Introduction to Discourse, Cohesion
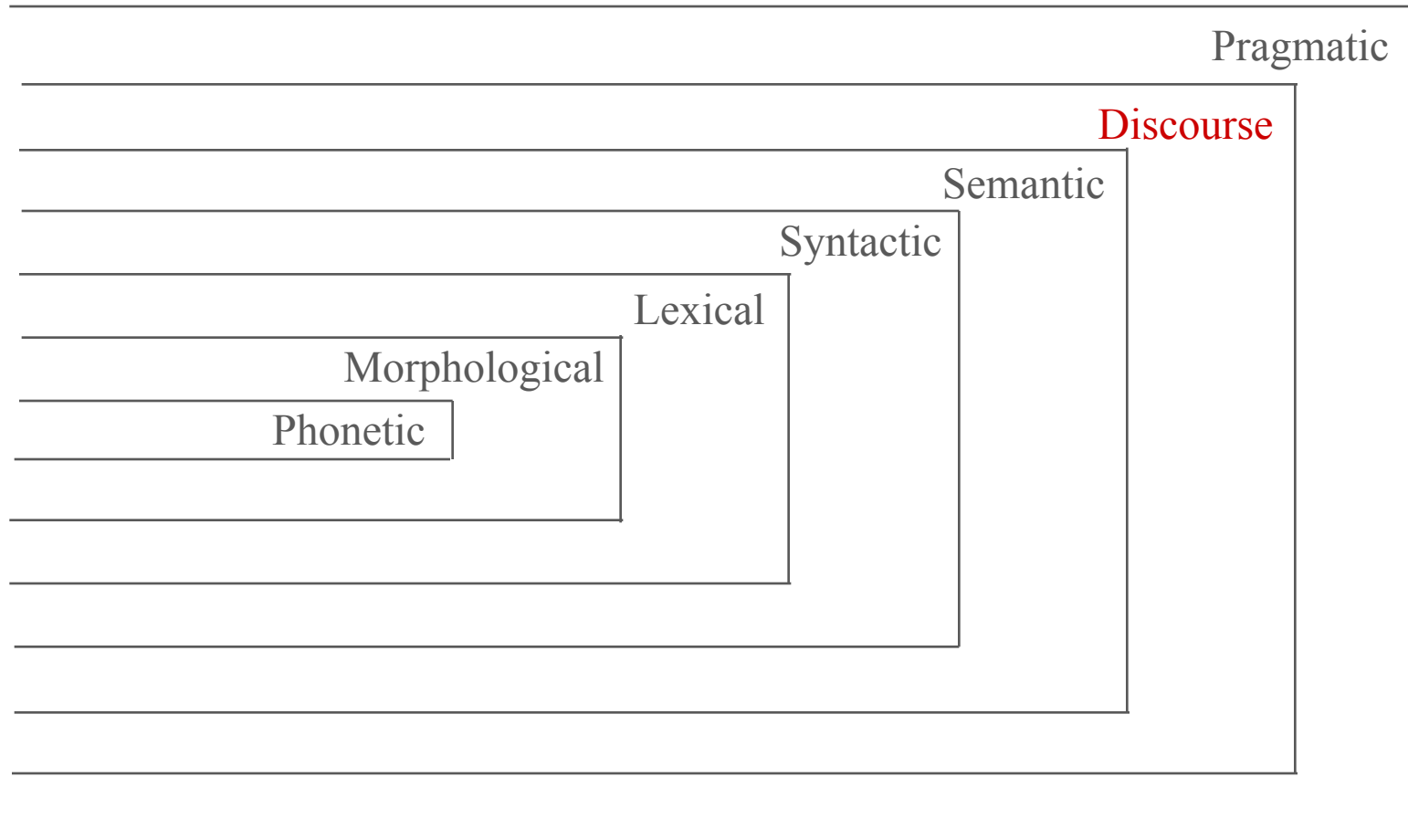
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Levels of Language

Pragmatic

Discourse

Semantic

Syntactic

Lexical

Morphological

Phonetic

Discourse Linguistics

Study of texts (linguistic units) larger than a sentence

Text is more than a sequence of sentences to be considered one by one

- Rather, sentences of a text are elements whose significance resides in the contribution they make to the development of a larger whole.

Each type of text has its own structure that can convey meaning to the reader

Some issues of discourse understanding are closely related to those in pragmatics that study the real-world dependencies of utterances

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Distinctions in Terminology Between Text and Discourse

In some contexts (e.g., in communication research), the word **discourse** means:

- Interactive conversation

- Spoken

And the word **text** means:

- Non-interactive monologue

- Written

But for (American) linguists, the word **discourse can mean both of these things at the discourse level** (i.e., either text or utterances longer than a sentence)

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Scope of Discourse Analysis

What does discourse analysis extract from text more than the explicit information discoverable by sentence-level syntax and semantics methodologies?

- Features which provide **cohesion and coherence** to text
  - Linguistic elements which contribute to the overall semantics of the document and make it read more fluently.
  - Can introduce references that must be resolved (**coreference resolution**) to understand semantics
  - Can show dependencies between sentences.
  - Some of these features are called **discourse markers**
- **Overall topic(s)** of the text
- **Structural organization** of the text
- What linguistic features of texts reveal this information to the analyst?

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Cohesion and Coherence

"A piece of text is intended and is perceived as more than a simple sequencing of independent sentences."

- Therefore, a text will exhibit unity/texture:
  - On the surface level (cohesion)
  - At the meaning level (coherence)

Cohesive ties provide the means whereby structurally unrelated elements are linked together.

Halliday and Hasan's *Cohesion in English* (1976) discusses types of cohesive ties.

- Grammatical: reference, substitution, ellipsis, conjunction
- Lexical: reiteration, collocation

In practice, there is overlap; some examples can show more than one type of cohesion.

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Reference

Items in a language that, rather than being interpreted in their own right, make reference to something else for their interpretation.

▪ **Anaphora** example with references (he, his, there) to previous text:
"Doctor Foster went to Gloucester in a shower of rain. He stepped in a puddle right up to his middle and never went there again."

▪ **Substitution:** a substituted item serves the same structural function as the item for which it is substituted
These biscuits are stale. Get some fresh ones.

▪ **Ellipsis:** something is left unsaid but understood nonetheless
Joan brought some roses and Kate _____ some sweet peas.

Resolving these references is the **coreference task**, which is one of the most important NLP tasks at the discourse level.

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Conjunction and Transition

Sets up a relation between two clauses or sentences that shows how they are connected

- *For the whole day, he climbed up the steep mountainside, almost without stopping.*

  - *And, in all this time, he met no one.*

  - *Yet he was hardly aware of being tired.*

  - *So, by night, the valley was far below him.*

  - *Then, as dusk fell, he sat down to rest.*

  - *In fact, he hiked farther than ever before.*

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Lexical Cohesion

Lexical cohesion is concerned with cohesive effects achieved by selection of vocabulary.

- **Reiteration**: changing lexical items to achieve the same meaning but varying the actual words
  I attempted an ascent of the peak. _ X __ was easy.

  > same lexical item: *the ascent*
  > synonym: *the climb*
  > superordinate term: *the task*
  > general noun: *the act*
  > pronoun: *it*

  - These are similar to substitution and will also be treated by **coreference**

- **Collocation**: using semantically related items in the same text

  - *boy/girl, wet/dry, order/obey, chair/table* (furniture)

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Uses of Cohesion Theory

Scoring text cohesiveness

- Halliday and Hasan's theory has been captured in a coding scheme used to quantitatively measure the extent of cohesion in a text.

- ETS has experimented with it as a metric in grading standardized test essays.

Language generation and machine translation can use cohesion and coherence to build fluent texts

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Coherence Relations: Semantic Meaning Ties

The set of possible relations between the meanings of different utterances in the text

Hobbs (1979) suggests relations such as the following:

- **Result:** The state in first sentence could cause the state in a second sentence.

- **Explanation:** The state in the second sentence could cause the first.
  John hid Bill's car keys. He was drunk.

- **Parallel:** The states asserted by two sentences are similar.
  The Scarecrow wanted some brains. The Tin Woodsman wanted a heart.

- **Elaboration:** Infer the same assertion from the two sentences.

Textual entailment

- This is an NLP task to discover the result and elaboration between two sentences.

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Discourse:
Lexical Cohesion Structure

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Lexical Chains

Building lexical chains is one way to find the lexical cohesion structure of a text, both reiteration and collocation

A lexical chain is a sequence of semantically related words from the text

Document can be viewed as a set of lexical chains
- A kind of clustering of words based on semantic similarity
- Each cluster can be viewed as a document "topic"

Algorithm sketch
- Select a set of candidate words
- For each candidate word, find an appropriate chain relying on a "relatedness" measure among members of chains
  - Usually semantic similarity between words
- If it is found, insert the word into the chain

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Example of Lexical Chains

Semantically related words are highlighted. Note that this assumes that coreference resolution has already occurred.

From Nineteen Eighty-Four [abridged]:

… the [book] that he had just taken out of the drawer. [It] was a peculiarly beautiful [book]. [Its] smooth creamy [paper] was of a kind that had not been manufactured for at least forty years past. He could guess, however, that the [book] was much older than that. He had seen [it] lying in the window of a frowsy little [junk-shop] and had been stricken immediately by an overwhelming desire to [possess] [it]. Party members were supposed not to go into ordinary [shops]. He had slipped inside and [bought] the [book] for two [dollars] fifty. Even with nothing [written] in [it], [it] was a compromising [possession]. ¶ The thing that he was about to do was to open a [diary]. Winston fitted a [nib] into the [penholder] and sucked [it] to get the grease off. The [pen] was an archaic [instrument], seldom used even for [signatures], and he had [procured] one, furtively and with some difficulty, simply because of a feeling that the beautiful creamy [paper] deserved to be [written] on with a real [nib] instead of being scratched with an [ink]-[pencil]. Actually he was not used to [writing] by hand. He dipped the [pen] into the [ink].

Example from Hirst and Budanitsky, slides from 2001

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Discourse Segmentation

Documents are automatically separated into passages, sometimes called fragments, which are different discourse segments.

- Discourse segments can inform semantic interpretation of document
- The distinguishing discourse elements will be specific to the different genre

Techniques to separate documents into passages include:

- Rule-based systems based on clue words and phrases
- Probabilistic techniques to separate fragments and to identify discourse segments
- Lexical cohesion to identify fragments (TextTiling)

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TextTiling

Uses lexical cohesion to identify segments, assuming that each segment exhibits "lexical cohesion" within the segment, but is not cohesive across different segments

Algorithm

- Identifies candidate segments

- Computes lexical cohesion score in each segment

  - Lexical cohesion score is the average semantic similarity of words within a segment.

- Identify boundaries by the difference of cohesion scores

NLTK has a TextTiling algorithm available

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Coreference Resolution

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Anaphora/Reference Resolution

One of the most important NLP tasks for cohesion at the discourse level

A linguistic phenomenon of abbreviated subsequent reference

- A cohesive tie of the grammatical and lexical types

  - Includes reference, substitution, and reiteration

- A technique for referring back to an entity that has been introduced with more fully descriptive phrasing earlier in the text

- Refers to this same entity but with a lexically and semantically attenuated form

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Types of Entity Resolutions

Entity resolution is an ability of a system to recognize and unify variant references to a single entity.

▪ Coreference algorithms usually performed within a larger task of entity resolution

There are two levels of resolution:

1. **Within document (includes coreference resolution)**

   ▪ Example: *bin Laden = he = his*

   ▪ *his followers = they*

   ▪ *terrorist attack = it*

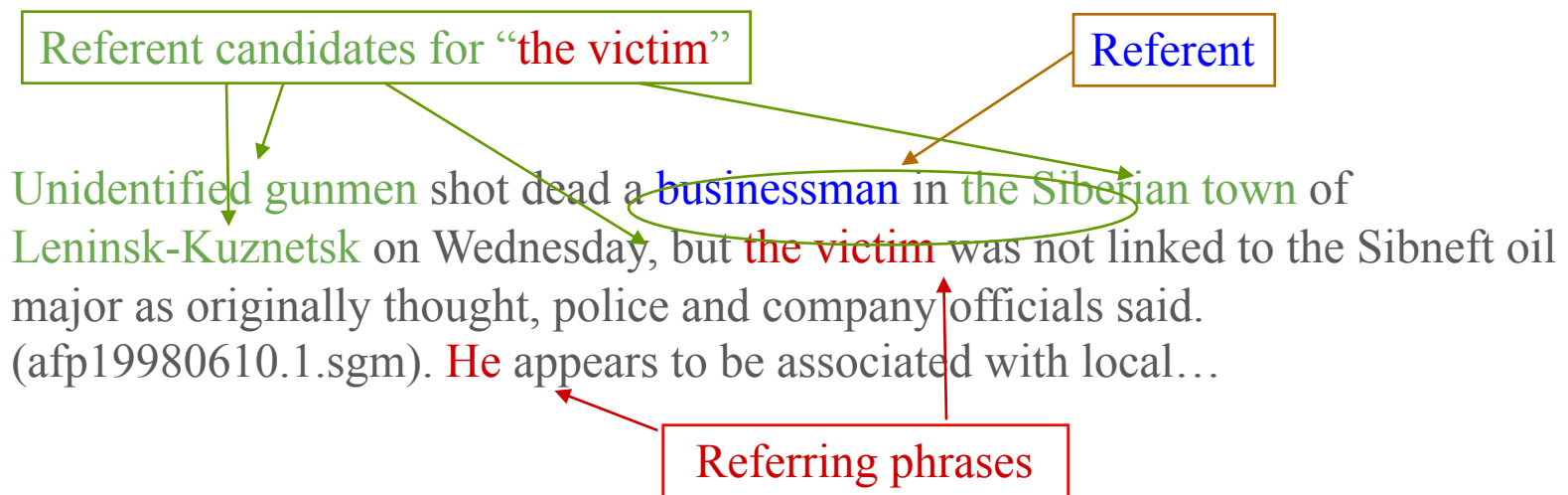   ▪ *the Federal Bureau of Investigation = FBI = the bureau*

2. **Across document (or named entity resolution)**

   ▪ Example: *Usama bin Laden = Osama bin Laden = bin Laden*

Event resolution is also possible but not widely used.

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Terminology Examples

The referent for a referring phrase is found by the resolution algorithm among the candidates, previous noun phrases.

Referent candidates for "the victim"

Referent

Unidentified gunmen shot dead a businessman in the Siberian town of Leninsk-Kuznetsk on Wednesday, but the victim was not linked to the Sibneft oil major as originally thought, police and company officials said. (afp19980610.1.sgm). He appears to be associated with local…

Referring phrases

Clues will involve people vs. objects and single vs. plural.

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Reference Types

An algorithm must first decide which are the referring phrases that must be resolved.

- Pronouns
- Definite noun phrases (*the*)
- Indefinite noun phrases (*a, an*)
- Demonstratives
- Names
- Others

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Pronouns

Pronouns can refer to entities that were introduced fairly recently, 1–4–5–10(?) sentences back.

- Nominative (*he, she, it, they,* etc.)

- Oblique (*him, her, them,* etc.)

- Possessive (*his, her, their,* etc. + *hers, theirs,* etc.)

- Reflexive (*himself, themselves,* etc.)

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Definite Noun Phrases: The X

Definite reference is used to refer to an entity identifiable by the reader because it is either:

a) Already mentioned previously (in the discourse)

b) Or, contained in the reader's set of beliefs about the world (pragmatics)—known entities like "the Grand Canyon"

c) Or, the object itself is unique ("the universe") (Jurafsky & Martin, 2000)

Example

▪ Mr. Torres and his companion claimed a hard-shelled black vinyl suitcase. The police rushed the suitcase to the Trans-Uranium Institute, where experts cut it open because they did not have the combination to the locks.

Indefinite Noun Phrases: A X or An X

Typically, an indefinite noun phrase introduces a new entity into the discourse and would not be used as a referring phrase to something else.

- The exception is in the case of cataphora, where the referring phrase occurs before the referent.

A Soviet pop star was killed at a concert in Moscow last night.
Igor Talkov was shot through the heart as he walked on stage.

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Demonstratives: This and That

Demonstrative pronouns can either appear alone or as determiners (*this ingredient, that spice*).

These NP phrases with determiners are ambiguous.

- They can be indefinite.
  I saw this beautiful car today.

- Or they can be definite.
  I just bought a copy of Thoreau's Walden. I had bought one five years ago. That one had been very tattered; this one was in much better condition.

Names

Names can occur in many forms, sometimes called name variants, and are included in the referring phrases.

Victoria Chen, Chief Financial Officer of Megabucks Banking Corporation since 2004, saw her pay jump 20% as the 37-year-old also became the Denver-based financial-services company's president. Megabucks expanded recently... MBC...

- Victoria Chen, Chief Financial Officer, her, the 37-year-old, the Denver-based financial-services company's president

- Megabucks Banking Corporation, the Denver-based financial-services company, Megabucks, MBC

Groups of a referent with its referring phrases are called a **coreference group** or coreference chain.

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Unusual Cases

Compound phrases
John and Mary *got engaged. They make a cute couple.*
John and Mary went home. She was tired.

Singular nouns with a plural meaning
The focus group met for several hours. They were very intent.

Part/whole relationships
John bought a new car. A door was dented.

Four of the five surviving workers have asbestos-related diseases, including three with recently diagnosed cancer.

Coreference Resolution Task

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Approach to Coreference Resolution

Naively identify all referring phrases for resolution

- All pronouns

- All definite NPs

- All proper nouns

Filter things that look referential but, in fact, are not

- Example: geographic names, *the United States*

- Pronouns without actual meaning

  - Pleonastic "it" (e.g., *it's 3:45 p.m., it was cold*)

  - Non-referential "it," "they," "there"
    - *it was essential, it is important, it is understood*
    - *they say*
    - *there seems to be a mistake*

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Identify Referent Candidates

- All noun phrases (both indefinite and definite) are considered potential referent candidates

- A referring phrase can also be a referent for a subsequent referring phrase

  - Example: (omitted sentence with name of suspect)
    He had 300 grams of plutonium 239 in his baggage. The suspected smuggler denied that the materials were his.
    (chain of four referring phrases)

- All potential candidates are collected in a table collecting feature information on each candidate

- Requires either parsing or chunking to identify noun phrases:

  - Example: the Chase Manhattan Bank of New York

  - Note nesting of NPs

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Features

Define features between a referring phrase and each candidate.

- **Number agreement:** plural, singular, or neutral
  - *He, she, it,* etc. are singular, while *we, us, they, them,* etc. are plural and should match with singular or plural nouns, respectively.
  - Exceptions: Some plural or group nouns can be referred to by either *it* or *they*. *IBM announced a new product. They have been working on it…*
- **Gender agreement**
  - Generally animate objects are referred to by either male pronouns (*he, his*) or female pronouns (*she, hers*).
  - Inanimate objects take neutral (*it*) gender.
- **Person agreement**
  - First and second person pronouns are "I" and "you."
  - Third-person pronouns must be used with nouns.

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More Features

Binding constraints

- Reflexive pronouns (*himself, themselves*) have constraints on which nouns in the same sentence can be referred to.
John bought himself a new Ford. (John = himself)
John bought him a new Ford. (John cannot = him)

Recency

- Entities situated closer to the referring phrase tend to be more salient than those farther away.
  - And pronouns can't go more than a few sentences away

Grammatical role, sometimes approximated by Hobbs distance

- Entities are more likely to be in a subject position than in the object position.

Example: Rules to Assign Gender Information

Assign gender to "masculine" if:

▪ It is a pronoun "he, his, him"

▪ It contains markers like "Mr."

▪ The first name belongs to a list of masculine names

Same for "feminine" and "neutral" (except for latter use categories such as singular, geo names, company names, etc.)

Or else, assign "unknown"

▪ A phrase with unknown gender can match other phrases known as either masculine or feminine

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Approach

Train a classifier over an annotated corpus to identify which candidates and referring phrases are in the same coreference group.

- Evaluation results (e.g., Vincent Ng at ACL 2005) are on the order of **F-measure of 70 for overall coreference,** with generally higher precision than recall.

- Evaluation typically uses the B-cubed scorer introduced by Bagga and Baldwin, which compares coreference groups.

- **A pronoun coreference resolution** by itself is much higher scoring, usually over **90.**

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Discourse Structures

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Discourse Structure

Human discourse often exhibits structures that are intended to indicate common experiences and respond to them.

- For example, research abstracts are intended to inform readers in the same community as the authors and who are engaged in similar work

- Essay structure taught to high school students

- Newspaper structure, where the story is given in several segments lending itself to shorter or longer versions

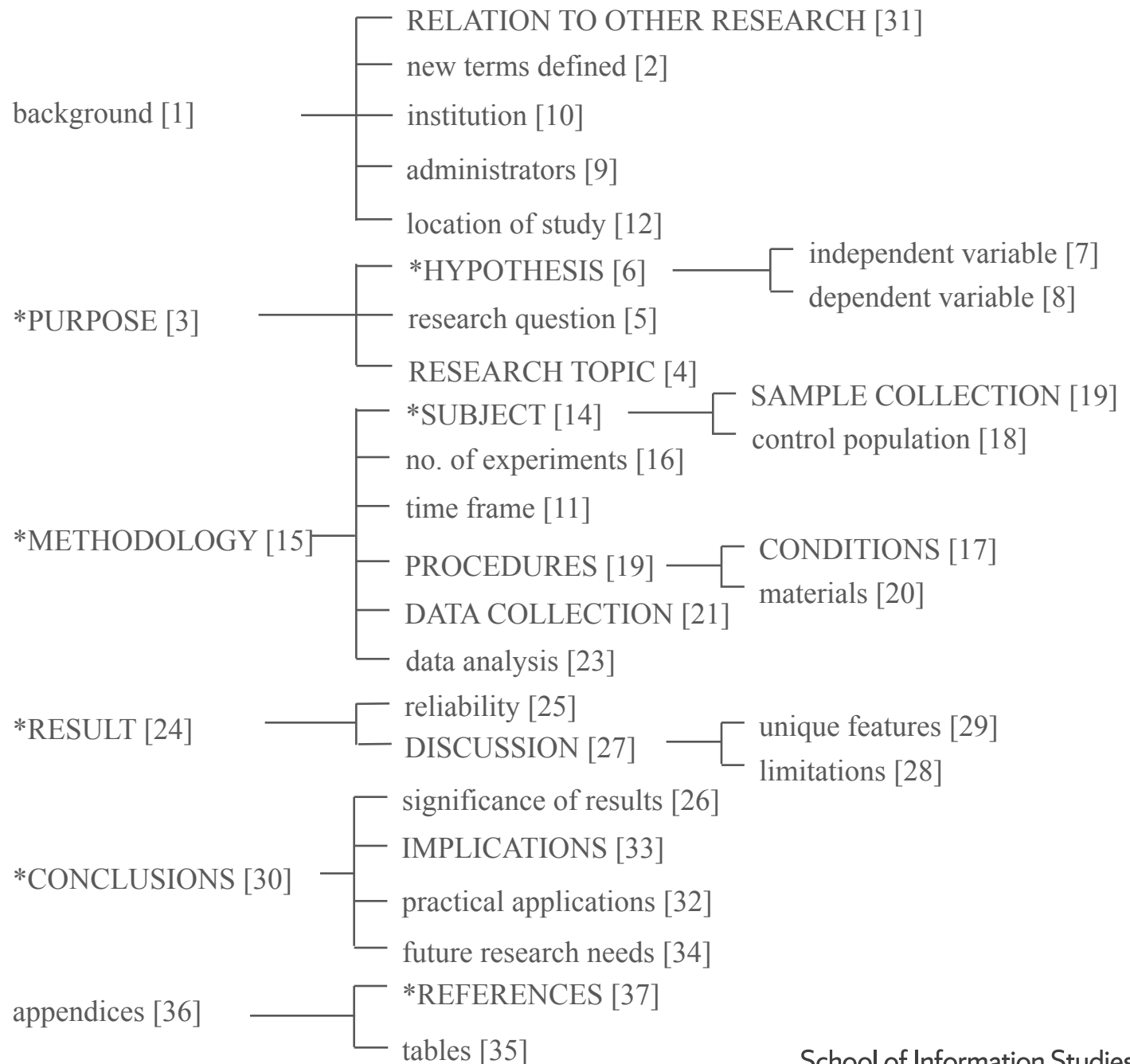School of Information Studies
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Discourse Structure

An empirical study in the dissertation by Liz Liddy identifies discourse structure of research abstracts.

- Hierarchical, componential text structure

- Examples from Liddy discourse structure taken from Robert N. Oddy, *Discourse Level Analysis of Abstracts for Information Retrieval: A Probabilistic Approach,* p. 22–23.

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Scheme of discourse elements for research abstracts

Note hierarchical structure

background [1]
- RELATION TO OTHER RESEARCH [31]
- new terms defined [2]
- institution [10]
- administrators [9]
- location of study [12]

*PURPOSE [3]
- *HYPOTHESIS [6]
  - independent variable [7]
  - dependent variable [8]
- research question [5]
- RESEARCH TOPIC [4]

*METHODOLOGY [15]
- *SUBJECT [14]
  - SAMPLE COLLECTION [19]
  - control population [18]
- no. of experiments [16]
- time frame [11]
- PROCEDURES [19]
  - CONDITIONS [17]
  - materials [20]
- DATA COLLECTION [21]
- data analysis [23]

*RESULT [24]
- reliability [25]
- DISCUSSION [27]
  - unique features [29]
  - limitations [28]

*CONCLUSIONS [30]
- significance of results [26]
- IMPLICATIONS [33]
- practical applications [32]
- future research needs [34]

appendices [36]
- *REFERENCES [37]
- tables [35]

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Empirical studies of Japanese work ethics have tended to focus on male workers while neglecting women. In addition, work values in both Japan and the United States appear to be changing. More information is needed on the work values of American and Japanese female workers.

BACKGROUND

Research abstract with discourse elements marked

Sections convey information to readers in terms of their own research

A study was conducted to explore

| the work ethics of Japanese women | *RESEARCH TOPIC* |

and to compare them to those of American women.

PURPOSE

Subjects were 261 Japanese and 347 American employed women

SUBJECT

who were tourists in Hawaii.

LOCATION

Subjects completed the Work Ethics questionnaire, an instrument designed to reflect the traditional values of both Japanese and American culture. The questionnaire was translated into Japanese for Japanese subjects.

DATA COLLECTION

T-tests used to test for significance of differences

DATA ANALYSIS

METHODOLOGY

revealed that the Japanese and American women differed significantly on 27 of 37 work ethics. In comparison with American women, Japanese women were more prone to value group participation; to work in large rather than small companies; to value loyalty to employer and country; to desire more time for leisure and recreational activities; and to believe that suffering adds meaning to life and that money acquired easily is usually spend unwisely. American women were more prone to value individualism, independence, self—expression and personal growth; and to believe that individual freedom is more important than group solidarity, that hard work pays off in success . . .

RESULTS

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Rhetorical Structure Theory

This theory belongs to the discourse level, as it can be used to explain coherence by defining explicit relations that hold between pieces of text

- But note there are some similarities to illocutionary acts (in the next section)

Formulated by computational linguists (Mann and Thompson) to guide text generation, but also important in text summarization

From examination of texts, a number of rhetorical relations are defined between two pieces of text (often adjacent)

- The texts are referred to as the nucleus and the satellite of the relation

Discourse Markers

Many rhetorical relations can be indicated by particular words or phrases (from Biran and Rambow, 2012)

▪ But many of these words are ambiguous, as they can be used for other functions in text as well.

Relation	Nb	Sample Indicators
analogy	15	as a, just as, comes from the same
antithesis	18	although, even while, on the other hand
cause	14	because, as a result, which in turn
concession	19	despite, regardless of, even if
consequence	15	because, largely because of, as a result of
contrast	8	but the, on the other hand, but it is the
evidence	7	attests, this year, according to
example	9	including, for instance, among the
explanation–argumentative	7	because, in addition, to comment on the
purpose	30	trying to, in order to, so as to see
reason	13	because, because it is, to find a way
result	23	resulting, because of, as a result of

Example of a Rhetorical Relation

The relation "Evidence":

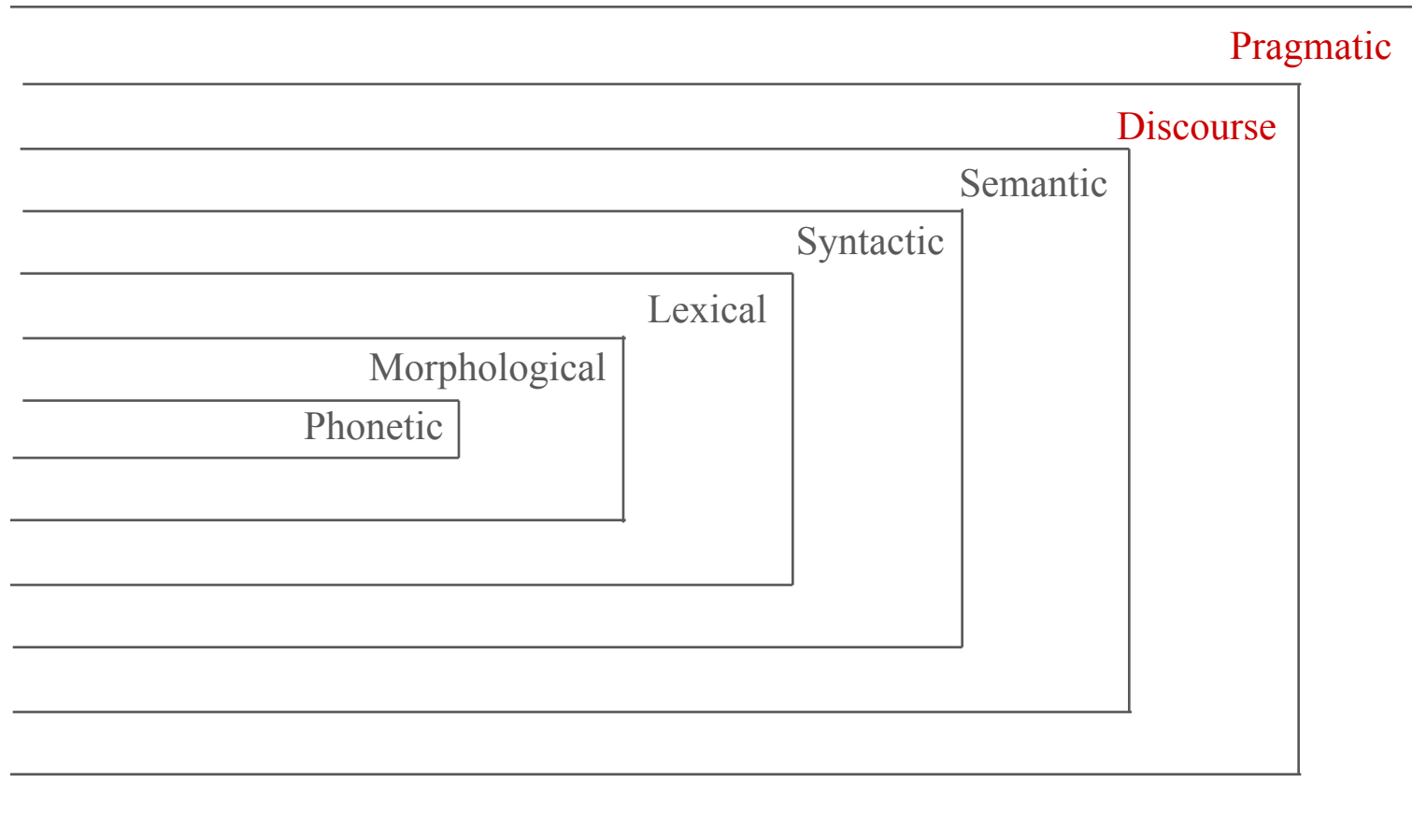1. *The program as published… really works.*

2. *In only a few minutes, I entered all the figures and got a result…*

- Sentence (2) is **evidence** for sentence (1), as it is provided to increase the reader's belief in the claim in (1).

- Note that there is no particular discourse marker in this example.

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Dialogue Theories

Levels of Language

Pragmatic

Discourse

Semantic

Syntactic

Lexical

Morphological

Phonetic

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Pragmatics

Functional perspective: how we use language to achieve things in the real world

Generally, aspects of language that require context to be understood

- How the situational context is grammaticalized

- World knowledge (knowledge bases) used for understanding

  - Useful pragmatics for semantic understanding of any text

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Pragmatics

One specific goal is to explain how extra meaning is read into utterances without actually being encoded in them

Relative emphasis

- More research interest in oral text than written text

- Then, focus on dialogue, rather than monologue

- Of prime interest to natural language generation and human–computer interaction researchers

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Topics in Dialogues

Theory: properties of human conversations

- Topics in order chronologically, and also from general to specific

- Speech act theory

- Gricean maxims

- Conversational structure

- Dialogue act theory

Analysis: computational tasks

- Using either transcripts of oral conversations or online written conversations, even chat

- Recognition of dialogue acts

- Plan recognition

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Speech Act Theory

Communication succeeds only if the intention of the speaker is recognized by the listener.

- Proposed by John Austin in 1962 in *How to Do Things With Words*

- Systematized by John Searle in 1969 in "Speech Acts: An Essay in the Philosophy of Language"

Propositional content (the literal meaning of the text) does not always fully communicate the speaker's intent.

- Example: *I'm going to pay you back for that.*

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Speech Act Theory

Three levels of speech acts affecting the social reality of the speaker and listener:

1. **Locutionary:** proposition of speech act

   - The literal meaning of the sentence (what we've been working on in NLP)

2. **Illocutionary:** intention of speech act

   - The act of asking, answering, promising, etc. in uttering a sentence

3. **Perlocutionary:** consequences of speech act

   - The (often intentional) production of certain effects upon the feelings, thoughts, or actions of the addressee

"Almost any speech act is really the performance of several acts at once, distinguished by different aspects of the speaker's intention: there is the act of saying something, what one does in saying it, such as requesting or promising, and how one is trying to affect one's audience." —Bach

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Taxonomy of Illocutionary Acts' Intentions

Assertives: commit the speaker to something being the case—suggest, swear, boast, conclude

Directives: attempts by the speaker to get the listener to do something—ask, order, request, invite, advise

Commissives: obligate oneself to future course of action—promise, plan, vow, oppose

Expressives: share the psychological state of the speaker about something—apologize, deplore, thank

Declarations: bring about a different state of the world as a result of the utterance—resign, baptize, marry

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Cooperative Principle

Grice, H. P. (1975). Logic and Conversation. In Cole & Morgan (Eds.). *Syntax and Semantics, 3,* 41–58

- Provide a principled explanation of how what is communicated is not necessarily what is said

A set of overriding conventions/maxims that are adhered to by both speakers and listeners

- We all intuitively adhere to them without being aware of them
- Pointing out the fact that conversation is cooperative

Cooperative principle

- Make sure that what you say furthers the purpose of the conversation

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Gricean Maxims

Specify what participants in a conversation do in order to converse efficiently

- **The maxim of quality**
  - Make your contribution one that is true.
    - Do not say what you believe to be false.
    - Do not say that for which you lack adequate evidence.
- **The maxim of quantity**
  - Make your contribution as informative as required for the current purpose of the conversation.
  - Do not make your contribution more informative than required.
- **The maxim of relevance:** make it relevant
- **The maxim of manner**
  - Be clear, avoid obscurity, avoid ambiguity, be brief, be orderly

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Conversational Implicatures

Speakers generally follow the cooperative principle and listeners generally assume that they are following it.

If the speaker is observing the maxims directly, he will rely on the listener to amplify what he is saying by some straightforward inferences, called implicatures.

Example

- A: makes statement/asks question

- B: responds but appears to fail to be cooperative

- A: assumes B is being cooperative; makes inferences in order to maintain assumption that B is being cooperative

These inferences are what have come to be known as "conversational implicatures."

Conversational Implicatures

Example 1

- A asks B: *Would you like to go to a movie tonight?*

- B responds: *I have to study for an exam.*

Example 2

- A: *Where's Bill?*

- B: *There's a yellow VW outside Ann's house.*

Example 3

- Tim: *Can I play cards with Pete?*

- Mom: *How is your homework coming along, Tim?*

Dialogue Structures

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Conversational Structure

Conversational analysis tries to understand how people organize conversation in order to achieve their communication

Some types of conversations exhibit particular structure

- Opening of telephone conversations have a four-part structure:
  - Stage 1: enter a conversation with a summons–response adjacency pair
  - Stage 2: identify speakers
  - Stage 3: establish joint willingness to converse
  - Stage 4: raise the first topic, usually done by the caller

Two more general conversational structures: turn-taking and sequencing

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Turn-Taking

Dialogue is characterized by taking turns: Speaker A says something, then Speaker B, etc.

Turn-taking components are the utterances of the participants.

Turn-taking allocation describes how participants organize the interaction by allocating turns to speakers.

- At each transition point, possible allocations:
  - If the current speaker has explicitly selected A as the next speaker, then A must go next: What do you think, Jessie?
  - If A doesn't speak, it is "significant silence," interpreted as a refusal to respond
  - If the current speaker hasn't explicitly selected a speaker, anyone can speak
  - If no one else takes the next turn, the current speaker may take it

Sequencing

Focuses on how the components are organized in the conversation

- **Adjacency pairs**: many types of interactions come in pairs (e.g., question/answer, offer assistance/rejection or acceptance, etc.)

- **Pre-sequences:** prelude to open the conversation or to start a new topic
  - Example: *Guess what?*

- **Preference organization**: preference for some actions over others (e.g., agreeing with someone more straightforward and shorter than expressing disagreement)

- **Repair**: how to deal with problems in hearing or understanding
  - Example: *What did you say?*
    Do you mean… ?

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Dialogue Act Theory

In computational linguistics, more detailed systems attempt to explain not only the informative aspects of conversations, but the dialogue control aspects of an utterance.

The theory by Bunt (1994) lists the following (top-level) categories:

- **Informative**
  - Task-oriented: information seeking or providing

Dialogue Act Theory

The theory by Bunt (1994) lists the following (top-level) categories:

- **Dialogue control**
  - Feedback: positive or negative
  - Discourse structuring: topic management, dialogue delimination
  - Interaction management
    - Turn management
    - Time management
    - Own communication managements
    - Social obligations management: introduction, greeting, apology, thanking

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Dialogue Acts
in Transcribed Speech

Systems of dialogue acts further developed by annotation of large amounts of transcribed speech (Stolcke et al., 2000)

Hand-labeled 1,155 conversations from transcribed telephone conversations, the Switchboard Corpus

Used the DAMSL tag set developed by Core and Allen (1997) of approximately 50 dialogue act tags in a hierarchy of groups and sub-groups

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Dialogue Act Tags and Examples

Examples from the Switchboard Corpus

- Statements and opinions
  Well, we have a cat…
  Well, rabbits are darling…

- Questions

  - Yes–no questions   *Do you have to have any training?*

  - Declarative question   *So you're taking a government course.*

  - Wh- questions   *Who was that man?*

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Additional Dialogue Act Tags

▪ Backchannels: any short utterance that plays a discourse-structuring role, such as indicating that the speaker should continue, meaning "I'm listening, I'm here"

   Uh, huh

   Um

▪ Turn exits and abandoned utterances

    So

▪ Answers and agreements

 ▪ Includes sub-tags of accept, reject, maybe, part

▪ And many other types, such as:

 ▪ Hedge *so I don't know*

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Switchboard Dialogue Example

Fragment of a labeled conversation (from Switchboard Corpus)

Speaker	Dialogue Act	Utterance
A	YES-NO-QUESTION	So do you go to college right now?
A	ABANDONED	Are you - ,
B	YES-ANSWER	*Yeah,*
B	STATEMENT	*It's my last year [laughter].*
A	DECLARATIVE-QUESTION	You're a, so you're a senior now.
B	YES-ANSWER	*yeah,*
B	STATEMENT	*I'm working on my projects trying to graduate [laughter].*
A	APPRECIATION	Oh, good for you.
B	BACKCHANNEL	*Yeah.*
A	APPRECIATION	That's great,
A	YES-NO-QUESTION	Um, is, is N C University is that, uh, State?
B	STATEMENT	*N C State.*
A	SIGNAL-NON-UNDERSTANDING	What did you say?
B	STATEMENT	*N C State.*

The 42 dialogue act labels. Dialogue act frequencies are given as percentages of the total number of utterances in the overall corpus.

Tag	Example	%
STATEMENT	*Me, I'm in the legal department.*	36%
BACKCHANNEL/ACKNOWLEDGE	*Uh-huh.*	19%
OPINION	*I think it's great*	13%
ABNDONED/UNINTERPRETABLE	*So,-/*	6%
AGREEMENT/ACCEPT	*That's exactly it.*	5%
APPRICIATION	*I can't imagine.*	2%
YES-NO-QUESTION	*Do you have to have any special training?*	2%
NON-VERBAL	*<Laughter>,<That _clearing>*	2%
YES ANSWERS	*Yes.*	1%
CONVENTIONAL-CLOSING	*Well, it's been nice talking to you.*	1%
WH-QUESTION	*What did you wear to work today?*	1%
NO ANSWERS	*No.*	1%
RESPONSE ACKNOLEDGEMENT	*Oh, okay.*	1%
HEDGE	*I don't know if I'm making any sense or not.*	1%
DECLERATIVE YES-NO-QUESTION	*So you can afford to get a house?*	1%
OTHER	*Well give me a break, you know.*	1%
BACKCHANNEL-QUESTION	*Is that right?*	1%
QUOTATION	*You can't be pregnant and have cats*	.5%
SUMMARIZE/REFORMULATE	*Oh, you mean you switched schools for the kids.*	.5%

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The 42 dialogue act labels, continued.

Tag	Example	%
AFFIRMATIVE NON-YES ANSWERS	*It is.*	.4%
ACTION-DIRECTIVE	*Why don't you go first*	.4%
COLLABORATIVE COMPLETION	*Who aren't contributing.*	.4%
REPEAT-PHRASE	*Oh, fajitas*	.3%
OPEN-QUESTION	*How about you?*	.3%
RETHORICAL-QUESTION	*Who would steal a newspaper?*	.2%
HOLD BEFORE ANSWER/AGREEMENT	*I'm drawing a blank.*	.3%
REJECT	*Well, no*	.2%
NEGATIVE NON-NO ANSWERS	*Uh, not a whole lot.*	.1%
SIGNAL-NON-UNDERSTANDING	*Excuse me?*	.1%
OTHER ANSWERS	*I don't know*	.1%
CONVENTIONAL-OPENING	*How are you?*	.1%
OR-CLAUSE	*or is it more of a company?*	.1%
DISPREFERRED ANSWERS	*Well, not so much that.*	.1%
3RD-PARTY-TALK	*My goodness, Diane, get down from there.*	.1%
OFFERS, OPTIONS & COMMITS	*I'll have to check that out*	.1%
SELF-TALK	*What's the word I'm looking for*	.1%
DOWNPLAYER	*That's all right.*	.1%

The five remaining tags were less than .1%
Maybe/accept
Tag-question
Declarative-question
Apology
Thanking

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Automatic Detection of Dialogue 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 dialogue 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)

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Dialogue Act Tagging Evaluation

Performance on the Switchboard Corpus

- Accuracy: 65% using automatic recognition of words
            71% on text transcripts with corrected words

- Human performance: 84%

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Pragmatics: Planning

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Planning

How is it that we as humans understand what another person means?

How do we understand an utterance that, 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

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Planning: Introduction

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 it's not enough

- System needs to understand purpose/plan that motivated these utterance—pragmatics

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.*

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Trip-Taking Planning

A travel-advisory system with a conversational interface may assume that the user has a plan to take a trip.
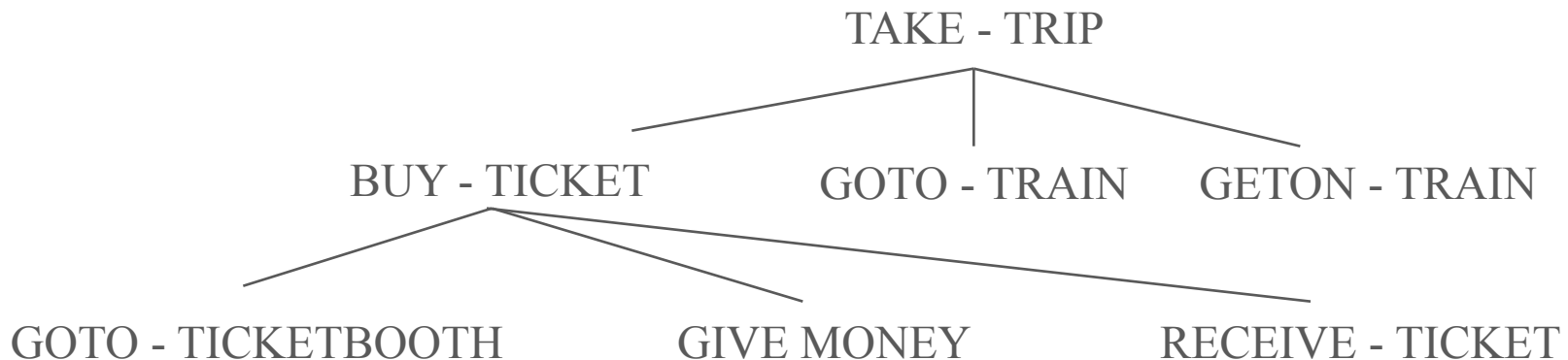
Sketch of a commonsense task plan to take a trip

Systems may have a number of plans that they can use to assist the user.

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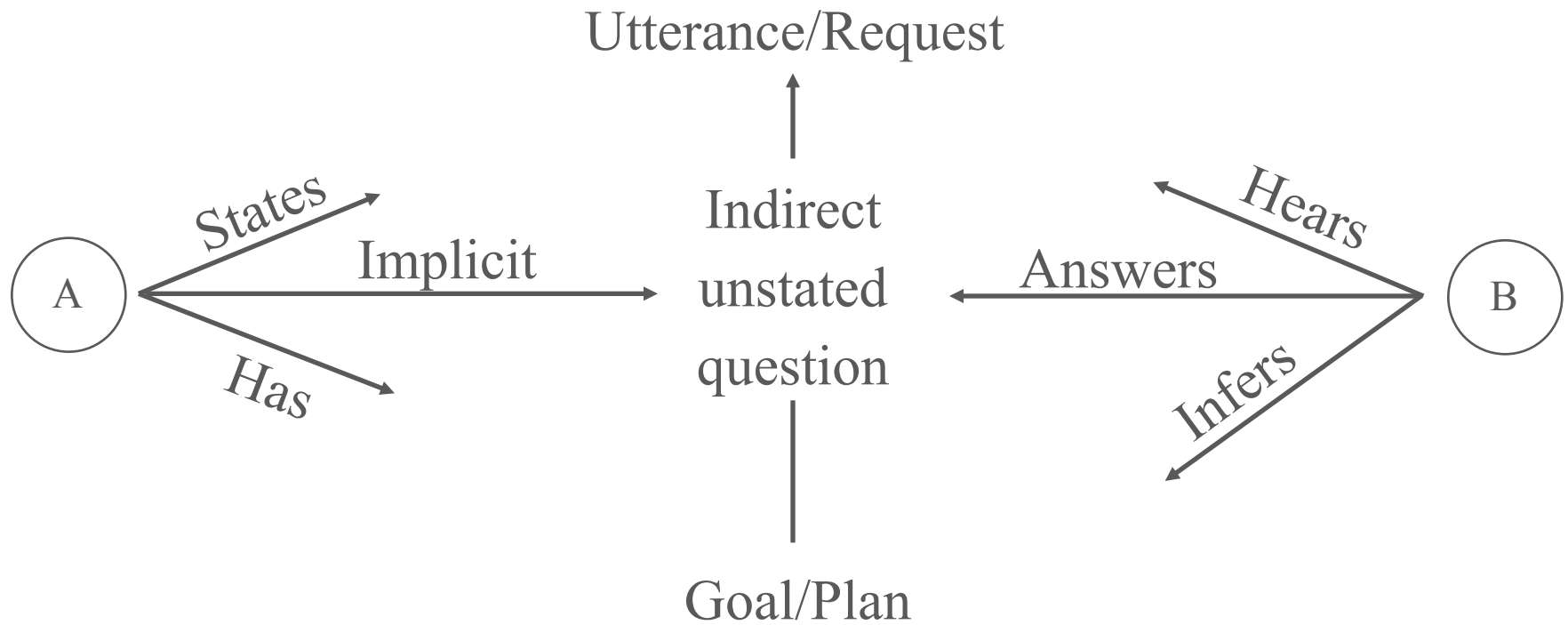
Conversational Agents

In addition to dialogue understanding, dialogues may be used as the basis of systems that interact with humans through dialogue.

▪ Airline reservation system example in Jurafsky and Martin

Involves:

▪ **Dialogue understanding to process user's utterances**

▪ **Plan analysis**

▪ **Keeping track of the information state**

▪ **Dialogue generation to make responses to the user**

Current proliferation of "chatbot" software

▪ From Eliza to Siri

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