Finite State Dialogue Management

- Tedious to specify all of the transitions (e.g., repeat, shortcuts)
- Tedious to specify all of the states (e.g., for shortcuts)

But ...

- Depending on response of user
  - Transitions define what successor states system might be in
  - TTS output specified for each state actions of system
  - A bunch of states and some global variables 

Overview

- Artificial Intelligence
- Philosophy of Language
- Review

What have we learned thus far?

- System behavior specified as:
  - What states the system can be in
  - What should it do in a particular state
  - What states the system can be in
  - System behavior specified as

Rather than continue on this engineering approach,

- What are the possible successor states depending on what the user does
- What should I do in a particular state
- What states the system can be in

Form-Filling Dialogue Manager

- Agenda + Value + Options defines system's state
- Dialogue manager uses system's state to determine what to say
- Dialogue manager uses system's state to determine what to say
- Nothing applies to many types of applications, that are not form-based

But, code in dialogue manager determines how to update system's state based on what the user said.
What does a particular sentence mean?

Some sentences can be viewed as being true or false:

- Snow is white

But, what about other sentences?

- I want to go to Boston
- I want to go to Boston?
- Snow is white
- Some sentences can be viewed as being true or false

Speaking is action

The beliefs of the hearer

Lifting a box changes the world

Saying 'I want to go to Boston' is an action that the speaker does to change

The speaker is doing an action

previoulsy have

Speaker is trying to give the listener information that the listener didn't

But, what about other sentences?

Some sentences can be viewed as being true or false

What does a particular sentence mean?
Under what conditions can a given speech act be made?

Searle was interested in the necessary and sufficient conditions

- Necessary: what conditions if not met will guarantee speech act will fail
- Sufficient: what conditions if met will guarantee success of action

Necessary \( \subset \) Sufficient

Can you say "I want to go to Boston," if you don't want to go?

If the listener already knows this?

If you don't want to go?

Types of Actions

- Locutionary acts: act of saying something
  - Sounds and words that are produced
  - Intentional force: inform, request, suggest, warn, apologize
  - Perlocutionary acts: acts performed by saying something
    - It is cold in here, turn on the heat
      + Can include indirect speech acts
    - Perlocutionary acts: acts performed by saying something
  - Illocutionary acts: acts performed in saying something
Overview

Philosophy of Language

Review

Artificial Intelligence

Searle: Types of Conditions

- Normal input-output conditions
  - Intelligible, paying attention
- Propositional content conditions
  - A promise must be about something in the future
- Preparatory conditions
  - A promise must be about something in the future
- Propositional content conditions
  - Intelligible, paying attention
- Essential conditions
  - Speaker should be intending to do what they are saying
  - Constraints on the world that make the speech act useful
- Sincerity conditions
  - Alignment of the speaker's actual attitudes with what was said
  - Constraints on the world that make the speech act useful
- Essential conditions
  - Speaker should be intending to do what they are saying
  - Constraints on the world that make the speech act useful
  - If I tell you someone I must be intending to tell you something
How can we guarantee reasoning is...
- sound: a plan that is found is guaranteed to work
- complete: if there is a plan that will work, it can be found

Formalizing Planning

Actions and Planning

A lot of work had taken place in AI on automated planning

Plan reasoning:
- How can the system decide which action(s) to perform?

Effects:
- After an action is performed, what will be true about the world?

Preconditions:
- What must be true of the world to do an action?

What sequence of actions will solve the Tower of Hanoi problem?

Much work in AI on formalizing planning

What sequence of actions will solve a problem for a robot to solve a problem?
What is needed for system to plan speech acts?

- Theory of Speech Acts based on planning should specify the following:
  - formal language for describing states of the world
  - actually, the state of the system
  - language for describing actions
  - a set of plan construction inferences
  - a set of plan construction inferences
  - a set of plan construction inferences
  - actually, the state of the system
  - formal language for describing states of the world
  - Actually, the state of the system
  - formal language for describing states of the world

Goals of Formalizing Speech Acts

- How is the meaning of an utterance \( x \) related to the acts that be performed in uttering \( x \)?
- Recognition of action:
  - Speaker's model of the hearer and to the hearer's model of the speaker
  - What changes does the successful performance of a speech act make to the model of the speaker?
- Effects:
  - for a hearer
  - and successfully performed a particular speech act in producing an utterance
  - under what circumstances can an observer believe that a speaker has successfully
  - performed a particular speech act

- Goals of Formalizing Speech Acts
Axioms about modal operators

- X is true, conclude bel(a,X)
- bel(a,bel(a,X)) → bel(a,X)
- Distribution axiom: bel(a,X → Y) → (bel(a,X) → bel(a,Y))
- T: reflexity axiom: bel(a,X) → X
- 4: positive introspection: bel(a,X) → bel(a,bel(a,X))
- negative introspection: ¬bel(a,X) → bel(a,¬bel(a,X))
- K: Distribution axiom: bel(a,bel(a,X)) → bel(a,X)
- distributive axiom: bel(a,X → Y) ↔ (bel(a,X) → bel(a,Y))

These make sense for want and belief?

Are there general rules about belief and want?
Formalize actions in terms of modal logic