Knowledge

willie

Announcements

Finish GitHub setup and assignment-0 today

Just your GitHub name

Assignment-1 announced at the end of class today

Today: AIMA Chapters 12 (sections 1 - 3) and 7 (sections 1 - 3)

Wednesday: AIMA Chapters 7 (section 4) & 8

This apple is a Granny Smith.

This apple is green.

This apple is ripe.

This apple is on table.

Apples are edible.

Apples are fruits.

Apples grow on a trees.

Apples are round.

Apples are small.

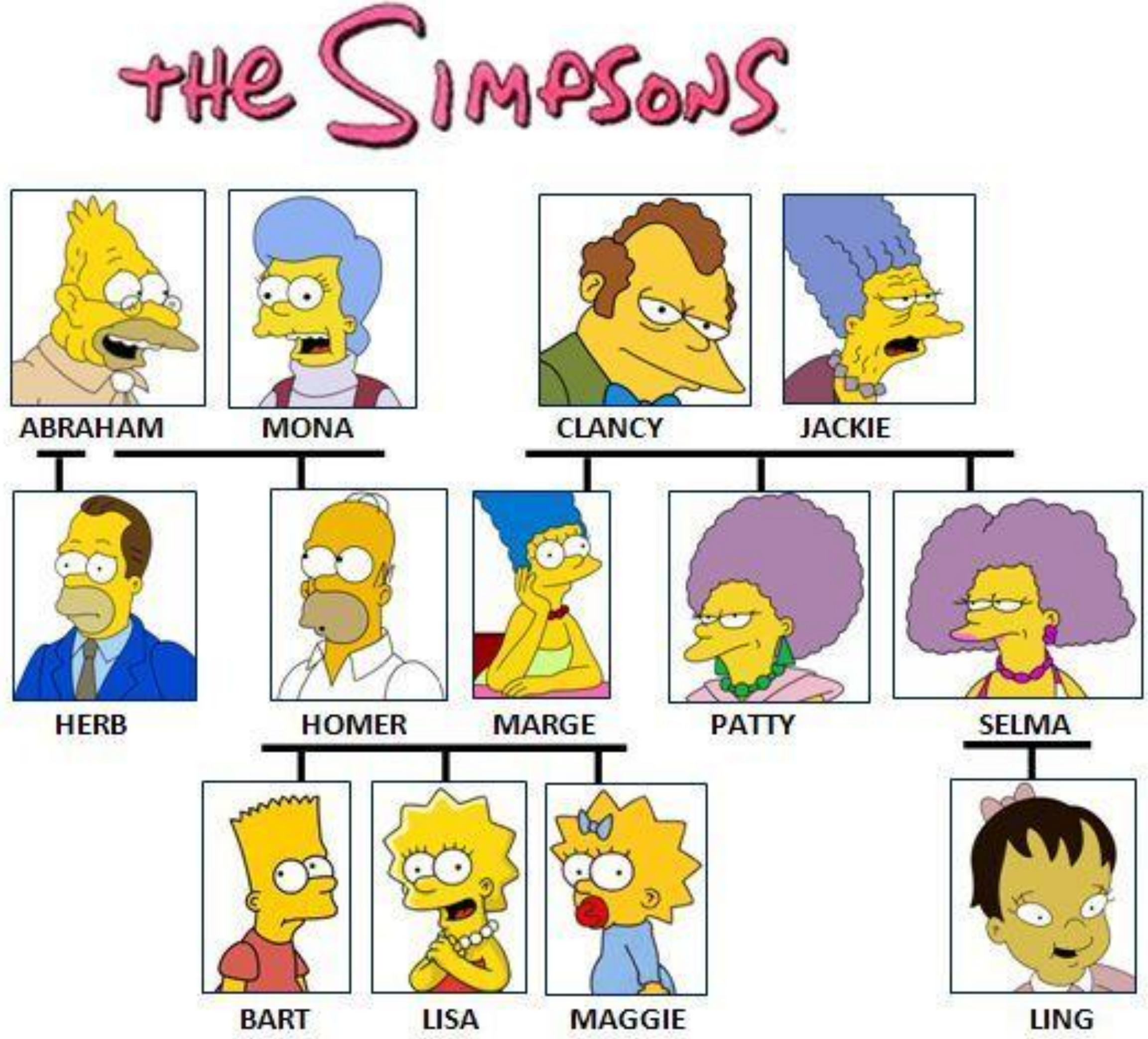
Small, round things can be thrown.

cvs & medicine :
cvs = pharmacy = buy medicine
or
cvs = buy medicine b/c of experience

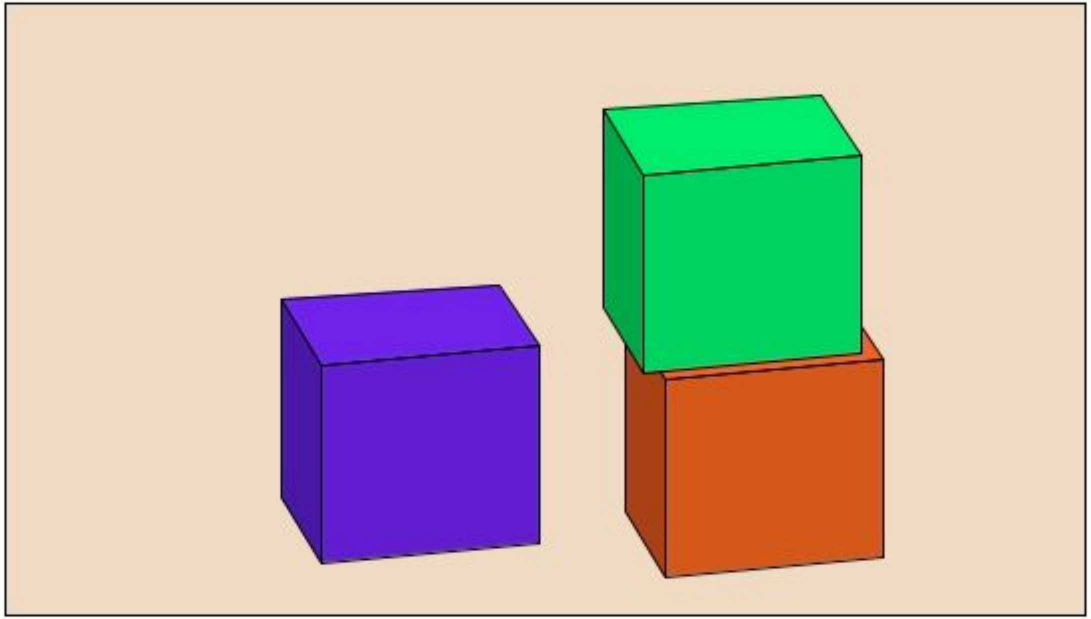
N
LAKE MICHIGAN
Civic Center
Service Center
Water Treatment Plant
Recreation Facility
Fire Department
Police Department
Library
Animal Shelter
Parking Garage
Main Road
Local Street
Railroad
Water
Park
Downtown Area
Evanston Hospital
Station #5
North Branch
Station #3
Chandler-Newberger
Water Treatment Plant
Noyes Cultural Arts Center
Ecology Center
Service Center
Fleetwood-Jourdain
Station #1
Northwestern University
Library
Clark Street Beach Office
Gibbs-Morrison
Mason Park Fieldhouse
Evanston Township High School
Fire Admin.
Police Station
Dempster Beachhouse
CAMS Branch
Crown Center
Station #4
Station #2
St. Francis
Animal Shelter
Levy Center
Police Outpost
City of Evanston
1 inch = 0.5 mile
1:31,680
0
0.25
0.5
1
Mile
CityLetterColor.mxd
6/30/2016

This map is provided "as is" without warranties of any kind. See www.cityofevanston.org/mapdisclaimers.html for more information.

Not evanston,
but a map of evanston


the Simpsons
ABRAHAM
MONA
CLANCY
JACKIE
HERB
HOMER
MARGE
PATTY
SELMA
BART
LISA
MAGGIE
LING

describe them in a procedural way,
ex. you can’t stack the blue atop the red
until you remove the green



Types of Knowledge

Know-how: Practical knowledge on how to accomplish things in the world

Know how to walk

Know how to move a chess piece

`chooseNextMove()`

Know-that: Specify facts about the world

EECS 348 is a course on Artificial Intelligence

It meets MWF at 4pm

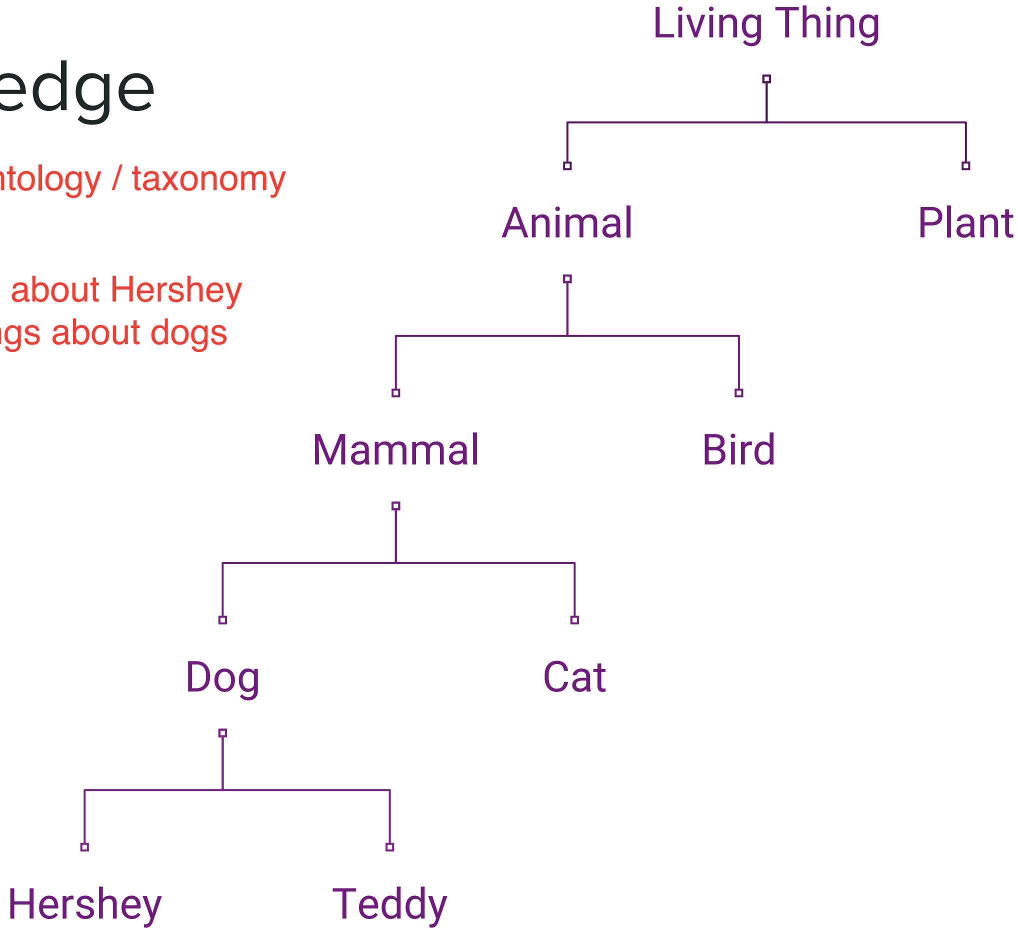
Classrooms have seats

`Today = Friday`

Organize knowledge

organize by ontology / taxonomy

we can generalize things about Hershey
b/c we know certain things about dogs



Living Thing

Animal

Plant

Mammal

Bird

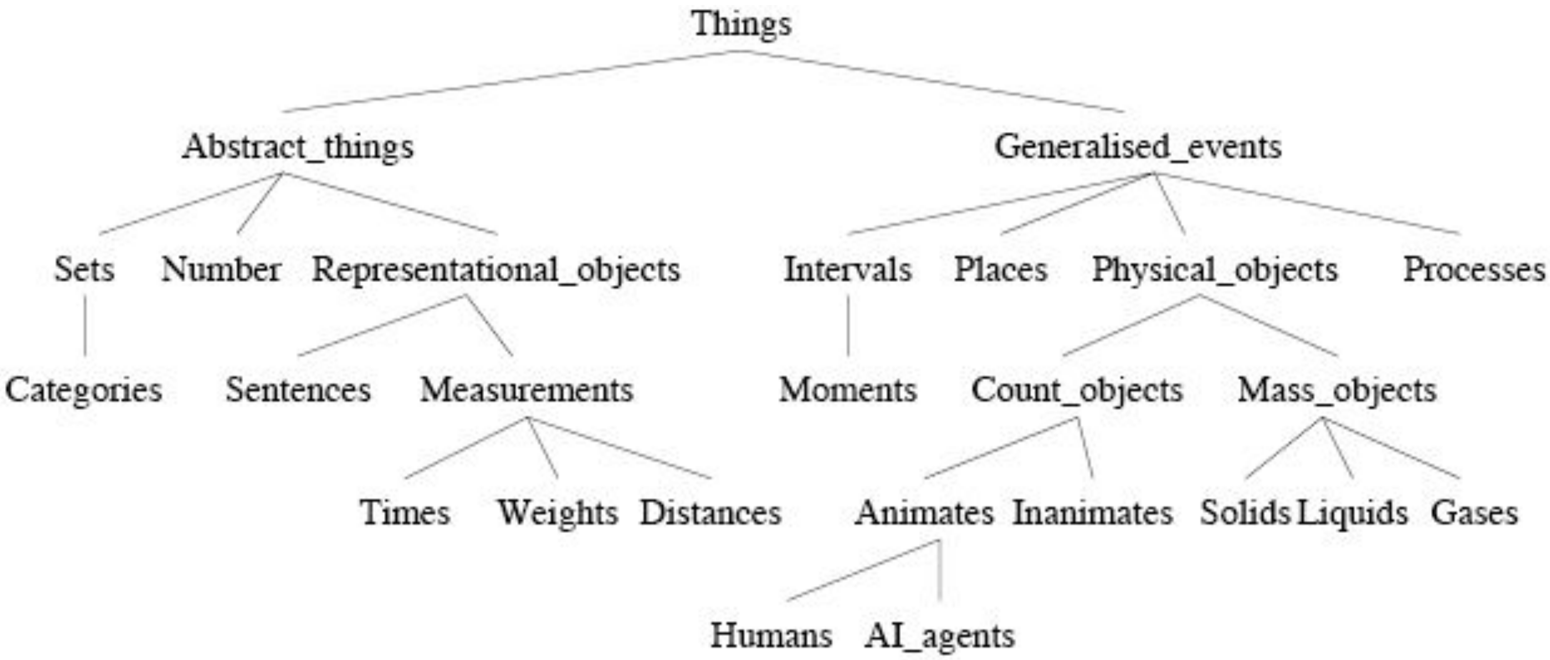
Dog

Cat

Hershey

Teddy

Upper Ontology



Properties

based off of properties
of elements in its ontology

Apples is a fruit

Green is a color

Physical objects have color

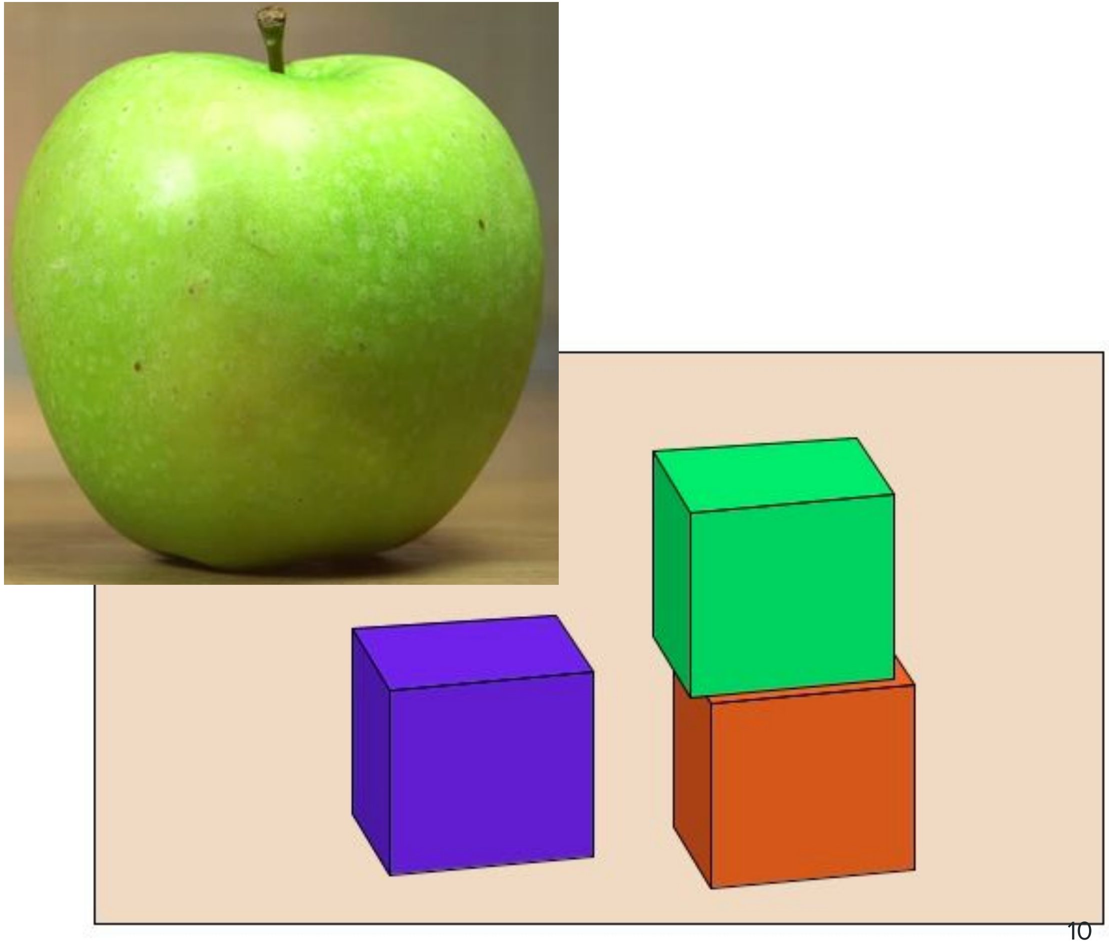
Fruits are edible

Blocks have color

Blocks are lightweight

Blocks are cubes

Blocks have 6 sizes



Affordances

affordances = what we can do with these things

Apple is a fruit

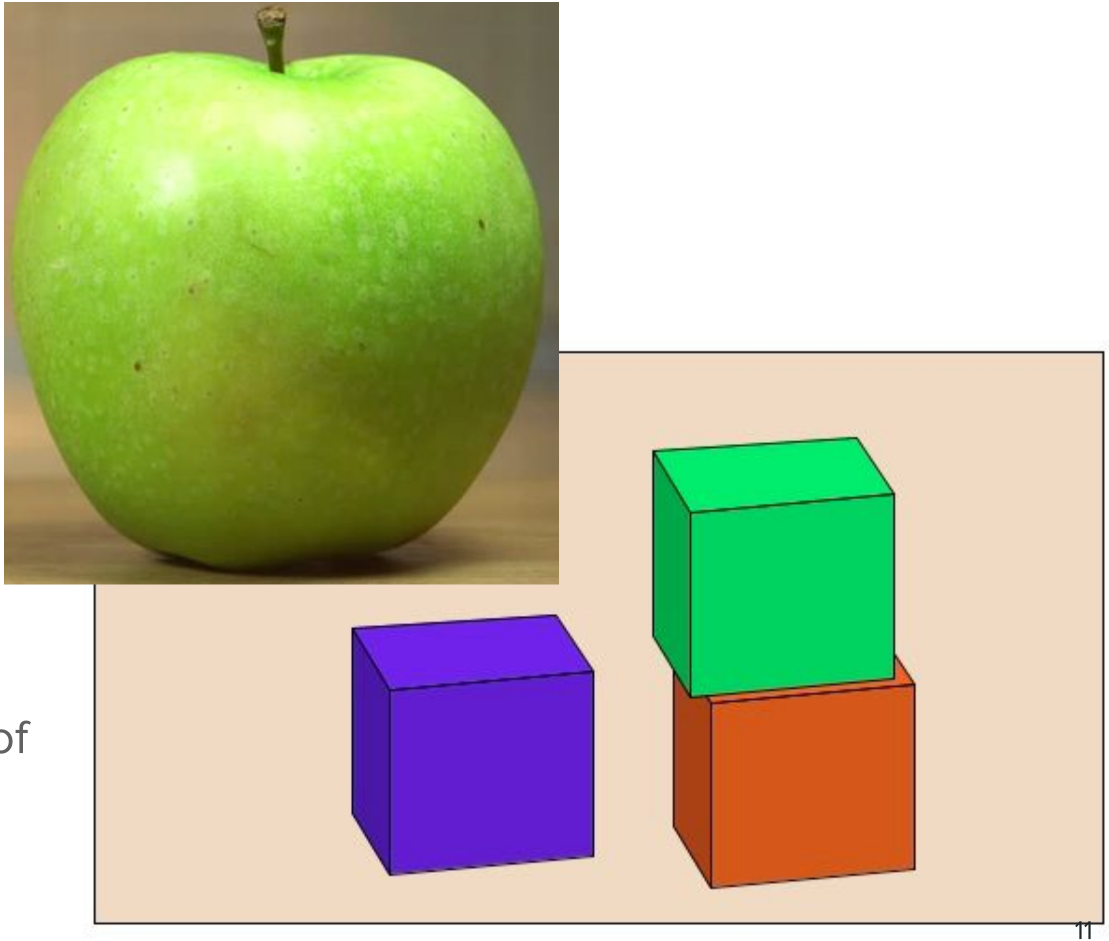
Fruits are edible

I can eat an apple

An apple will satisfy my hunger

Blocks are stackable

I can place another block on top of the green block



Rules about things

If A is an apple, then A is a fruit

If A is an apple, then A is edible

I can eat things that are edible

If ?x is a bird then

?x has wings

?x has feathers

?x can fly…

Commonsense Reasoning

A body of knowledge and reasoning capabilities that are taken for granted by humans but are difficult to formalize properly

Example

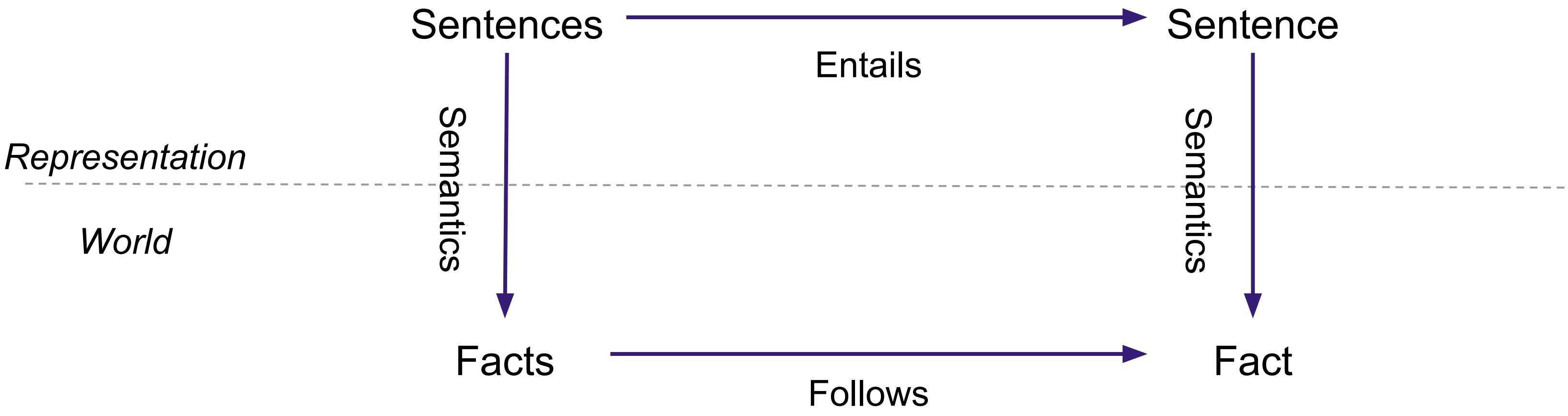
- Birds fly
- Tweety is a bird
- Can Tweety fly? YES

A refinement

- Birds fly
- Penguins are birds. Penguins cannot fly
- Tweety is a penguin
- Can Tweety fly? NO

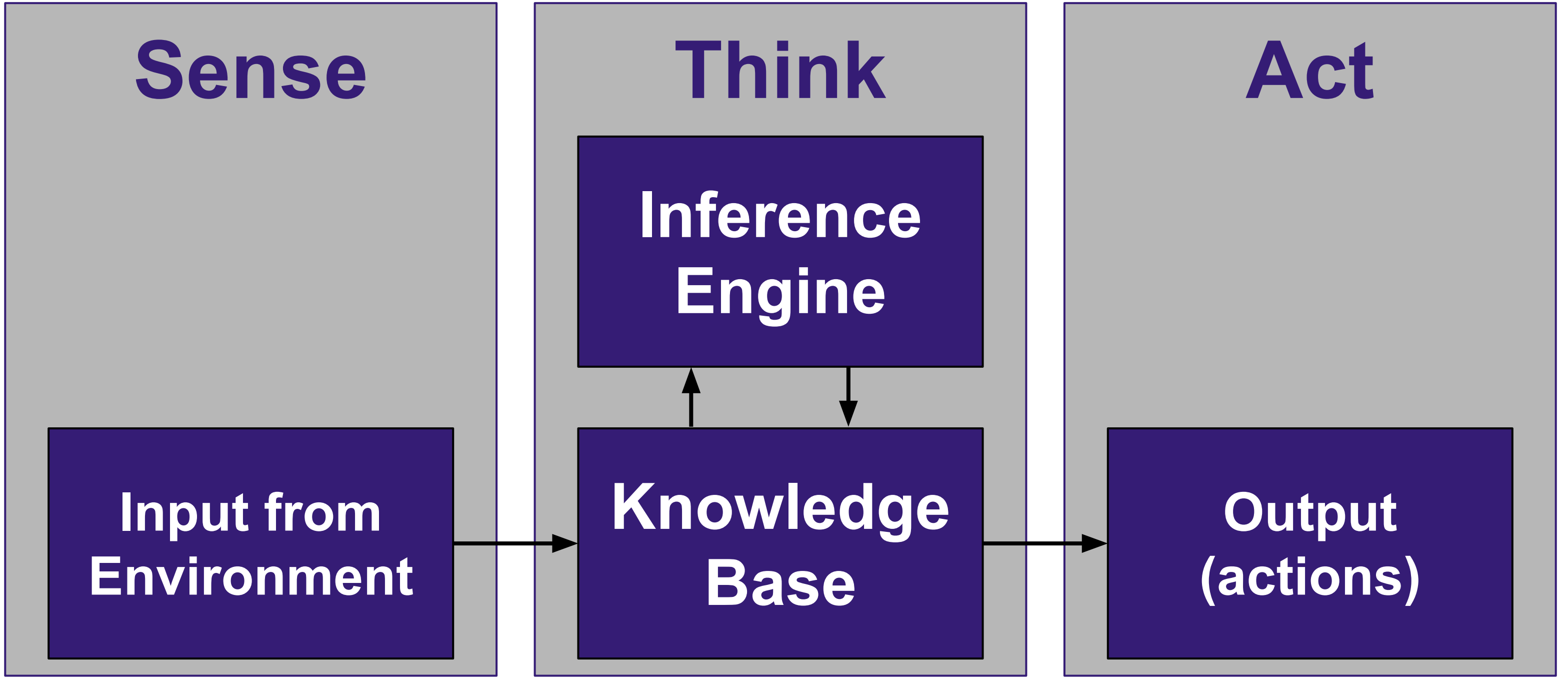
How do you know this?

World - Representation



Knowledge-based agent

first assignment!

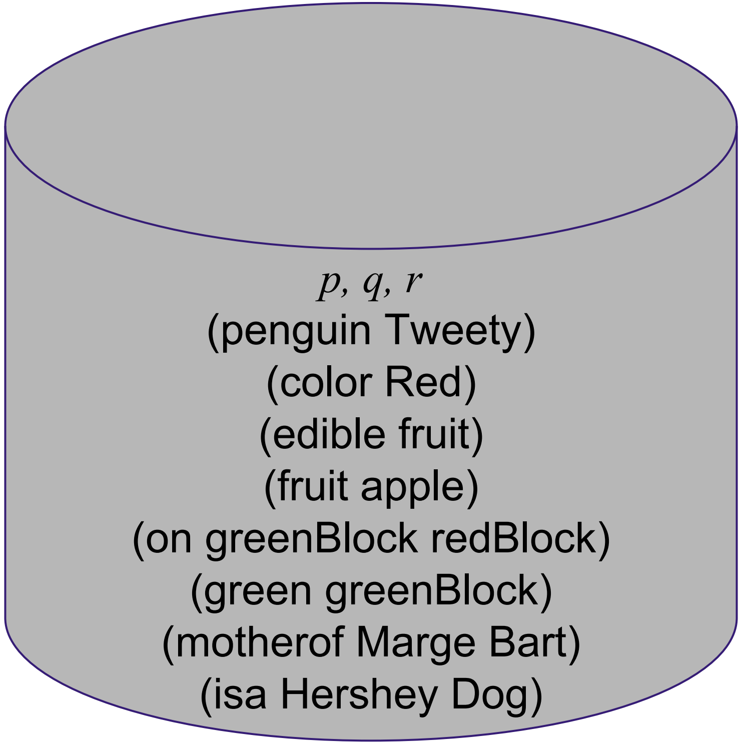


Knowledge base

A set of representations of facts of the world

Each individual representation is called a sentence

Sentences are expressed in a knowledge representation language



p, q, r

(penguin Tweety)

(color Red)

(edible fruit)

(fruit apple)

(on greenBlock redBlock)

(green greenBlock)

(motherof Marge Bart)

(isa Hershey Dog)

Logic for knowledge representation

Logic is a **declarative** language to:

- Reason at the knowledge level, as opposed to the implementation level

To reason, we:

we have some facts, and we want to represent it in a logical sentence,
and then assert to the knowledge base that it is true

- **Assert** sentences representing facts that hold in a world W (these sentences are given the value *true*)
- Deduce the true/false values to sentences representing other aspects of W
- **Ask** whether some fact holds in W

hershey is a dog. inference enging should take “hershey is a dog” to deduce that “hershey has a tail”.
We don’t want it to say “no” when indeed hershey does have a tail.
We’re more or less okay with it saying “I don’t know” if we ask it that question.
Basically we want it to be sound

Two types of logic

We will examine two types of logic:

1. Propositional logic

   Simple, but not very powerful

   $$p \wedge q \Rightarrow r$$

2. First-order logic (aka, Predicate calculus)

   More powerful, but more complicated

   $$\forall p \ \exists q \ \text{motherof}(p, q)$$

Another new game from Creative Computing . . . .

HUNT THE WUMPUS

By GREGORY YOB

Goals of the game

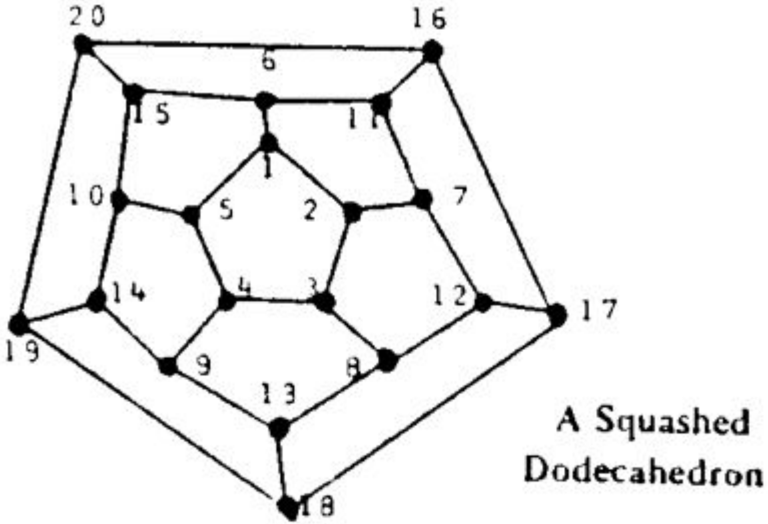
Navigate the network of caves

Avoid the wumpus

Avoid the pits

Find the gold!

Get out alive!



A Squashed Dodecahedron

The **Wumpus World** Environment

The agent explores a cave consisting of rooms connected by passageways

Lurking somewhere in the cave is the **Wumpus**

- Who eat any agent that enters its room

Some rooms contain **bottomless pits**

- That traps any agent that wanders into the room

In one room is a heap of **gold**

History of “Hunt the Wumpus”

WUMPUS /wuhm'p*s/ n. The central monster (and, in many versions, the name) of a famous family of very early computer games called “Hunt The Wumpus,” dating back to 1972

- Cave with the topology of a dodecahedron
- Later versions supported other topologies, including an icosahedron and Mobius strip
- 5 crooked arrows
  - Kill the Wumpus on a hit
  - Shot through up to three connected rooms
  - Later versions, wounded the Wumpus, which got very angry

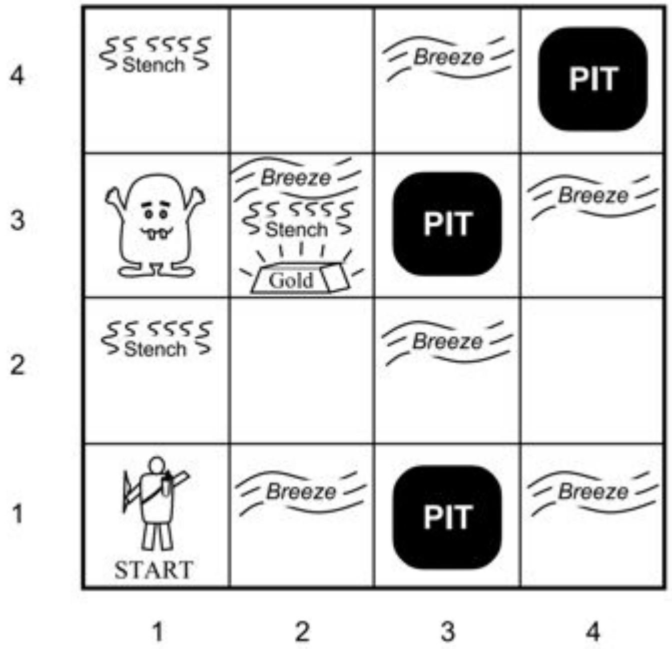
More info: http://www.atariarchives.org/bcc1/showpage.php?page=247

A simpler Wumpus world

Wumpus world is a small grid world

The agent starts in the field at [1 , 1]

The task is to find the gold, return to [1 , 1] to climb out of the cave



A simpler Wumpus world

Performance measure

- Gold +100, Death -100

Environment

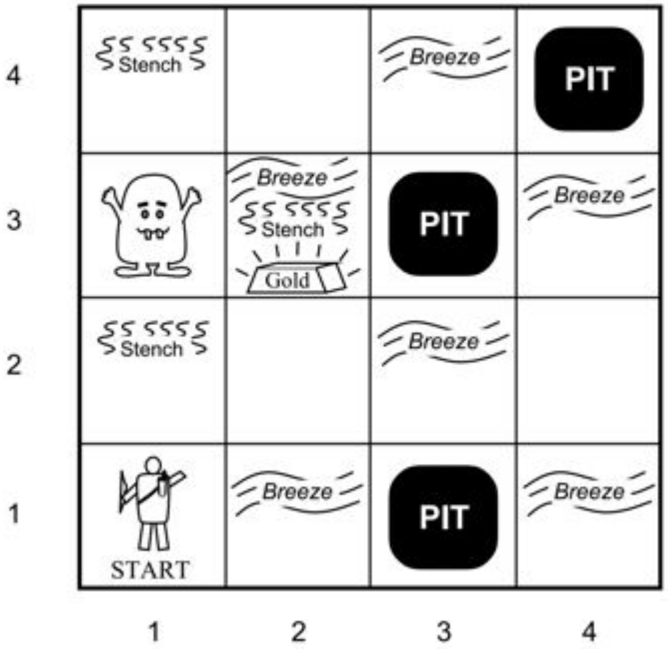
- Squares next to Wumpus are smelly
- Squares next to Pit are breezy

Actuators

- Move up, down, left, or right
- Grab

Sensors

- Breeze, Glitter, Smell

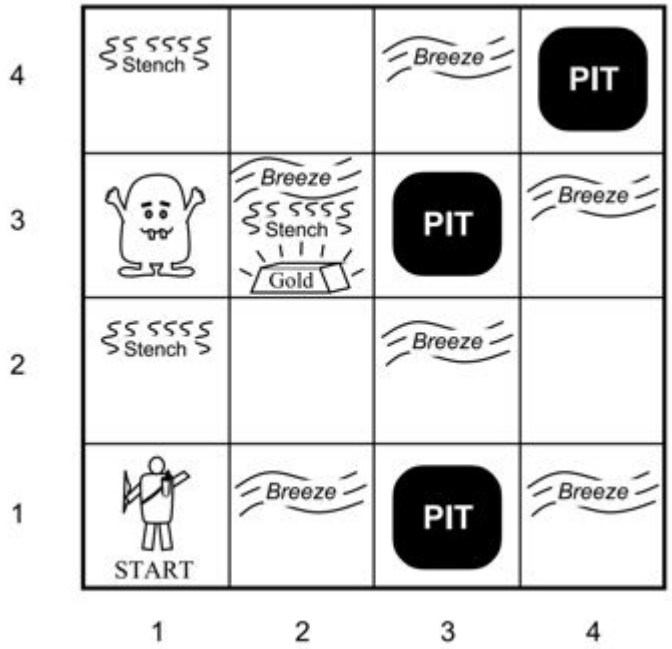


Wumpus world

How do we design a knowledge-based agent to survive the Wumpus world?

1. **Assert**: Tell the KB what the agent perceives
2. **Ask**: Ask the KB what action is should perform
3. **Act**: Execute the action

^ for now



Assignment 1

Next time (week? or class?) we'll talk about rules

Start building a knowledge base

Implement assert and ask

wednesday we'll talk about predicate calculus & first-order logic

Assert facts into the KB

object code will give you a fact and you have to move that into a kb?

Ask for facts. Facts may have variables

some things we ask about may have variables (things we want the knowledge base to fill in)

to do that we have to dump in a lot of information

Lots of starter code,

But not too much code to write

Prepare for Assignment 2