



WiSe 06/07 Seminar „Sprachdialogsysteme“

1. Introduction to Spoken Dialogue Systems

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Content

- What are Spoken dialogue systems?
- Types of spoken dialogue systems
- Examples of spoken dialogue systems
- What is Dialogue in spoken dialogue systems
- Architecture of spoken dialogue systems

What are Spoken Dialogue Systems (SLDS) ?

- An SLDS is a software tool allowing communication via voice in order to perform a certain task
- According to the goal of the task one can identify:
 - Transaction-based systems which allow the user to perform a transaction (e.g. reserving a seat in a train, buying or selling stocks)
 - Information-provision systems which provide information as answer to a query (e.g. weather information, timetables for a train)
- The output can be in form of synthesised voice or some data

Why Voice Input/Output ?

- Most part of these systems are designed for telephones or wireless devices which:
 - have quite small screen if at all
 - are used for communication in real time therefore typing the input is not a solution
 - sometimes have to be used in hands-free mode (e.g. in the car)
- Such systems can be used for people with certain disabilities where typing or screen reading is not possible
- Speech is the most natural way of communication at least at telephone

Dialogue systems and the market

- Voice portals are becoming extremely used in eCommerce
- Call centres are replacing at least part of their human-services through such systems
- According to a statistic from 2004 there were only 250 million computers with Internet access but **1.3 billion telephones !!!** in the world
- Recent trend: more and more services are integrated on the mobile phone chip.

Areas of current usage of SLDS

- Remote banking
- Travel reservations
- Information enquiry
- Stock transactions
- Taxi bookings
- Route planning

2 Examples

- Call centre
 - <http://www.clarity-ag.net/demo+M54a708de802.html>
- Weather forecast
 - <http://groups.csail.mit.edu/sls//about/jupiter.wav>
- Collection of Dialogue systems examples:
 - <http://www.voice-community.de/index.aspx?page=17>

How looks dialogue with a machine? -1-

- **Communicator:** How can I help you?
- **User:** I'd like to travel to San Francisco next Tuesday.
- **Communicator:** Leaving on Tuesday, April 24th, arriving in San Francisco.∧ Leaving what city? **User:** New York ∧∧∧ [*the system misunderstands, and thinks the user said Newark*]
- **Communicator:** Leaving Newark Airport.∧ Leaving at what time?
- **User:** Um, no, change Newark to New York -- J F K Airport
- **Communicator:** Leaving New York J F K.∧ Leaving at what time?
- **User:** Anytime is fine
- **Communicator:** What airline would you prefer?
- **User:** It doesn't matter to me.
- **Communicator:** I currently have you leaving New York J F K on Tuesday, April 24th anytime during the day, arriving in San Francisco.∧ Is this correct?
- **User:** Sure, that's right.

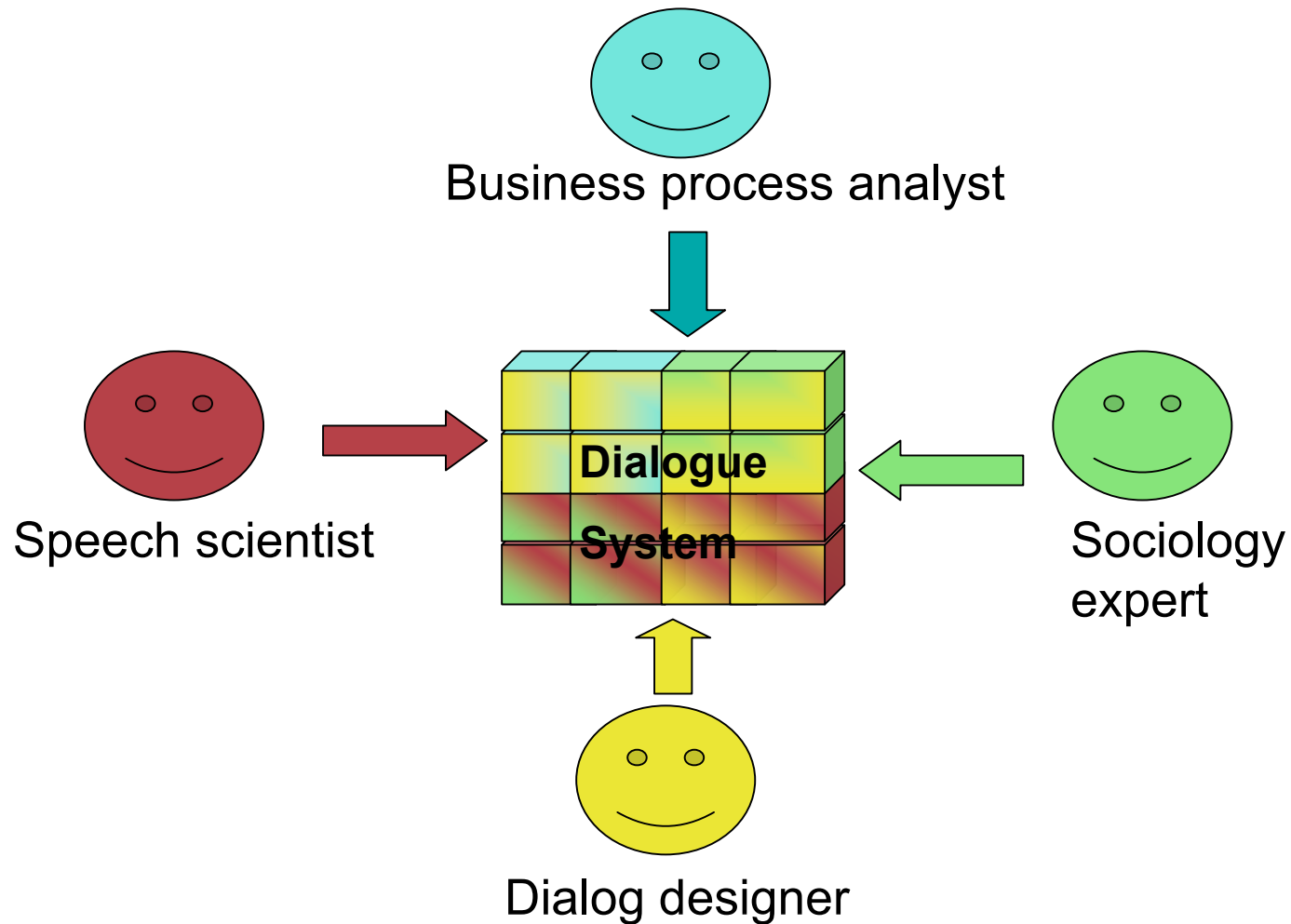
From Bell Labs Communicator : A mixed-initiative spoken dialog system operating in the air travel-planning domain. The system acts as a travel agent, and is able to handle multi-leg trips, hotel and car reservations.

<http://www.bell-labs.com/project/communicator/Tutorial.htm>

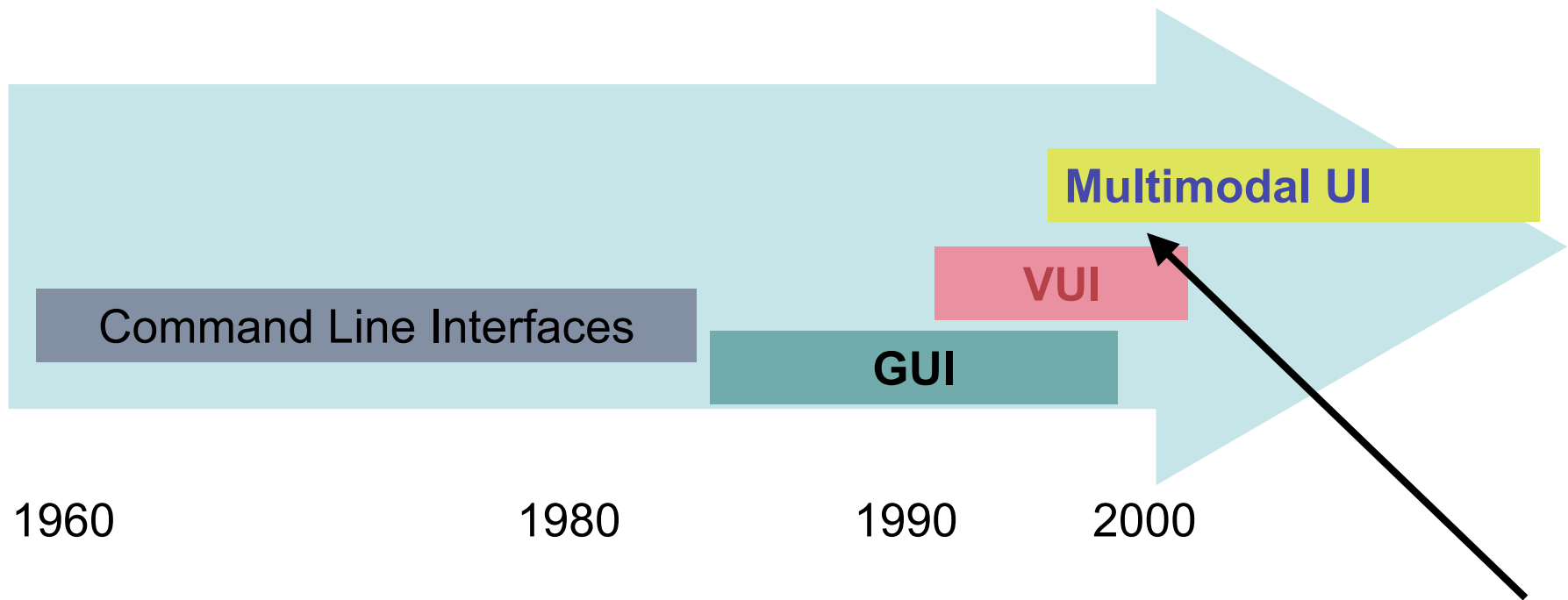
How looks dialogue with a machine?-2-

- But often works not as it was planned
- Example: DB- Auskunftssystem

Human factors involved in the design and deployment of high quality speech applications



A little bit of History



Dialogue

- It is important for developers of dialogues systems to have a sound understanding of nature of human dialogue:
 - How it is structured
 - How people engage in dialogue
- Even when conversational modelling is not the main aim, understanding the complexity of human dialogue is important for knowing how to constrain systems in the interests of performance and avoidance of errors

Dialogue vs. Conversation

- Dialogue = a process of exchanging views, sometimes with the purpose of finding a solution to a problem or to solve differences
- Conversation = informal spoken interaction with main purpose: developing and maintenance of social relationships

Key aspects of dialogue

Here only those relevant for SLDS:

- **Dialogue as discourse** : the analysis of the use of words, phrases and utterances in the context of extended discourse
- **Dialogue as purposeful activity**: examination of the purposes for which people engage in dialogue, the actions that they perform and the meanings that they convey
- **Dialogue as collaborative activity**: how dialogue is best understood as joint activity in which people work together to engage in conversational turn-taking and to achieve mutual understanding
- **Utterances in dialogue**: the nature and form of utterances produced in naturally occurring dialogues

Dialogue as discourse

- A dialogue consists of 2 turns, one by each speaker
- A coherent dialogue will produce elements whose interpretation depends on the dialogue context.
- To participate in the dialogue it is necessary to keep track of all these elements
- Usually a record of entities introduced in the dialogue model is maintained. This is used for anaphora resolution
- Sometimes to solve such references world knowledge is necessary

Examples of Anaphora resolution

- Speaker 1: You have to obtain first the **residence permit** ←
- Speaker 2: What do I have to do with **it** ?

- Speaker 1: You have to obtain first the **residence permit in the foreigners department** ✗
- Speaker 2: What do I have to do with **it** ?

Record of the focus

Examples of World knowledge involved in dialogue

- Speaker 1: You have to obtain first the residence permit
- Speaker 2: But **my supervisor** did not mentioned this.

„my supervisor“ was mentioned probably in a previous turn.

How look dialogues in simple SLDS

- System: You can ask about restaurants, traffic, news, sport or weather
- User: Traffic
- <traffic dialogue>
- System: What next? You can ask about restaurants, traffic, news, sport or weather
- User: sport
- <sport dialogue>

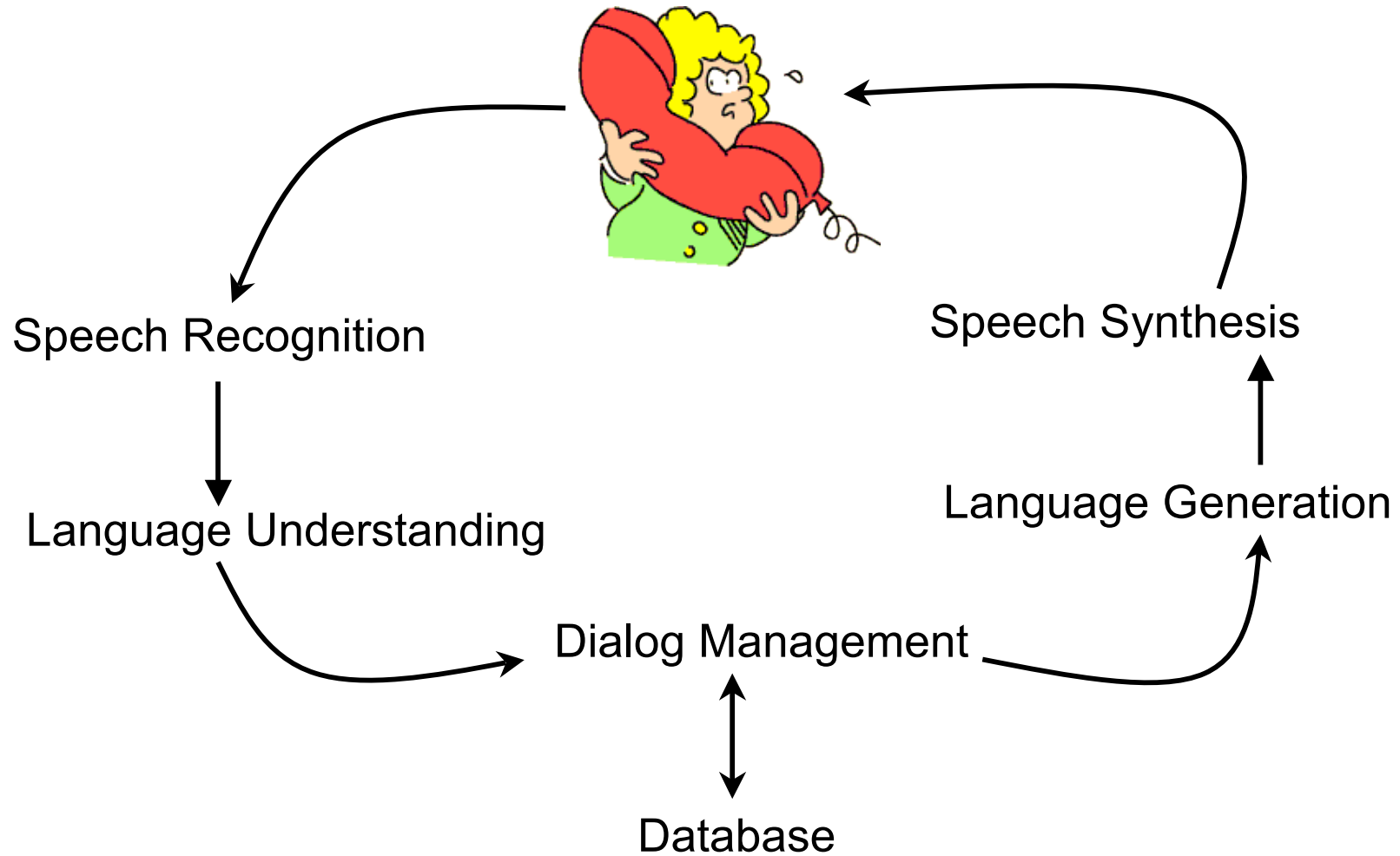
The system offers a choice of topic to the user and the dialogue follows the topic selected, then another choice of topic is offered

How look dialogues in advanced systems

- <event dialogue in progress>
- System: What sort of event are you interested in
- User: A concert
- System: there is a concert in the university grounds at 9 this evening
- User: What's the weather forecast?

In the middle of one dialogue the user changes the topic and the system should realise this

Architecture of an SLDS -1-



Architecture of an SLDS -2-

- Speech Recognizer - analyses the audio speech input signal to extract linguistic units (words , phonemes etc.)
- Language Understanding Module - determines the meaning of the input . In most case of the existent SLDS this is reduced to the mapping on stored patterns
- Dialogue Management Module: manages the flow of the conversation, maintains history and context and accesses the Database
- Database - stores the information required by dialogues.
- Language Generator: formulates answers
- Speech Synthesiser produces the audio speech output signal

Themen im Seminar

- 23.10.2006 und 30.10.2006 Einführung
- 06.11.2006 Spracherkennung: Methoden, State of the Art und Role in Sprache Dialogsysteme
- 13.11.2006 Sprachsynthese: Methoden, State of the Art und Role in Sprache Dialogsysteme
- 20.11.2006 Dialogmodellierung
- 27.11.2006 VoiceXML
- 04.12.2006 Semantische Modellierung in VoiceXML
- 11.12.2006 Mixed initiative in Sprachdialogsysteme
- 18.12.2006 Multimodale Sprachdialogsysteme
- 08.01.2007 - 29.01.2007 Experimente mit TELAS „Ein Telefonauskunftssystem für ausländische Studenten“
- 05.02.2007 - 29.01.2007 Präsentation Ergebnisse, Zusammenfassung

Scheinkriterien

- Präsentation einer Thema im Seminar
- Hausarbeit bis Ende der Semester
- Evaluation und Verbesserung einer TELAS - Komponente
- Anwesenheit : 2 Abwesenheiten möglich. Sonst gilt nur Attest.

Kontakt

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<http://nats-www.informatik.uni-hamburg.de/view/DialogSys/WebHome>

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- Bitte bis an dem Freitag vor der Präsentation mit mir absprechen !