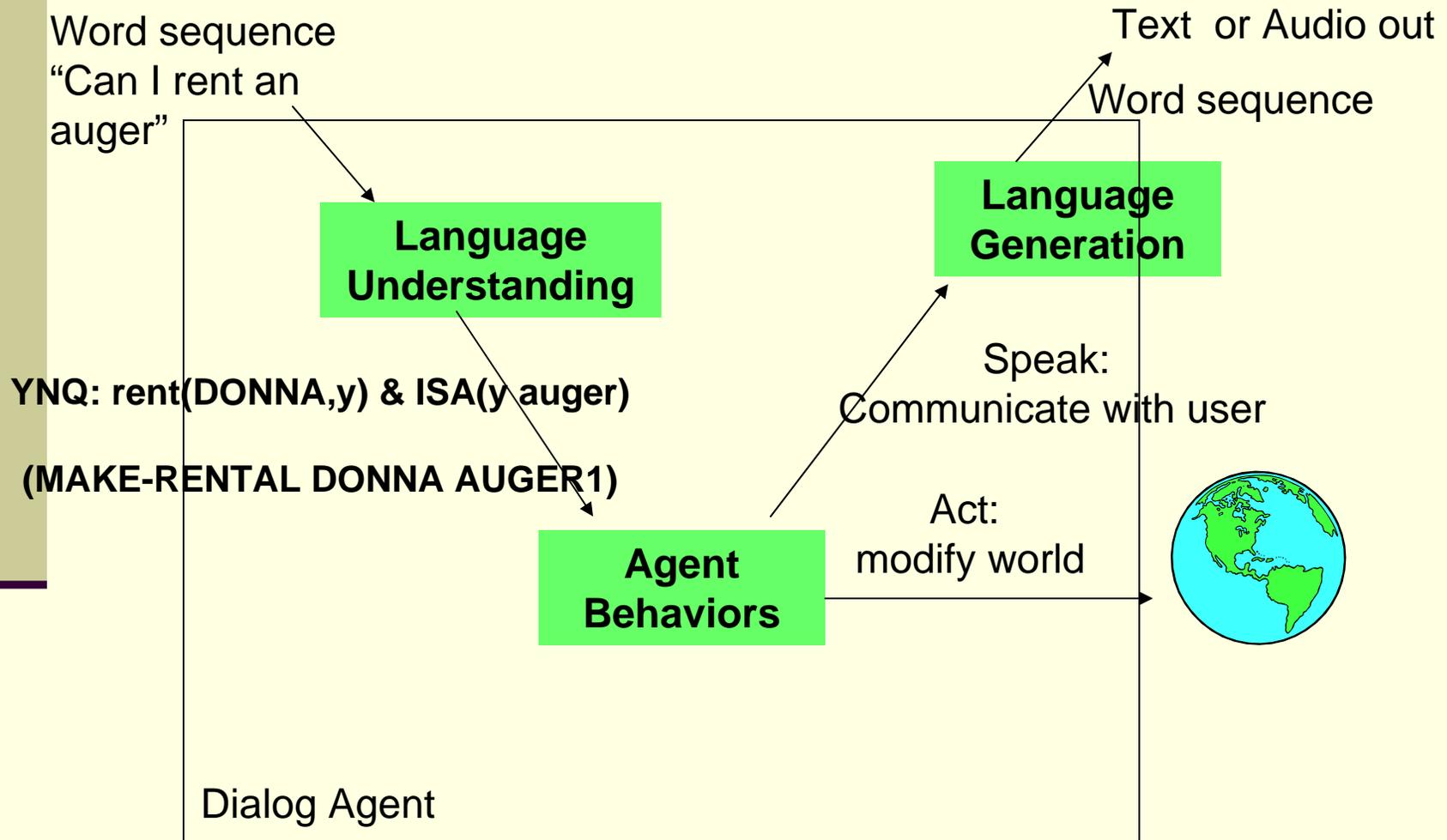


Chapter 19: Dialog acts and interaction

- Dialog acts are set of labels used to classify entire utterances
- They connect the language layer to the cooperative problem-solving activity
- Determining dialog act labels is the final step in disambiguating the user's input
- The dialog act assigned will constrain the response generated by the system

Basic components of a spoken dialog agent



Form vs. function

- Each utterance has a form and a function
- The speaker might make a statement, which is really a request or suggestion:
 - I need to fly to Austin on Friday
 - A: we could use the engine at Avon
 - B: But it doesn't have a tanker
 - A: OK, then we'll have to use the other engine

Possible responses depend on input

A) "Tell me the time" (imperative)

B) "do you know the time?" (Yes-no question)

Exists x ISA(x time) & WHEN(x now) & Valueof(x y)

- 1) Yes, it's three o'clock
- 2) No. I'm afraid not.
- 3) Three o'clock
- 4) OK. It's three o'clock.
- 5) I lost my watch

Criteria for DA categories

- Should cover naturally-occurring human conversation
- Should be useful for driving the Agent's linguistic behavior
- Should be taggable by humans, computable by machines

Monolog-based speech acts (Austin/Searle)

- Older taxonomies classify the purpose of the utterance:
 - To direct the hearer to do something
 - To inform the hearer of a proposition
 - To apologize
 - To greet

Communicator dialog fragment

...

C: I need to travel in May

A: And what day in May did you want to travel

C: Okay uh I need to be there for a meeting that's from
the 12th to the 15th

A: And what city will you be flying into?

C: Seattle

A: And what time would you like to leave Pittsburgh?

C: um hmm. I don't think there's a non-stop option

Observations about interaction

- Some behavior is obligatory after certain acts from your partner:
 - I greet you -> You greet me
 - I ask you a question -> You provide info
 - I give you info -> You signal that you understand

Observations about interaction

- Some utterances operate at different levels of communication:
 - You didn't answer my question about the date.
 - Can you repeat that?
 - Let me see .. Um ... I need to be there on the 12th

DAMSL tags

- Communicative-Status
- Information-Level
- Forward Looking Function
 - Statement
 - Info-Request
 - Influencing-addressee-future-action (Influence-on-listener)
 - Committing-speaker-future-action (Influence-on-speaker)
- Backward Looking Function
 - Agreement
 - Understanding
 - Answer
 - Information-Relations

Examples of DAMSL Dialog acts

- Forward-function
 - Statement: the speaker makes an assertion
 - Info-request: the speaker has asked for info
 - Commissives:
 - Commit: the speaker commits to doing something
 - Offer: the speaker offers to do something
 - Directives:
 - Open-option: suggest a list of options
 - Action-directive: a command
 - Conventional:
 - Greet
 - Thank
- Backward function
 - Signal agreement
 - Answer question

-> Look at tagged TRIPS dialog

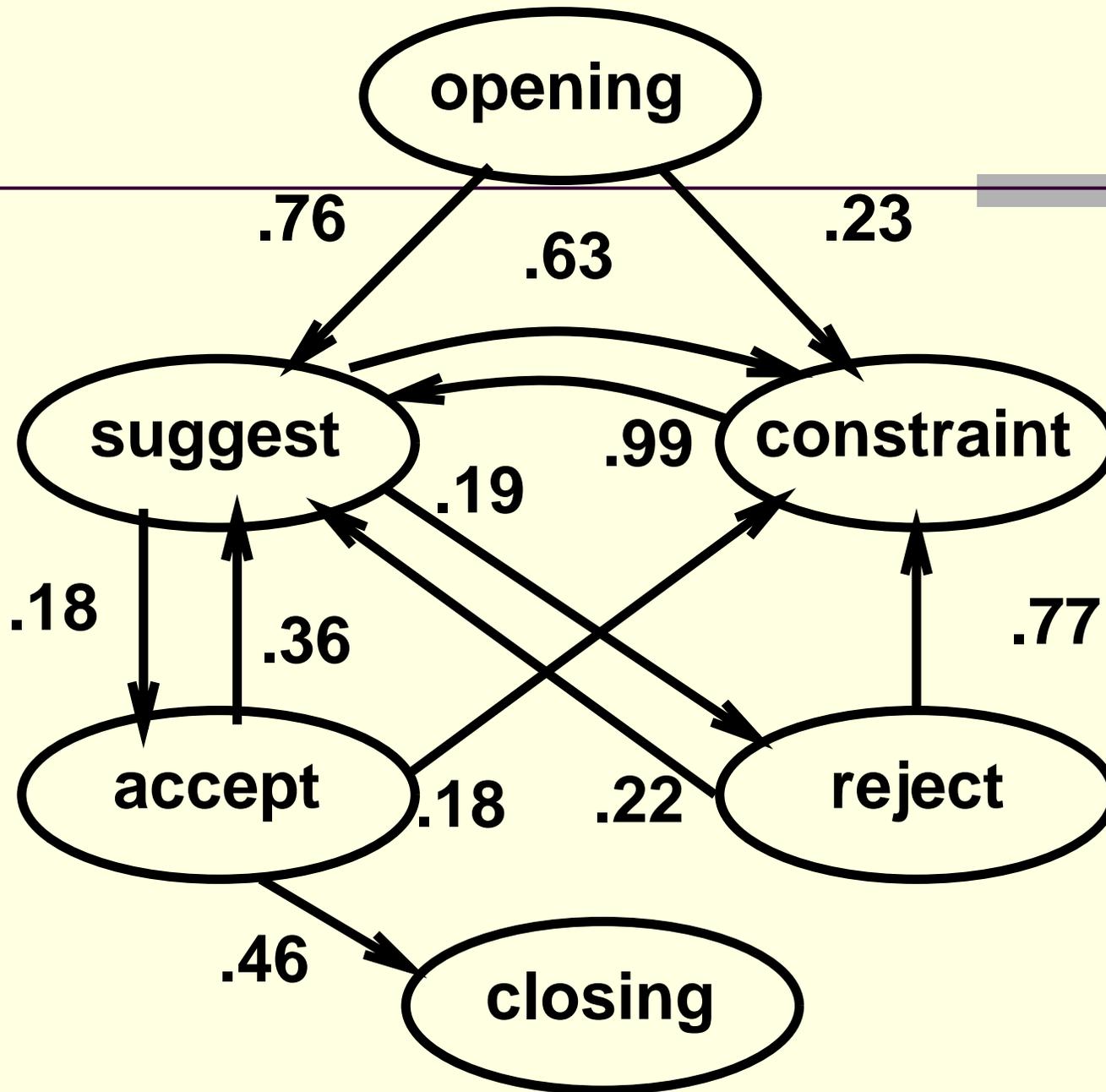
Automatic labeling of dialog acts

- Using cue words
 - Request: 'Please' or 'would you'
- Prosody:
 - Rising intonation on questions
- Learning dialog act labels
 - Transformation-based learning
 - N-gram dialog act grammar (using sequences of tags)
 - Decision tree

[Jurafsky et. al 1997; Shriberg, 1998; Oates, 2000; Stolke et al, 2000; Samuel and Carberry, 1998]

What do we do with tagged data?

- Learn which act the system should produce given a user act
- Learn association between phrasing and DAMSL tags



Determining the intention

- Classifying the speech act is important to partially determine the agent's obligation for response
- The next task is determining the *intention*
 - An intention is a task-relevant behavioral option of the system
 - Make a reservation
 - Cancel a reservation
- The intention answers the question 'why is SPEAKER saying that to me right now?'
- We can decide which intention is more plausible for the speaker if we infer what his plans might be.

Plan recognition in communication

To all trains

What track is the
Cleveland train on?



Plan recognition in communication

What track is the Cleveland train on?



To all trains



Recipe libraries

Action: Load(equipment, truck)

Precondition:

1. Equipment and truck at same location
2. Equipment fits in cargo area of truck
3. Truck is empty

Effects: Truck is not empty

Truck and equipment are attached

Plan Inference

■ **Action-Effect rule:**

- For all agents S and H,
- if Y is an effect of action X,
- and H believes that S wants X to be done,
- then it is plausible that H believes that S wants Y to obtain.

■ **Precondition-action rule:**

- For all agents S and H,
- if X is a precondition of action Y
- and if H believes that S wants X to obtain,
- then it is plausible that H believes that S wants Y to be done

[Perrault and Allen, 1980]

Recipe libraries and interpretation

U: Use the red pickup to take the backhoe to Laura.

S(1): Didn't we just load it with sod?

S(2): The red pickup is in Dayton today

S(3): We'll need to attach the trailer first

Recipe libraries and communication

- Some recipes are for communication acts:

Action: MotivateByRequest(act)

Preconditions: speaker and hearer have open communication channel

Effects: Intend(hearer, perform act)

Action: ConvinceByInform(prop)

Preconditions: same

Effects: believe(hearer, prop)

Action: ConvinceByInformRef(pred)

Preconditions: same

Effects: Knowref(hearer, pred)

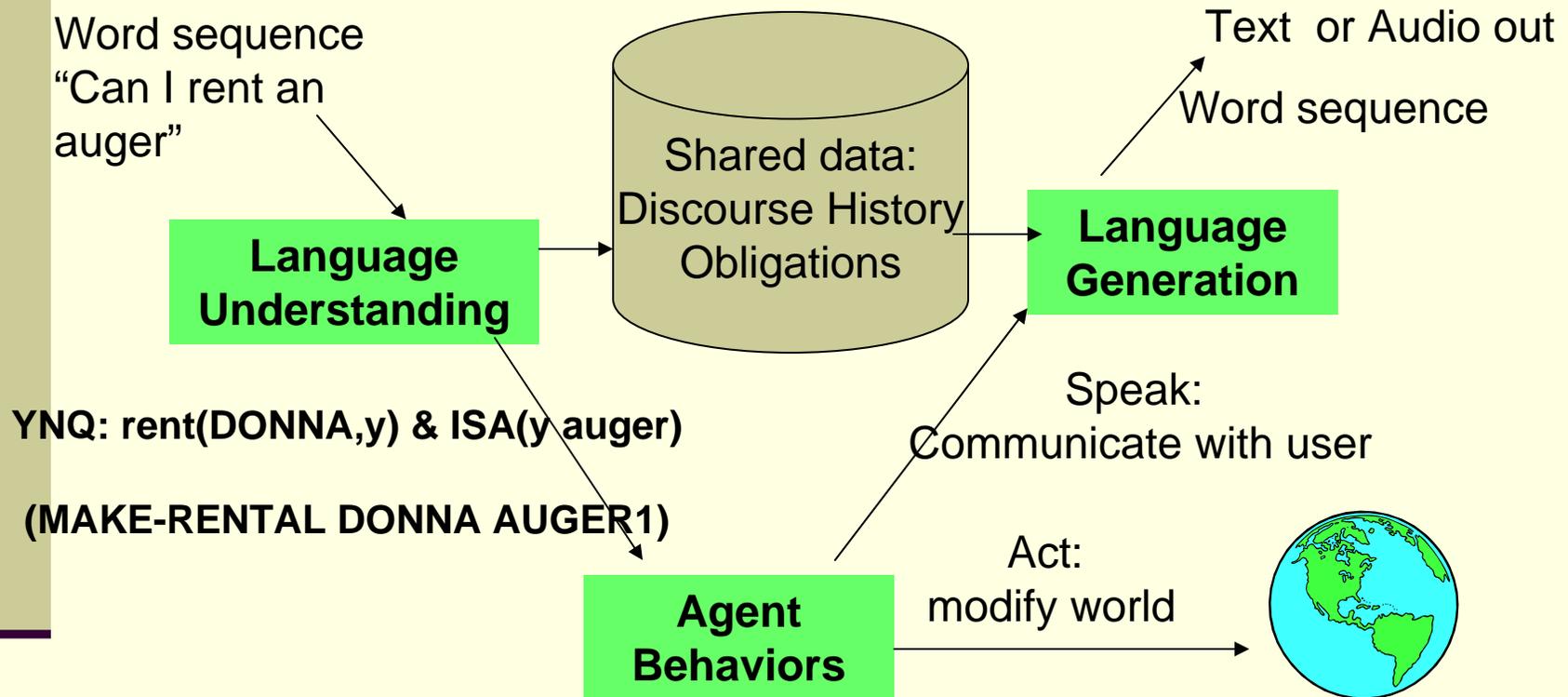
Obligations go on the agenda

User “I need to get my lawn mowed on Friday”

System Agenda:

1. Signal that I heard the user
2. Show that I understood what they asked for
3. Comply with the request (make the reservation)
4. Inform user of the outcome

Basic components of a spoken dialog agent



Obligations go on the agenda

User “I need to get my lawn mowed on Friday”

Assertion: user needs lawn mowed on Friday

Intention Recognition: User tells us this in order to get us to schedule the mowing crew

Obligations go on the agenda

User “I need to get my lawn mowed on Friday”

Assertion: user needs lawn mowed on Friday

(SYNSEM :speech act ASSERT

:who user1

:words “(string)”

:syntax (tree)

:sem (semantics))

System Agenda:

- Signal that I heard the user
- Show that I understood what they asked for

Obligations go on the agenda

User “I need to get my lawn mowed on Friday”

Assertion: user needs lawn mowed on Friday

Intention: User tells us this in order to get us to
schedule the mowing crew

(REQUEST schedule-crew :for DONNA
:who (JOHN AMY)
:date 5/13/05)

System Agenda:

- Comply with the request (make the reservation)
- Inform user of the outcome

Dialog Management

- What part does the agent play in the higher-level structure of the conversation?
 - What piece of information should be gathered next?
 - What obligations is the agent under, based on user's utterance (Question/answer)
- DM is in charge of:
 - formulating discourse intentions of the agent
 - choosing between obligations

DIALOGUE_MANAGER

```
while conversation is not finished
  if user has completed a turn
  then interpret user's utterance
  if system has obligations
  then address obligations
  else if system has turn
  then if system has intended conversation acts
    then call generator to produce NL utterances
    else if some material is ungrounded
    then address grounding situation
    else if high-level goals are unsatisfied
    then address goals
    else release turn or attempt to end conversation
  else if no one has turn
  then take turn
  else if long pause
  then take turn
```

