

A Cognitive Model of Interaction for Software Agents

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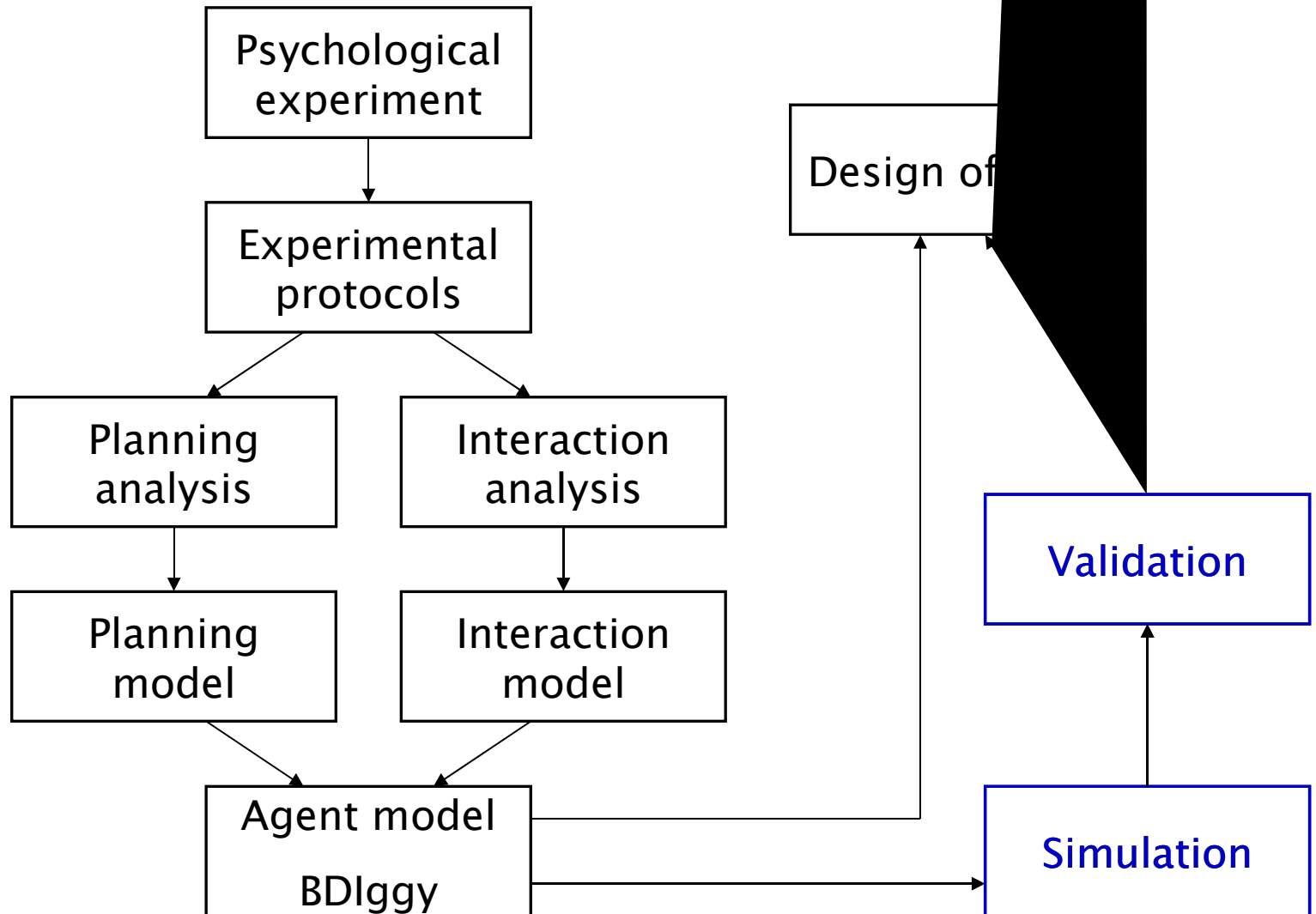


Cognitive modelling and Multi-Agent Systems (MAS)

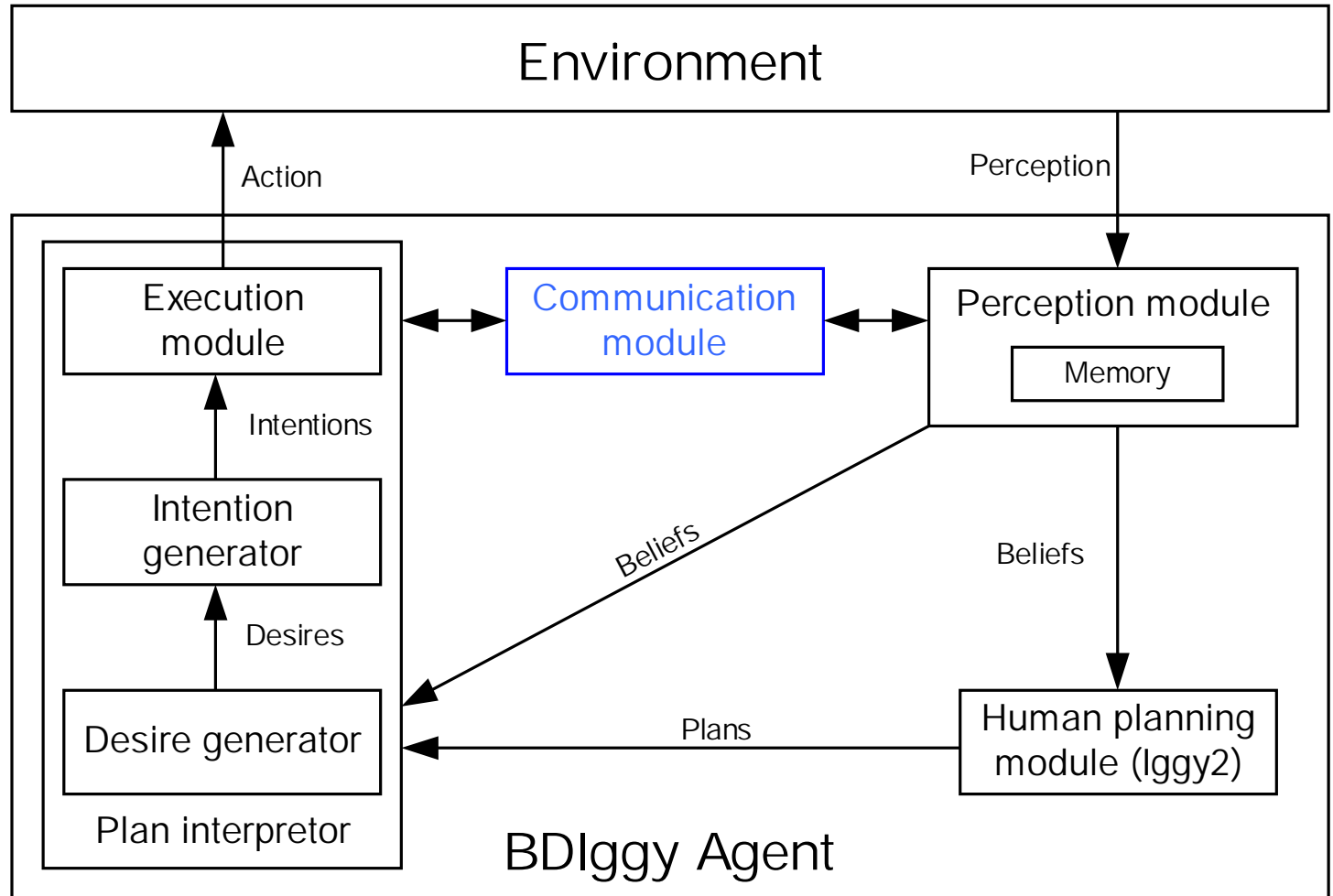
Aim : analyzing, modelling and simulating human capabilities of planning and interaction

- Design systems able to well interact with human beings
- Benefit from the robustness of human communication and reasoning processes in MAS

Approach



Agent architecture: BDIggy [IAT'03]



Cognitive modelling of human interaction

- Analysis of the e-mail corpus, from the psychological experiment:

at the utterance level

- List of pertinent performatives
- Performatives applied to mental states

at the discourse level

- Grouping together linked performatives into an *intervention*
- Represented by timed automata

discourse and utterance levels

- Semantics of the performatives

Modelling human interaction (1/5)

List of observed performatives

Performatives	Speech act	Occurrence
<i>query</i>	directive	474 (42.97%)
<i>reply</i>	descriptive	437 (39.62%)
<i>refine</i>	directive	60 (5.44%)
<i>thank</i>	descriptive	30 (2.72%)
<i>propose</i>	commissive	29 (2.63%)
<i>inform</i>	descriptive	26 (2.36%)
<i>cancel</i>	directive	18 (1.63%)
<i>acceptProposal</i>	directive	10 (0.91%)
<i>notUnderstood</i>	descriptive	9 (0.82%)
<i>refuseProposal</i>	directive	3 (0.27%)

Modelling human interaction (2/5)

Utterance

Speech Act Theory : $F(P)$

→ **performative(mental state)**

○ **directive(locutor's desire) :**

air→railway : *query(pD(air pStage(Orleans Paris ? <10h30 train ?? false)))*

○ **descriptive(belief) :**

railway→air : *reply(pB(pStage(Orleans Paris 08h25 09h30 train 180 false)))*

○ **commissive(interlocutor's desire) :**

railway→air : *propose(pD(air pStage(Orleans Paris ? ? ? ? train ?? false)))*

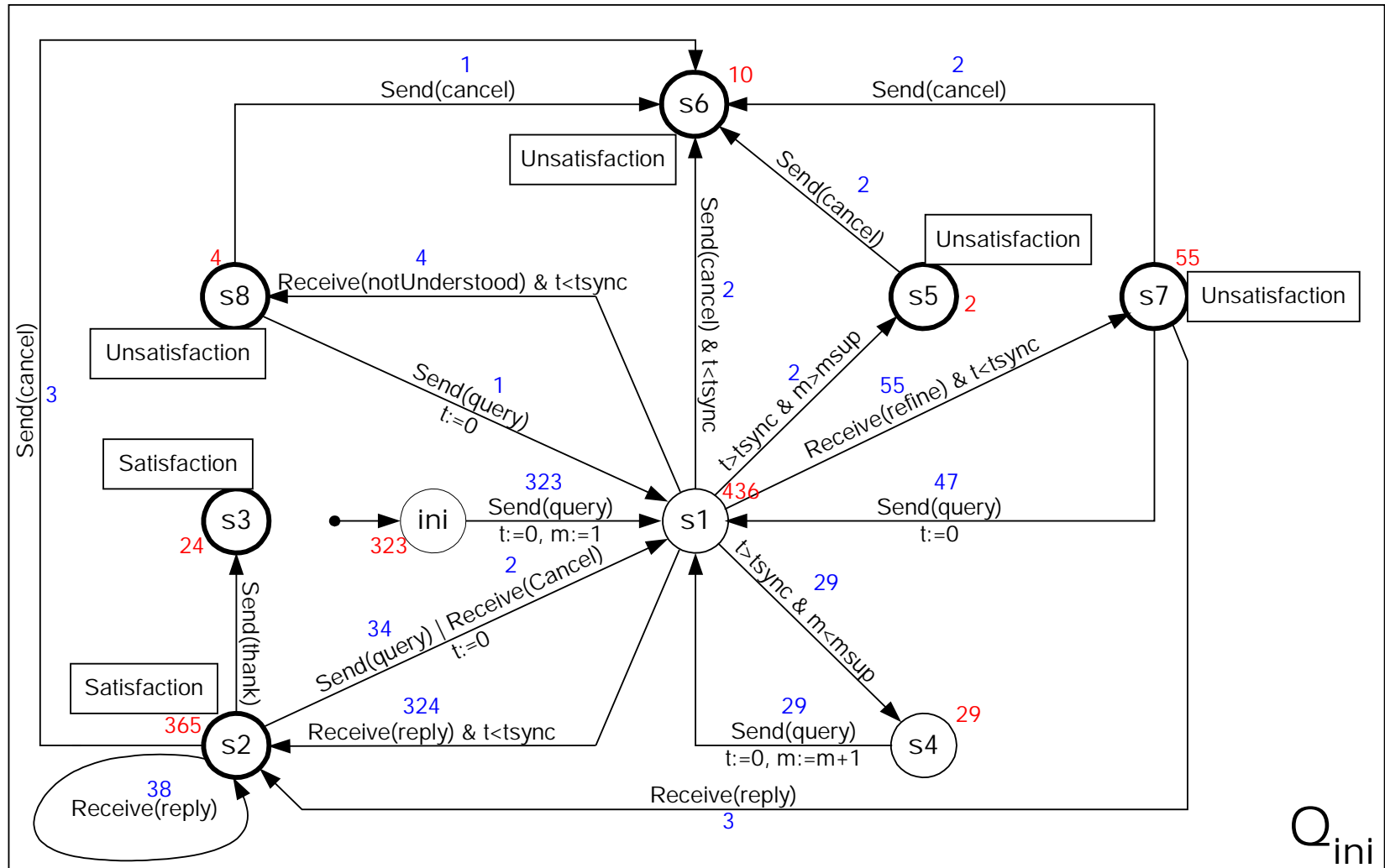
Modelling human interaction (3/5)

Timed automata

- **Intervention:** series of utterances guided by the discourse goal
- Represented by timed automata
- Timed automata direct the agent:
 - to generate a message
 - to interpret a message

Modelling human interaction (4/5)

Example of a timed automaton



Modelling human interaction (5/5)

Semantics of performatives : *query*

$$\frac{\left. \begin{array}{l} pD(A_{s'}, S) \\ \neg pMeans(S) \\ \neg pB(S) \\ \neg pB(\neg S) \end{array} \right| Q_{ini}(ini, s_2, s_4, s_7, s_8) \xrightarrow{\text{send(query)}} Q_{ini}(s_1)}{aUpdateTA(M)}$$

$$\frac{Q_{int}(ini, s_1, s_2, s_4) \xrightarrow{\text{receive(query)}} Q_{int}(s_1)}{aAdd(pB(pD(A_{s'}, S))); aUpdateTA(M)}$$

Conclusions...

- Cognitive model of human planning (Iggy2)
- Cognitive model of human interaction :
 - Performatives applied to mental states
 - Timed automata
 - Semantics of performatives
- Planning and interaction integrated in an homogeneous agent architecture (BDIggy)
- Implementing BDIggy
- Parametrizing our system

... and perspectives

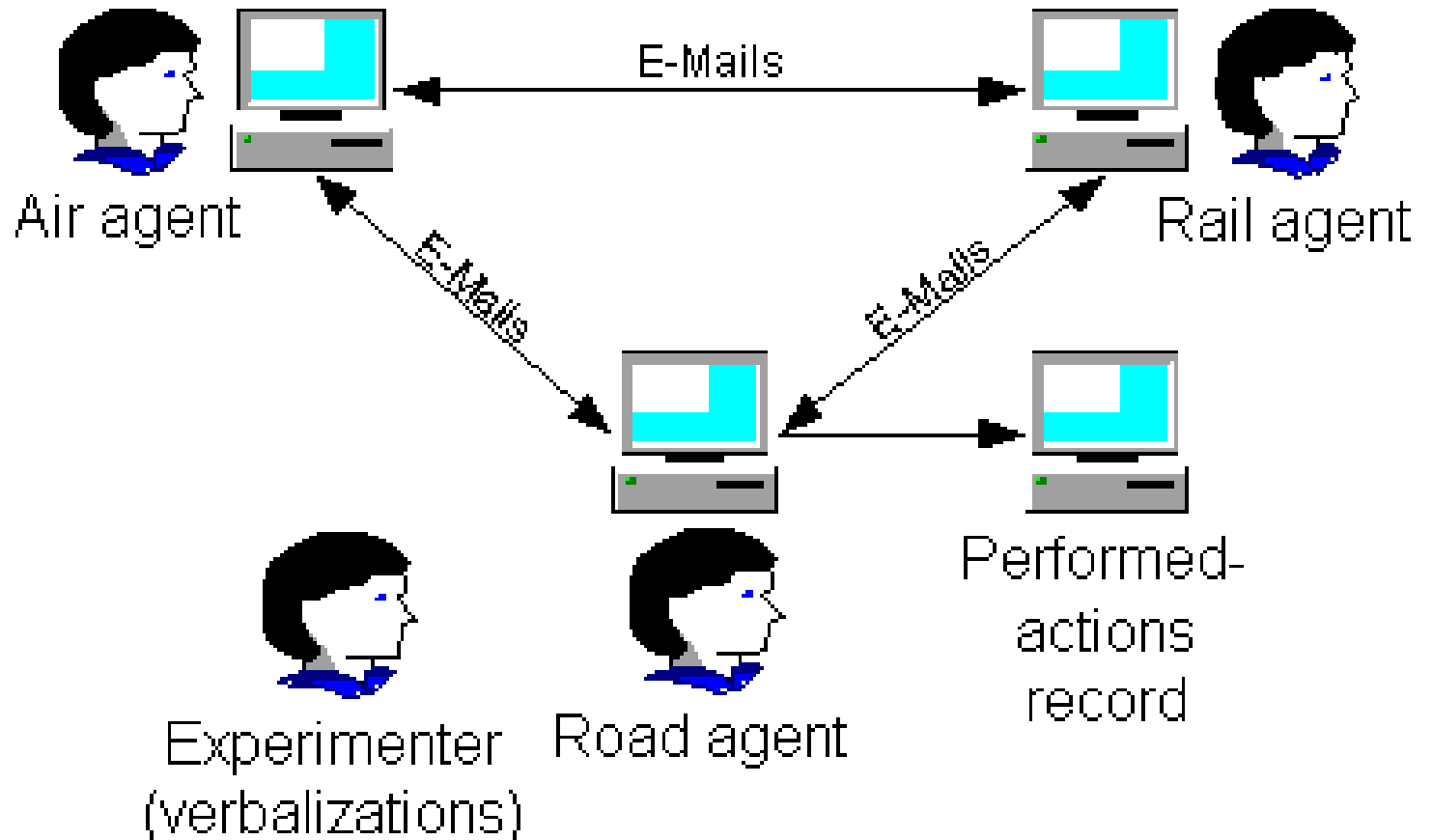
- Implementing BDlggy
- Parametrizing our system
- Simulation
- Validating the cognitive models
(Turing-like test)



That's all folks $\frac{1}{4}$

?

Psychological experiment



Example of conversation

