

Dialogsysteme

Discourse Structure Part 2

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Overview

- ▶ Remaining stuff from last session
 - Data structures from Grosz and Sidner (1986)
 - Data structures from Webber (1991)
- ▶ Comments on the assignment
- ▶ SmartKom
- ▶ Discourse processing in SmartKom

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Components of Discourse Structure

- ▶ Linguistic Structure
 - Structure of the actual sequence of utterances
- ▶ Intentional Structure
 - Structure of Intentions underlying the parts of the discourse
- ▶ Attentional State
 - Salient entities for each point of the discourse

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Data Structures in Grosz and Sidner

- ▶ Contribution of discourse segments are stored in a stack structure.
- ▶ Stack is updated with every utterance.
- ▶ Elements of the stack correspond to discourse segments.
- ▶ Stack reflects embedding relation at any point of the dialogue.

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Focus Spaces

- ▶ Basic structure for modeling the attentional state
- ▶ Associated with a discourse segment
- ▶ Contains the salient elements introduced by a DS
 - Elements that are explicitly mentioned
 - Elements that become salient indirectly
 - Elements:
 - DSP
 - Relations between Intentions
 - Objects which can be referred to

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Focus Stack

- ▶ Lower focus spaces are accessible from higher ones
- ▶ Stack control by intentional structure (dominance hierarchy)
- ▶ PUSH
 - if DSP contributes to DSP of immediately preceding DS
- ▶ POP
 - if DSP contributes to some DSP higher in the dominance hierarchy, there are several POPs before a PUSH

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Overhead Slide

Dialogue from Grosz and Sidner
and
Attentional State

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Distinctions between Intentional and Attentional Components

- ▶ The intentional structure is a history for discourse level intentions including relationships between them.
- ▶ The intentional structure controls the focusing structure
- ▶ The focusing structure contains the snapshot of the intentional structure which is relevant at any given point

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Summary Attentional State

- ▶ summary of the relevant parts of a discourse at any given point.
- ▶ focusing structure provides contextual information for processing utterances
- ▶ holds salience for objects, properties, and relations.
- ▶ directly constrains the interpretation of referring expressions
- ▶ contains links to linguistic structure and intentional structure.

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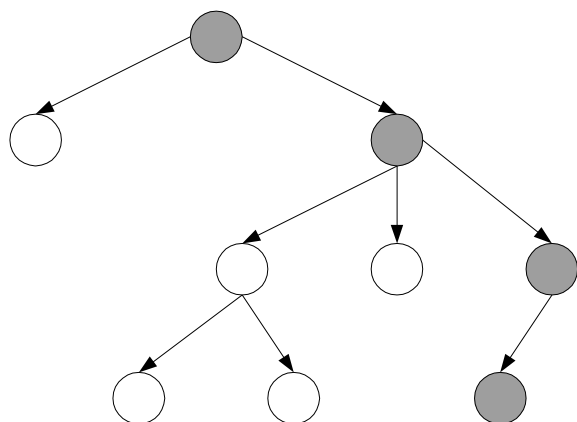
Data Structures from Webber's Approach

- ▶ Trees as a model of discourse structure
- ▶ Two relations between nodes (discourse segments)
 - Parent-of (\sim dominance)
 - Right-sibling-of (\sim satisfaction-precedence)
- ▶ Right Frontier
 - Only segments of the right frontier are **accessible** to new utterances
- ▶ Tree construction
 - Attachment
 - Adjunction

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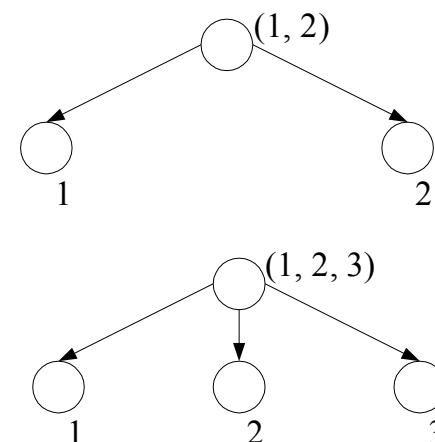
Right Frontier



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Attachment - as rightmost daughter

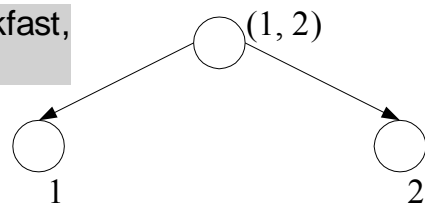


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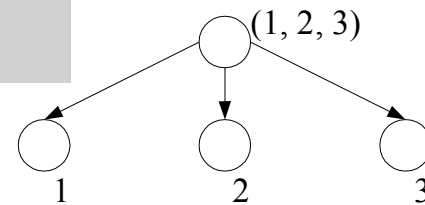
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Example - Attachment

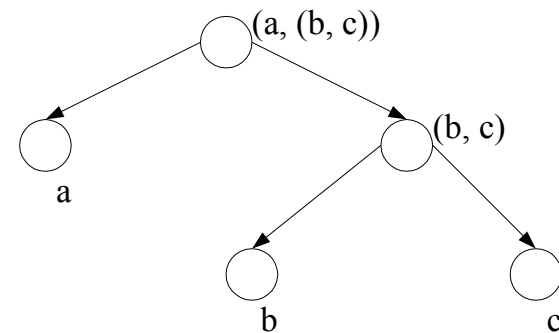
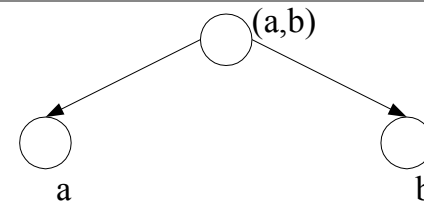
1)John eats yoghurt for breakfast,
2)Fred eats Cheerios,



1)John eats yoghurt for breakfast,
2)Fred eats Cheerios,
3)and Mary, muffins.



Adjunction – insert non-terminal

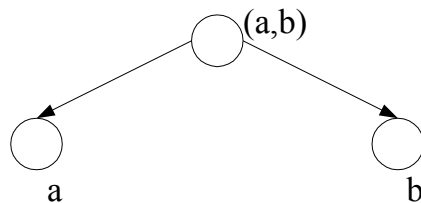


Example – Step 1 and 2

a)John hates snakes.

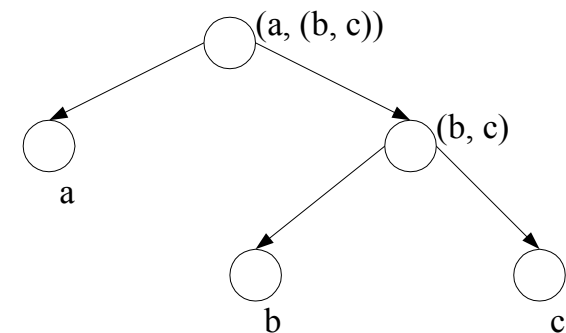


a)John hates snakes.
b)His next-door neighbour has kept snakes,



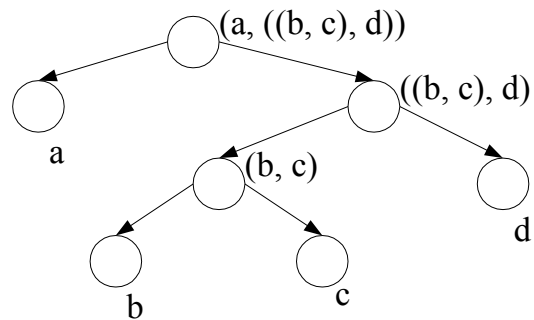
Example – Step 3

a)John hates snakes.
b)His next-door neighbour has kept snakes,
c)and he had hated his neighbour.



Example – Step 4

- a) John hates snakes.
- b) His next-door neighbour has kept snakes,
- c) and he had hated his neighbour.
- d) Later in college, his roommate had kept snakes.



Comparison Webber and G+S

- ▶ Nodes on the right frontier correlate with focus spaces.
- ▶ Any path from a leaf to the root node can be mapped onto a stack.
- ▶ Operations
 - Attach ~ push operation
 - Adjoining ~ some pop operation and a push operation
- ▶ Webber's tree bundles intentional structure and attentional state

Why use a Discourse Model ?

- ▶ The resolution of anaphoric expressions and deictic expressions requires the knowledge of the actual context
 - Pronouns
 - often: definite descriptions
 - sometimes: names
 - Deictic pronouns
- ▶ This knowledge is hard to get without keeping track of the actual utterances
 - Compare with the Assignment 2

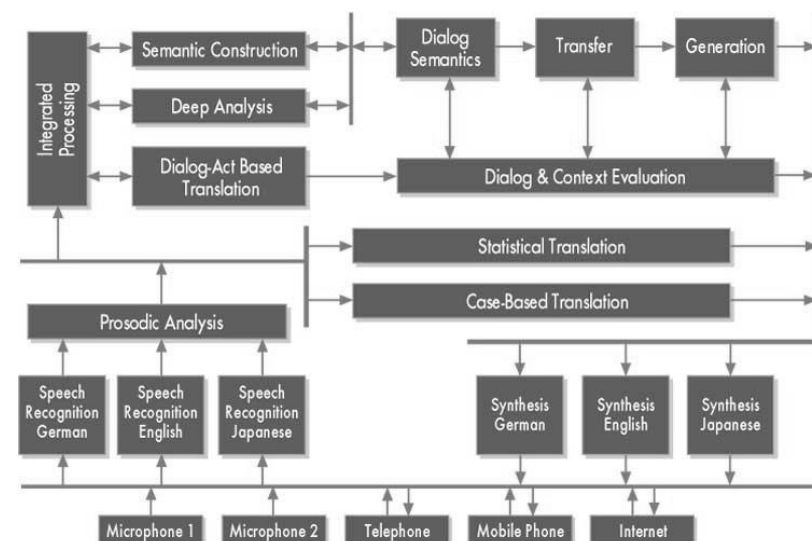
SmartKom - Movie

Movie

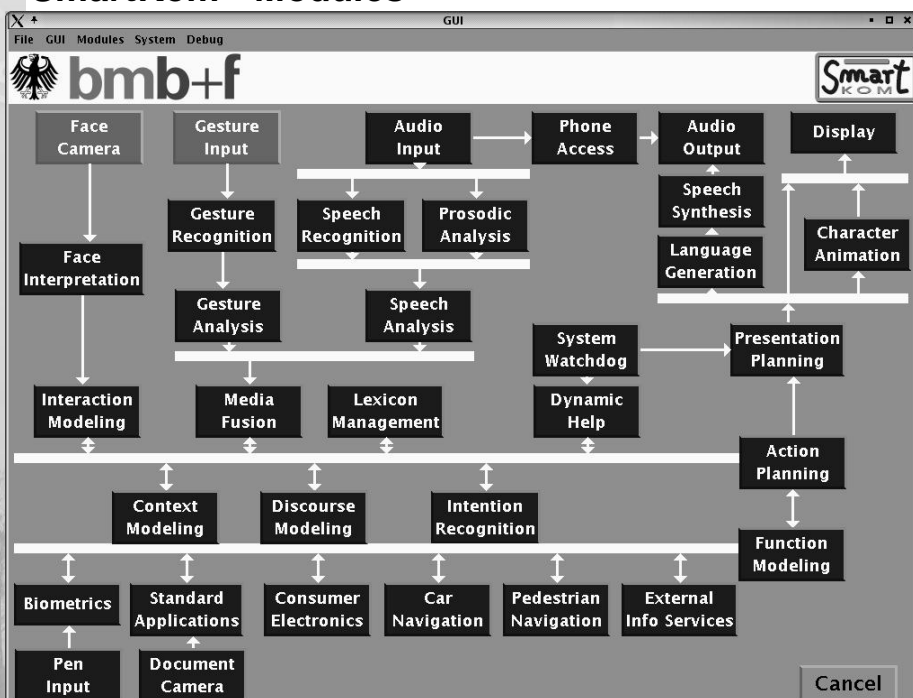
SmartKom

- ▶ BMBF Project (Prof Wolfgang Wahlster)
- ▶ Development line
 - Verbmobil (1993-2000)
 - Speech-to-speech translation for negotiation dialogue
 - <http://verbmobil.dfki.de/>
 - SmartKom (2001-2003)
 - Intuitive Human-Technology Interaction
 - <http://smartkom.dfki.de/>
 - SmartWeb (2004-?)
 - <http://smartweb.dfki.de/>
 - „Mobile broadband access to the semantic web“

Verbmobil



SmartKom - Modules



SmartKom Dialogue Management

- ▶ DFKI Dialogue-backbone
 - Action Planner
 - Discourse Model
 - Analysis Module
 - Presentation Module
- ▶ Dynamic Help
- ▶ Context Model

DFKI Discourse Model - Context

- ▶ Multimodal discourse processing
 - Unified representation for all modalities
- ▶ Three layered structure
- ▶ Modality Layer
 - linguistic objects, visual objects, gesture objects
- ▶ Discourse Object Layer
 - discourse objects: unique representations of referents
- ▶ Domain Object Layer
 - domain information about objects, processes and actions

DFKI Discourse Model – Attentional State

- ▶ Global focus
 - Focusing structure
 - List of focus spaces ordered by salience
 - Controlled by ActionPlanner by means of discourse topics
- ▶ Local focus
 - Pointers to discourse objects
 - List of possible referents ordered by salience
- ▶ Note: identification takes into account modality of presentation