Today: Pragmatics and the problem of inference

- Text coherence
- Scripts

Pragmatics

Understanding sentences in context.

Disambiguation:

Tired (Students)
not (Alive (Students,S3))

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 \( A \rightarrow B \) is true and \( B \) true, then \( A \) true.

\[ X = Fred \text{ desperately needed money for the mortgage payment.} \]
\[ B = Fred \text{ called his sister.} \]

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 previous 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: \( \neg \)OWNS(Buyer, Money), \( \neg \)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), ¬PLEASSED(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 $e_1, e_2, \ldots$
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

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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.*