Pragmatics Level: Dialogue Analysis Planning

Automatic detection of dialog tags

- First task is utterance segmentation – unit of analysis in the corpus
  - Can be Sentences, Speaker Turns or shorter utterances
  - Techniques similar to sentence detection, rule-based or classification
- Labeling dialog tags
  - Can be modeled with HMMs to capture the sequence of speaker turns
    - Or a discourse grammar to model the sequence
  - Other types of automatic classification using features
    - Cue words and phrases for specific tags
    - All the words (Bag of words)
- Performance on the Switchboard corpus:
  - Accuracy: 65% using automatic recognition of words
    71% on text transcripts with corrected words
  - Human performance: 84%

Dimensions of Dialog Tags

- Difficult to model dialogs with the labeling of utterances with a single tag; many utterances have multiple functions in the dialog
  - DAMSL does allow multiple labels
- Other dimensional systems include Bunt's system in 2006, "Dimensions in Dialog Act Annotation"
  - Example: The second utterance answers the question and provides positive feedback on the understanding of the question.

1. U: Can you tell me what time is the first train to the airport on Sunday morning?
2. S: On Sunday morning the first train to the airport is at 5.32.
3. U: Thank you.

Types of dialogs

- The Switchboard corpus is transcribed phone conversations
- Other types of transcribed conversations
  - Focus groups, meeting minutes
- Text Conversations from on-line systems
  - Example of reference librarian system on next slide (from Keisuke Inoue)
- IM and other types of chat
  - Chat has the additional difficulty of utterance identification in that
    - utterances can be separated by speaker turn
    - Sequences of utterances can occur out of order
      - While B is typing a response to A, another comment from A arrives before the response is done

DA Labels for online reference

Question
Initial Question

Which colleges did top fashion designers go?

Question
Clarifying Question

You mean top fashion designers anywhere?

ASK US!

Inform
Info. Provision

Answer, Inform
Pos. Ans., Additional Info. Spec

Yep, anywhere in U.S.

Inform
Neg. Feedback

Calvin Klein Graduated from NY's Fashion Institute of Technology in 1964

ASK US!

Inform
Clarifying Question

I need more recent ones…

Answer, Inform
Neg. Answer, User Context/Purpose

Do you have anyone in mind?

ASK US!

Question, Inform
Clarifying Question, URL Ref., Info. Provision

No… I'm deciding which school to go.

Answer, Inform
Pos. Feedback / Info. Request

How' bout Erica Tanov?
http://ericatanov.com/bio.htm
She graduated Parsons Design Institute, NY in 1985

ASK US!

Ok, I need more schools…

(continue…)

Chats obtained from the OCLC online reference librarian service.

Reference Librarian online dialogue

- Dialogues manually annotated for (multiple) dialogue acts
- Separated dialogue into segments, where each segment is labeled with the dimension and the more specific function

Thank you very much for using the service.	
	Social Rel. Mgmt / Gratitude
Please come again.	Social Rel. Mgmt / Rapport Building
Bye!	Social Rel. Mgmt / Valediction

Results of automatic detection

- Machine Learning compares
  - classification using Support Vector Machines (SVM)
  - with sequential classification of Hidden Markov SVM (HM-SVM)
  - to see importance of sequence of dialog acts in learning
- Compares features as well, showing following results:

	Setup	TP Rate	FP Rate	Precision	Recall	F-Measure
S-16	SVM + word vector	0.4434	0.0514	0.5315	0.4434	0.4138
H-16	HM-SVM + word vector	0.6909	0.0576	0.6881	0.6909	0.6674
H-17	H-16 + sequence number	0.6815	0.0548	0.6741	0.6815	0.6604
H-18	H-16 + speaker	0.7046	0.0564	0.7176	0.7046	0.6826
H-20	H-16 + message length	0.6836	0.0555	0.6856	0.6836	0.6608
H-24	H-16 + message position	0.6946	0.0510	0.6797	0.6946	0.6722
H-48	H-16 + bigram vector	0.7185	0.0523	0.7189	0.7185	0.6996
H-58	16,18,24,48	0.7400	0.0461	0.7379	0.7400	0.7272

Keisuke Inoue, An Investigation of Digital Reference Interviews: A Dialogue Act Approach, Ph.D. dissertation, April 2013.

Planning

- How is it that we as humans understand what another person means?
- How do we understand an utterance which, on the surface means one thing, but clearly means another in our daily life?
- Based on the situation, we recognize their plan!
  - Planning comes from the field of Artificial Intelligence
- Important in:
  - Conversational agents
  - Processing transcripts
  - Natural language generation

Planning: Intro (Cont'd)

- Unhelpful system responses:

  2a. User: *Do you know when the train leaves for Boston?*
  2b. System: *Yes.*

  3a. User: *Does the train for Washington leave at 4:00?*
  3b. System: *No.*

- System has made use of surface-level syntax and semantics to understand the user's questions, but no pragmatic knowledge

Planning: Intro (Cont'd)

- Surface level syntax and semantics is not enough
  - System needs to understand purpose / plan which motivated these utterances

- Helpful system response:

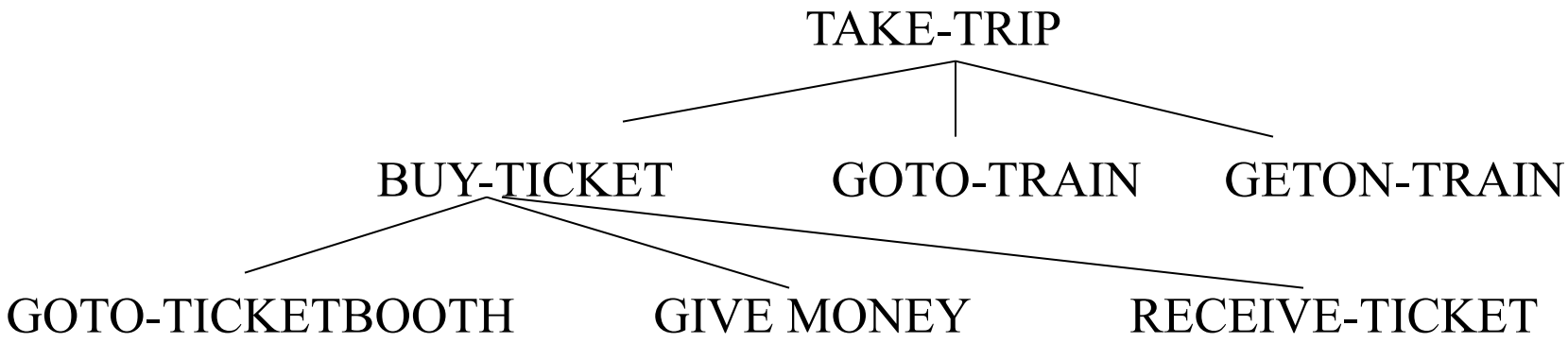
4a. User: *The 3:15 train to Detroit?*

4b. System: *Gate 10.*

4c. System: *It's going to be 10 minutes late.*

Trip-Taking Planning

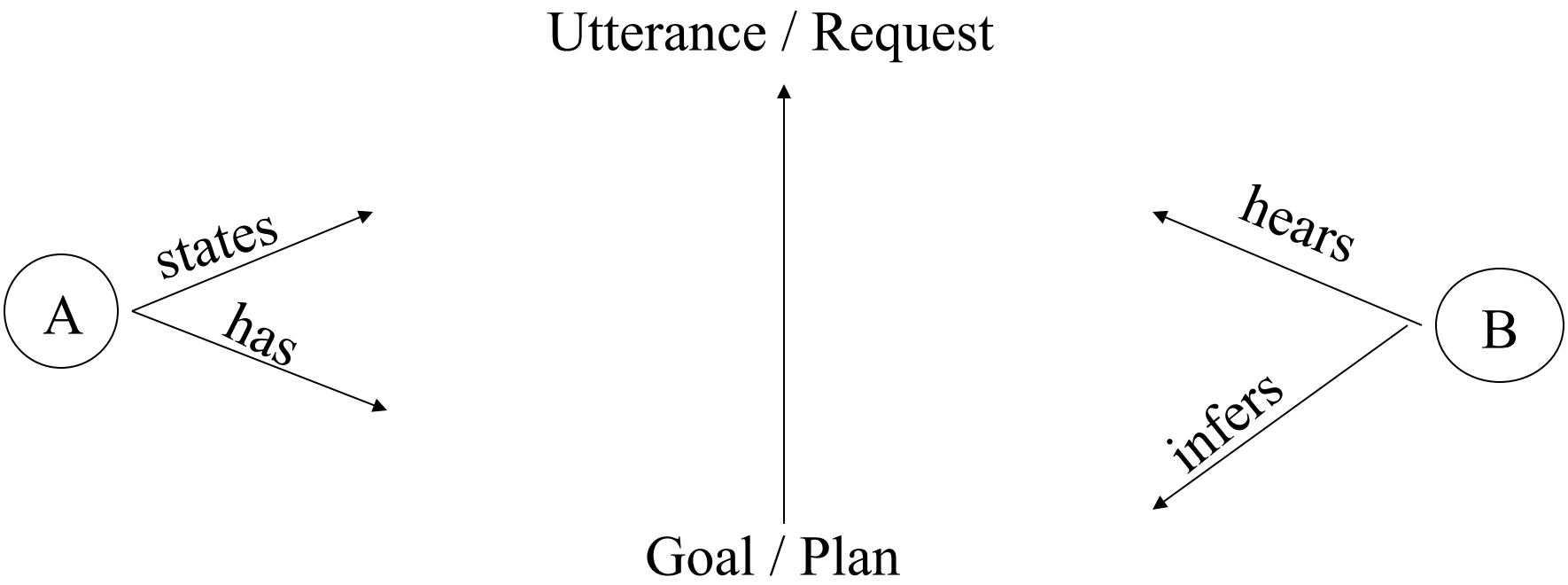
- Travel advisory system with a conversational interface may assume that the user has a plan to take a trip.

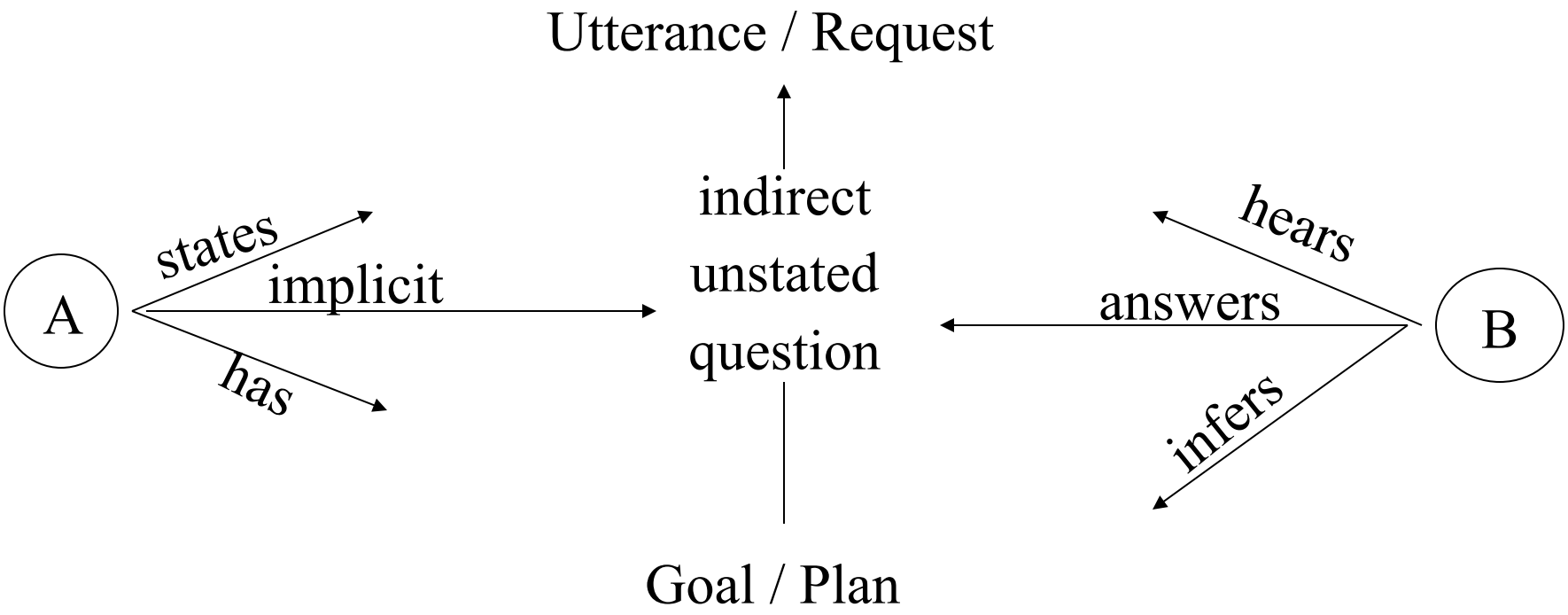


Sketch of a commonsense task plan to take a trip

- Other systems may have a number of plans that they can use to assist the user.

Utterance / Request


Utterance / Request
A
states
has
hears
B
infers
Goal / Plan


Utterance / Request
indirect
unstated
question
Goal / Plan
A
states
implicit
has
hears
answers
infers
B

Conversational Agents

- In addition to dialog understanding, dialogs may be used as the basis of systems that interact with humans through dialog
  - Airline reservation system example in Jurafsky and Martin
- Involves
  - **Dialog understanding to process user's utterances**
  - **Plan analysis**
  - **Keeping track of the information state**
  - **Dialog generation to make responses to the user**
- Current proliferation of "chat-bot" software
  - From Eliza to Siri

Summary of Pragmatics Level

- Properties of Human Conversations
  - Speech Act Theory introduces "illocutionary" acts for the intent of the speaker's utterance
  - Gricean Maxims give the "cooperative principle" where we infer the speaker's meaning
  - Conversational Structure identifies turn-taking and other forms of conversation
  - Dialogue Act Theory identifies more detailed conversational structures
- Computational Tasks
  - Automatic recognition of Dialogue Acts
    - Humans label dialogue acts with a performance of about 84%
    - Systems label dialogue acts with a performance of about 74%
  - Plan Recognition contributes to the organization of conversational agents
  - Using world knowledge in NLP applications