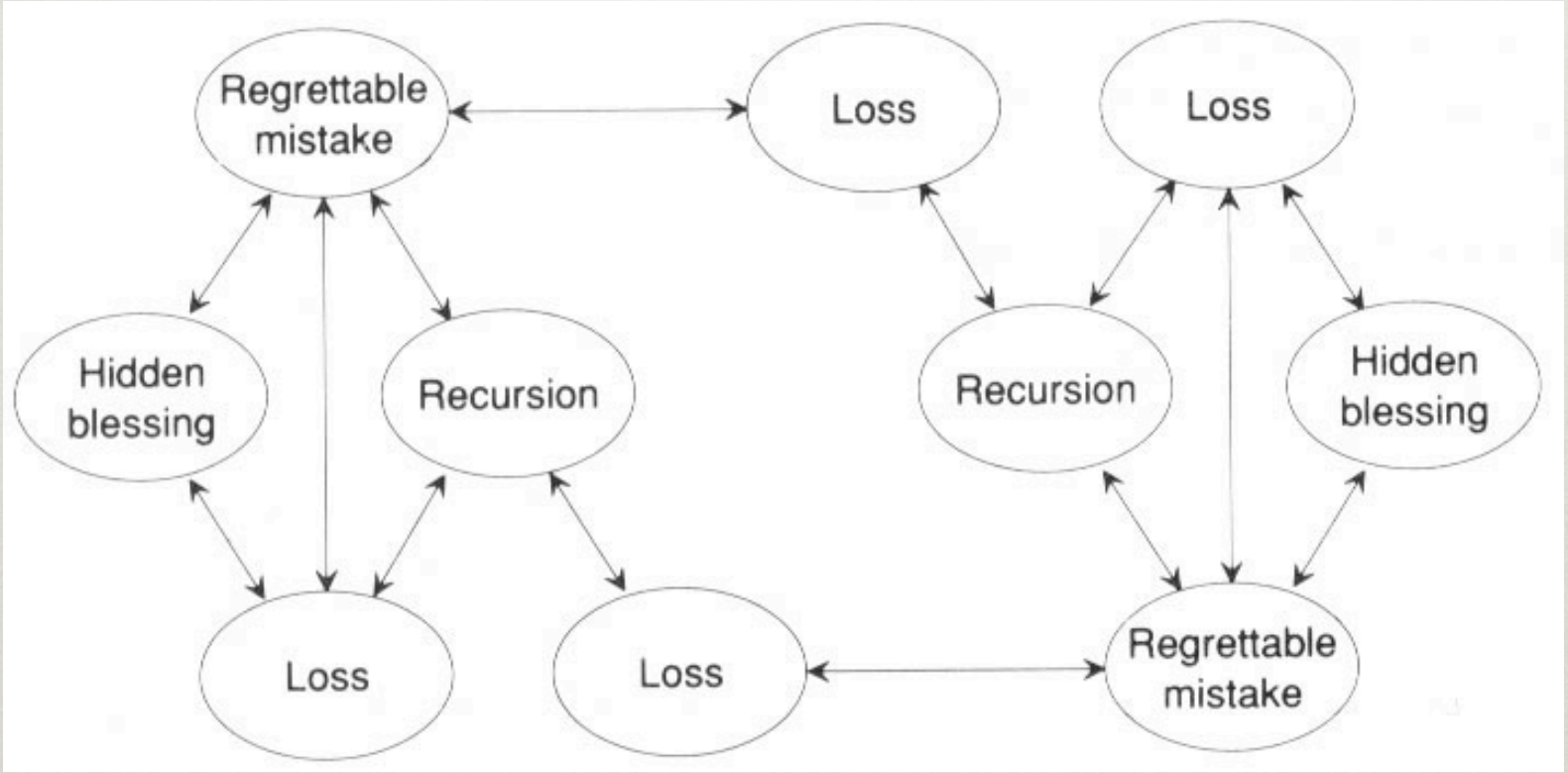
Albert *retaliated* against Thomas because Thomas went thought an *intentional problem resolution* that was bad for Albert. The *retaliation* caused a *loss* for Thomas and a *positive trade off* for Albert. The *loss* reversed Thomas's previous *success*.

What Good Is This?

- Can answer “What is the story about?”
- Can answer “What is the result?”
- Does the story contain a certain theme?
- Exposes story structure.
- Allows comparison of multiple stories.

Gift of the Magi

Della & Jim



[Winston 1992]

Another Christmas Story