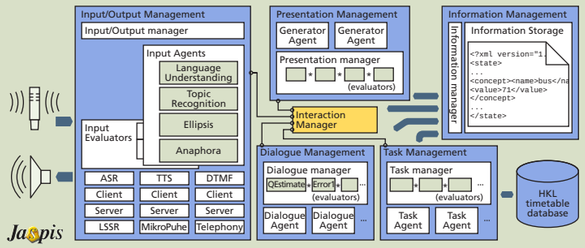
Agent-based Adaptive System Architecture

University of Tampere

Tauchi Unit http://www.cs.uta.fi/research/hci/

The Interact system is based on the **Jaspis architecture**. Jaspis is general purpose speech application architecture, which supports adaptive interaction techniques at architectural level. The Jaspis architecture contains several features which support adaptive applications.

The architecture uses blackboard-type shared **system context**, which can be accessed by each system component, allowing them to utilize all the information that the system contains, such as dialogue history and user profiles. System components can be stateless, and the system can switch between them dynamically and adapt the interaction to the user and situation.



The adaptive interaction management scheme is based on three kinds of components: managers, agents and evaluators. Specialized agents handle various interaction situations such as speech output presentations and dialogue decisions. The agents have different capabilities and the selection of agents is done using **evaluators** which determine applicability of the agents to various interaction situations.

The system is organized into modules, which are coordinated by **managers**. The number and type of modules that can be connected to the system is not limited. The Interaction Manager handles all the connections between modules and the system can be distributed for multiple computers. Using the distributed IO architecture it is possible to use several input and output devices, such as speech recognizers, to adapt the interaction to the user.

Natural Language Analysis and Generation

University of Helsinki

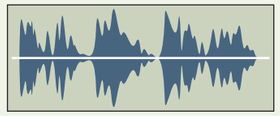
Language Technology http://www.ling.helsinki.fi/

The extreme multiplicity of word form prevents the use of all-including dictionaries. Different word forms are analyzed using Fintwol, the two level morphological analyzer for Finnish. The forms are input to the syntactic parser CPARSE. The system uses the Lingsoft Speech Recognizer for the spoken language input and the Timehouse Mikropuhe for the spoken language output.

The task of the parsing component is to map the speaker utterances into task-relevant domain concepts which are to be processed by the dialogue manager.

The language generation function is located in the system's Presentation Manager module.

The system architecture allows multiple generators to be used. In addition to the XML-based pipeline components we have some pregenerated outputs, such as greetings at the start and end of the dialogue or meta-acts such as wait-requests and thanking.



speech recognition

miten pæ:sen malmil:e

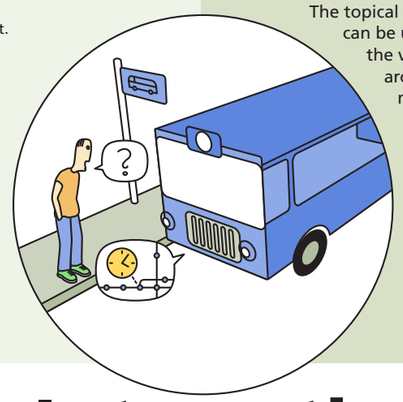
Fintwol + Cparse

miten pääsen Malmille?

miten	päästä	Malmi
INTERR ADV	V PRES ACT SG1	PROP N ILL SG

morph-synt.

consept:	name:	line
	status:	user-ask
consept:	name:	place
	constraint:	arrival
	value:	malmi



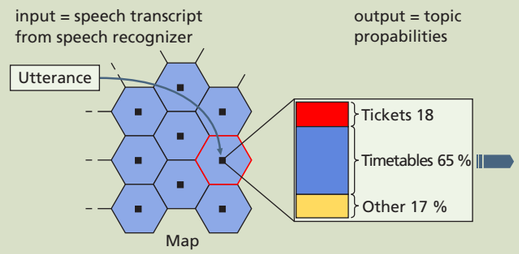
Topic recognition

Helsinki University of Technology

Neural Networks Research Centre http://www.cis.hut.fi/research/

Topic refers to the general subject matter that a dialogue is about, such as 'bus timetables' and 'bus tickets', realized by particular words in utterances.

Statistical Topic Model
estimated using labeled training data



The document map forms a kind of **topically ordered semantic space.** A new dialogue segment, either an utterance or a longer history, can be automatically positioned on the map. The coordinates of the best-matching map unit may be considered as a latent topical representation for the dialogue segment.

The topical semantic representation, i.e. the map coordinates, can be used as input for the dialogue manager, as one of the values of the current dialogue state. The system architecture thus integrates a special topic recognition module that outputs the utterance topic in the Information storage.

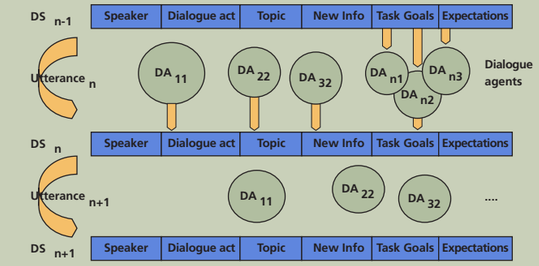
Constructive Dialogue Model

University of Art and Design Helsinki

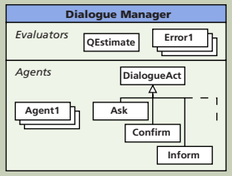
Media Lab http://mlab.uiah.fi/

Dialogue is cooperative action between speakers who exchange new information on a particular topic and, bound by communicative obligations, construct a shared context in which the underlying task can be resolved satisfactorily.

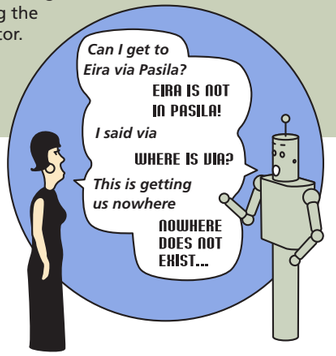
Dialogues are modeled as a set of dialogue states, defined with the help of the speaker's observations of the context and expectations about possible next states. Each dialogue act results in a new dialogue state.



The Dialogue Manager consists of dialogue agents corresponding to possible system actions. There are also some agents for internal system interaction (Agent1). The evaluators are responsible for choosing the agent that best fits in the particular situation. In the normal case, the QEstimate evaluator chooses the agent that has proven to be most rewarding so far. If one of the error evaluators (Error1) detects that an error has occurred, the QEstimate evaluator is overridden and a predetermined agent is selected to handle the error situation.



All possible system actions are reusable agents. It is thus easy to implement a different dialogue management strategy by adding evaluators, or by replacing the current QEstimate evaluator.



Adaptive Dialogue Systems - Interaction with Interact

The Interact project is a three-year collaboration between four Finnish universities: University of Art and Design Helsinki (project coordinator), University of Helsinki, University of Tampere, and Helsinki University of Technology. The project is It is funded by the National Technology Agency (TEKES), the leading IT-companies (Fujitsu Invia Oyj, Sonera Oyj, Tecnomen Oyj, Lingsoft Oy, and Gurusoft Oy) as well as the Finnish Association of the Deaf (Kuurojen Liitto ry) and the Arla Institute (Arlainstituutti), vocational training and development centre for visually impaired and deafblind people.

The project aims at exploring natural human-computer interaction and developing dialogue models which will allow users to interact with the computer in a natural and robust way. The need for flexible interaction is apparent not only in everyday computer use, but also in various situations and services where interactive systems can diminish routine work on the part of the service provider, and cater for the users with fast and tailored access to digital information. This also implies that the special needs of disabled people will be taken into account when designing more natural interactive systems for access to information. The innovative goal is to enable natural language interaction in a wider range of situations than has been possible so far, and in situations where its use has not been functional or robust enough. Within the demonstration system, such scenarios include e.g. an intelligent bus-stop which allows spoken and text interaction concerning city transportation. Various application types such as intelligent question-answer systems, automatic call-centers, and other services that would benefit from flexible natural interaction will be investigated within the project.

The explosion of available information also requires that the systems should be able to deal with the problem of knowledge acquisition, and in this respect systems that can learn are of great interest. The capacity of computers has also increased, enabling rapid testing and comparison of various machine learning techniques. The project uses various soft-computing and learning techniques to automate and build a learning system that will also learn from its interaction with the user.

Contact Dr. Kristiina Jokinen, kjokinen@uiah.fi for more information.

USIX INTERACT

TEKES FUJITSU sonera TECNOMEN gurusoft LINGSOFT LANGUAGE SENSE ARLAINSTITUUTTI