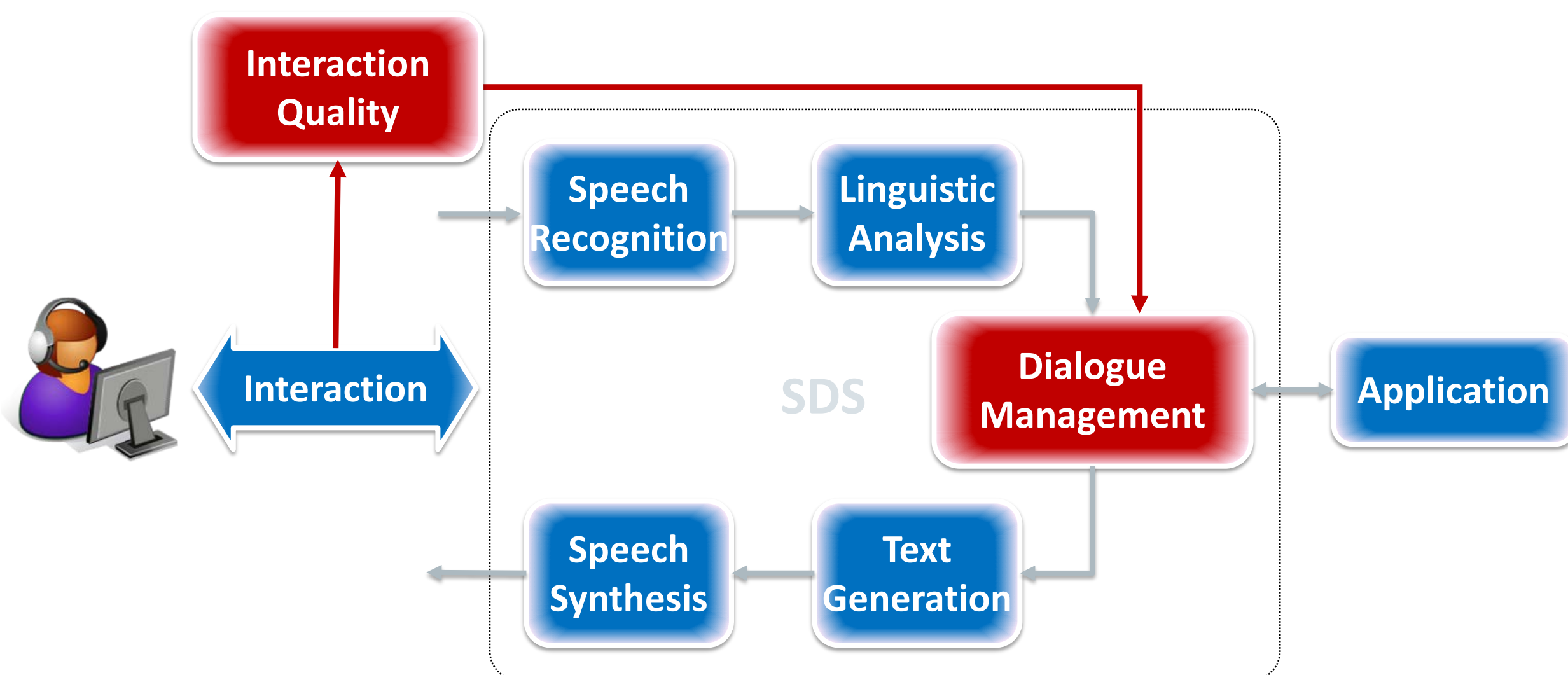


Quality-Adaptive Dialogue

Stefan Ultes
Ulm University, Institute of Communications Engineering, Ulm, Germany

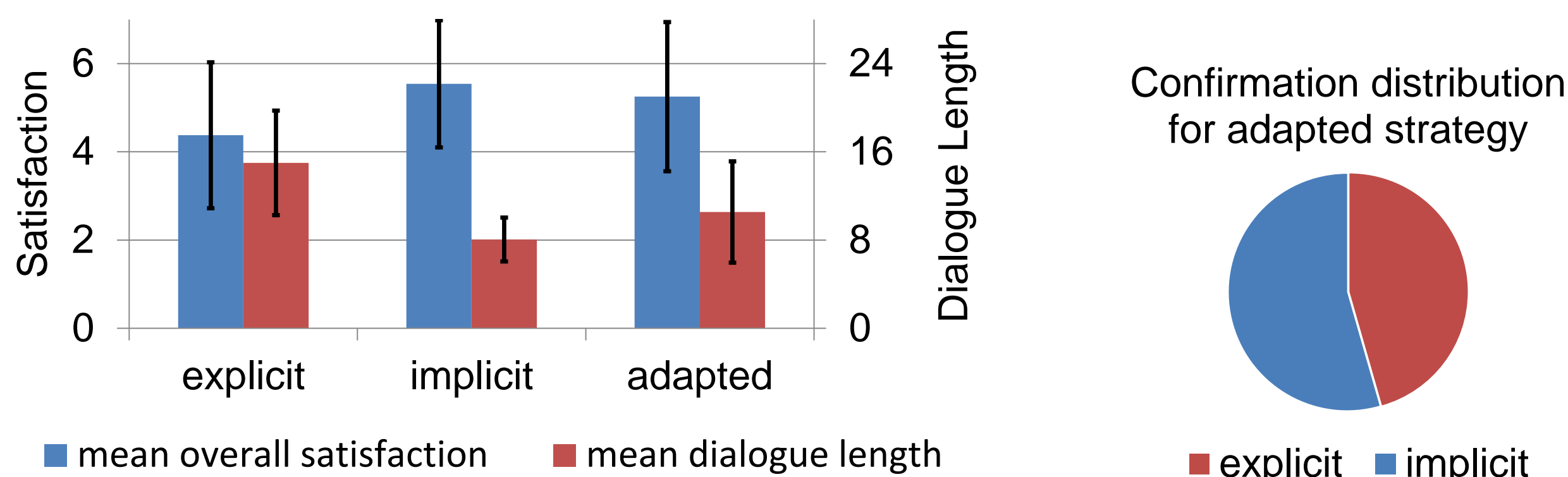
Motivation

- Usage of quality to **automatically adapt the dialogue** during the ongoing interaction
- Goal: Improvement of system performance

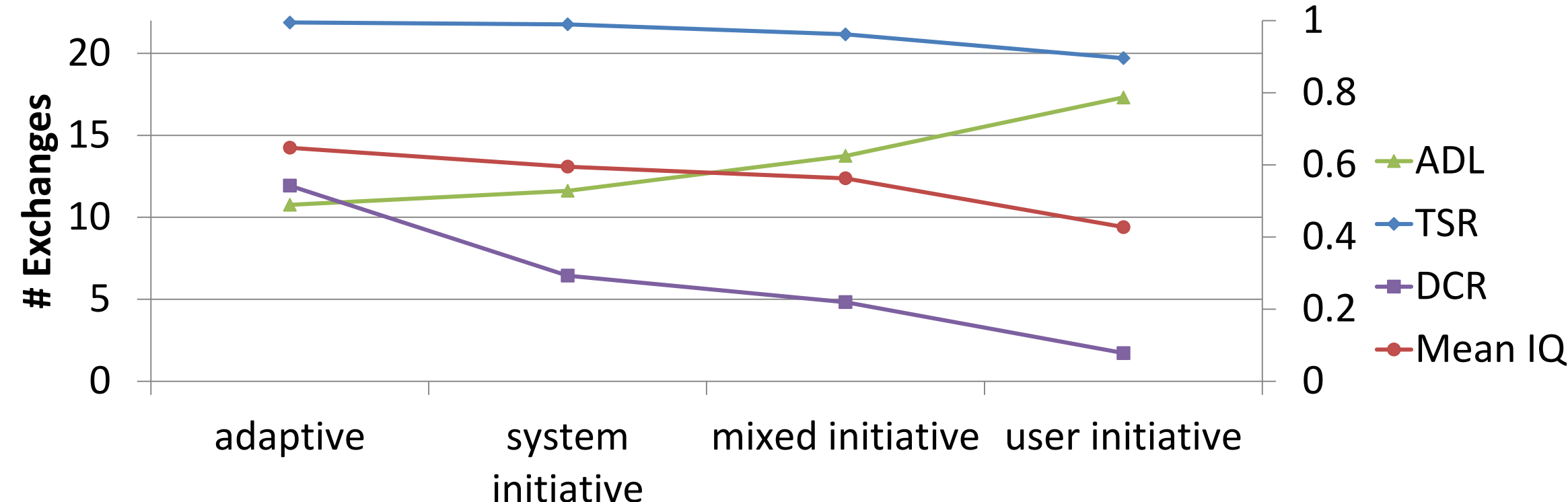


Rule-Based Dialogue Adaption

- Use IQ to influence dialogue strategy
 - Confirmation strategy
 - Initiative
 - Prompt design / prompt complexity
- Preliminary Results
 - Adaption of grounding strategy
 - Variants: explicit, implicit, adapted
 - User Study (24 people, 72 dialogues)

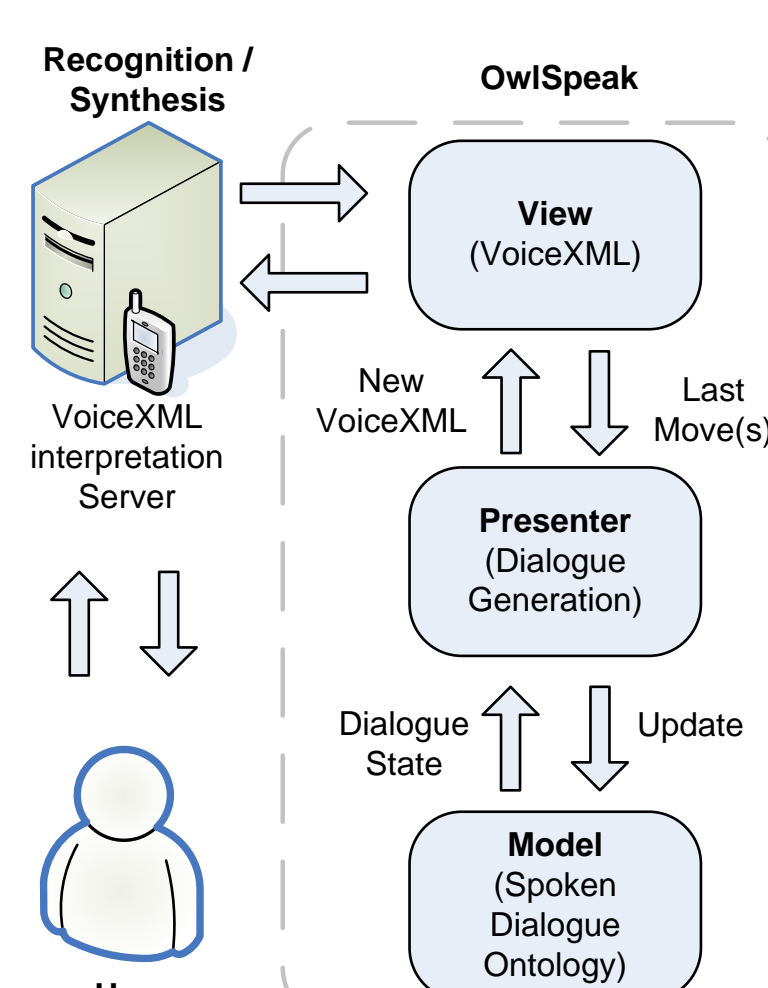


– User Simulator (1000 dialogues / strategy)



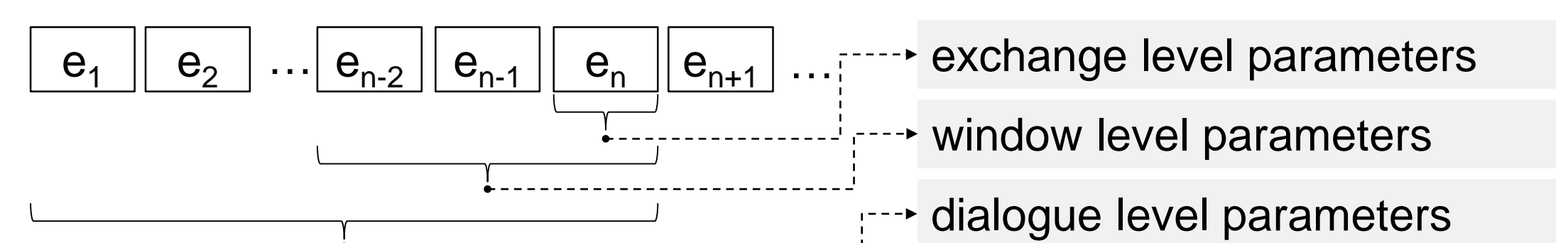
Evaluation System

- HIS-OwlSpeak (Ultes and Minker, 2013a)
- Multiple Control Modes
- Domain-independent architecture
- Control-independent dialogue description

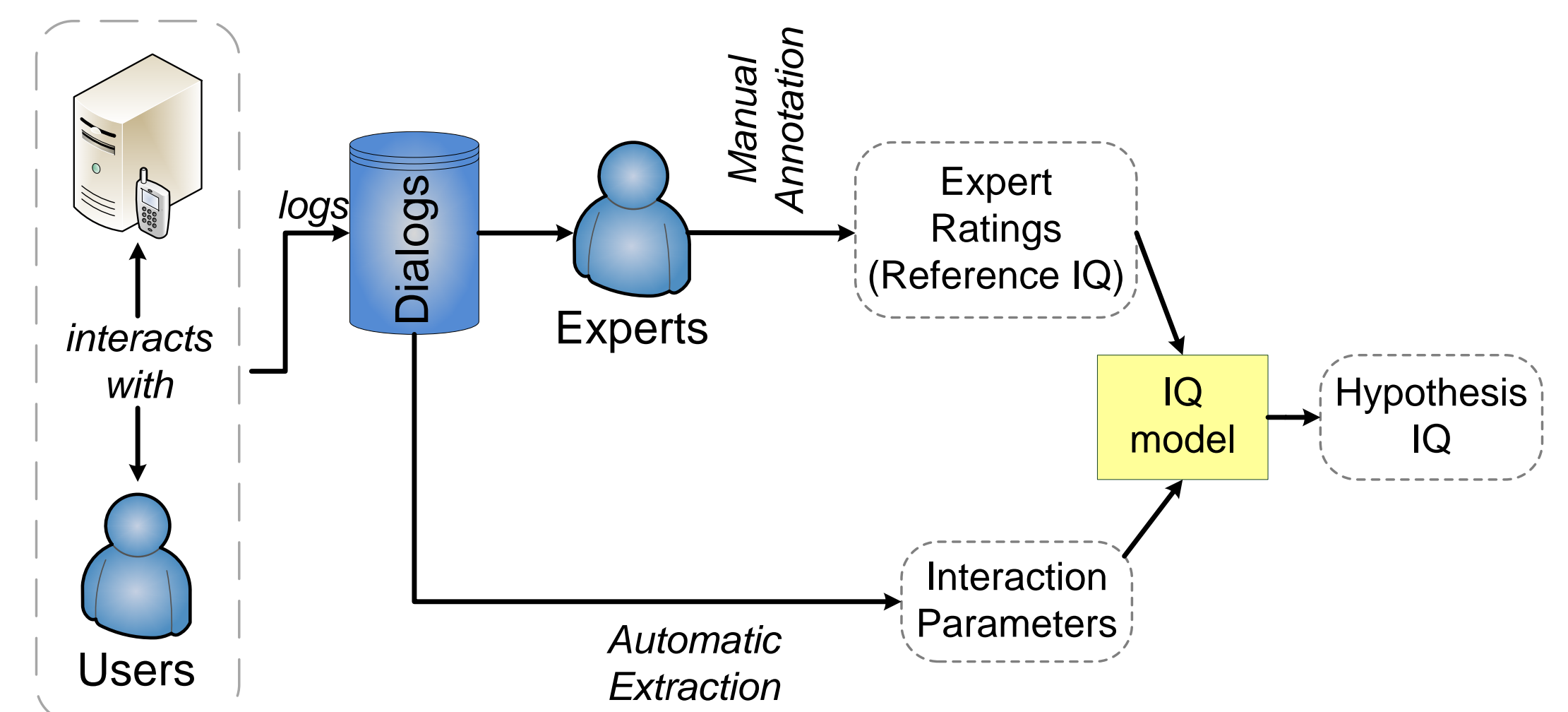


Interaction Quality (IQ) (Schmitt et al., 2012)

- Three **expert ratings** (Cohen's κ : 0.54):
 - 5 (satisfied) to 1 (extremely unsatisfied)
- **Interaction Parameters** for each exchange
 - Derived from ASR, SLU, and DM module



- **Automatic quality estimation** using statistical models



- Investigated Approaches for IQ modeling:

- SVM (Schmitt et al., 2011)
- HMM / CHMM (Ultes et al., 2012)
- Hybrid HMM (Ultes and Minker, 2014)
- Error Correction (Ultes and Minker, 2013b)

POMDP Dialogue Adaption

- Based on SDS-POMDP (Williams and Young, 2007)

- Use IQ as part of internal dialogue state

- Dialogue state $s = (u, g, h)$ extended by IQ-state s_{iq}

$$s = (u, g, h, s_{iq})$$

(u = user act, g = user goal, h = dialogue history)

- Observation space O extended by IQ-act

$$O = U \times IQ$$

(U = set of all user actions, IQ = set of all iq values)

- Use IQ for policy optimization in reward function

- Rewarding improvements in IQ

Future Work

- POMDP evaluation: IQ in reward
- Extensive user study: Comparison of rule-based and POMDP system
- Change of domain

Contact

Stefan Ultes
stefan.ultes@uni-ulm.de

nt.uni-ulm.de/ultes

References

Schmitt, A. and Schatz, B. and Minker, W.: "Modeling and Predicting Quality in Spoken Human-Computer Interaction", in Proceedings of the 12th SIGDIAL Conference, ACL, Portland, Oregon, USA, pp. 173-184, 2011

Schmitt, A. and Ultes, S. and Minker, W.: "A Parameterized and Annotated Corpus of the CMU Let's Go Bus Information System", in LREC, Istanbul, Turkey, May 2012

Ultes, S. and ElChab, R. and Minker, W.: "Application and Evaluation of a Conditioned Hidden Markov Model for Estimating Interaction Quality of Spoken Dialogue Systems", in IWSDS, Springer, Ermenonville, France, pp. 141-150, November 2012

Ultes, S. and Minker, W.: "HIS-OwlSpeak: A Model-driven Dialogue Manager With Multiple Control Modes", in Series: 9th International Conference on Intelligent Environments (IE), July 2013a

Ultes, S. and Minker, W.: "Improving Interaction Quality Recognition Using Error Correction", in Proceedings of the 14th SIGDIAL Conference, ACL, Metz, France, August 2013b

Ultes, S. and Minker, W.: "Interaction Quality Estimation in Spoken Dialogue Systems Using Hybrid-HMMs", in Proceedings of the SIGDIAL 2014 Conference, ACL, Philadelphia, PA, USA, June 2014

Williams, J. and Young, S.: "Partially observable Markov decision processes for spoken dialog systems", in Computer Speech and Language (21), pp. 393-422, 2007