

Speech Dialog Systems

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Harman/Becker Automotive Systems
Speech Dialog Systems
Ulm - Germany***

High-Tech driven by Passion.



- **Introduction**
- **Motivation**
- **Project**



- **Introduction**
 - Stefan Hamerich
 - Harman/Becker
- **Motivation**
- **Project**



- **1994 - 2001 studied Computer Science in Hamburg**
 - 1996 - 2001 member of NatS
 - 1999 working student at IBM European Speech Research
 - 2000 diploma thesis at IBM European Speech Research
- **since 2001 working for Temic / Harman/Becker in Ulm**
 - Dialog Research and Tools

**Erstes Spracherkennungsprodukt
im Auto weltweit: „Linguatronic“
eine „Command & Control“
Lösung für das Autotelefon
in der Mercedes-Benz S-Klasse**

**Fahrplan-Information
für Deutsche Bahn AG,
Linguatronic:
2. Generation für
fast alle Mercedes PKW
Sprachbedienung für
BMW**

- **G2P BMW**
- **Ganzworteingabe für
die Navigation in der
Mercedes E-Klasse**
- **Launch UHV Audi A3**
- **Bluetooth (SIM Access
Profile Prototyp)**

['70] '80 1990 1991 1992 [1993] 1994 1995 [1996] 1997 [1998] 1999 [2000] 2001 [2002]² [2003]³ 2004

**Erstes Forschungs-
projekt bei AEG
Telefunken für die
Entwicklung von
Spracherkennungs-
algorithmen**

**Produktentwicklung
bei Daimler-Benz für
die Automobil- und
Telekommunikations-
industrie**

**Sprachbedien-
system für Audi**

- **TEMIC Speech Dialog Systems
geht von DaimlerChrysler
zu Harman/Becker
Automotive Systems über**
- **Weltweit erste Spracheingabe
bei Navigationssystemen**

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Harman/Becker
Automotive
Systems

Hamerich

19.04.06

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Harman International

Consumer Group



harman/kardon
JBL
Infinity
Mark Levinson
Lexicon
Citation
Proceed
Revel
Audio Access
Control +
VMAx

Professional Group



JBL Professional
Lexicon
DOD - Digitech - DBX
BSS
Turbosound
Soundcraft / Spirit
AKG
Studer
Orban

Automotive Group



harman/kardon
JBL
Infinity
Mark Levinson
Lexicon
Becker
****Temic SDS****
AKG Automotive
Wavemakers

OEM



System Supplier



Hands Free Car Kit Supplier, Aftermarket



1996

1997

1998

1999

2000

2001

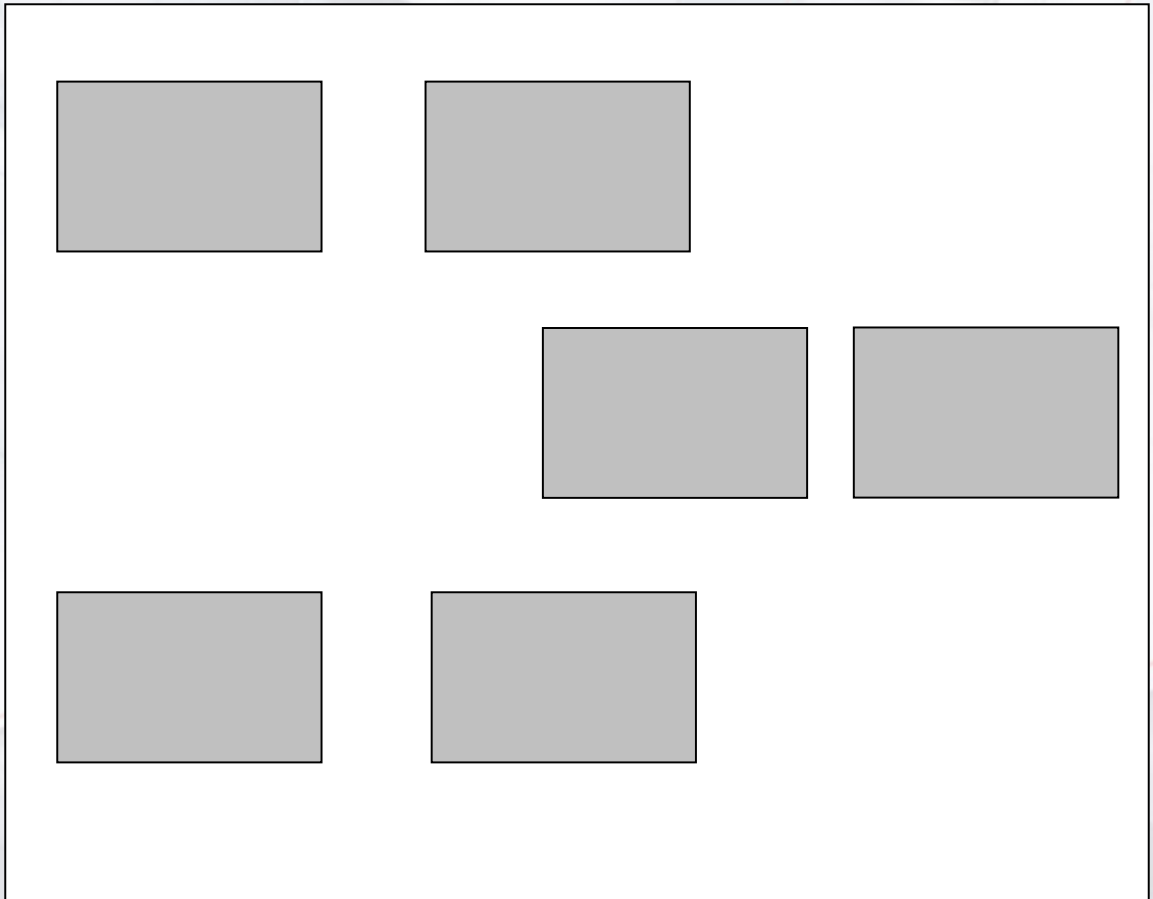
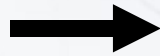
2002

2003

2004



- **Introduction**
- **Motivation**
 - How does a Speech Dialog System work?
 - Fields of study
 - SDS in practise
- **Project**



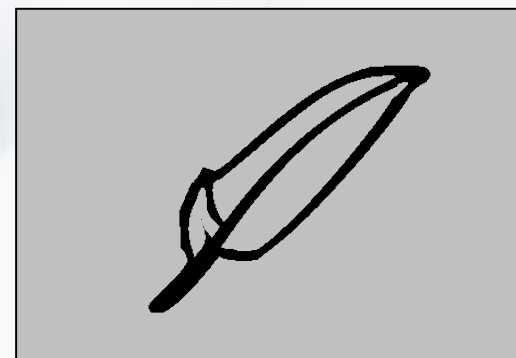


- **Input: Speech Signal**
- **Capture Speech Signal**
- **Noise Reduction**
- **Echo Cancellation**
- **Output: Cleared Speech Signal**



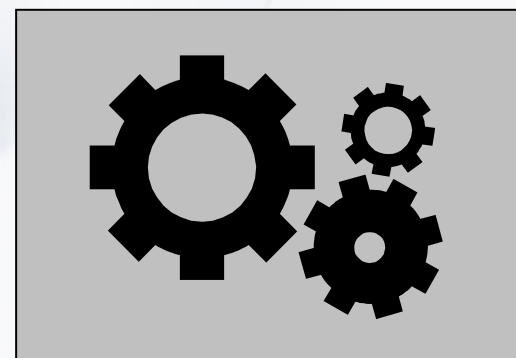


- **Input: Cleared Speech Signal**
- **Recognise Speech**
- **Parse Text**
- **Output: Text Structures**



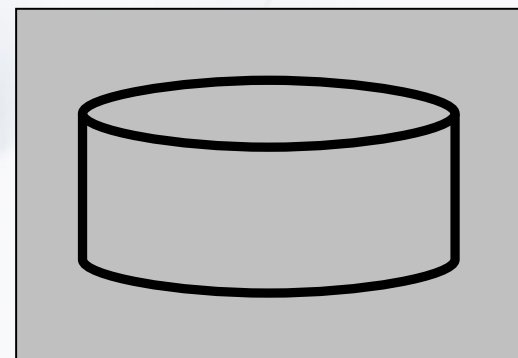


- **Input: Text Structures**
- **Execute Dialog Script**
- **Initiate System Reactions**
- **Output: Text Structures**



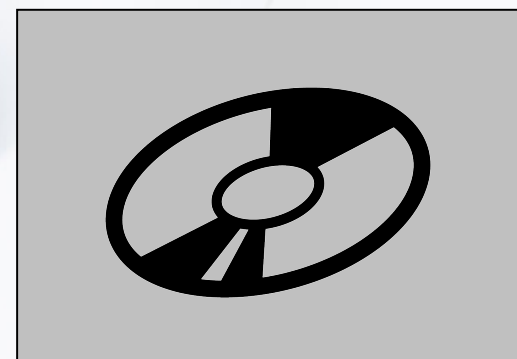


- **Input: Text**
- **Dialog Script**
- **Speech Grammar**
- **Speech Prompts**
- **Domain Knowledge**
- **Connects to Backend / Database**
- **Output: Text**



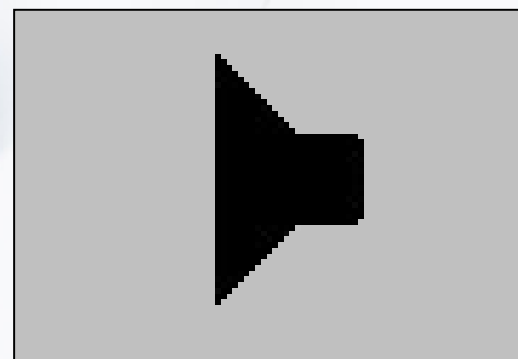


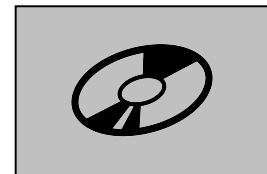
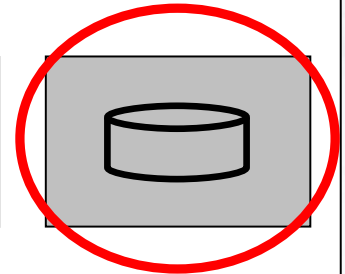
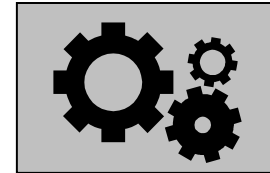
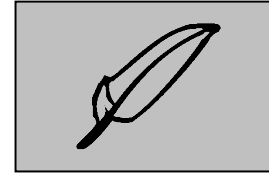
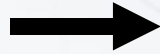
- **Input: Text Structures**
- **Mapping Text To Speech (TTS)**
- **Calling Wave Files**
- **Output: (Synthesised) Speech**





- **Input: (Synthesised) Speech**
- **Plays Speech Prompts**
- **Output: Speech Signal**







Acoustics

Engineering

Speech Recognition

Parsing

*Computational
Linguistics*

Grammars

**Computer
Science**

Programming

HMI Design

Psychology

Evaluation / Usability



- **Telephony Systems**
 - Information Systems
 - Shopping Systems
 - Translation Systems
- **Control Systems**
 - Automotive Systems
 - Washing Machine
- **Desktop Systems**
 - Entertainment Systems
 - Action Systems



- **Speech Control in Cars**
 - Successful
 - Technically challenging
 - More and more features to come
 - Growing complexity in cars demands for intuitive control
 - Growing market
 - Several competing companies, e.g. HBAS, IBM, Nuance



■ **Telephony Systems**

- Pushed by industry
- Not always loved by customers
- Market slightly growing
- Usability more and more in focus
- Numerous competing companies
 - Technology coming from AT&T, IBM, Nuance (> 75%)
 - Thousands of small service providers



- **Desktop Systems**
 - Currently no market
 - Still a research area



- **Official speech dialog system from Deutsche Bahn**

- Free from fixed line network: 0800 / 150 70 90
- From Nortel Networks (ASR from Temic)
- System-driven dialog strategy
- Explicit confirmation prompts

- **Speech dialog system from Philips / Nuance**

- Number: 0241 / 60 40 20
- Mixed-initiative dialog strategy
- Implicit confirmation prompts



- **Video Presentation Linguatronic 2**



- **Introduction**
- **Motivation**
- **Project**
 - Structure
 - Practical Part
 - Contact
 - Schedule



- **Theoretic part (essential for practical part!)**
 - by Cristina Vertan and Walther von Hahn
 - important basics
 - theoretical background
- **Practical Part**
 - by Stefan Hamerich
 - application of methods learned in theoretic part
 - specification / implementation / testing of SDS
 - evaluation of the system
 - presentation of group work



- **Organisation**

- Creation of groups
 - Consisting of about five to six people
 - Each implementing an own prototype
- Approach
 - Specification
 - Implementation
 - Testing
 - Evaluation



- **No office at UHH**
- **Contact by E-Mail only:**
 - shamerich@harmanbecker.com
 - stefan@hamerich.de



- **Assignment of groups in June**
- **Send a rough specification until July 1st by e-mail**
- **See you again on July 17th!**