PRAGMATICS, DISCOURSE AND DIALOGUE

- **Introduction**
- **Pragmatics. Reference**
- **Discourse**
- **Dialogue**

Introduction

Dave Bowman: Open the pod bay doors, HAL

HAL (The robot): I'm sorry Dave, I'm afraid I can't do that.

Stanley Kubrick and Arthur C. Clarke, Screenplay of 2001: A Space Odyssey

Introduction (II)

The knowledge needed

- **Morphology**: Meaningful components of words. Lexicon
  e.g., doors is plural

- **Syntax**: Structural relationships between words. Grammars
  e.g., many sentences consists of a noun phrase followed by a verbal phrase

- **Semantics**: Meaning of words and how they combine.
  Grammar, domain knowledge
  e.g., O*pen, you, the pod bay door*

- **Pragmatics**: How language is used to accomplish goals.
  Domain and dialogue knowledge
  e.g., to be polite

- **Discourse**: How single utterances are structured
  e.g., How the interventions of participants in a conversation are related

Introduction (III)

- **Semantics** => meaning
  - Combining the meaning of several parts of a sentence

- **Pragmatics** => using language in context
  - Using language to achieve goals
  - Inferring participant desires

Introduction (IV)

- Example of pragmatics interpretation:

Do you know how to get there?
  - What "there" refers to?
  - Is it a question about your capacities or is a demand for an action?

Pragmatics and semantic representation

Representing domain concepts following a formalism
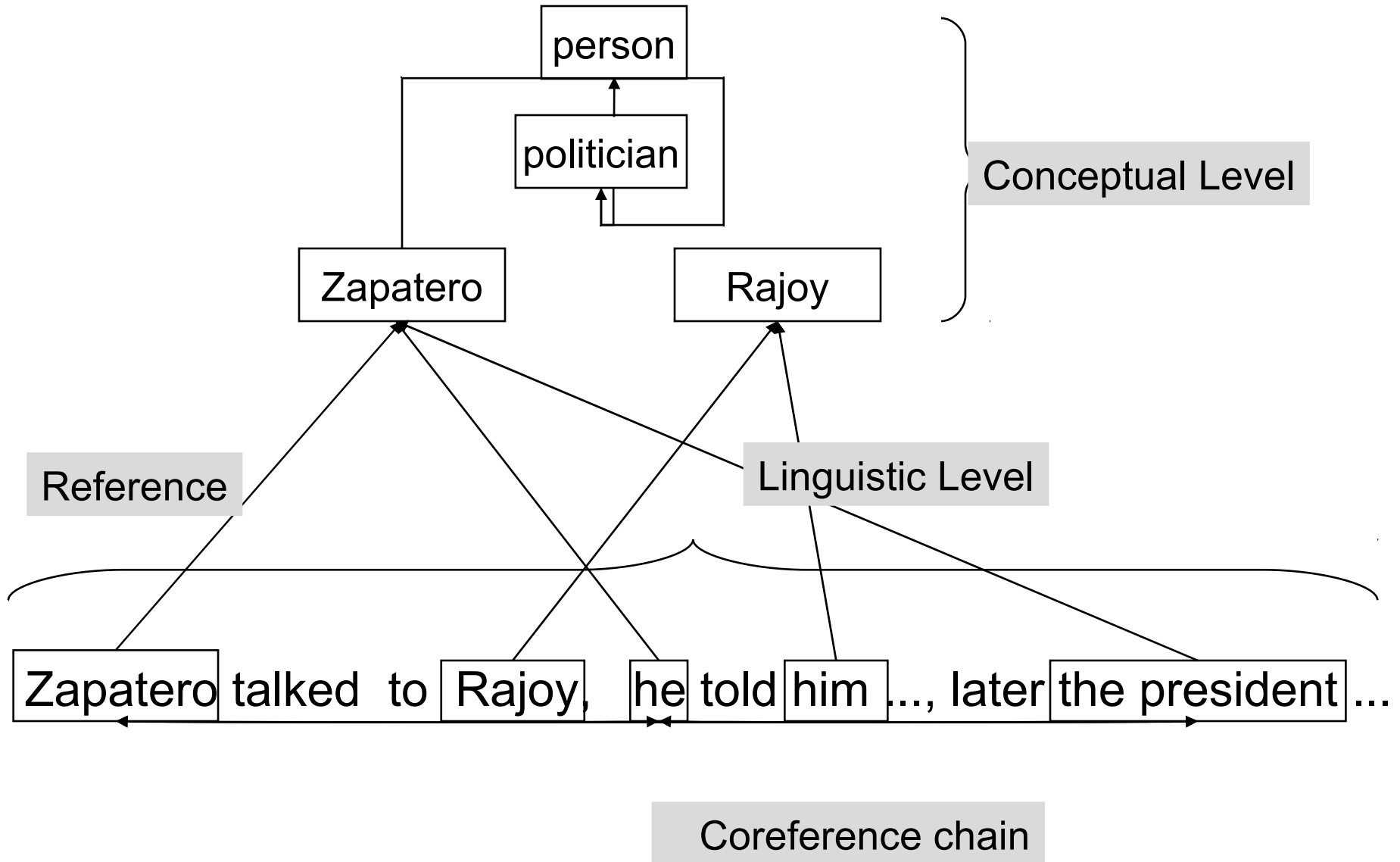 Logic, frames, ontologies,...

Ontologies
 It is an appropiate formalism to represent concepts and
 supporting reasoning
Logic
exists (X, instance (X, cat),
      exists (Y, instance (Y, fish),
                        eats (X,Y)))

cat, fish, eat belong to an ontology

Pragmatics and semantic representation(II)

Pragmatics. The reference
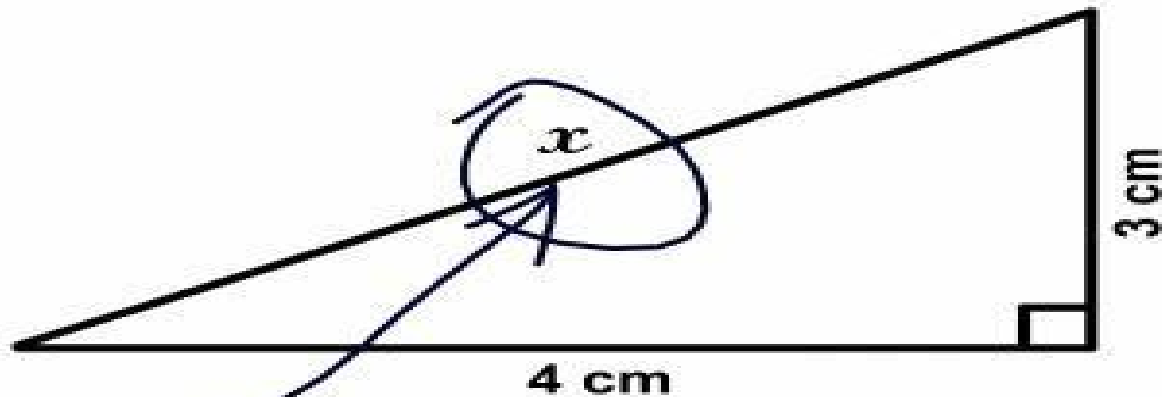
What is the **reference**?

- It is relationship between a domain entity and the linguistic objects representing it
- First it is the presentationof the entity, next it is the reference to this entity
- It is a pragmatic phenomenon

Pragmatics. The reference (II)

Example of reference ambiguity

3. Find x.

x

3 cm

4 cm

Here it is

Ocular Trauma – by Wade Clarke ©2005

Pragmatics. The reference (III)

Resolving ambiguous input

- Using models and algorithms
- Using knowledge
  - Using linguistic knowledge
  - Using domain and context knowledge.
    (Shallow or Partial analysis)

- Using data-driven methods

Examples of references

- *I let <u>the book</u> at the table. One hour later I took <u>it</u> .*
- *I let the book at <u>the table</u>. Then I clean <u>it</u>.*
- *I gave <u>the book</u> to <u>Pedro</u>. A week later I asked <u>it</u> to him.*
- *I gave <u>the book</u> to <u>Pedro</u>. A week later I asked <u>another one</u>.*
- *I bought a <u>cat</u>. <u>The animal</u> did not let me sleep.*
- *I bought <u>a car</u>. <u>The wheels were</u> burnt.*

Examples of references (II)

- *Puse <u>el libro</u> en la mesa. Más tarde <u>lo</u> cogí.*
- *Puse el libro en <u>la mesa</u>. Más tarde <u>la</u> limpié.*
- *Dejé <u>el libro</u> a <u>Pedro</u>. Luego <u>se</u> <u>lo</u> pedí.*
- *Dejé <u>el libro</u> a <u>Pedro</u>. Luego <u>le</u> pedí <u>otro</u>.*
- *Compré <u>un gato</u>. <u>El animal</u> no me dejaba dormir.*
- *Compré <u>un coche</u>. <u>Las ruedas</u> estaban gastadas.*

Pragmatics. The reference (III)

Terminology

Reference. Linguistic expressions to denote an entity or individual

Referring expression. Language expression used to perform reference

Referent. The entity referred

Anaphora. Reference to an entity preiously introduced

Reference resolution. The task to determine what entities are referred to by which expressions:

- **Coreference resolution**. References to the same entity. **Coreference chain**.

- **Pronominal anaphora resolution**. Antecedent for a pronoun.

Pragmatics. The reference (IV)

Five types of referring expressions

Indefinite noun phrases. Entities that are new in the context.

He sent her *a beautiful goose*

Definite noun phrases. Identifiable entities.

I read about it in *The New York Times*

Pronouns. Definite reference

Emma smiled as cheerfully as *she* could

Demostratives. *This* and *that*

This ingredient

Names. Names of people, organization and location

Miss Wood had not done him justice

Pragmatics. The reference (V)

Features for pronominal anaphora resolution

Number agreement. *John has a Ford. It is red.*

Person agreement. First, second and third.

Gender agreement. Male, female, nonpersonal (it).

John has a Ford. It is attractive.

Binding theory constrains. Antecedent noun phrases.

John bought himself a new Ford. John bought him a new Ford.

Selectional restrictions. Verb arguments.

John parked his car in the garage after driving it.

Recency. Proximity.

The doctor found an old map. Jim found an even older map. It described an island

Pragmatics. The reference (VI)

Features for pronominal anaphora resolution (II)

Grammatical role. Subject position is more salient than object

Billy went to the bar with Jim. He call for a glass of wine

Repeated mention. Entities mentioned in previous sentences in the discourse

Parallelism. *John went with Jim to the bar. Billy went with him to the gym.(him = Jim)*

Verb semantics

John telephone Bill. He lost the laptop.

John critized Bill. He lost the laptop.

Pronominal anaphora baseline: The Hobbs algorithm

It uses: a syntactic parser + a morphological gender and number checker

- The input: a pronoun to be resolved + a syntactic parse of the sentences

- It starts with the target pronoun and looks up the parse tree to the root S.

  – For each NP found (or S node) it does breadth-first left-to.right search.First, central elements of the sentences have to be selected

  – For each candidate, it is checked for gender, number and person agreement with the pronoun

  – If no referent is found in the sentence, previous sentences are checked

- It approximates the binding theory, recency and grammatical preferences.

Example

Victoria Chen, Chief Financial Officer of Megabucks Banking Corp since 2004, saw her pay jump 20%, to 1.3 million, as the 37-year-old also became the Denver-based financial services company's president. It has been ten years since she came to Megabucks from rival Lotsabucks.

Find the four coreference chains

Example of coreference chains

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1. Victoria Chen, Chief Financial Officer of Megabucks Banking Corp since 2004,her, the 37-year-old, the Denver-based financial services company's president, she.

2. Megabucks Banking Corp, the Denver-based financial services company, Megabucks.

3. her pay

4. Lotsabuck

Example

FC Barcelona president Joan Laporta has warned Chelsea off star strike Lionel Messi.This warning has generated dicouragement in Chelsea.Aware of Chelsea owner Roman Abramovich's interest in the young Argentine, Laporta said last night: " I will answer as always, Messi is not for sale and we do not want to let him go."

Find the four coreference chains

Discourse level

- Discourse: a related group of sentences
- Types of discourse:
  - Monologue
    - Comminucation flows from the speaker to the hearer
  - Dialogue
    - Participants takes turns being a speaker and hearer
    - They consits of several communicative acts:
      - Asking questions, giving answers, making corrections
    - Human-computer interaction is different from human-human interaction

Discourse (I)

Anaphora: Reference to a previous entity

Coherence: Relations between sentences and paragraphs

- Justification, result, etc.
- The meaning of a fragment is more than meaning of the parts

Structure: Hierarchical structure. Discourse segments are related

Several theories and algorithmes to deal with these phenomena

Discourse (II)

Several processes

- Discourse segmentation (considering events)
- Representing and processing the discourse events (and objects involved in them)
- Detecting and representing main focus
- Solving references

Discourse Model (I)

- Theory used to interpret the expressions

- Elements of all Discourse theories:
  - **- Common ground (Shared knowledge)**
  - - **P**articipants actions on common ground
    - Expanding, asking , negation,…

Discourse Model (II)

- Contributions of participants
  ==> modify the common ground
- Presentation by one participant
- Acceptation by other(s) participant(s)

Discourse Model (III)

- ***Hobbs Theory (78)***
  - Coherence relations between sentences
    - Result
    - Explication
    - Parallelism
      - *Maria is from Barcelona. Joana from Mallorca*
    - Elaboration The proposition infered from two different sentences is the same
    - Occasion
      - *Pere brought his computer. They worked until late.*
  - There is a hierarchical structure between relations
    Discourse coherence
  - Domain knowledge is used to determine relations

Discourse Model (IV)

Mann, Matthiessen and Thompson Theory (87)

Rhetorical Structure Theory (RST)

Hierarchical organization of the relations

- Nucleus and Satellite:
  - Evidence
    » Kevin must be here. His car is parked outside.
  - Elaboration
  - Contrast
  - Condition
  - List
  - Background

23 rhetorical relations are defined

Authomatic Coherence Assigment

Cue based. Using explicit marks

- Splitting items
  - *First, second*
- Elaboration
  - I*n particular, additionally*, …
- Parallel constructions
  - *In a similar form*
- Changing the focus
  - *A different problem*, …
- Ending
  - *In summary, concluding*, …

Authomatic Coherence Assigment(II)

- Using several features
  - Syntactic structure
  - Order
  - Time in verbs
  - Entonation
  - Cue words

DIALOGUE

The dialogue is a type of discourse

Main features in discurse

Anaphora: Reference to a previous entity

 Coherence: Relations between sentences

- – Justification, result, etc.
- – The meaning of a fragment is more than meaning of the parts

Structure: Hierarchical structure. Discourse segments are related

Several theories and algorithmes to deal with these phenomena

What makes dialogue different?

- Turn-taking
  - Turn-taking Rules
    - Participant A, Participant B, Participant A
  - A turn does not necessary consist of a sentence
    - Dialogue segmentation is not easy
- Common ground
  - Speaker and hearer perform a joint action
  - They constantly establish common ground
- Utterance can be considered as (dialogue) actions
  - They are classified: directives, assertive,...

What makes dialog different (II)

- Dialogues are short
  - Interventions are usually clausules
  - Subjects are usually pronouns
- New phenomena appear
  - Pauses
  - Errors, rectifications
  - Confirmations
  - New begining
- Human-machine dialogs and human-machine dialogues are different
  - Users try to be clearer and more direct

Dialogue SystemTasks

- Interpreting user intervention
  - Using dialog and domain knowledge
- Dialogue Management
  - Determine next system action considering user's intention
- Answer Generation
  - Generation of the appropiate sentences to achieve the system's goals.

Interpretation of the user intervention

- Goal: understanding user's intention
- The complexity of this process depends on the system
  - Complete (deep) syntactic and semantic analysis
  - Partial (shallow) syntactic and semantic analysis
  - *Processing key words*

- This process is restricted by considering limited applications tasks

Pragmatics
Intention Recognition

- User's interventions are interpreted as one (or more) **dialogue act** (*speech act* or *dialogue move*)

- Examples of dialogue acts

  Greet/Thank you/Goodbay
  - Opinion
  - Confirming/Accepting
  - Recognizing
  - Question/Answer/Yes-No
  - Quit

- Efforts for standard definition

Pragmatics
Intention Recognition (II)

- User's interventions are interpreted as one (or more) **dialogue act** (*speech act* or *dialogue move*)

- Examples of dialogue moves
  - **Switchboard DAMSL**
    - Ini/final conventional
    - Opinion
    - Confirming/Accepting
    - Recognizance
    - Question/Answer/Yes-No
    - No-verbal
    - Quit

  - **Verbmobil**
    - Greet/Thank you/Goodbay
    - Suggestion
    - Acceptation/Rebuig
    - Confirmation
    - question/ clarification/Answer
    - Giving the reason
    - Thinking

- Efforts for standard definition

Pragmatics
Intention Recognition (III)

Empirical methods

- Statistical classifiers of dialogue acts
  - Methods based on **Hidden Markov Models**
  - Using several types of information
    - words, punctuation,dialogue history
- Rule based dialogue acts recognizers
- Machine learning techniques

Pragmatics
Intention Recognition (IV)

Knowledge Sources

- – Application Specification
  - • Consulting information, transaction
- – Linguistic information
  - • Punctuation
  - • Words/cue words: *but, because*
- – Dialogue knowledge (or history)
- – Dialogue Structure
  - • Subdialogues
  - • Subject shift
- – Prosody information
  - • Duration, pauses

Reference resolution in dialogue

- Central elements of the sentences have to be selected
  - They are grammatically related to the main verb (subjecte, objecte,…)
  - They can connect a sentence with previous
  - They can connect a sentence with next
- When pronouns are found several rules are used to range and filter the possible central elements

Reference resolution in dialogue(II)

- Most references are solved using knowledge discourse

- Central elements (focus) are stored in a stack
    - Only lasts nominal groups are stored
- Objects satisfying syntactic, semantic and pragmatic restrictions are selected
    - Starting by the stack top
        - "There " is a place
    - Considering discourse structure
        - Relating objects and subdialogues

Example of reference resolution

U: On fan Heroes a Sant Cugat?

S: Heroes la passen al Cinema Cinesa de Sant Cugat

U: Quan la fan?

S: La fan a les 8:30pm, a les 10pm, i a les 11:30pm.

U: Vull 2 entrades per adults i 2 per nens per la primera sessió.
Quant serà en total?

- Knowledge Sources:
  - Domain Knowledge
  - Dialogue Knowledge
  - Domain (world) knowledge

Example of reference resolution (II)

U: Where the movie Heroes is shown in Sant Cugat?
S: Heroes is shown at Cinema Cinesa in Sant Cugat
U: At what time is it shown?
S: It is shown at 8:30pm, 10pm and 11:30pm.
U: I want 2 tickets for adults and 2 for children nens for first session
    How much is it?

- Knowledge Sources:
    - Domain Knowledge
    - Dialogue Knowledge
    - Domain (world) knowledge

Dialogue Management

- Controlling dialog to help user to achieve his goals
  - At each step of the conversation
    - **Who can speak**
    - What can be said

  - Used information
    - Interpretation of the user intervention
    - Application (domain) knowledge

Dialogue management (II)

- Determine the next system's action(s)
  - Answer user's questions
  - Ask the user for more information
  - Confirm/Clarify user's interventions
  - Notify problems when accessing the application
  - Suggest alternatives
- Generation of the system's messages
  - The content
  - The presentation