

Implementing tacit sensing for dialogues situated in an extra-linguistic task

- In situated dialogue, the interaction moves forward not only through dialogue acts but also through physical and sensing acts.
- Acts can be performed either explicitly or tacitly during the interaction.
- Tacit acts can be inferred from subsequent explicit acts. Tacit act inference can be done by different methods in a dialogue system (DS).
- Tacit dialogue acts can be inferred using abduction [Tho06].
- Tacit physical acts can be inferred using classical planning [Ben07].
- Tacit sensing acts can be inferred using planning with knowledge and sensing [Ben08].

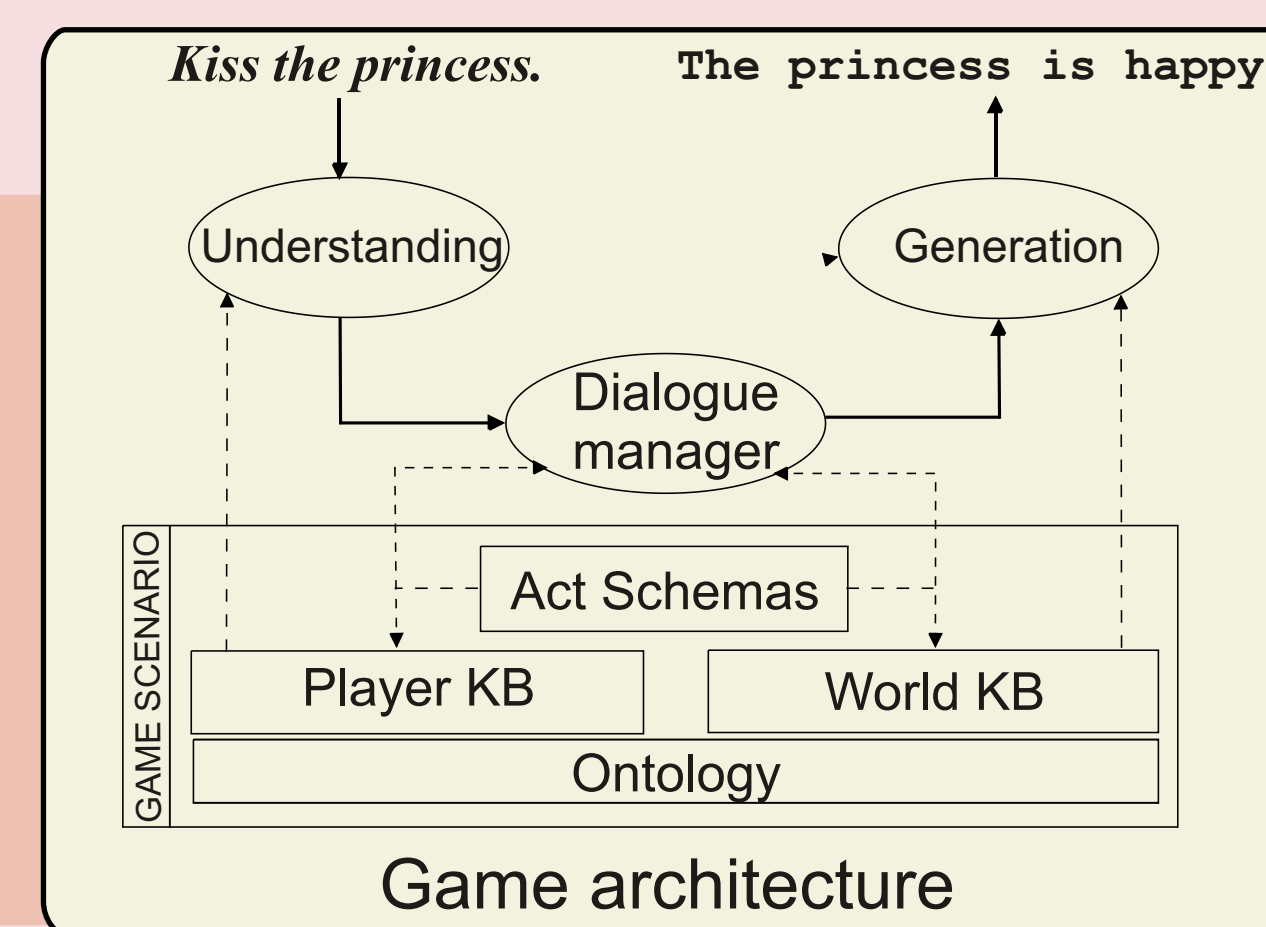
Technical framework

These are the two systems that we use for our implementation

COMPUTATIONAL LINGUISTICS

Dialogue situated in a text-adventure game [Kol04]

- The world KB represents the game world where the player is situated.
- The player KB represents mutual information about the player beliefs.
- Unlike task-oriented DS, player and game do not share a common goal.
- Like task-oriented DS, the system knows the task (the act schemas).



On the difference with an old big topic Planning and Dialogue Systems

The use of planning in dialogue systems has a long history but there is a basic difference with our approach:

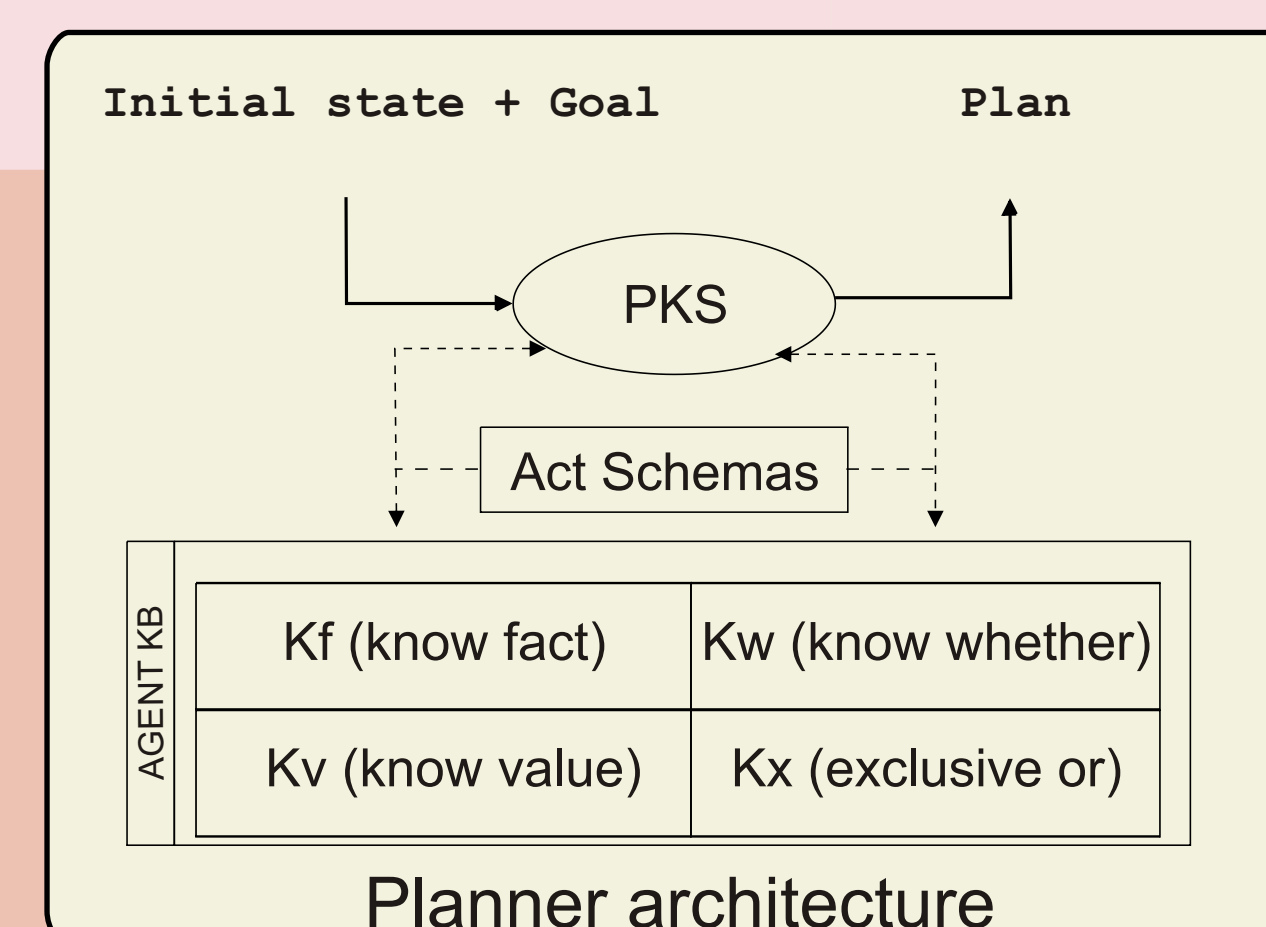
The whole dialogue is a plan [All79]
 (Plan recognition is the task of matching the observed dialogue act with a step in the speaker's plan)

A single dialogue act is a plan [Ben07]
 (Inference of tacit acts is the task of linking the previous known context with the observed explicit act)

AUTOMATED PLANNING

Planning with knowledge and sensing (PKS) [Pet04]

- Planning is the task of inferring a plan (sequence of actions) that achieves a given goal when the plan is executed in a given initial state.
- All actions update the agent knowledge instead of the world state.
- Sensing actions are actions that obtain knowledge (e.g. Look, read).
- PKS's inference algorithm is sound but incomplete.

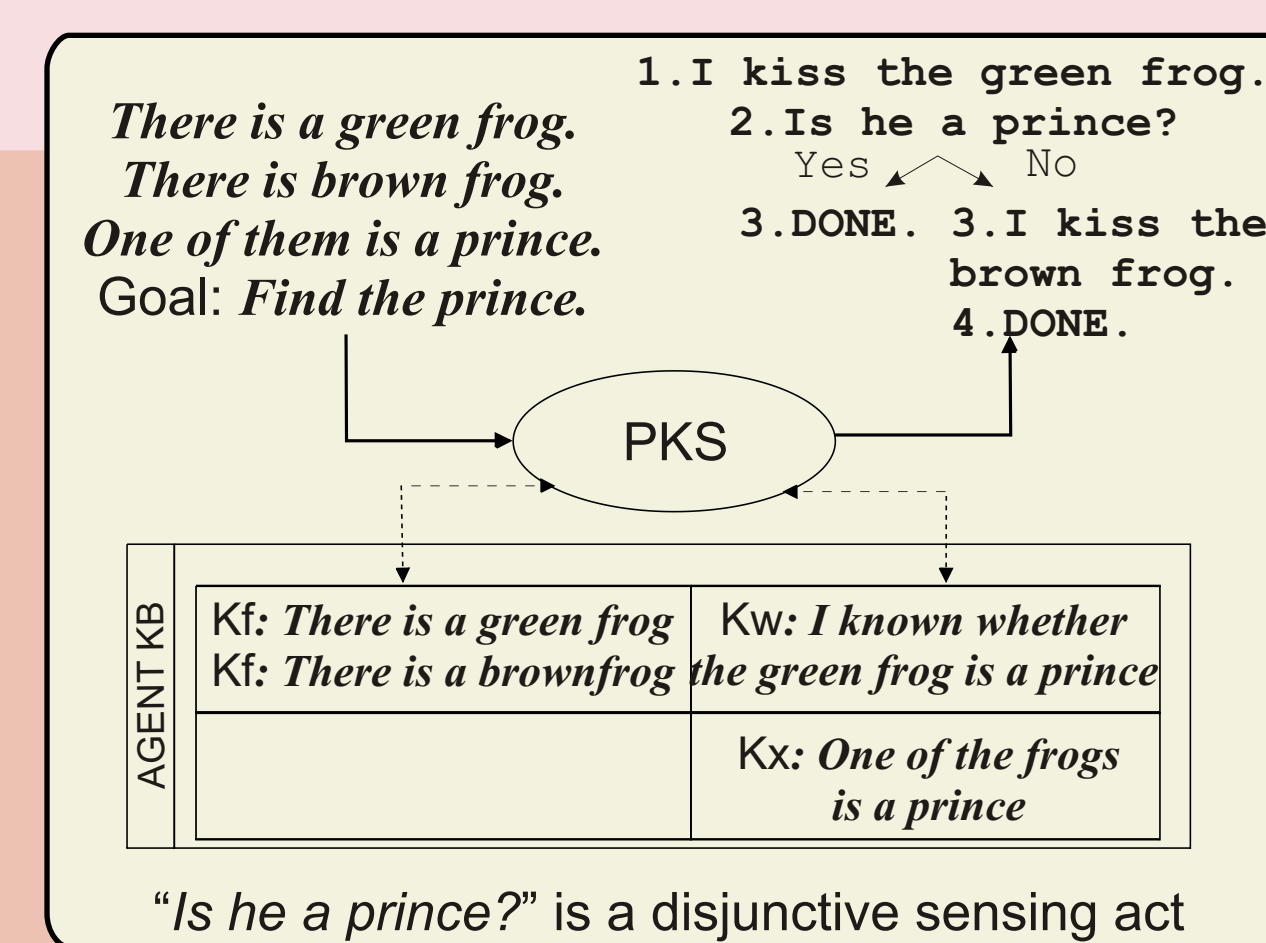


Two case-studies

There are two sorts of sensing acts \Rightarrow two sorts of underspecification for the resulting plans

Disjunctive sensing acts (DSA) \Rightarrow conditional plans

- In the text adventure, not all truth values of propositions are known by the player. A DSA observes the truth value of a proposition.
- In PKS, a DSA modifies the Kw database (*know whether* database).
- Plans including DSA are conditional, they contain branches representing the alternative plans that can be executed at run time.
- In the text adventure, conditional plans can be executed by choosing which branch to execute according to the dialogue context.



On the similarity with an old big topic Accommodation

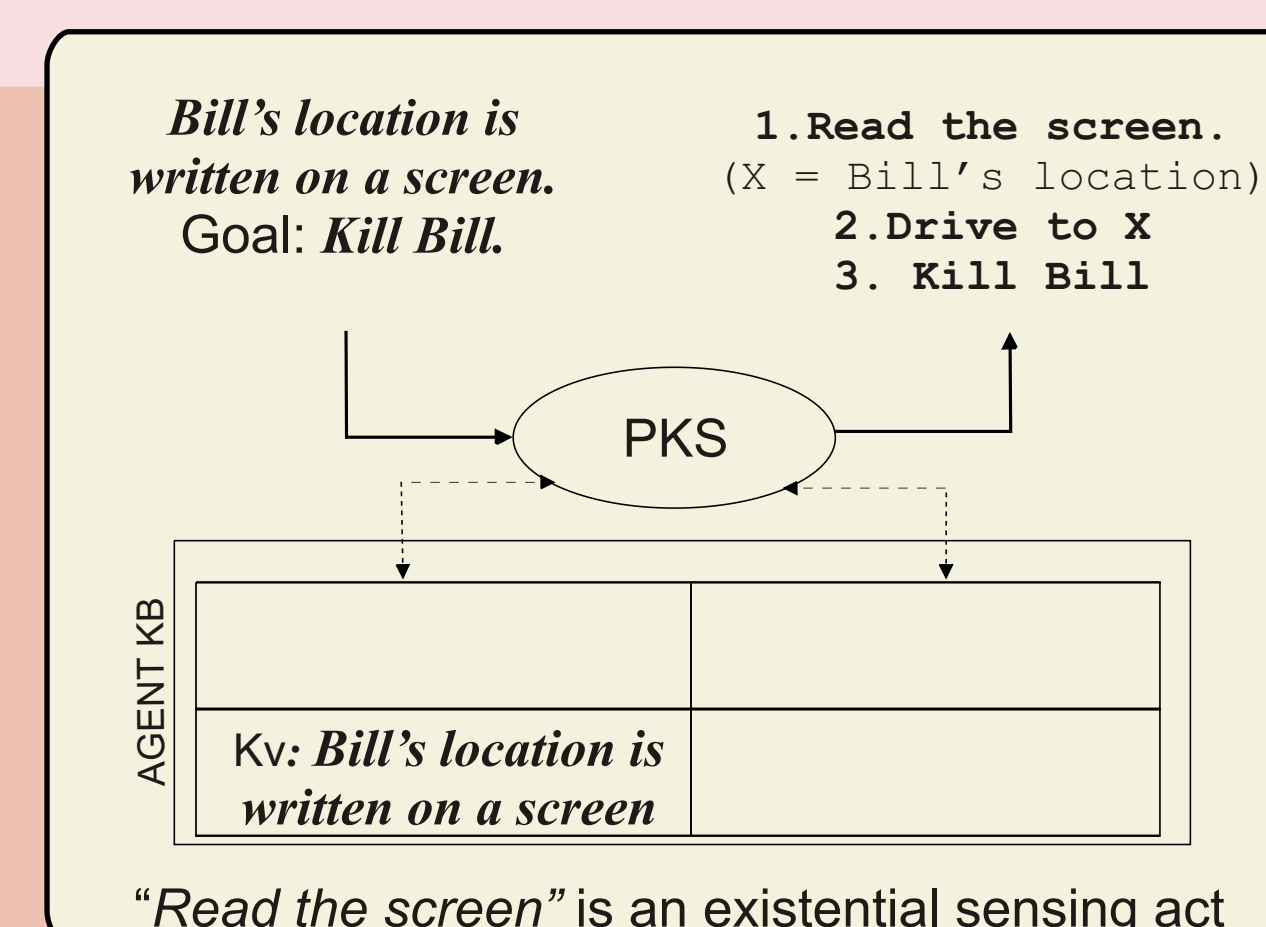
Accommodation is a strategy for coordinating information in an economic way:

If something is said which requires X to be in the conversational scoreboard, then (under certain conditions) X will become part of the scoreboard [Lew79]

If something is done which has a precondition X, then (if they exist) Tacit acts that add X to the agent KB will be inferred [Ben07]

Existential sensing acts (ESA) \Rightarrow parametric plans

- In the text adventure, not all objects are known by the player. An ESA can identify an object having a property (e.g. X = Bill's location).
- In PKS, an ESA modifies the Kv database (*know value* database).
- Plans including ESA are parametric, they contain a placeholder X for the object that will be known only at run time.
- In the text adventure, parametric plans can be executed by instantiating the parameters according to the dialogue context.



[All79] Allen. A plan-based approach to speech act recognition. 1979

[Ben07] Benotti. Incomplete knowledge and tacit action: Enlightened update in a dialogue game. 2007.

[Ben08] Benotti. Accommodation through tacit sensing. 2008.

[Kol04] Koller, Debusmann, Gabsdil, and Striegnitz. Put my galakmid coin into the dispenser and kick it: Computational linguistics and theorem proving in a computer game. 2004.

[Lew79] Lewis. Scorekeeping in a language game. 1979

[Pet04] Petrick and Bacchus. Extending the knowledge based approach to planning with incomplete information and sensing. 2004.

[Tho06] Thomason, Stone and DeVault. Enlightened update: a computational architecture for presupposition. 2006.

Summing up, the inference of tacit sensing acts is crucial for the modeling of situated dialogue.