BDI & INTRODUCTION TO JASON

AE4M36MAS - Multiagent systems

BELIEF-DESIRE-INTENTION

What is it?

Model for programming autonomous agents using three concepts:

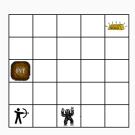
- Beliefs
- Desires
- Intentions

Beliefs

 \sim agent's model of the world (what he supposes to be true)

Example:

breeze(0, 1). stench(1, 0).
pos(0, 0). safe(0, 0).
safe(0, 1). safe(1, 0).



Beliefs

Beliefs are not knowledge!

• An agent may believe facts that are not true.

Example:

Weather forecast announces nice weather for the weekend.

```
nice_weather(sat). nice_weather(sun).
```

ightarrow You can believe that, but you cannot take it for granted.

Desires

 \sim state of the world agent is **dreaming** about

Agent need not succeed in achieving all his desires, e.g.:

- → Situation may not allow completing some of the desires
- ightarrow Desires may be mutually exclusive

Intentions

~ Active goals of the agent (should not contradict beliefs)

Agent **commits** to fulfiling some of his desires. He must do everything he can to complete his intentions (unless specified otherwise).

Turning desires into intentions: **deliberation**Realizing intentions: **means-ends reasoning**

Example:

!organize_picnic(sat).

Commitments

 \sim indicate that an agent has **commited** to some intention

Optional: Situation in which an agent may forget about his intention (i.e. **decommit**)

- Individual commitments
- Social commitments

- Blind commitment the only way to decommit is to succeed
- **Single-minded commitment** agent may decommit when he believes it is no longer possible to succeed
- Open-minded commitment agent may decommit when he no longer believes it is possible to succeed

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- Single-minded commitment Agent will be organizing the event until rainy Saturday. He than resigns on his intention and the life goes by.
- **Open-minded commitment** Agent drops his intention as soon as the updated forecast is released.

JASON PROGRAMMING

Key components

- Set of beliefs (belief base)
- Set of intentions

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- Set of beliefs (belief base)
- Set of intentions
- Plan library
- Set of events

Specifying initial beliefs and intentions

• Specifying beliefs

 \sim what agent knows at the beginning of the simulation

$$depot(5,5)$$
.

$$next(X,X+1)$$
.

Specifying intentions

 \sim what agent has to accomplish

```
!say_hello.
```

!find_gold.

 $!go_to(5,5)$.

!say_hello.

!say_hello.

In order to execute an intention there must be an appropriate plan:

```
+!say_hello <- .print("Hello").
```

Incorporating beliefs:

daytime(afternoon).
!say_hello.

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```
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!say_hello.
```

```
+!say_hello : daytime(morning) <- .print("Good morning").
+!say_hello : daytime(afternoon) <- .print("Good afternoon").
+!say_hello : daytime(evening) <- .print("Good evening").</pre>
```

Incorporating variables (starting with capital letters):

```
daytime(afternoon).
!say_hello("Bob").
```

```
+!say\_hello(X) \; : \; daytime(T) \; \leftarrow \; .print("Good ", T, ", ", X) \, .
```

$$\underbrace{+! \texttt{say_hello(X)}}_{\mbox{trigger}} : \underbrace{\frac{\texttt{daytime(T)}}{\texttt{context}}} < - \underbrace{\underbrace{.print("\texttt{Good}\ ", T, ", ", X)}_{\mbox{plan}\ / \mbox{subgoals}} \bullet$$

- Trigger what event does the plan handle
- Context condition when the plan is applicable
- Plan what has to be done in order to fulfil the intention

Variables get **unified**, i.e. they get the value matching the intention specification / belief base.

Triggers

	+ (additions)	- (removals)
Intentions	+! intention(args)	-!intention(args)
Beliefs	+belief(args)	-belief(args)

- Context Logical formula (using beliefs and percepts)
 a & b, a | b, not a (belief a is not present), ~a
 Percepts: pos(X,Y), cell(X,Y,T) (T=gold,depot,ally), carrying_gold, name(N), gsize(_,W,H)
- Plan subgoals to achieve (separated by ;)
 - Nesting intentions !subgoal
 - Environment actions do(left), do(right), do(up), do(down), do(pick), do(drop)
 - Internal actions e.g. .print("Hello")
 - Belief base manipulation +belief, -belief