

Intelligent Systems Principles and Programming

Xiaoqing Zheng
zhengxq@fudan.edu.cn



Expert systems

Programs = Algorithms + Data Structures

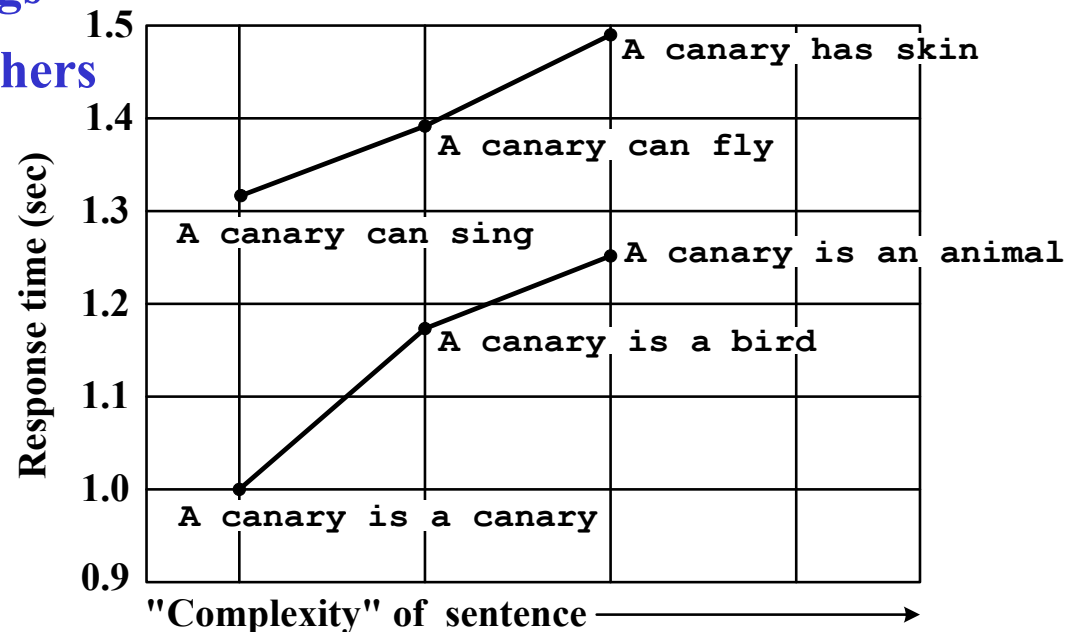
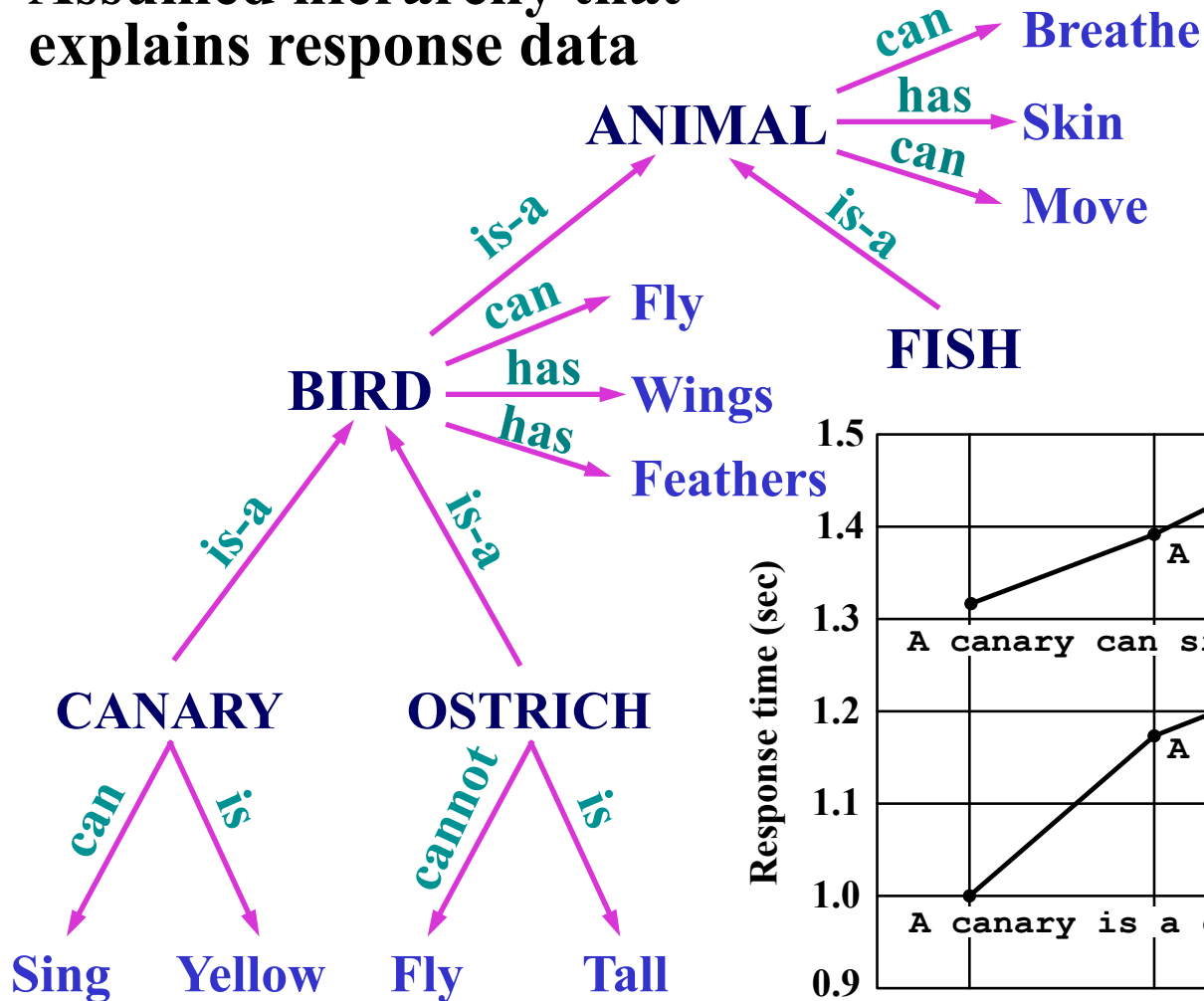
Expert Systems = Knowledge + Inference

Knowledge representation

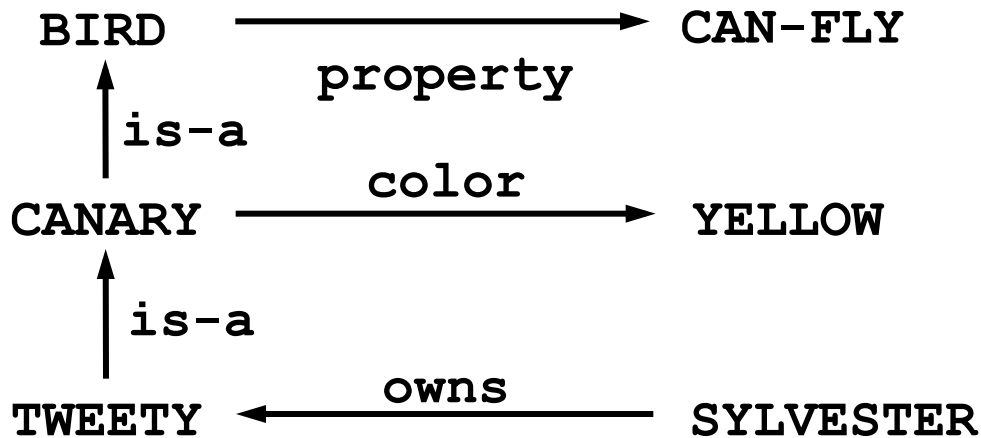
- *Representation*, *acquirement* and *use* of knowledge are three main domain of research and application in artificial intelligent.
- Knowledge representation serving as a starting point or *basis* of the two later.

Psychological evidence

Assumed hierarchy that explains response data

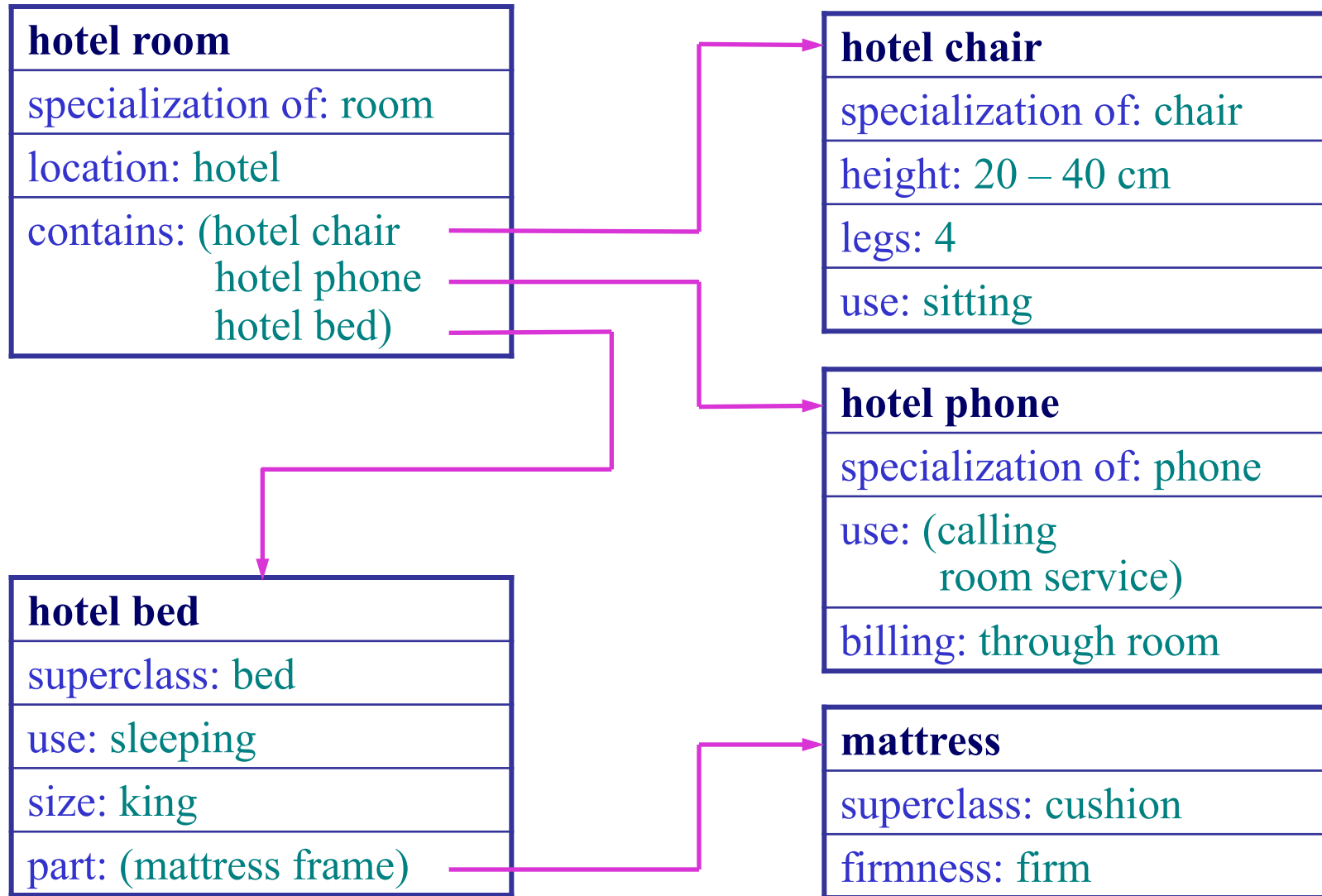


Inference in semantic networks



- CAN-FLY (CANARY)
- CAN-FLY (TWEETY)
- SYLVESTER owns Something that can fly
- TWEETY is YELLOW
- SYLVESTER owns a CANARY
- SYLVESTER owns a BIRD

Frame



Types of slot

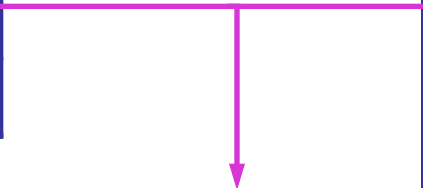
- Frame *identification* information.
- *Relationship* of this frame to other frames.
- Descriptors of *requirements* for a frame.
- *Procedural* information.
- Frame *default* information.
- *New instance* information.

Inference in frame systems

John like a fire engine.

John
isa: human
gender: male
enterprise: average
activity:
volume:

fire engine
isa: motor vehicle
color: red
activity: high
volume: very high
fuel efficiency: average
ladder: 5m



A pink line connects the 'activity:' slot of the 'John' frame to the 'activity: high' slot of the 'fire engine' frame. A pink arrow points from this connection down to the 'activity: high' slot of the new 'John' frame. Another pink line connects the 'volume:' slot of the 'John' frame to the 'volume: very high' slot of the 'fire engine' frame. A pink arrow points from this connection down to the 'volume: very high' slot of the new 'John' frame.

John
isa: human
gender: male
enterprise: average
activity: high
volume: very high

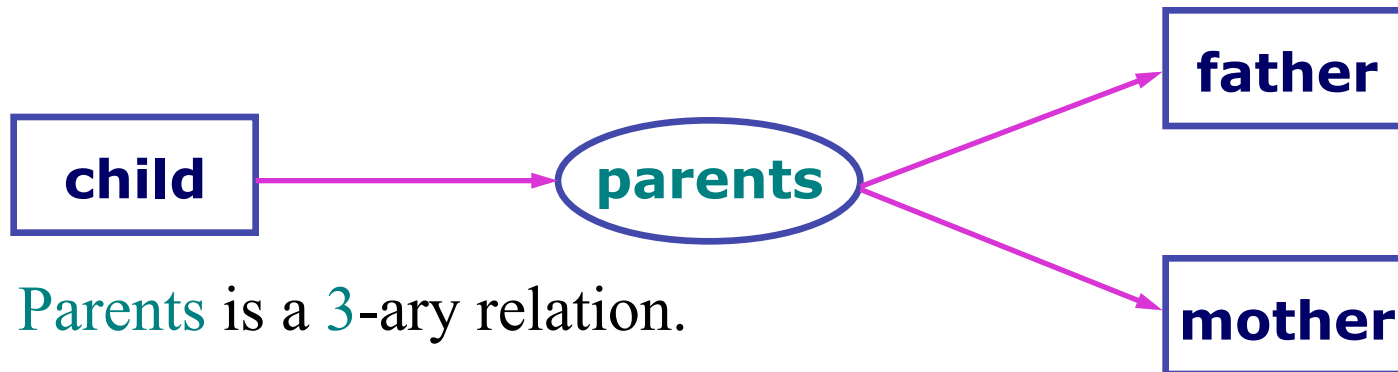
Conceptual graph



flies is a 1-ary relation.

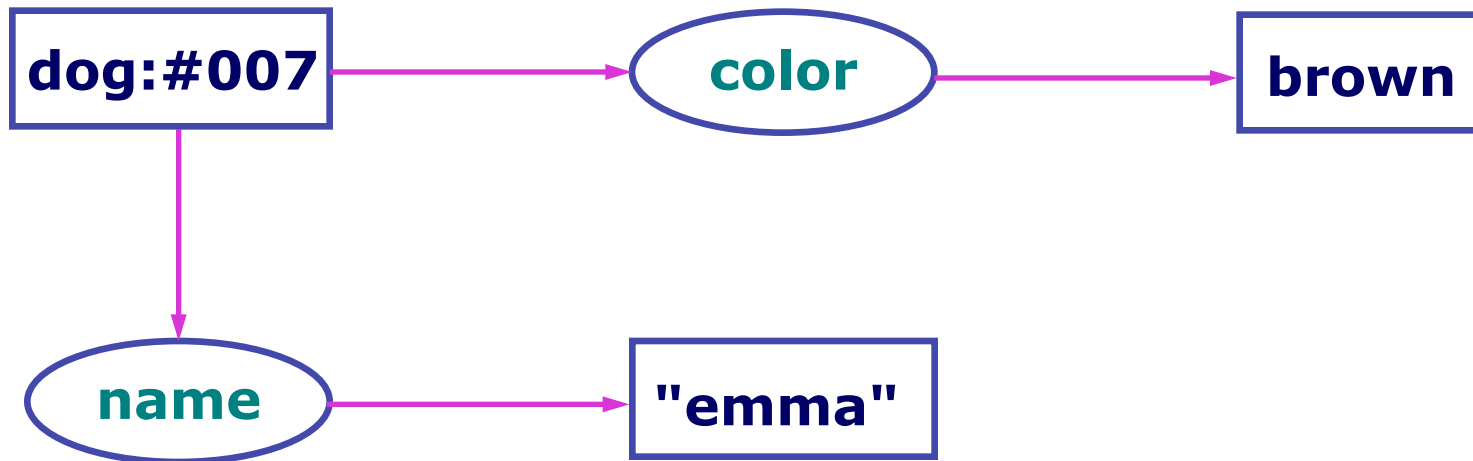


Color is a 2-ary relation.



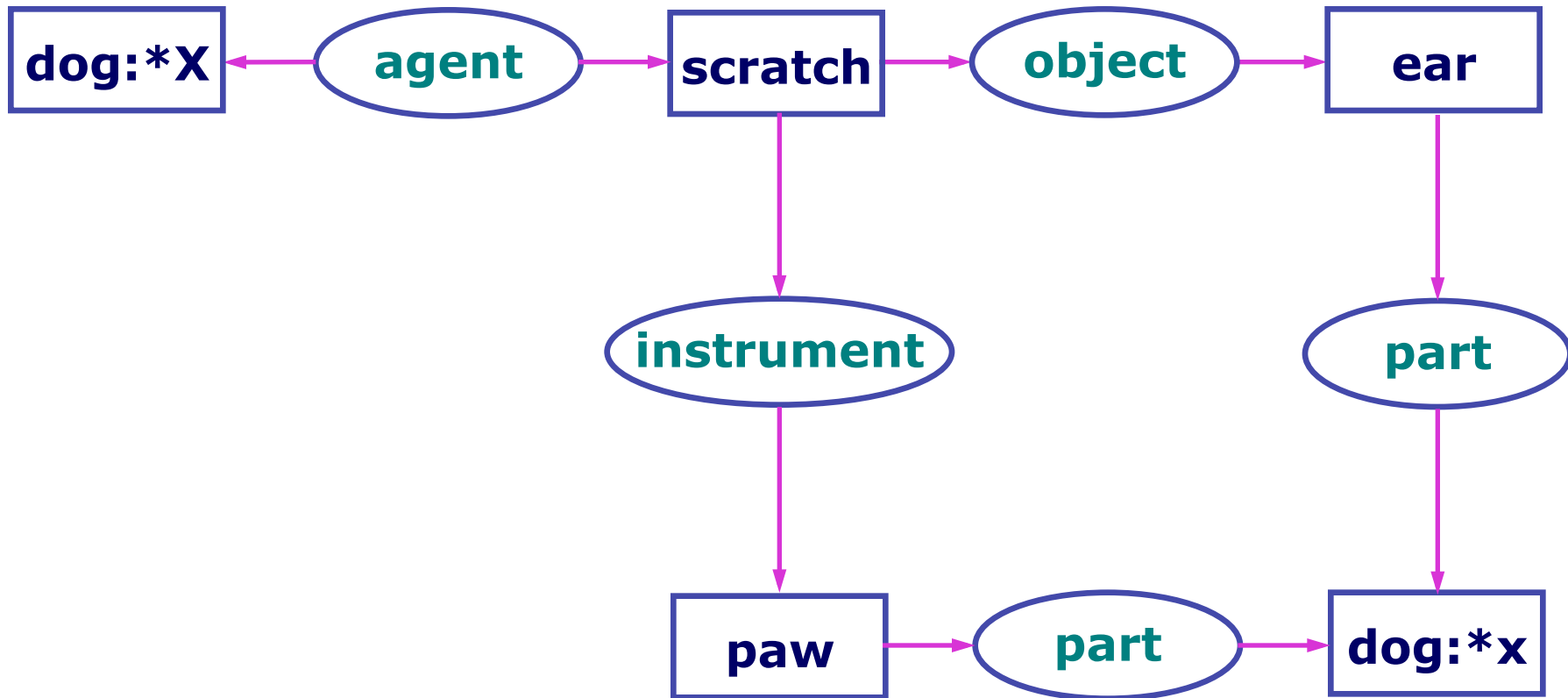
Parents is a 3-ary relation.

Unique token: maker



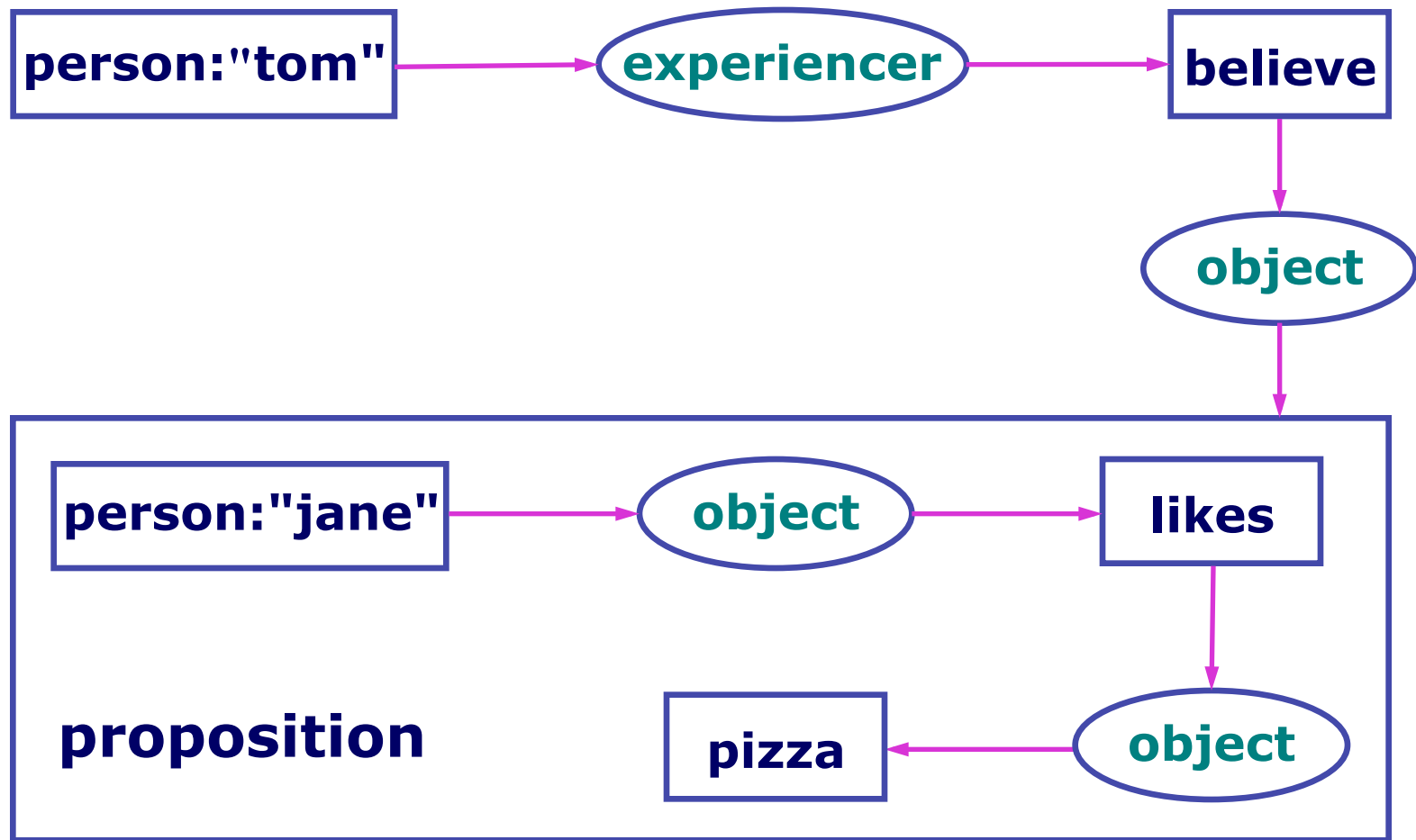
A dog **name** emma is brown.

Generic maker



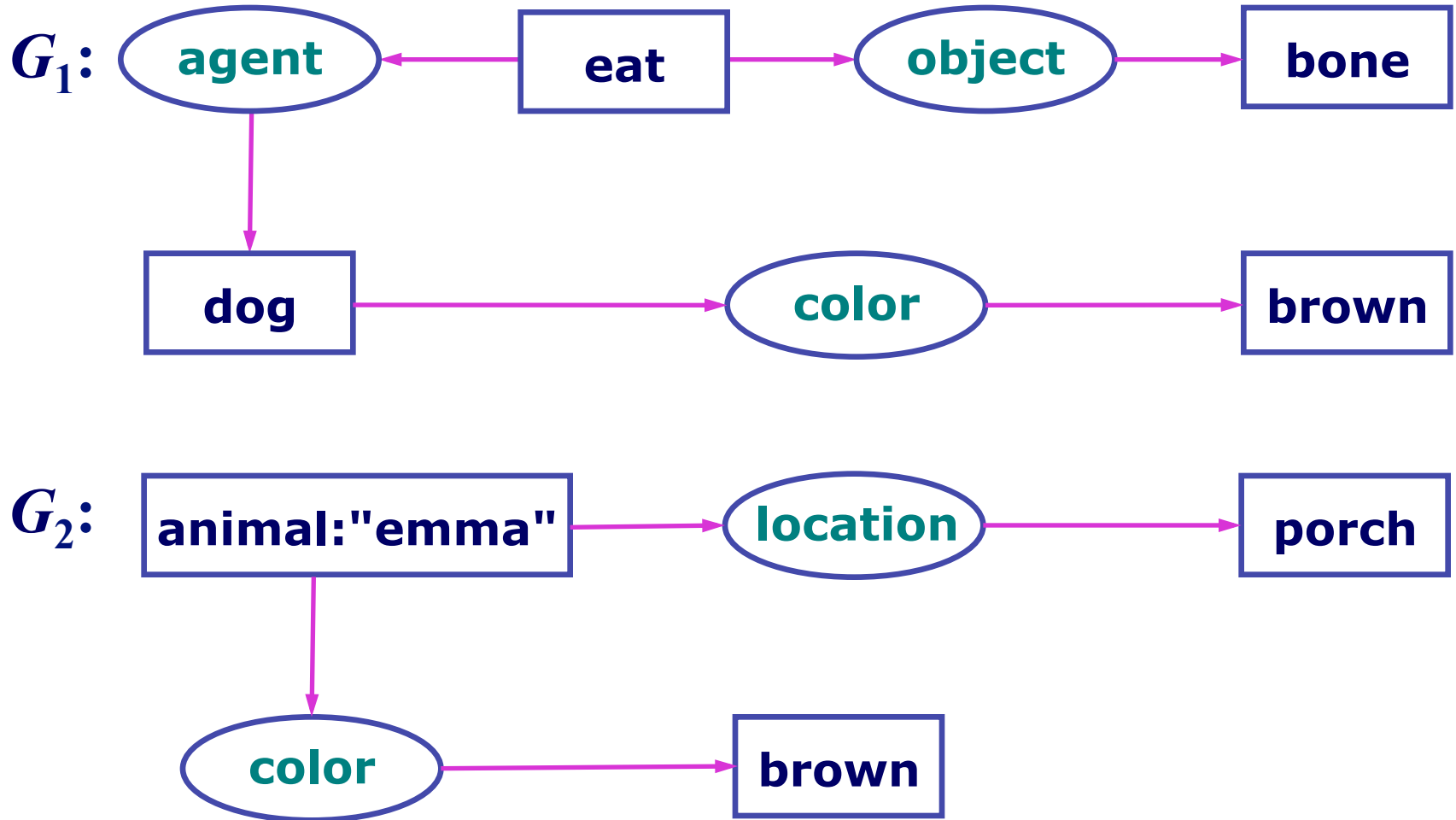
The dog scratches its ear with its paw.

Propositional concept

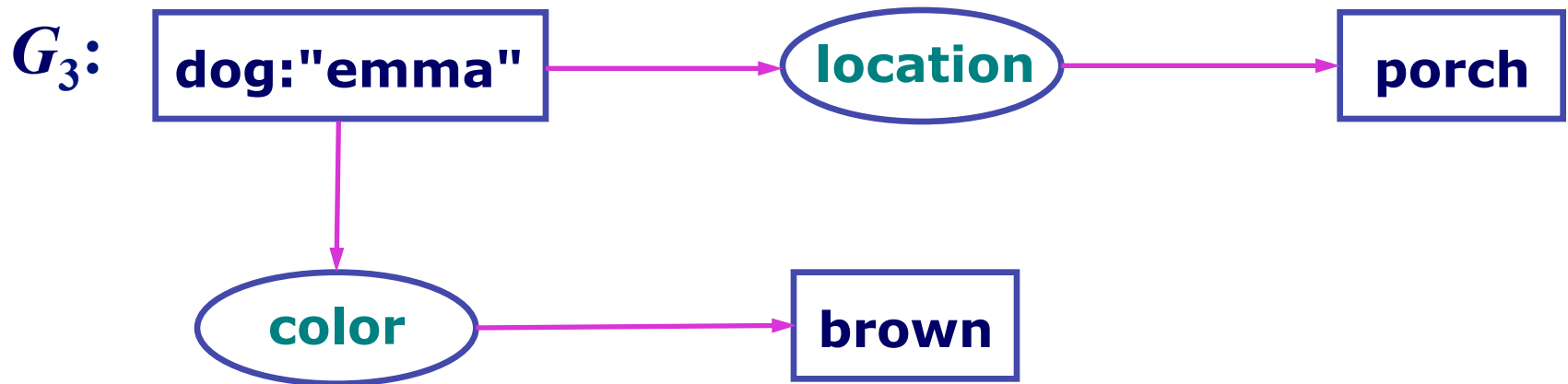


Tom believes that Jane likes pizza.

Inference in conceptual graphs

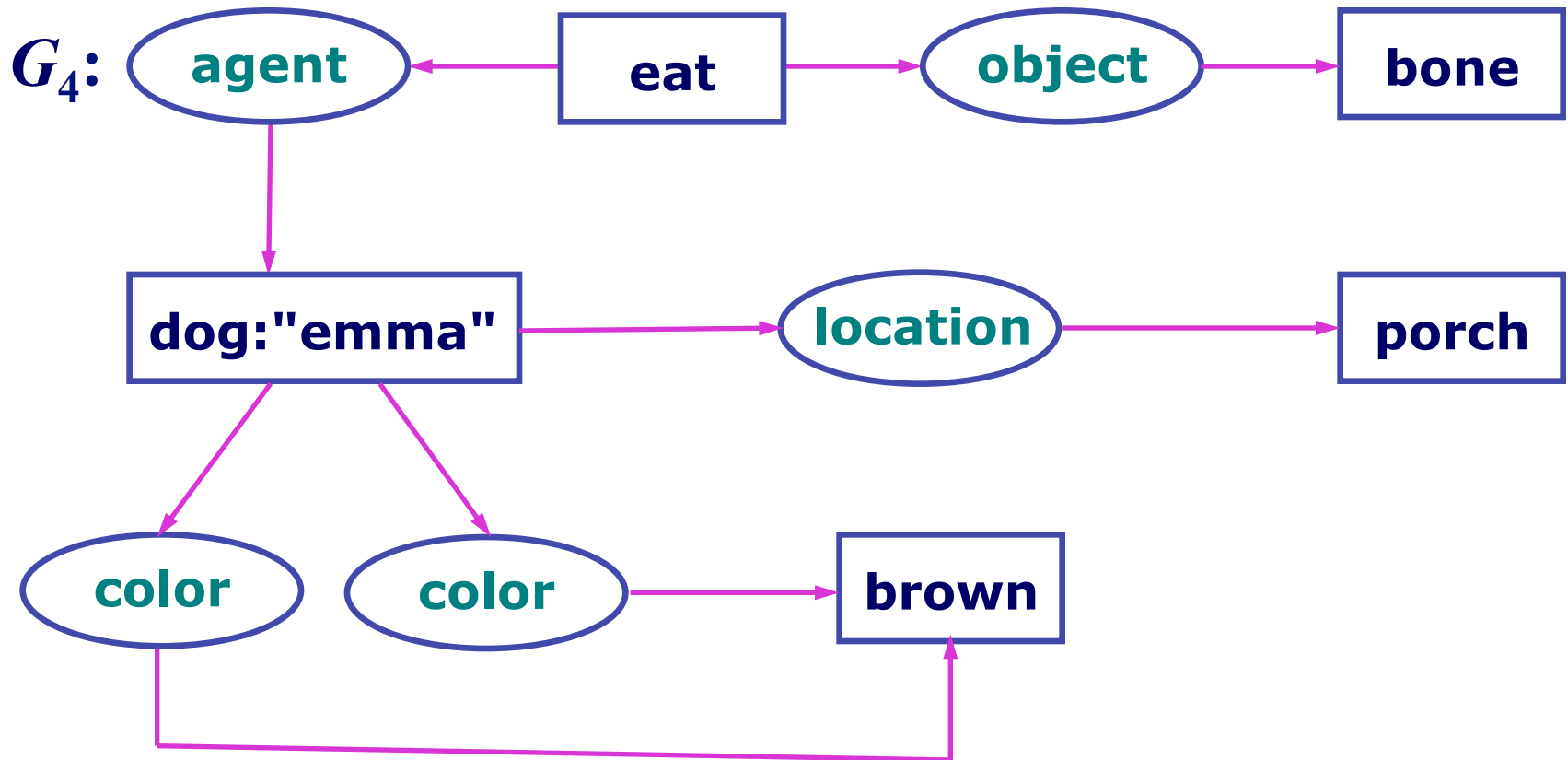


Restriction operation



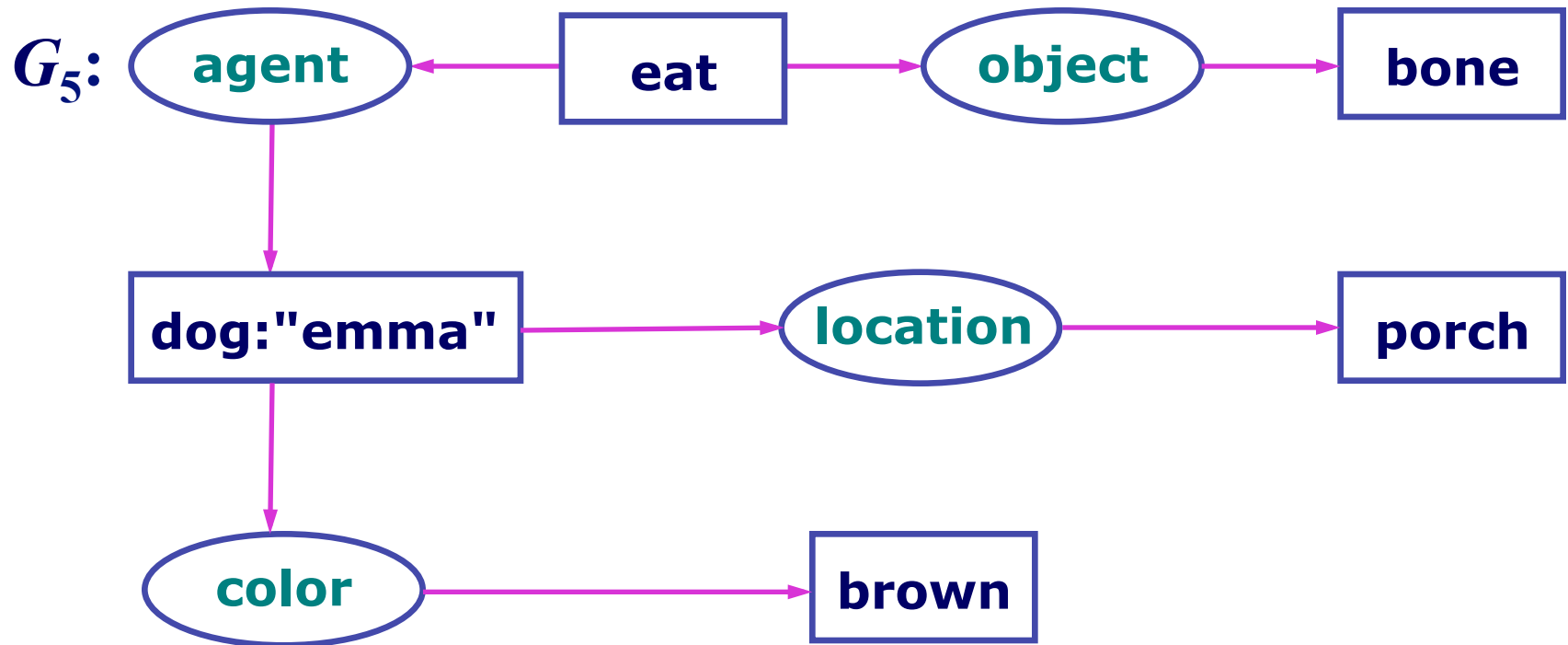
The *restriction* of G_2 .

Join operation



The *join* of G_2 and G_3 .

Simplify operation



The *simplify* of G_4 .

Others

- *Logics: propositional, first-order, description, modal*
- *Production rule*
- *Artificial neural network*
- *Bayesian network*
- *Knowledge Petri net*
- *Script*
- *Decision table*
- *Object-attribute-value triples*
- *Neurules*
- *Language field theory*
- ...

Any question?



Xiaoqing Zheng
Fudan University