

Natural Language Processing

Inference and all that

On to Inference

- ◆ Need to figure out how meanings fit together.
- ◆ The latter is the big AI knowledge representation/commonsense reasoning problem, at which we have made little stabs, but no convincing solution.
- ◆ The structure of events seems to be important here.
 - I.e., if events of a text are part of a well-known scenario, can fit them into the scenario, finding referents and making inferences in the process.

Example

John went to a restaurant. He asked the waiter for a hamburger. The waiter brought it to him. Later, when the check came, he paid it and left.

In this example we

- ◆ Fill in missing steps.
 - What did John eat?
- ◆ Interpret events.
 - What did John order?
- ◆ Provide conceptual referents for definite descriptions.
 - E.g., story can say "the waiter" despite the fact that there is no explicit prior mention.
- ◆ Find referents for pronouns.
 - "He" in the last sentence is John, not the waiter.

Scripts (Schank and Abelson)

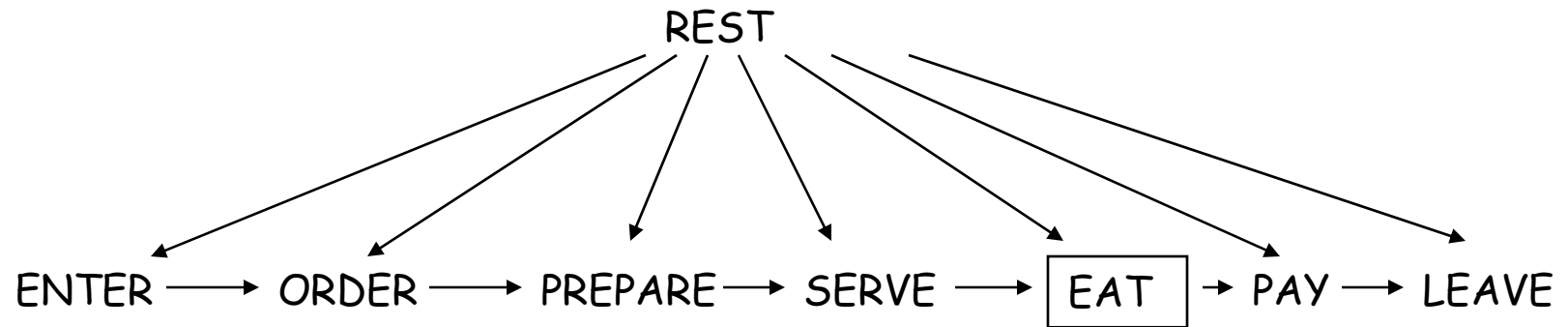
- ◆ Event schemata for reasoning about the mundane world
- ◆ Scripts are
 - ordered sequences of event types
 - about mundane situations
 - slightly abstracted from experience (but still primarily episodic)
 - hierarchical in structure
 - comprise a “frozen” plan for a common goal.

The Structure of Scripts

- ◆ Scripts were thought to have:
 - roles: slots to be filled, possibly with associated constraints.
 - defaults: for fillers of roles, setting, time spans.
 - » e.g., the default filler for the waiter role was a waiter
 - episodes: patterns of events connected together into chains
 - » e.g., "buying a token" in the subway script
 - scenes: chunks of episodes describing different ways of performing an important script activity.
 - » e.g., Entering the subway was a scene, which might contain an episode involving buying a token, or one just involving going over to the turnstile.

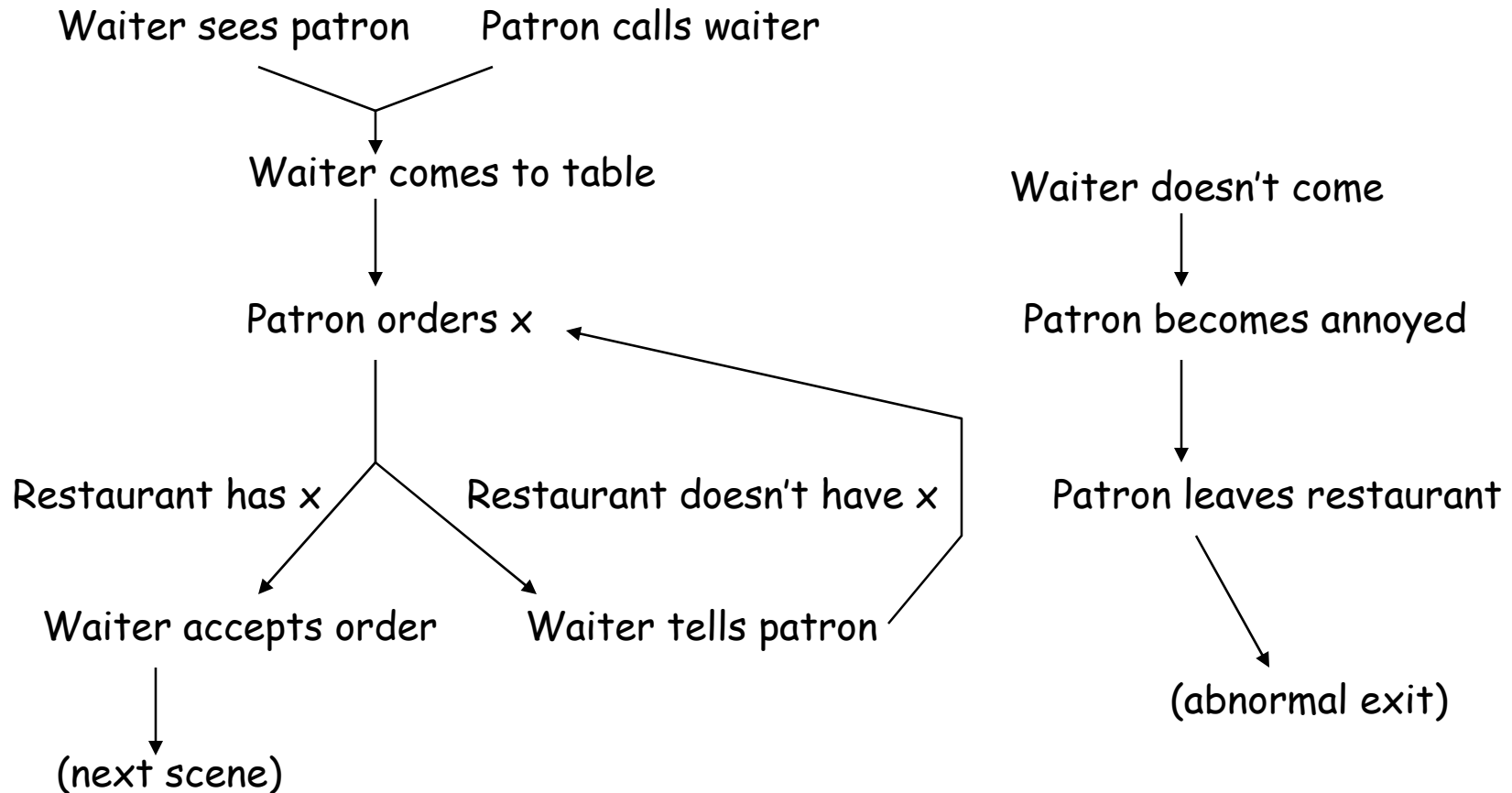
Example

Restaurant script overview:



(There is more detail to represent, e.g., "RESULT-ENABLE" links between most events.)

Example: Scenes from a restaurant



SAM

- ◆ Script Applier Mechanism
- ◆ Written by Richard Cullingford.
- ◆ Usually credited as the first computer story understanding system.

Typical SAM Example

- ◆ Input:

John went to a restaurant. The hostess seated John. The hostess gave John a menu. John ordered a lobster. He was served quickly. He left a large tip. He left the restaurant.

- ◆ Output (short paraphrase):

JOHN WENT TO A RESTAURANT AND HE ATE A LOBSTER.

SAM Example: Q/A

- ◆ Q1: Why did the hostess give John a menu?
- ◆ A1: SO JOHN COULD ASK THE WAITER FOR A MEAL.

- ◆ Q2: Why did John go to a restaurant?
- ◆ A2: SO JOHN COULD EAT A MEAL.

- ◆ Q3: Did the waiter give John a menu?
- ◆ A3: JOHN GOT THE MENU FROM THE HOSTESS.

- ◆ Q4: Why did John leave the waiter a large tip?
- ◆ A4: JOHN REMEMBERED THE WAITER SERVED A LOBSTER TO HIM QUICKLY.

- ◆ Q5: Did John pay the check?
- ◆ A5: JOHN PAID THE CHECK.

SAM Example with Abnormalities

- ◆ Input:

John went to a restaurant. He sat down.
He got mad. He left.

- ◆ Output (long paraphrase):

JOHN WAS HUNGRY. HE DECIDED TO
GO TO A RESTAURANT. HE WENT TO
ONE. HE SAT DOWN IN A CHAIR. A
WAITER DID NOT GO TO THE TABLE.
JOHN BECAME UPSET. HE DECIDED
HE WAS GOING TO LEAVE THE
RESTAURANT. HE LEFT IT.

More Complex Abnormalities Example

◆ Input:

John went to Leone's. He ordered a hot dog. The waiter said they didn't have any. He asked for a hamburger. When the hamburger came, it was burnt. He left the restaurant.

Example (con't)

◆ Q/A

- Q1: Did John order a hot dog?
- A1: YES.
- Q2: Did John eat a hot dog?
- A2: NO THE WAITER TOLD JOHN THE MANAGEMENT WAS UNABLE TO GIVE IT TO HIM.
- Q3: What did the waiter serve John?
- A3: THE WAITER SERVED JOHN A HAMBURGER.
- Q4: Why didn't John eat the hamburger?
- A4: BECAUSE THE HAMBURGER WAS OVERDONE.
- Q5: Was John angry?
- A5: YES.
- Q6: Did John pay the check?
- A6: NO JOHN WAS ANGRY BECAUSE THE HAMBURGER WAS OVEDONE AND SO HE LEFT

Premier SAM Example

- ◆ Input (slightly modified from the New Haven Register):

Friday evening a car swerved off Route 69. The vehicle struck a tree. The passenger, a New Jersey man, was killed. David Hall, 27, was pronounced dead at the scene by Dr. Dana Blanchard, medical examiner. Frank Miller, 32, of 593 Foxon Rd., the driver, was taken to Milford Hospital by Flanagan Ambulance. He was treated and released. No charges were made. Patrolman Robert Onofrio investigated the accident.

Example (con't)

- ◆ Output (summary):

AN AUTOMOBILE HIT A TREE NEAR HIGHWAY 69 FOUR DAYS AGO. DAVID HALL, AGE 27, RESIDENCE IN NEW JERSEY, THE PASSENGER, DIED. FRANK MILLER, AGE 32, RESIDENCE AT 593 FOXON ROAD IN NEW HAVEN, CONNECTICUT, THE DRIVER, WAS SLIGHTLY INJURED. THE POLICE DEPARTMENT DID NOT FILE CHARGES.

Example (con't)

- ◆ Output (Spanish summary)

UN AUTO CHOCO CONTRA UN ARBOL CERCA DE AL CARRETERA 69 EL VIERNES AL ANOCHECER. DAVID HALL, DE 27 ANOS, QUE VIVIA EN NEW JERSEY, EL PASAGERO, SE MURIO. FRANK MILLER, DE 32 ANOS, QUE VIVIA EN 593 CALLE FOXON EN NEW HAVEN, CONNECTICUT, EL CHOFER, QUEDO UN POCO HERIDO. EL DEPARTAMENTO DE POLICIA NO ACUSO A NADIE.

Example (con't)

◆ Q/A

- Q1: Was anyone killed?
- A1: YES, DAVID HALL DIED.
- Q2: Was anyone hurt?
- A2: YES, FRANK MILLER WAS SLIGHTLY INJURED.
- Q3: Why was Miller hurt?
- A3: BECAUSE THE AUTOMOBILE HIT THE TREE.
- Q4: Did Miller go to the hospital?
- A4: YES, HE WAS IN THE MILFORD HOSPITAL.
- Q5: How did Miller get to the hospital?
- A5: THE FLANAGAN AMBULANCE COMPANY TOOK HIM TO THE MILFORD HOSPITAL.

"Trip-script" Example

◆ Input:

John went to New York by bus. On the bus he talked to an old lady. When he left the bus, he thanked the driver. He took the subway to Leone's. On the subway his pocket was picked. He got off the train and entered Leone's. He had some lasagna. When the check came, he discovered he couldn't pay. The management told him he would have to wash dishes. When he left the restaurant, he returned to New Haven.

"Trip-script" Example (con't)

- ◆ Short paraphrase in Chinese (Harvard Romanization):

JOHN TZUOH CHARNG TWU CHIH CHE DAW NEOU LUE
CHIUH LE. TA TZAY CARNG TWU CHI CHE LII. TA GEN I
WEY LAO TAY TAY TARN I TARN. TA TSORNG CHARNG
TWU CHIH CHE LII CHIUH CHUH LE. TA SHIEH SHIEH
SY JI. TA TZOUH DIH SHIAH HUOO CHE DAW LEONE'S
CHIUH LE. TA TZAY DIH SHIAH TIEE LUH CHE LII. I GE
PAR SHOOU TOU LE CHYAN. TA TSORNG DIH SIAH
TIEE LUH CHE CHUH CHIUH LE. TA JINN LE LEONE'S.
TA CHR LE I DA LI TSAY. TA TSORNG CHAR FARNG
NADAW I GE JANQ DHAN. TA FA SYANN TA BU KEE YII
FU CHYAN. CHAR FARNG JIAW TA BIH SHIU YAW SHII
BEI TZ. TA TSORNG FANG GUAR LII CHU CHIUH LE. TA
TZOUH CHARNG TU CHI CHE DAW SHIN GANG CHIUH
LE.

Q/A for "Trip-script" Story

- ◆ Q1: Who went to New York?
- ◆ A1: JOHN WENT TO NEW YORK.

- ◆ Q2: Why did John go to New York?
- ◆ A2: BECAUSE JOHN WANTED TO GO TO LEONE'S

- ◆ Q3: Why did John go to Leone's?
- ◆ A3: BECAUSE JOHN WANTED SOME LASAGNA.

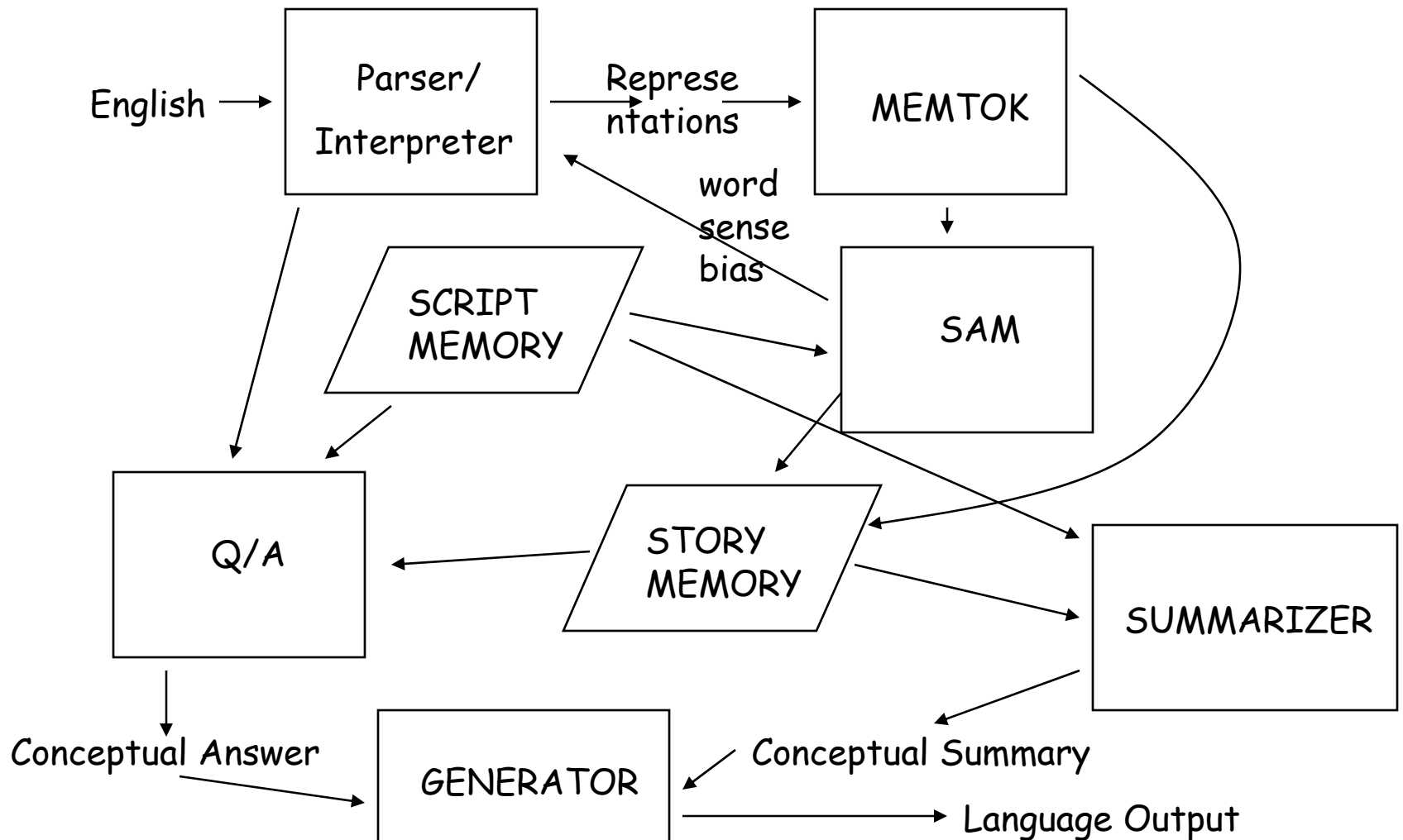
- ◆ Q4: How did John get to New York?
- ◆ A4: JOHN TOOK A BUS TO NEW YORK.

- ◆ Q5: How did John get to Leone's?
- ◆ A5: JOHN TOOK A BUS TO NEW YORK AND THEN HE TOOK THE SUBWAY TO LEONE'S.

Q/A for "Trip-script" Story (con't)

- ◆ Q6: What did John eat?
- ◆ A6: JOHN HAD SOME LASAGNA.
- ◆ Q7: Did John order lobster?
- ◆ A7: NO JOHN ORDERED SOME LASAGNA.
- ◆ Q8: Did John pay the check?
- ◆ A8: NO JOHN DIDN'T HAVE ANY MONEY.
- ◆ Q9: Did John leave the waitress a tip?
- ◆ A9: NO JOHN DIDN'T HAVE ANY MONEY.
- ◆ Q10: Why didn't John pay the check?
- ◆ A10: JOHN DISCOVERED THAT HE DID NOT HAVE ANY MONEY AND SO HE HAD TO WASH DISHES.
- ◆ Q11: Why didn't John have any money?
- ◆ A11: BECAUSE A THIEF PICKED JOHN'S POCKET.

SAM Architecture



SAM's Processing

- ◆ Two problems
 - Determine which script, if any, is applicable to a text.
 - Applying it.
- ◆ SAM had only a rudimentary means of addressing the first issue.
 - SAM just knew of particular conceptualization types were associated with scripts:
 - » preconditions or goals ("Jan was hungry.")
 - » locale ("Jan went to a soccer field.")

The *Frame Finding* Problem

- ◆ Need frame to understand text; need text to suggest frame.
- ◆ Seems to be an intersection search type problem, e.g.:
 - While walking down the aisle, John picked up a can of tuna fish.
 - While walking down the aisle, John dropped his carnation.

Beyond Scripts

- ◆ Of course, not even all simple texts conform to scripts.
- ◆ However, it is still possible to make sense out of them. E.g.:
 - John, the vice-president, wanted to become president.
He went and got some arsenic.
 - Willa was hungry. She picked up the Michelin guide.
- ◆ These require *plan recognition*.
- ◆ Plan recognition is harder than script-based understanding, but somewhat more general.
- ◆ Neither is anything like a complete solution to our problem.

PAM

- ◆ Plan Applier Mechanism
- ◆ First attempt at plan-based text understanding.
- ◆ An explanation-driven natural language understanding system
- ◆ Challenge is how context can influence interpretation

PAM Example

@RU PAM

*(UNDERSTAND CD1)

THE STORY IS

John wanted money.

He got a gun and walked into a liquor store.

He told the owner he wanted some money.

The owner gave John the money and John left.

PROCESSING...

FINISHED UNDERSTANDING PHASE

NIL

PAM Example

*(DOQA)

QUESTION:

Why did John get a gun?

Because John wanted to rob the liquor store.

QUESTION:

Why did John threaten the shopkeeper?

Because John needed to get some money.

QUESTION:

Why did the shopkeeper give John the money?

Because the shopkeeper didn't want to get hurt.

QUESTION:

Why did John leave?

Because John didn't want to get caught.

PAM Example (con't)

QUESTION:

What were the consequences of John getting a gun?

John had a weapon which enabled him to rob the liquor store.

QUESTION:

What were the consequences of John threatening the shopkeeper?

The shopkeeper didn't want to get hurt so he gave John the money.

QUESTION:

What were the consequences of John leaving?

This enabled John to avoid getting caught.

QUESTION:

What happened when John got a gun?

John robbed the liquor store.

PAM Example (con't)

QUESTION:

What happened when John threatened the shopkeeper?
The shopkeeper gave John the money and he left.

QUESTION:

What happened when the shopkeeper gave John the money?
John left.

QUESTION:

How did John get a gun?
I don't know

QUESTION:

How did John go to the liquor store?
John walked to the liquor store.

PAM Example (con't)

QUESTION:

How did John leave?

John walked.

*(TELL)

WHO SHOULD TELL THE STORY? *JOHN

I needed to get some dough. So I got myself this gun, and I walked down to the liquor store. I told the shopkeeper that if he didn't let me have the money then I would shoot him. So he handed it over. Then I left.

WHO SHOULD TELL THE STORY? *THE OWNER

I was minding the store when a man entered. He threatened me with a gun and demanded all the cash receipts. Well, I didn't want to get hurt, so I gave him the money. Then he escaped.

WHO SHOULD TELL THE STORY? *

Interrupt (?=help): ^x

Another PAM Example

@RU PAM

*(UNDERSTAND CD1)

THE STORY IS

John wanted money.

He got a gun and walked into a liquor store.

He told the owner he would give him the gun if the owner gave him ten dollars.

PROCESSING...

FINISHED UNDERSTANDING PHASE

NIL

PAM Example (con't)

*(DOQA)

QUESTION:

Why did John get a gun?

Because John wanted to sell the gun.

QUESTION:

Why did John ask the shopkeeper to buy a gun for ten dollars?

Because John needed to get some money.

QUESTION:

What happened when John walked into the liquor store?

John asked the shopkeeper to buy a gun for ten dollars.

QUESTION:

How did John go to the liquor store?

John walked to the liquor store.

PAM Example (con't)

*(TELL)

WHO SHOULD TELL THE STORY? *JOHN

I needed to get some dough. So I got myself this gun, and I walked down to the liquor store. I offered to sell the shopkeeper my gun for ten dollars.

WHO SHOULD TELL THE STORY? *THE OWNER

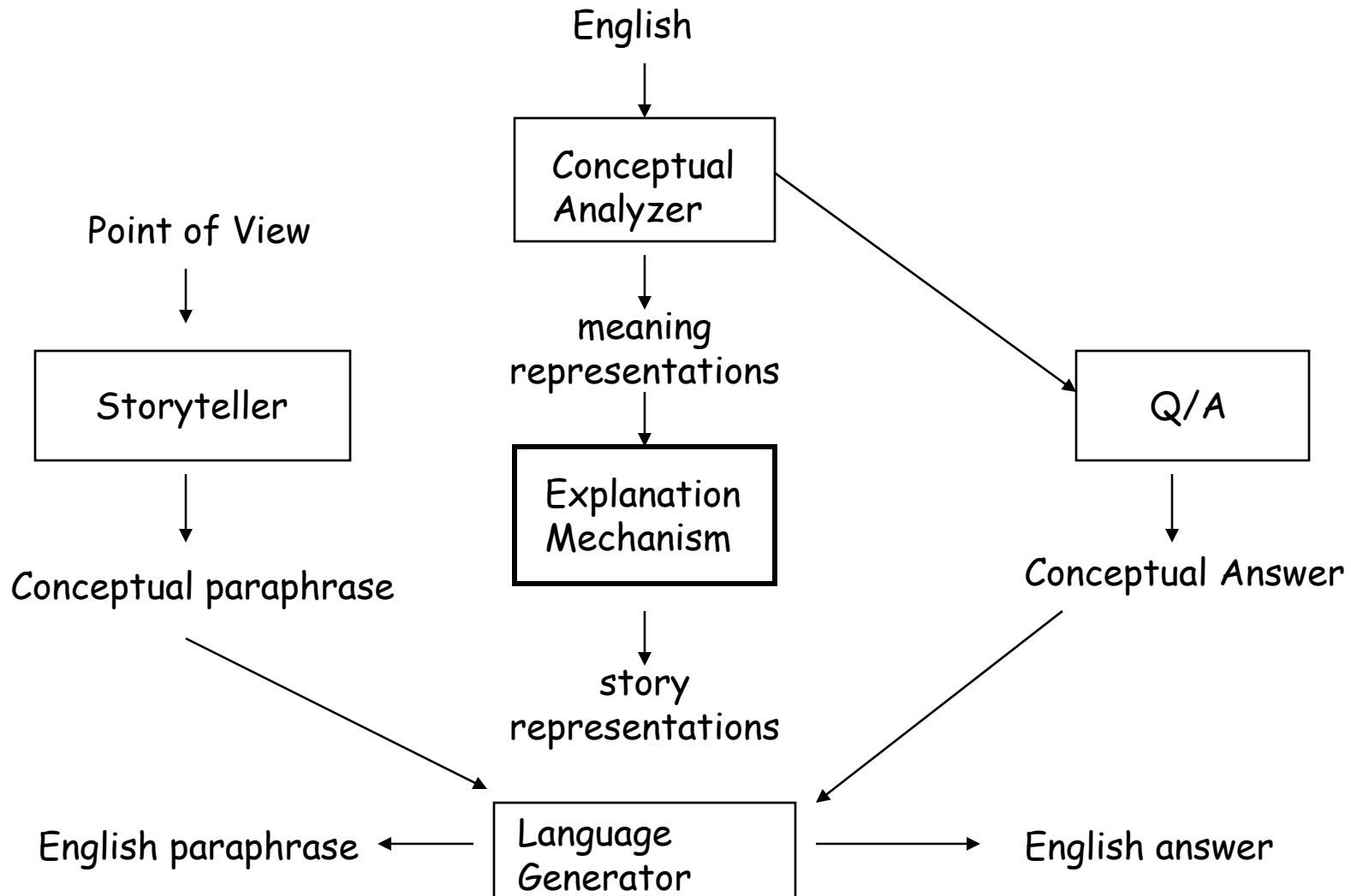
I was minding the store when a man entered. He asked me to buy a gun for ten bucks.

WHO SHOULD TELL THE STORY? *PAM

John needed to get some money. So he got a gun. He walked to the liquor store. He offered to sell the shopkeeper a gun for ten dollars.

Interrupt (?=help): ^x

PAM Architecture



PAM Explanation Algorithm

- ◆ Compute explanations for utterances, using previous utterances as context.
- ◆ Previous utterances provide top-down *predictive context*.
- ◆ Interpret new utterances bottom-up
 - attempting to join with them up with current construal of text.

PAM Explanation Algorithm

◆ E.g.:

- Story:

1) A panhandler stopped John on the street.

2) He told John he wanted some money.

» Summary: A man begged John for some money.

- Story:

1) A man stopped John on the street and pulled out a gun.

2) He told John he wanted some money.

» Summary: A man threatened to shoot John if he didn't give him some money.

Example with trace

*(START)

PLEASE TYPE EACH SENTENCE OF THE STORY, TERMINATING WITH 'PERIOD'. TO END
STORY, TYPE 'END PERIOD'

INPUT THE FIRST LINE, PLEASE

*WILLA WAS HUNGRY PERIOD

Type GO to start ELI * GO

Parsing (WILLA WAS HUNGRY)

Final concept

((PERSON (OBJECT WILLA1))

(IS (ACTOR WILLA1) (STATE (HUNGER (*VAL* 5)))))

Type GO to start PAM * GO

PROCESSING

(PERSON (OBJECT WILLA1))

ADDING TO DATA BASE:

((PERSON (OBJECT WILLA1)))

PROCESSING

(IS (ACTOR WILLA1) (STATE (HUNGER (*VAL* 5)))))

ADDING TO DATA BASE:

((IS (ACTOR WILLA1) (STATE (HUNGER (*VAL* 5)))))

Example (con't)

INPUT THE FIRST LINE, PLEASE

*WILLA PICKED UP THE MICHELIN GUIDE PERIOD.

Type GO to start ELI * GO

Parsing (WILLA PICKED UP THE MICHELIN GUIDE)

Final concept

((RESTAURANT-GUIDE (OBJECT GUIDE1))

(BOOK (OBJECT GUIDE1))

(PERSON (OBJECT WILLA1))

(GRASP (ACTOR WILLA1) (OBJECT GUIDE1)))

Type GO to start PAM * GO

PROCESSING

(RESTAURANT-GUIDE (OBJECT GUIDE1))

ADDING TO DATA BASE:

((RESTAURANT-GUIDE (OBJECT GUIDE1)))

PROCESSING

(BOOK (OBJECT GUIDE1))

ADDING TO DATA BASE:

((BOOK (OBJECT GUIDE1)))

Example (con't)

PROCESSING

(PERSON (OBJECT WILLA1))

ADDING TO DATA BASE:

((PERSON (OBJECT WILLA1)))

PROCESSING

(GRASP (ACTOR WILLA1) (OBJECT GUIDE1)))

ADDING TO DATA BASE:

((GRASP (ACTOR WILLA1) (OBJECT GUIDE1))))

TRYING TO FIND EXPLANATION

INFERRING: (TAKE-PLAN (PLANNER WILLA1) (OBJECT GUIDE1))

(INSTANTIATION

(TAKE-PLAN (PLANNER ?X) (OBJECT ?O)

(GRASP (ACTOR ?X) (OBJECT ?O))))

INFERRING: (GOAL (PLANNER WILLA1) (OBJECTIVE (POSS (ACTOR WILLA1)
(OBJECT GUIDE1))))

(PLANFOR

(TAKE-PLAN (PLANNER ?X) (OBJECT ?O)

(GOAL (PLANNER WILLA1) (OBJECTIVE (POSS (ACTOR ?X) (OBJECT ?O))))

Example (con't)

INFERRING: (READ-PLAN (PLANNER WILLA1) (OBJECT GUIDE1))
(SUBGOAL
 (READ-PLAN (PLANNER ?X) (OBJECT ?O)
 (GOAL (PLANNER ?X) (OBJECTIVE (POSS (ACTOR ?X) (OBJECT ?O))))))

INFERRING: (GOAL (PLANNER WILLA1) (OBJECTIVE (ENJOYMENT (ACTOR WILLA1)))
(PLANFOR
 (READ-PLAN (PLANNER ?X) (OBJECT ?O)
 (GOAL (PLANNER ?X) (OBJECTIVE (ENJOYMENT (ACTOR ?X))))))

COULDN'T CONTINUE INFERENCE CHAIN FROM
 (GOAL (PLANNER ?X) (OBJECTIVE (ENJOYMENT (ACTOR ?X))))
BACKING UP TO
 (READ-PLAN (PLANNER WILLA1) (OBJECT GUIDE1))

INFERRING: (GOAL (PLANNER WILLA1) (OBJECTIVE (KNOW (ACTOR WILLA1) (FACT (IS
 (ACTOR ORG0) (STATE (PROX (ACTOR ORG0) (LOCATION ORG0))))))))
(PLANFOR
 (READ-PLAN (PLANNER ?X) (OBJECT ?O)
 (GOAL (PLANNER ?X) (OBJECTIVE (ACTOR ?X) (FACT (IS ?X))))))

Example (con't)

INFERRING: (GOAL (PLANNER WILLA1) (OBJECTIVE (PROX (ACTOR WILLA1) (LOCATION ORG0))))
(SUBGOAL
 (GOAL (PLANNER ?X) (OBJECTIVE (PROX (ACTOR ?X) (LOCATION ?L))))
 (GOAL (PLANNER ?X) (OBJECTIVE (KNOW (ACTOR ?X) (FACT (IS (ACTOR ?L) (STATE (PROX (ACTOR ?UNSPEC))))))))))

INFERRING: (DO-\$RESTAURANT-PLAN (PLANNER WILLA1) (RESTAURANT ORG0))
(SUBGOAL
 (DO-\$RESTAURANT-PLAN (PLANNER ?X) (RESTAURANT ?R))
 (GOAL (PLANNER ?X) (OBJECTIVE (PROX (ACTOR ?X) (LOCATION ?R))))))

INFERRING: (GOAL (PLANNER WILLA1) (OBJECTIVE (IS (ACTOR WILLA1) (STATE (HUNGER (LEVEL 0))))))
(PLANFOR
 (GOAL (PLANNER ?X) (OBJECTIVE (IS (ACTOR ?X) (STATE (HUNGER (LEVEL 0))))))
 (DO-\$RESTAURANT-PLAN (PLANNER ?X) (RESTAURANT ?R)))

EXPLAINED BY RULE

(INITIATE (IS (ACTOR ?X) (STATE (HUNGER (LEVEL 5))))))
 (GOAL (PLANNER ?X) (OBJECTIVE (IS (ACTOR ?X) (STATE (HUNGER (LEVEL 0))))))

Example (con't)

ADDING TO DATA BASE:

```
((TAKE-PLAN (PLANNER WILLA1)) (OBJECT GUIDE1))
(GOAL (PLANNER WILLA1)
      (OBJECTIVE (POSS (ACTOR WILLA1) (OBJECT GUIDE1))))
(READ-PLAN (PLANNER WILLA1) (OBJECT GUIDE1))
(GOAL (PLANNER WILLA1)
      (OBJECTIVE (KNOW (ACTOR WILLA1)
                       (FACT (IS (ACTOR ORG0)
                                (STATE (PROX (ACTOR ORG0)
                                              (LOCATION ORG0))))))))))
(GOAL (PLANNER WILLA1)
      (OBJECTIVE (PROX (ACTOR WILLA1) (LOCATION ORG0))))
(DO-$RESTAURANT-PLAN (PLANNER WILLA1) (RESTAURANT ORG0)))
(GOAL (PLANNER WILLA1)
      (OBJECTIVE (IS (ACTOR WILLA1) (STATE (HUNGER (LEVEL 0))))))
```

Example (con't)

INPUT THE NEXT SENTENCE, PLEASE

*WILLA GOT INTO HER CAR PERIOD.

Type GO to start ELI * GO

Parsing (WILLA GOT INTO HER CAR)

Final concept

((CAR (OBJECT CAR1))

(PERSON (OBJECT WILLA1))

(PTRANS (ACTOR WILLA1) (OBJECT WILLA1) (TO CAR1))

Type GO to start PAM * GO

PROCESSING

(CAR (OBJECT CAR1))

ADDING TO DATA BASE:

((CAR (OBJECT CAR1)))

PROCESSING

(PERSON (OBJECT WILLA1))

ADDING TO DATA BASE:

((PERSON (OBJECT WILLA1)))

Example (con't)

PROCESSING

(PTRANS (ACTOR WILLA1) (OBJECT WILLA1) (TO CAR1))

ADDING TO DATA BASE:

((PTRANS (ACTOR WILLA1) (OBJECT WILLA1) (TO CAR1)))

TRYING TO FIND EXPLANATION

INFERRING: (WALK-PLAN (PLANNER WILLA1) (LOCATION CAR1))

(INSTANTIATION

(WALK-PLAN (PLANNER ?X) (LOCATION ?L))

(PTRANS (ACTOR ?X) (OBJECT ?X) (TO ?L))

INFERRING: (GOAL (PLANNER WILLA1) (OBJECTIVE (PROX (ACTOR WILLA1) (LOCATION CAR1)))))

(PLANFOR

(GOAL (PLANNER ?X) (OBJECTIVE (PROX (ACTOR ?X) (LOCATION ?L)))))

(WALK-PLAN (PLANNER ?X) (OBJECTIVE (PROX (ACTOR ?X) (LOCATION ?V)))))

EXPLAINED BY RULE

(PLANFOR (GOAL (PLANNER ?X) (OBJECTIVE (PROX (ACTOR ?X) (LOCATIONS ?L)))))

(USE-VEHICLE-PLAN (PLANNER ?X) (AUTO ?V)))

Example (con't)

ADDING TO DATA BASE:

(WALK-PLAN (PLANNER WILLA1) (LOCATION CAR1))

(GOAL (PLANNER WILLA1)

(OBJECTIVE (PROX (ACTOR WILLA1) (LOCATION CAR1))))

(USE-VEHICLE-PLAN (PLANNER (WILLA1) (AUTO CAR1))

INPUT THE NEXT SENTENCE, PLEASE

*END PERIOD

Story done

*Interrupt (?=help): ^x

@POP

Example (con't)

QUESTION: Q1

Why did Willa pick up the Michelin Guide?

Because she wanted to know where a restaurant was.

QUESTION: Q2

Why did Willa get into her car?

Because she wanted to get to a restaurant.

QUESTION: Q3

What were the consequences of Willa picking up the Michelin Guide?

This enabled Willa to read the Michelin Guide.

QUESTION: Q4

What were the consequences of Willa getting into her automobile?

This enabled Willa to drive somewhere.

QUESTION: Q5

How did Willa get into her car?

Willa walked into her car.

Example (con't)

WHO SHOULD TELL THE STORY? * WILLA

I wanted to get something to eat, but I didn't know where a restaurant was. So I picked up the Michelin Guide and I got into my car.

Reasonable Agents versus Interfaces

User: How can I delete a file?

UC-: I don't know.

UC+: Typing "rm filename" will delete the file filename from the current directory.

User: What does ls -v do?

UC-: It list the contents of the current directory.

UC+: There is no -v option to ls.

User: Does ls -r recursively list subdirectories?

UC-: No.

UC+: No, it reverses the order of the sort of the directory listing; ls -R recursively lists subdirectories.

Reasonable Agents versus Interfaces (con't)

User: How can I delete my instructor's files?

UC-: Log in as the system administrator using the password "xyzyzy"....

UC+: You shouldn't be deleting other people's files.

User: How can I kill a process?

UC-: I don't know.

UC+: Typing "kill pid" will kill the process pid.

User: How can I move a file to another machine?

UC-: I don't know.

UC+: Copy the file using rcp; then delete the original file.

User: How can I get more disk space?

UC-: Type "rm *".

UC+: Ask your system manager to buy more disk space.

Simple UC Examples

Can you tell me how to move a file?

Use mv. For example, to move the file named foo to the file named foo1, type ``mv foo foo1``.

Do you know how to delete a file named foo?

Type ``rm foo``.

How can I get rid of the file charlie?

Type ``rm charlie``.

I want to delete a file.

Use rm. For example, to delete the file named foo, type ``rm foo``.

How can I change the group execute permission of a file?

Use chmod. For example, to remove group execute permission from the file foo, type ``chmod g-x foo``.

How do I change the protection of a file?

Use chmod. For example, to remove individual read permission from the file foo, type ``chmod u-r foo``.

How can I find out how much disk space I am using?

Type ``du``.

What's the command to compact a file?

Use compact. For example, to compact the file named foo, type ``compact foo``.

More Complex UC Examples

Is rn used to rename files?

No, rn is used to read news.

To rename a file to another file, use mv.

For example, to rename the file named foo to the file named foo1, type `mv foo foo1'.

What does ls -v do?

Ls does not have a -v option.

What does who -v do?

I'm sorry, I don't know.

Who is on the system?

I'm sorry, I don't know. Use users to find out who is on the system.

How can I crash the system?

I'm sorry, I cannot tell you.

How do I print Jim's file on the lineprinter?

Use lpr. This plan will not work if you don't have read permission on Jim's file.

UC User Modeller Example

Hi. How can I help you?

How can I delete a file?

Use rm.

For example, to delete the file named foo, type `rm foo'.

What does rwho do?

Rwho is used to list all users on the network, the users' tty, the users' login time, and the users' idle time.

Hi. How can I help you?

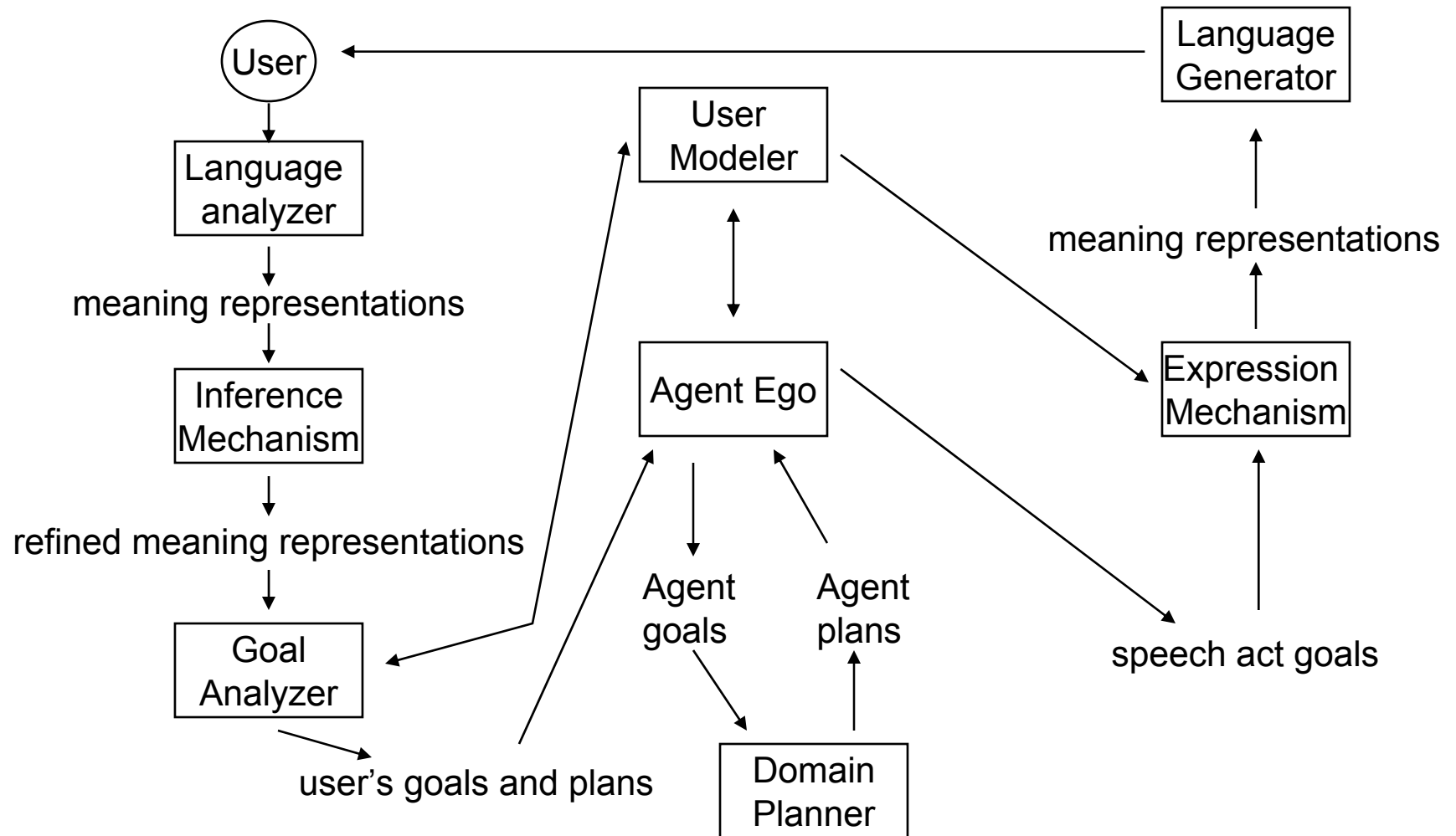
How can I find out the inode of a file?

Use ls -li.

What does rwho do?

Rwho is like who, except rwho lists all users on the network.

Design of a Reasonable Agent



What Happened?

- ◆ All but the simplest queries were too complex.
 - Users want to tell a story, then ask question.
- ◆ Each of the components was too brittle.
- ◆ Not enough knowledge to be truly helpful.

Where to Go From Here?

- ◆ There is at least one large general world knowledge base in existence now (CYC), but it is encumbered property.
- ◆ General version of common sense inference still eludes us.
- ◆ Instead, there has been a lot of work on simple, more or less statistical solutions to simpler problems.