

CPSC 322

Introduction to Artificial Intelligence

November 10, 2004

Things...

Midterm 2 marks this week

The final exam will be at noon on
Friday, December 10, in MCML 166



One more thing your book wants you to know...

AI is a software engineering enterprise...there are lots of questions that you need answers to before you start hacking

Many of these questions have to do with how to represent the knowledge in your system

Some representations are qualitatively better than others depending on the problem you're trying to solve

Semantic (relational) networks and slot-filler representations are useful and flexible approaches to knowledge representation

You should read chapter 5, where you'll find different questions to be answered, including...

What kind of solution is acceptable?

optimal solution - the “best” best solution by some measure of quality - can you afford the cost of computing the optimal solution?

satisficing solution - a solution that’s “good enough” but not necessarily optimal

approximately optimal solution - close to the best, but not the best - the cost of finding the approximately optimal solution is often much less than the cost of finding the optimal solution

probable solution - would it be ok if the computer gets it right some percentage of the time, but not always? (robot vacuum cleaner vs. robot aircraft pilot)

More movie

Today we finished watching the last ten minutes of the documentary on artificial intelligence.

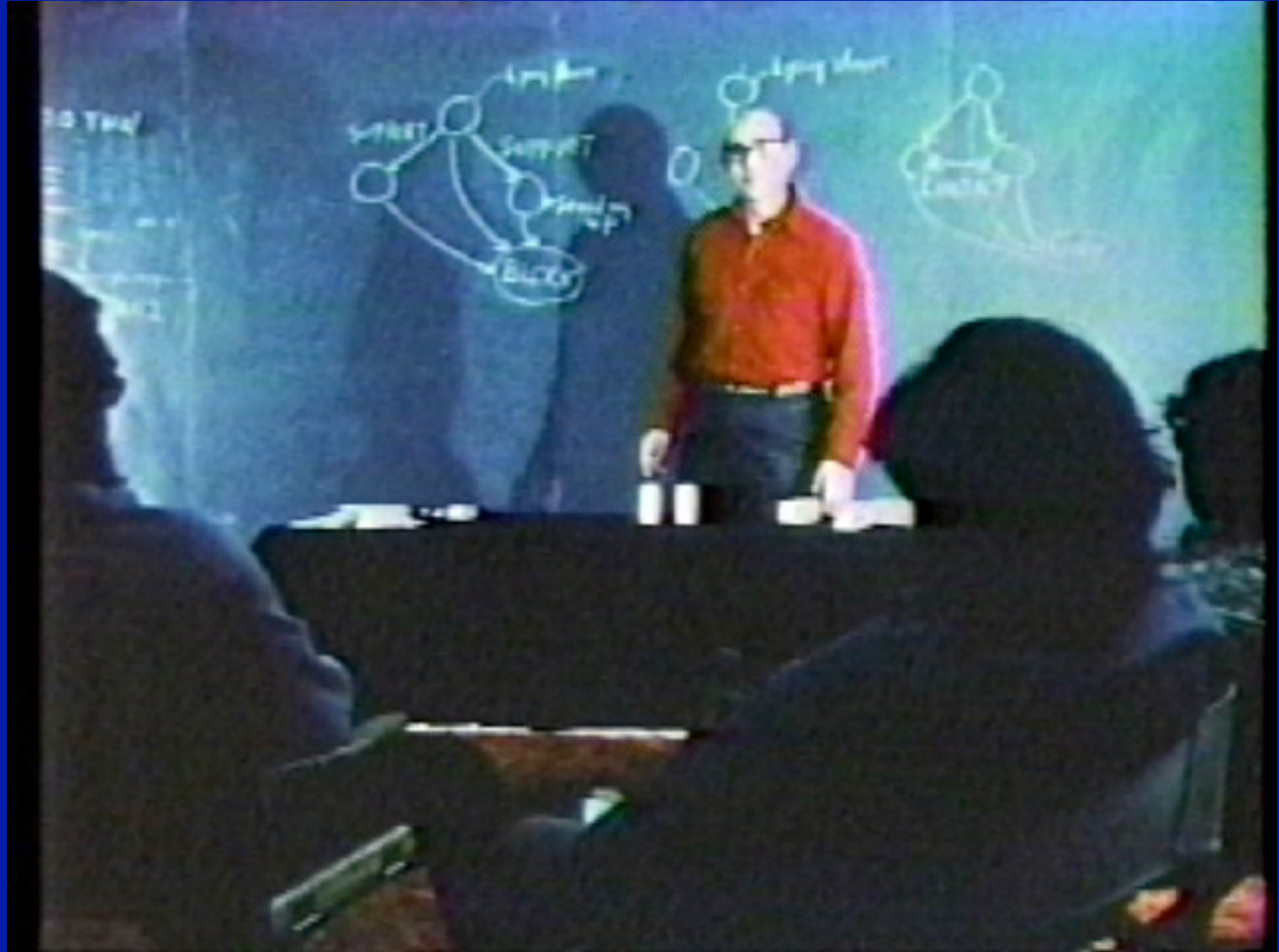
Observations about the movie

There are more than 10 million neurons in your brain...more like 100 to 150 billion neurons

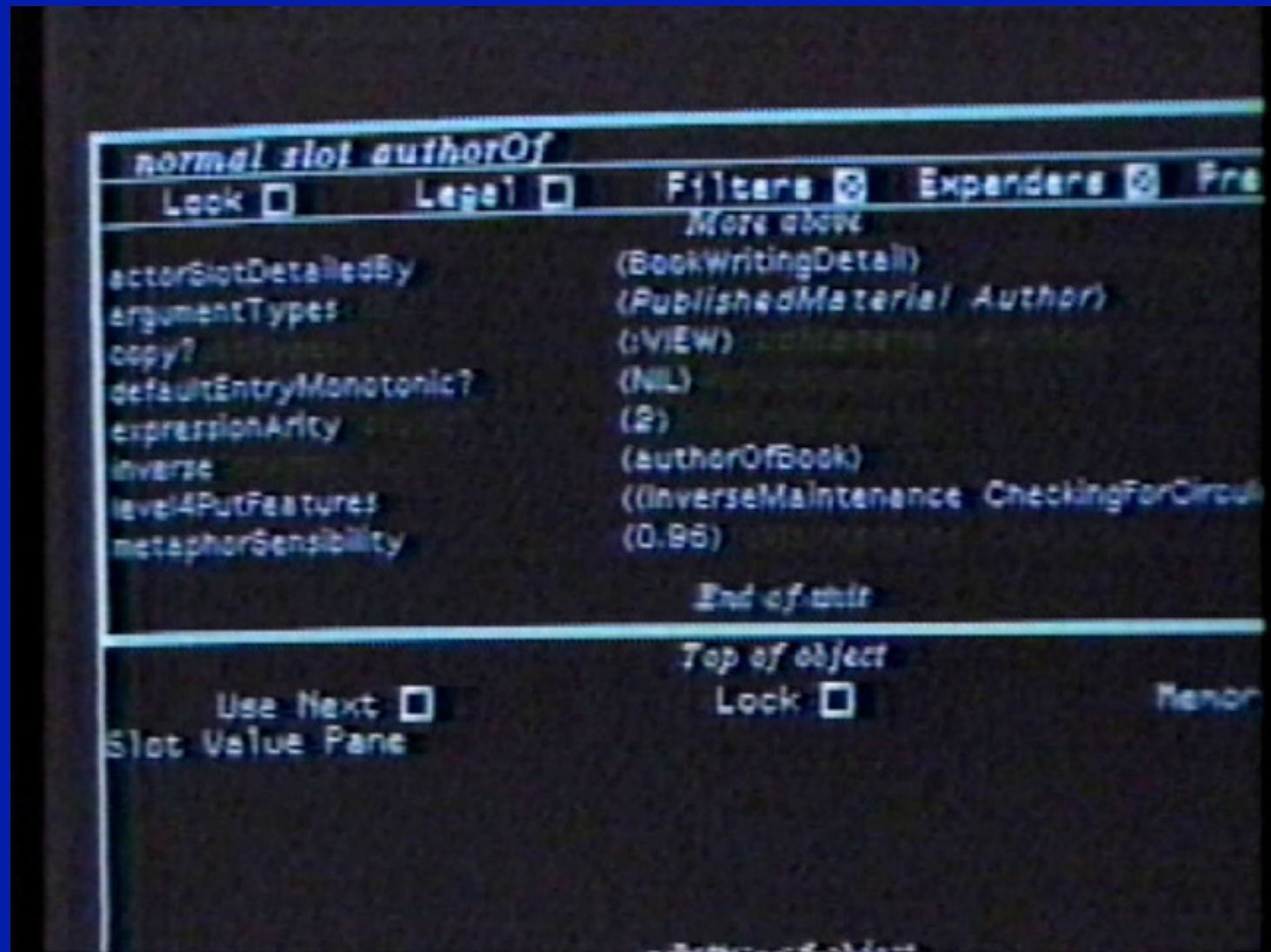
The CYC project is still progressing

Semantic or relational networks usually aren't just nice clean hierarchies

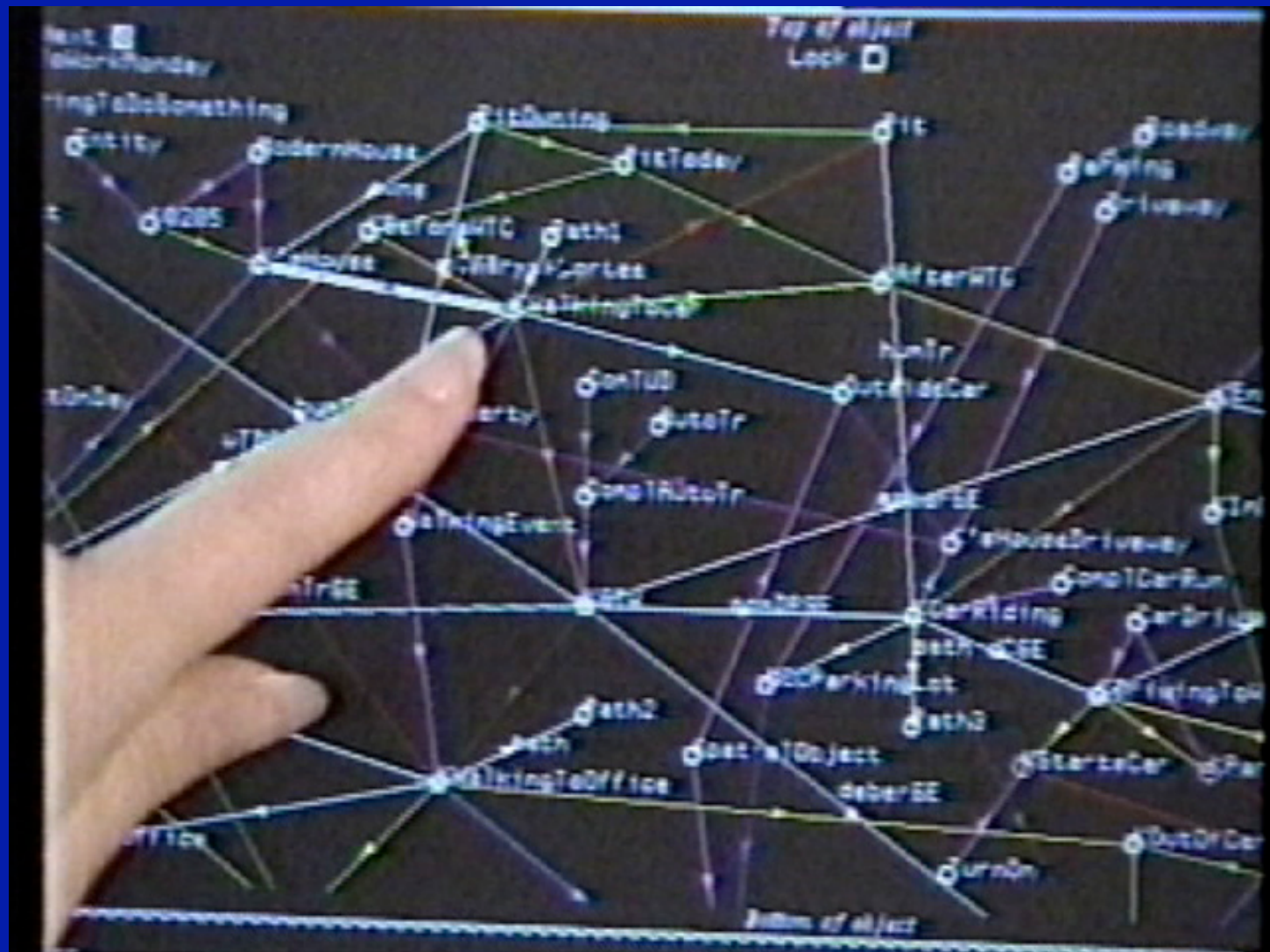
Observations about the movie



Observations about the movie



Observations about the movie



Observations about the movie

Systems like Eliza actually have some utility

Philosophers have a vested interest in promoting the “specialness” of being human

AI people have historically been overly optimistic

What we've seen so far...

Search-based intelligence can:

- prove theorems
- solve puzzles
- play games
- parse sentences into syntactic components

What we've seen so far...

This approach can be summarized like this:

All the “intelligence” is placed in a single complex function which is then used to evaluate the “goodness” of some state of a problem being solved

The function is based on converting attributes of the problem in to numerical values, performing computations on those values, and returning some number corresponding to goodness

...isn't necessarily good enough

Consider Deep Blue

It plays better chess than the best human ever, but

- its knowledge doesn't resemble what we think we know about chess (you won't find a lot of number crunching in a book about chess)
- it's not obvious what needs to be fixed if Deep Blue isn't working right
- its knowledge doesn't help us see what to add if there's a need for improvement

...isn't necessarily good enough

Consider Deep Blue

It plays better chess than the best human ever, but

- in short, its heuristic knowledge is obscured, cryptic, not easily accessible

Another approach

Historically, people have made “how to” knowledge available to others as a (possibly large) set of tests and associated actions.

For example, look at the owner’s manual that comes with just about anything you buy, and you’ll find a troubleshooting guide - a “how to make it work” guide with tests and actions...

Troubleshooting cable tv box

TROUBLESHOOTING

Before calling your service provider, review the troubleshooting guide. This information is to help you quickly solve a problem. If your problem still exists, contact your service provider.

Problem	Possible Solution
No sound	Press MUTE on the remote control to restore the volume level. Check that the stereo is set to the proper input source. Turn your VCR on. Make sure the TV or stereo volume is set to an appropriate level. For best audio level control, use the remote control to set the DCT2500 to approximately $\frac{3}{4}$ of the maximum volume level and then adjust the audio levels of the external devices.
No picture	Check to be sure that all cables are connected properly (hand-tighten if necessary). If connected through the baseband RCA video connection, make sure the cables are connected properly. If you are watching TV using your VCR, be sure your VCR is on.
Picture or sound is noisy on one channel	Reconnect the cable and hand-tighten if loose.
Sound from only one stereo speaker	Hand-tighten or reconnect the cables properly. Be sure wires are not frayed and plugs are not bent or broken.

Troubleshooting television

Troubleshooting Chart

Before you call for service, determine the symptoms and make a few simple checks shown below.

Symptoms		Check
Picture	Sound	
 SNOWY PICTURE	 NOISY SOUND	– ANTENNA LOCATION AND/OR CONNECTION
 MULTIPLE IMAGE	 NORMAL SOUND	– ANTENNA DIRECTION AND/OR LOCATION – ANTENNA LEAD-IN WIRE
 INTERFERENCE	 NOISY SOUND	– ELECTRICAL APPLIANCES, LIGHTS, CARS AND TRUCKS – DIATHERMY AND OTHER MEDICAL EQUIPMENT
 NORMAL PICTURE	 NO SOUND	– VOLUME CONTROL SETTING – MUTE CONTROL (IF APPLICABLE) – TV SPEAKER SWITCH (IF APPLICABLE) IN OFF OR EXT. POSITION – TRY ANOTHER CHANNEL
 NO VIDEO	 NOISY SOUND	– TV/ANT-CABLE TUNING SYSTEM SET TO PROPER SETTING – ANTENNA INPUT MODE INCORRECT
 NO PICTURE	 NO SOUND	– CHECK THAT AC POWER LINE IS PLUGGED INTO AC OUTLET AND POWER BUTTON IS ON – BRIGHTNESS & AUDIO CONTROLS SET PROPERLY – TRY ANOTHER CHANNEL
 NO COLOR	 NORMAL SOUND	– COLOR CONTROL SETTINGS – TRY ANOTHER CHANNEL
 BLUE PICTURE	 NO SOUND	– RECEIVER IN VIDEO MODE WITH NO SIGNAL
 NO VIDEO	 NOISY SOUND	– CHANNEL LOCKOUT FEATURE ACTIVATED
 BLACK BOX IN PICTURE	 SOUND	– CC (CLOSED CAPTION) IN TEXT MODE – PUT IN CAPTION OFF MODE TO ELIMINATE BLACK BOX

Should this unit turn ON momentarily and then turn OFF, or fail to operate, unplug the AC cord, and contact your Authorized Servicer for repairs.

Troubleshooting

G4 PowerBook

Problems That Prevent You From Using Your Computer

If the computer won't respond or the pointer won't move

- Press Command (⌘)-Option-Esc to force a frozen application to quit. If a dialog appears, select the application you would like to quit and click Force Quit.

If you are working in Classic, hold down the Option and Command (⌘) keys and then press the Esc key.

Next, save your work in any open applications and restart the computer to be sure the problem is entirely cleared up.

- If you are unable to force the application to quit, press and hold the Power button (⏻) for a few seconds to shut down the computer.
- If the computer still doesn't respond, try to restart it by simultaneously pressing the Command (⌘) and Control keys on your keyboard and the Power button (⏻).

If the problem occurs frequently, choose Help > Mac Help from the menu bar at the top of the screen. Search for the word “freeze” to see help for instances when the computer freezes or doesn't respond.

If the problem occurs only when you use a particular program, check with the program's manufacturer to see if it is compatible with your computer. If you know an application is compatible, you may need to reinstall your computer's system software or, if you're using Classic, you may need to check for incompatible system extensions. See the next topic for instructions.

If the computer freezes during startup or you see a flashing question mark

Try using Disk Utility to repair your hard disk.

- 1 Insert the first software install and restore disc into your computer. Then restart your computer and hold down the C key as it starts up.
- 2 Choose Installer > Open Disk Utility. When Disk Utility opens, follow the instructions in the First Aid pane to see if the utility can repair your disk.

If using Disk Utility doesn't work, you may need to reinstall your computer's system software. For instructions, see page 63.

If you are using the Classic environment in Mac OS X, you might have an incompatible extension. (Mac OS X does not use system extensions.)

Try turning off your system extensions to see if that solves the problem. To turn off extensions in Classic, open System Preferences, click Classic, click the Advanced tab, and choose Turn Off Extensions from the pop-up menu. Click Restart Classic.

If turning off extensions appears to solve the problem, you may need to identify and eliminate or reinstall the extension that is causing the problem. Open the Extensions Manager control panel and turn off the extensions you suspect are causing the problem. Then restart Classic with the extensions turned on again.

Troubleshooting people

there are manuals for
us too - this is from the
DSM-IV: The Diagnostic
and Statistical Manual of
Mental Disorders

Schizophrenia

A group of psychotic disorders characterized by disturbances in thought, perception, affect, behavior, and communication that last longer than 6 months.

Symptoms. For a material part of at least one month (or less, if effectively treated) the patient has had 2 or more of:

 **Delusions** (only one symptom is required if a delusion is bizarre, such as being abducted in a space ship from the sun)

 Hallucinations (only one symptom is required if hallucinations are of at least two voices talking to one another or of a voice that keeps up a running commentary on the patient's thoughts or actions).

 Speech that shows incoherence, derailment or other disorganization

 Severely disorganized or catatonic behavior Any negative symptom such as flat affect, reduced speech or lack of volition.

Duration. For at least 6 continuous months the patient has shown some evidence of the disorder. At least one month must include the symptoms of frank psychosis mentioned above. During the balance of this time (either as a prodrome or residual of the illness), the patient must show either or both:

 Negative symptoms as mentioned above.

 In attenuated form, at least 2 of the other symptoms mentioned above (example: deteriorating personal hygiene plus an increasing suspicion that people are talking behind one's back).

Dysfunction. For much of this time, the disorder has materially impaired the patient's ability to work, study, socialize or provide self-care.

Mood exclusions. Mood and **schizoaffective** disorders have been ruled out, because the duration of any depressive or manic episodes that have occurred during the psychotic phase has been brief.

Other exclusions. This disorder is not directly caused by a general medical condition or the use of substances, including prescription medications.

Developmental Disorder exclusion. If the patient has a history of any Pervasive Developmental Disorder (such as **Autistic Disorder**), only diagnose **Schizophrenia** if prominent hallucinations or delusions are also present for a month or more (less, if treated).

After at least 1 year as passed since onset, classify the course of psychosis. Until a year has passed, you cannot assign any of these course specifiers.

Continuous. There has been no remission of "A" symptoms (first bullet). If

Tests and actions

Not limited to troubleshooting -- you could write a “program” of tests and actions to play tic-tac-toe:

```
if    you occupy two squares in the same row or column and  
      the third square in that row or column is empty  
then put your token in that third square
```

```
if    opponent occupies two squares in the same row or column and  
      the third square in that row or column is empty  
then put your token in that third square
```

```
if    the center square is empty  
then put your token in the center square
```

```
if    a corner square is empty  
then put your token in that corner square
```

```
if    any square is empty  
then put your token in that empty square
```

Tests and actions

You could create a language understanding system with test and actions for each word in the language

had:

```
if    the word precedes me is a noun and it's of type animal and  
      the word that follows me is a noun and it's of type edible  
then my meaning is ate or ingested
```

```
:
```

```
:
```

```
and so on
```

Tests and actions

Test-action pairs go by many other names:

- if-then rules
- left-hand-sides and right-hand-sides
- antecedent-consequent pairs

Systems that employ test-action pairs are called:

- rule-based systems
- production systems (rules are called productions)
- expert systems (when they're really smart)

Rule-based systems

Typically have three parts:

the rule base

- knowledge encoded as if-then rules
- rules are modular and independent
- each rule has as many tests and actions as necessary
- rules are written in a high-level “rule language” to be interpreted by a “rule interpreter”

Rule-based systems

Typically have three parts:

the working memory or data base

- knowledge of the current state of the world
 - facts
 - goals
 - partial solutions
- this knowledge is changed by application of rules from the rule base

Rule-based systems

Typically have three parts:

the rule interpreter or inference engine

- defines a language for writing rules
- applies rules to working memory so as to change or update working memory in the following way....

Rule-based systems

The inference engine algorithm is simple:

```
until (no tests are true) or  
      (some goal has been reached)
```

```
repeat
```

1. go through the rule base and collect all rules whose tests (left-hand sides) are true (these rules are said to be "triggered")
2. select one rule to execute
3. perform the actions (right-hand side) of the selected rule (this rule is said to have "fired")

```
end repeat
```

Rule-based systems

What if more than one rule is triggered?

```
until (no tests are true) or  
      (some goal has been reached)
```

```
repeat
```

1. go through the rule base and collect all rules whose tests (left-hand sides) are true (these rules are said to be "triggered")
2. select one rule to execute
3. perform the actions (right-hand side) of the selected rule (this rule is said to have "fired")

```
end repeat
```