

# BDI ARCHITECTURE

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BE4M36MAS - Multiagent systems

# Model-based goal-based agents

How to implement them and get actions from goals effectively?

## BELIEF-DESIRE-INTENTION

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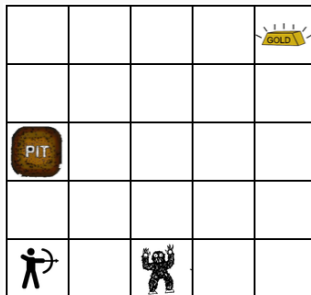
Model for programming autonomous agents using three concepts:

- **Beliefs**
- **Desires**
- **Intentions**



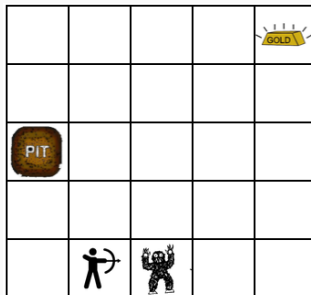
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*Example:*



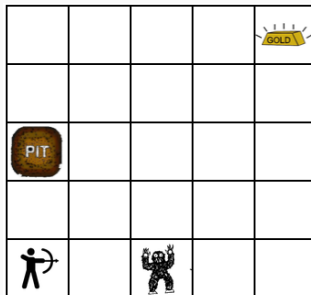
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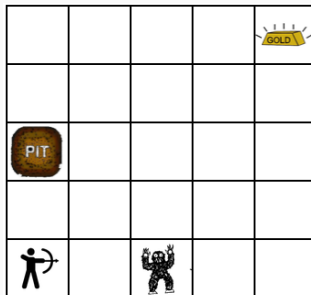
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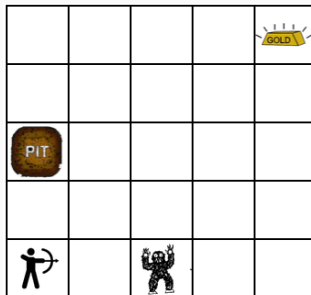
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# BELIEFS

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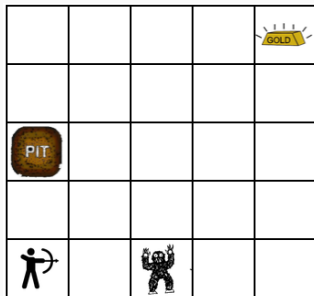
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```
breeze(0, 1). stench(1, 0).  
pos(0, 0). safe(0, 0).  
safe(0, 1). safe(1, 0).
```



Belief = Knowledge?

Beliefs **are not** knowledge!

- An agent may **believe** facts that are **not true**.

*Example:*

Weather forecast announces nice weather for the weekend.

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nice_weather(sat). nice_weather(sun).
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→ You can believe that, but you cannot take it for granted.

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*Example:* Communication between agents





~ 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
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*Example:* Vacuum cleaner — what desires does the agent have?





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- Intention do **persist**.
- Agent need **not intend** side effects





# PRACTICAL REASONING

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How do we turn **desires** into **actions** the agent performs?



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Decide what desires we want to accomplish at the moment

*Result:* intentions the agent is committed to accomplish

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# COMPONENTS OF PRACTICAL REASONING

The image shows a software interface for a grid world simulation. On the left, a 4x4 grid represents the world. The bottom-left cell contains a black stick figure with a bow, representing an agent. The top-right cell contains a yellow treasure chest icon with the word "GOLD" written on it. Above the grid is a dropdown menu labeled "Current world: -- Select world --".

On the right, there is a code editor window titled "Initialization". It contains a single line of code: `1 agent.go(agent.adjacent().random());`. Below the code editor is a "Run" button. A large red oval is drawn around the code editor area, and the text "BDI?" is written in large red letters across the center of the oval.



What if Roomba finds out that cables prevents it from going to another room?



~ indicate that an agent has **committed** 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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- **Open-minded commitment** — Agent drops his intention as soon as the updated forecast is released.

## INDIVIDUAL COMMITMENTS



## IMPLEMENTING BDI

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  - Desires
  - Intentions

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  - Events
  - Plans

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  - Desires
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  - **Plans**



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Agent responds to an event by executing appropriate **plan**

A plan has:

- **trigger** – what event (i.e., intention) it is able to handle
- **context** – under what circumstances the plan is applicable
- **body** – what actions/subgoals should the agent perform

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*Example:* Think of a plan for realizing !cleanup intention of a Roomba.

NEXT TUTORIAL

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## Assignment of the 1<sup>st</sup> semestral project

If possible, bring your computer with working Java environment (JDK + IDE), please