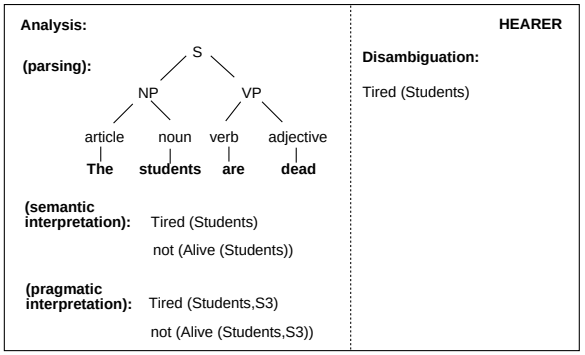
Today: Pragmatics and the problem of inference

- Text coherence
- Scripts

Pragmatics

Understanding sentences in context.



Interpretation in Context

Jack took out a match. He lit a candle.

Jack took out a match. The sun set.

Useful to divide context into:

- **discourse context:** information from preceding text
- **situational context:** relevant world knowledge

The Problem of Inference

When the balloon touched the light bulb, it broke. This made the baby cry. Mary gave John a dirty look and picked up the baby. John shrugged and picked up the balloon.

NLU as Abduction

If A → B is true and B true, then A true.

X = *Fred desperately needed money for the mortgage payment.*

B = *Fred called his sister.*

Rule1 = If you need money then you can get it from a family member.
Rule2 = If you want to get something from someone, then you can ask them for it.
Rule3 = One way to ask someone for something is to call them.

Framework for Using World Knowledge

Expectation-Based Processing

1. Assume setting of discourse is represented by content of previous sentences and any inferences made when interpreting those sentences.
2. Use this information to **generate a set of expectations** about plausible eventualities.
3. **Match** possible interpretations of new sentences against expectations generated from the prevous discourse.

Knowledge About Action and Causality

Forms of Causality:

[**effect causality**] Set of intended effects or side effects typically caused by an action.

[**precondition causality**] Set of conditions that typically must hold just before action starts.

[**enablement**] A enables B if the effects of the first establish the preconditions of the second.

[**decomposition**] A is a substep of B if A is the first is one of a sequence of steps that constitute the execution of B.

Definition of BUY

Roles: Buyer, Seller, Object, Money

Constraints: Human(Buyer), SalesAgent(Seller), IsObject(Object), Value(Money, Price(Object))

Preconditions: AT(Buyer, Loc(Seller)), OWNS(Buyer, Money), OWNS(Seller, Object)

Effects: ¬OWNS(Buyer, Money), ¬OWNS(Seller, Object), OWNS(Buyer, Object), OWNS(Seller, Money)

Decomposition: GIVE(Buyer, Seller, Money), GIVE(Seller, Buyer, Object)

Scripts [Schank & Abelson]

- Prepackaged chain of causal relations between events and states that encodes expectations.
- Don't have to generate expectations from first principles using causality reasoning.
- Knowledge structure that encodes stereotypical sequences of events.

John was hungry. He went into Goldstein's and ordered a pastrami sandwich. It was served to him quickly. He left the server a large tip.

$RESTAURANT Script

Roles: Customer(S), Server(W), Cook(C), Cashier(M), Food(F)

Props: Table, Utensils, etc.

Constraints: HUMAN(S), HUMAN(W), etc.

Preconditions: HAS-MONEY(S)

Effects:
HAS-LESS-MONEY(S), HAS-MORE-MONEY(M), ¬HUNGRY(S),¬PLEASED(S)

Decomposition (Conceptual Dependency form):

1. **Enter:** S PTRANS S into Restaurant; S ATTEND Eyes to Tables; S MBUILD where to sit; S PTRANS S to Table; S MOVE S to sitting position.
2. **Order:** S MTRANS food-order to W (main)
3. **Eat:** S INGEST X (main)
4. **Exit:** S ATRANS money to M (main)

Using Scripts to Understand a Story

Assume: script $S, consisting of events e_1, e_2, ...
For each sentence, s in text:

1. Parse s into its propositional CD form.
2. While event, e, in list of script events:
   (a) If s matches e,
      i. Instantiate e with current script roles.
      ii. Instantiate all intervening events, i, with current script roles.
   (b) Else move pointer to next event, saving e in i.

Output is instantiated script.

Problems with Scripts

1. Script selection
2. Managing multiple scripts
3. Aborting scripts
   John went to Goldstein's. He left.
4. Allowing for optional paths through scripts
   John was pick-pocketed on the way to restaurant.
5. Knowledge engineering requirements

Novel Situations

John was hungry. He took out some ground beef.

John was hungry. He took out the Yellow Pages.

John needed money for the mortgage payment. He called his sister.

John needed money for the mortgage payment. He got a gun.