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Paulius Dilkas

School of Computing Science

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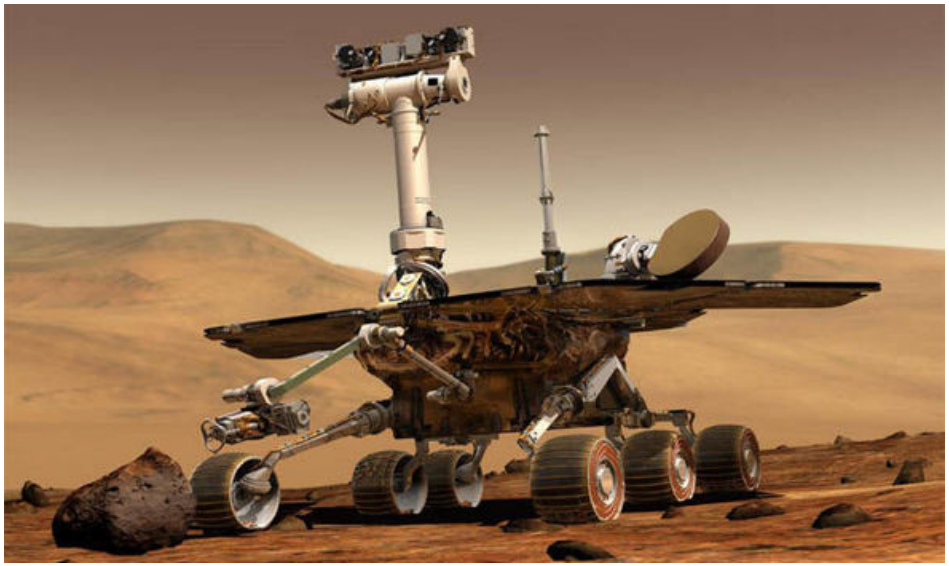
Motivation



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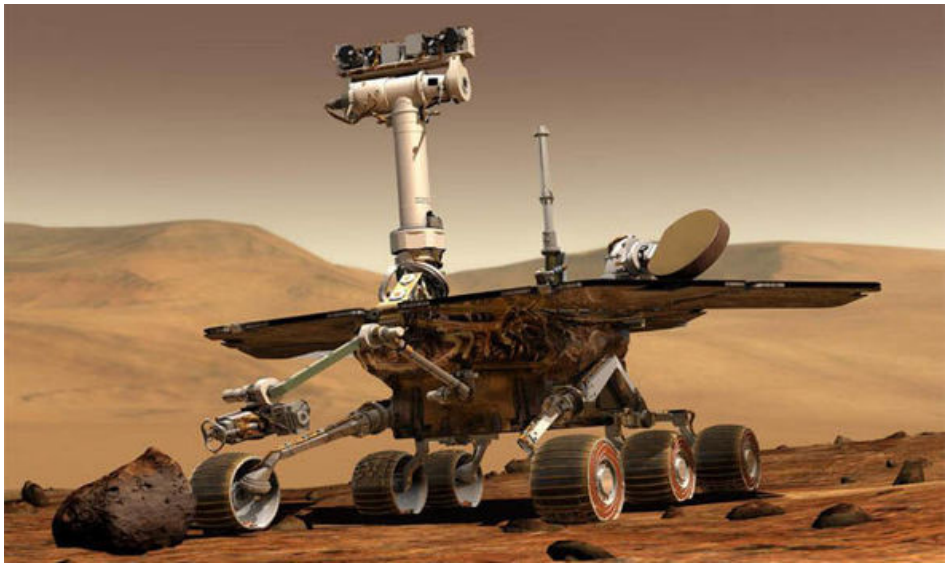

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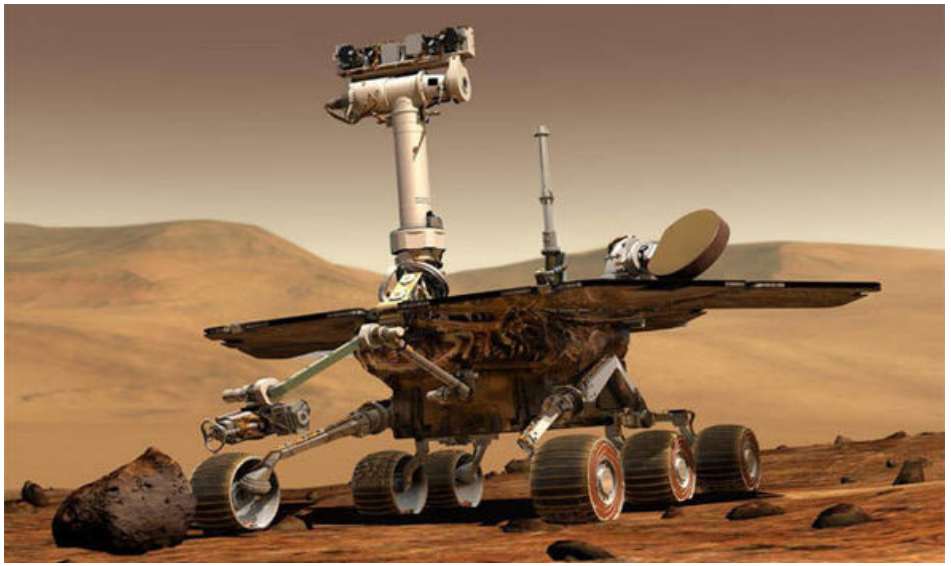

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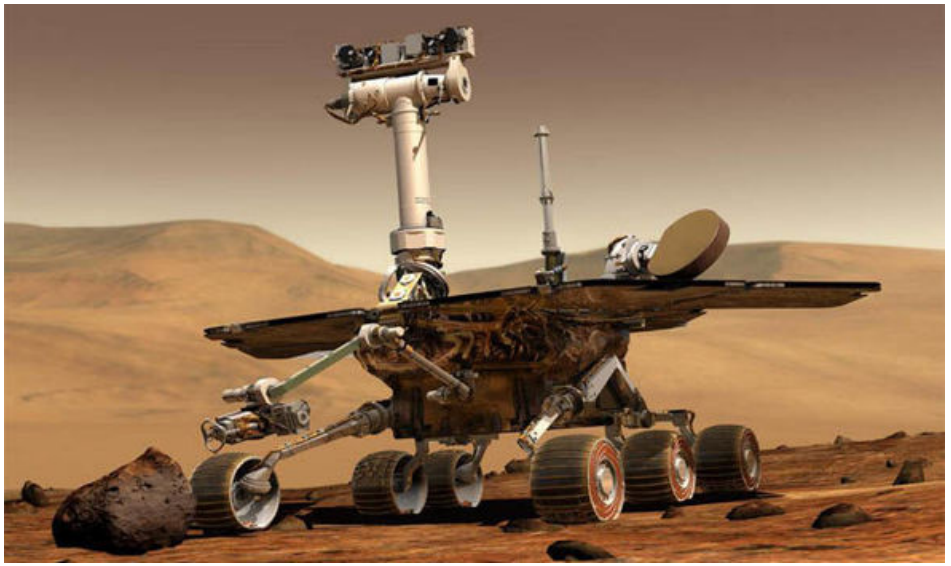
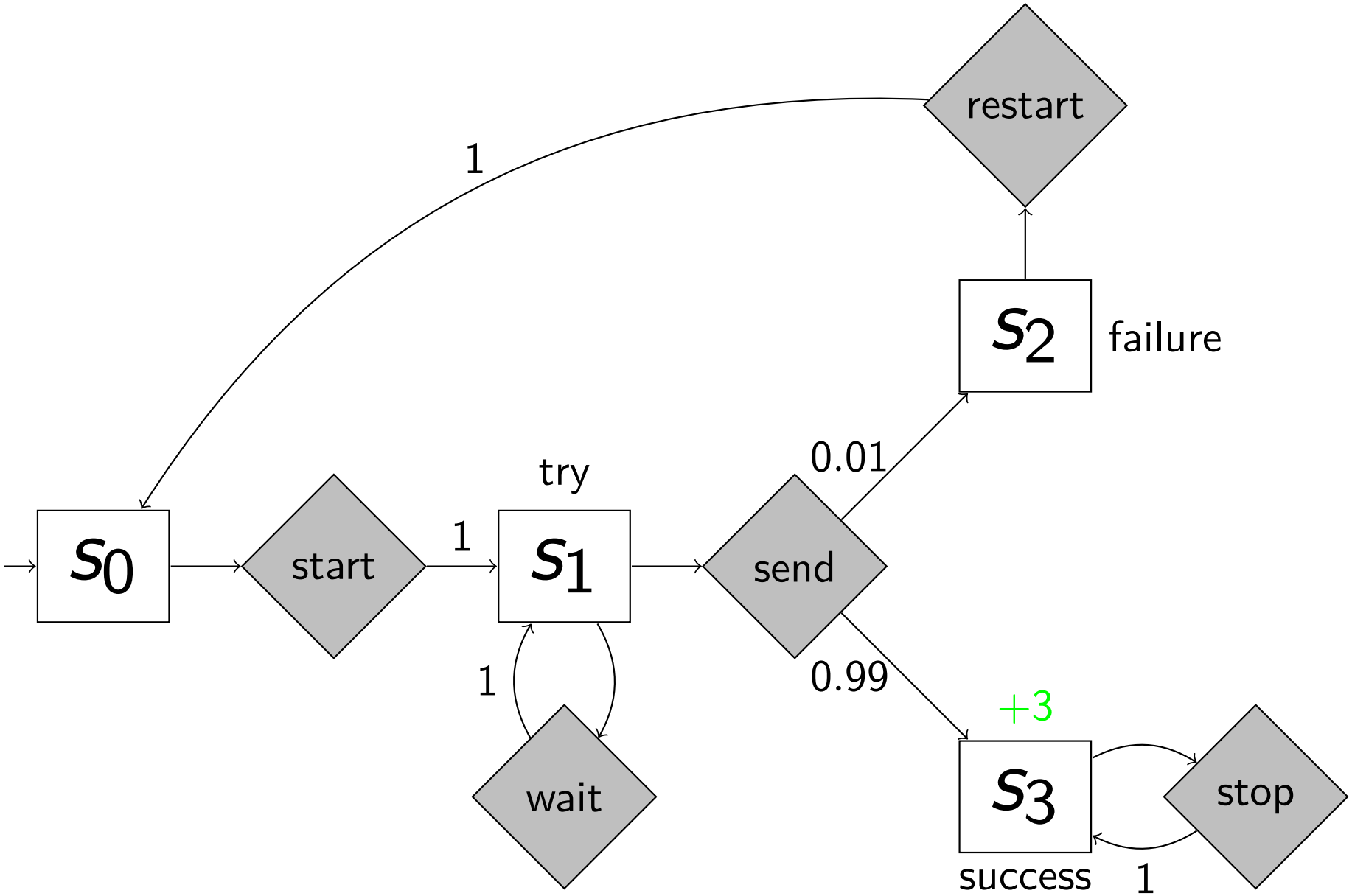


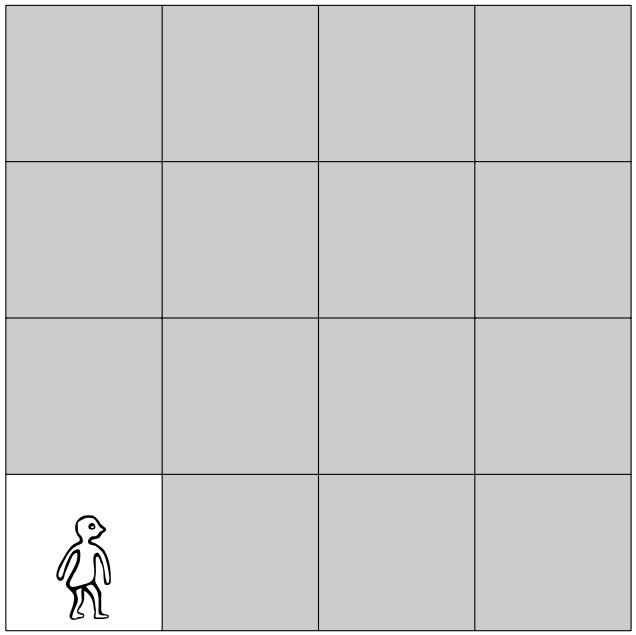
Markov Decision Process



Collecting Objects in a Grid

- Each cell is either visited or unvisited.
- When entering an unvisited cell, with probability p the agent may receive an object.
- Once a set number of objects is collected, the agent heads home.

Collecting Objects in a Grid



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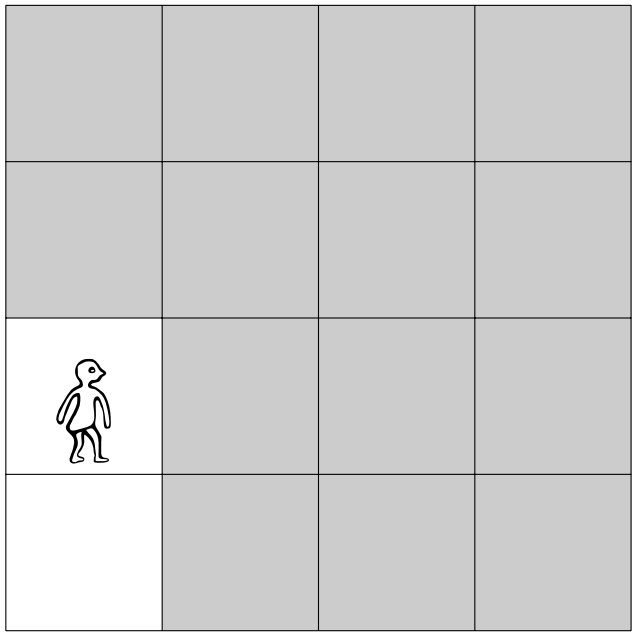

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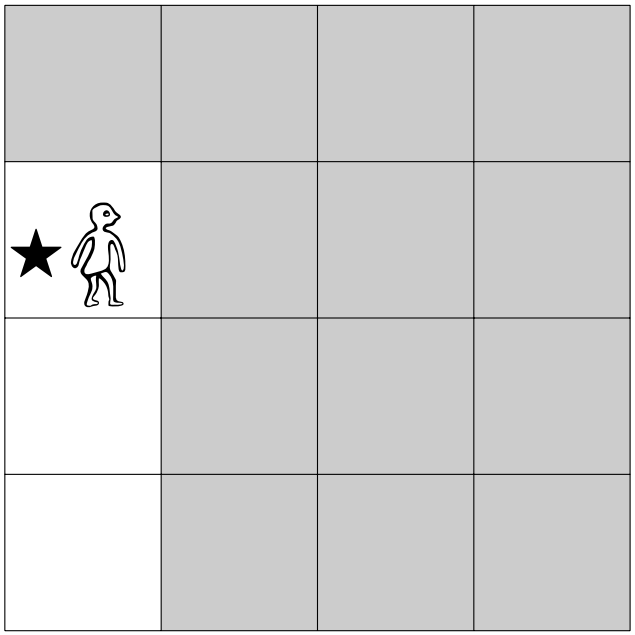

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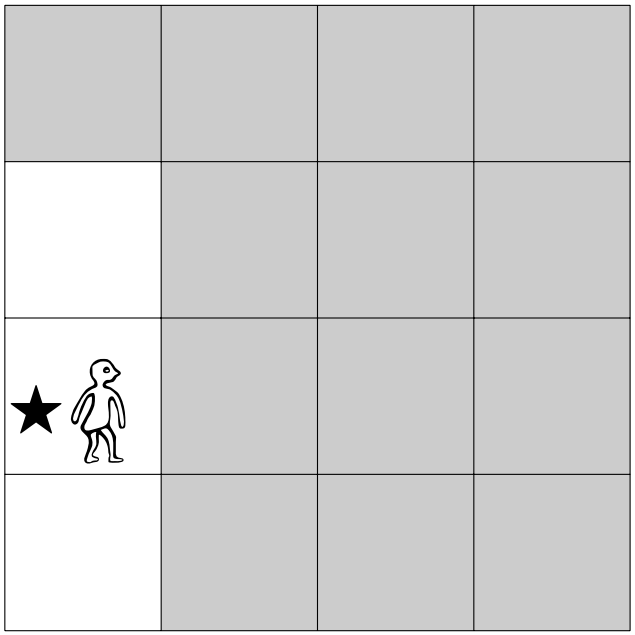

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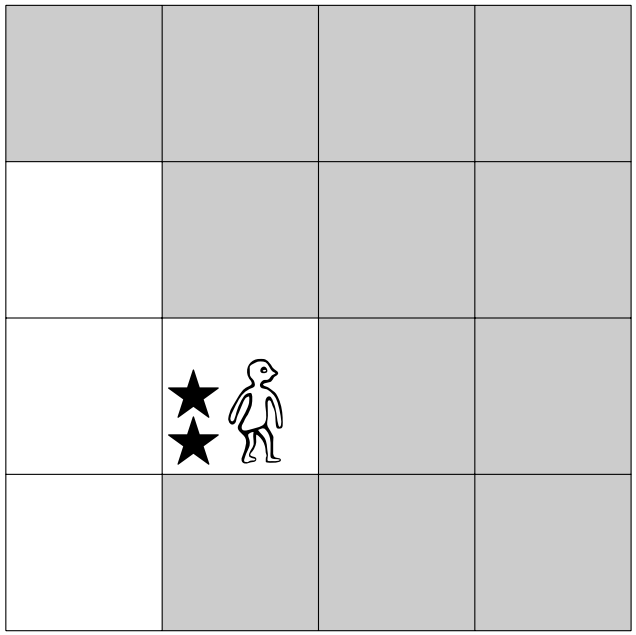

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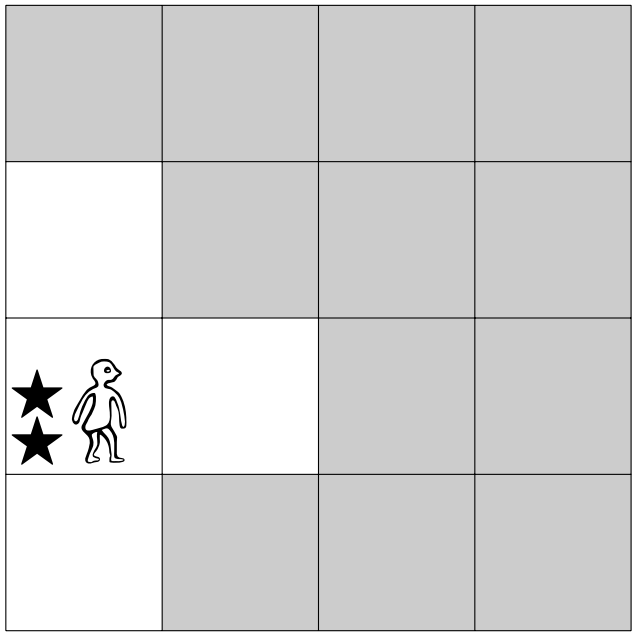
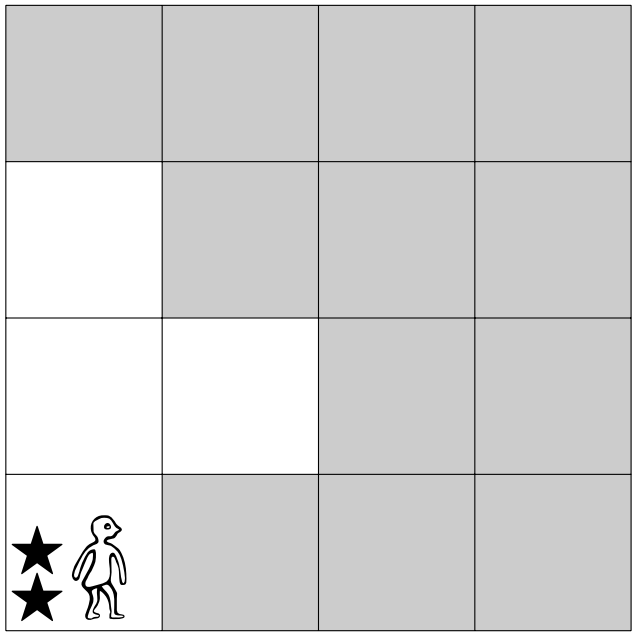


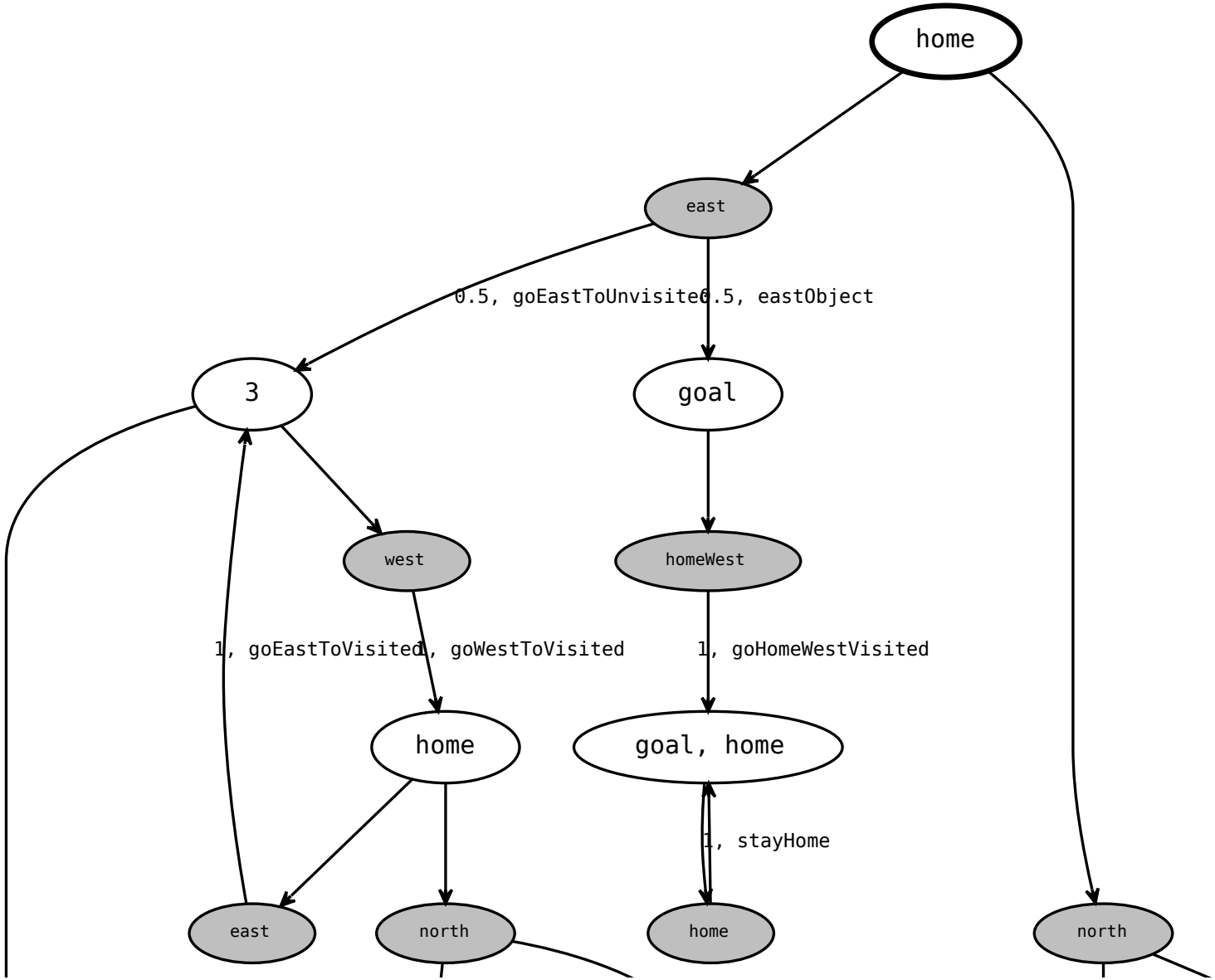
Collecting Objects in a Grid



A High Level View

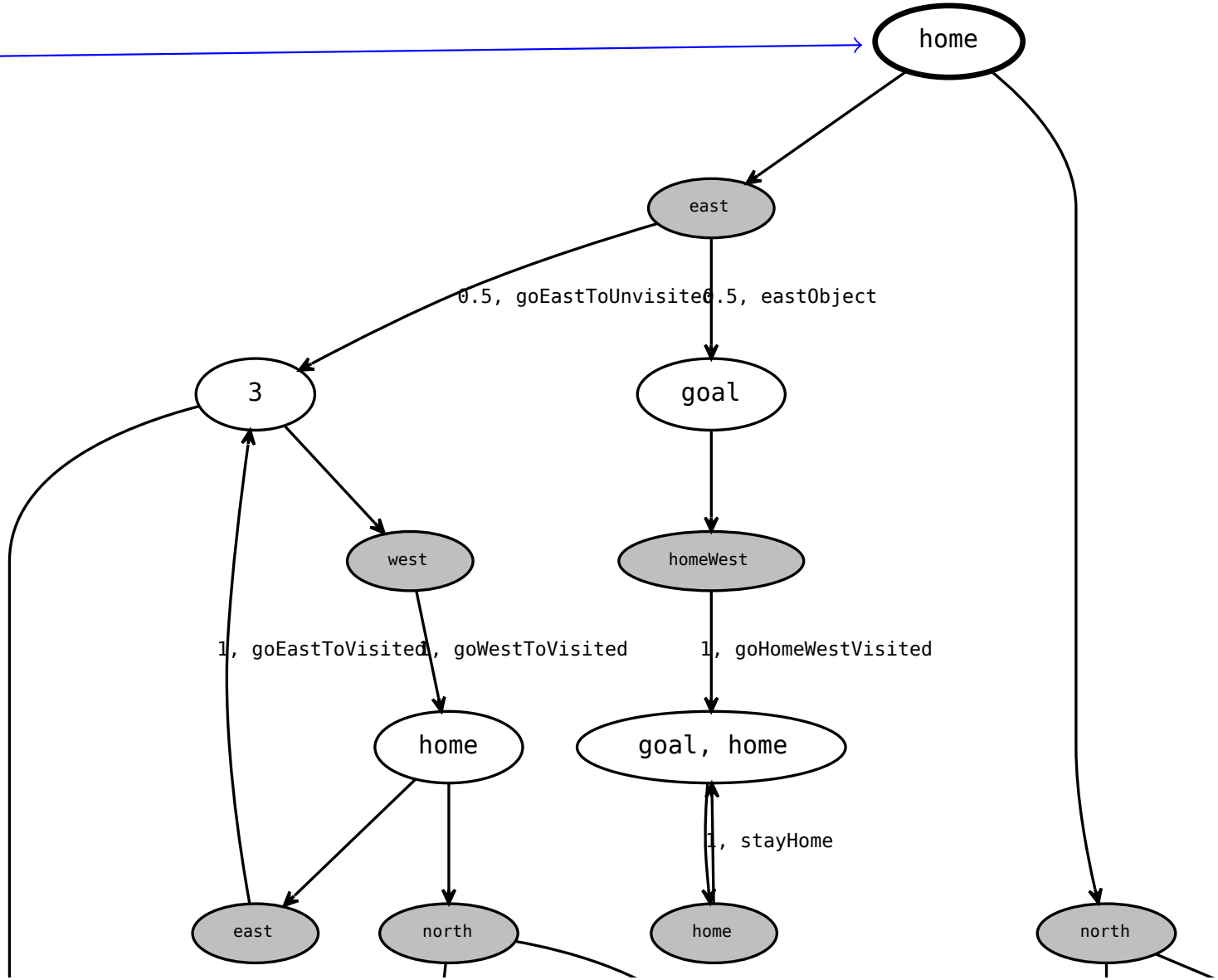
- Controls (types of nodes)
  - `Cell, Agent, Directions, Object`
  - `North, East, West, South`
  - `Visited, Unvisited`
- Predicates (properties to check)
  - `goal`: collected the required number of objects
  - `home`: is in the southwest corner of the grid
- Reaction rules (how the state changes)
  - Categorised into actions by direction
  - Different rules for going to visited and unvisited cells
  - Priority 1: going/staying home (5 rules)
  - Priority 2: 3 rules per direction
    - ★ visited
    - ★ unvisited
    - ★ unvisited + object

Transition System



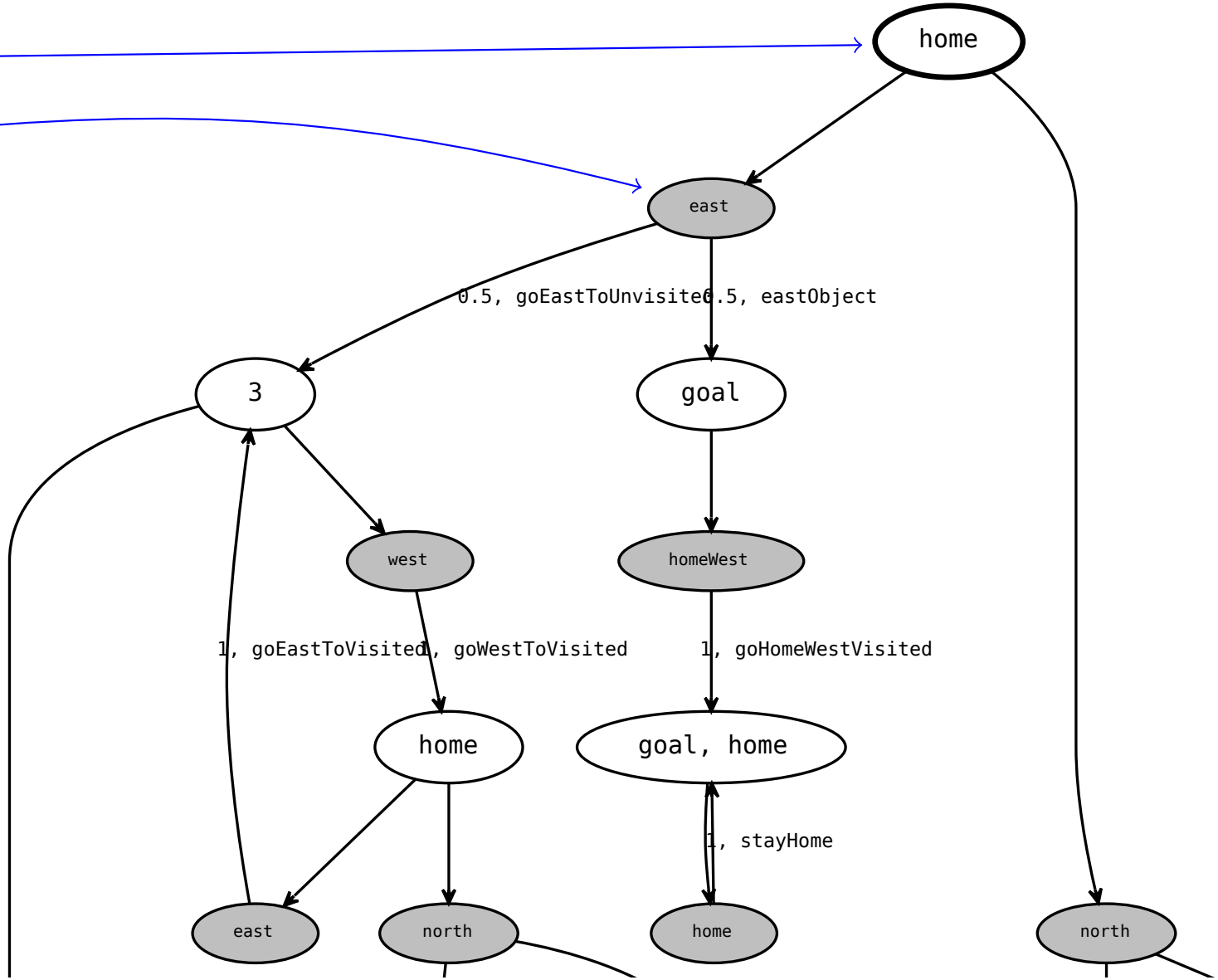
Transition System

- States



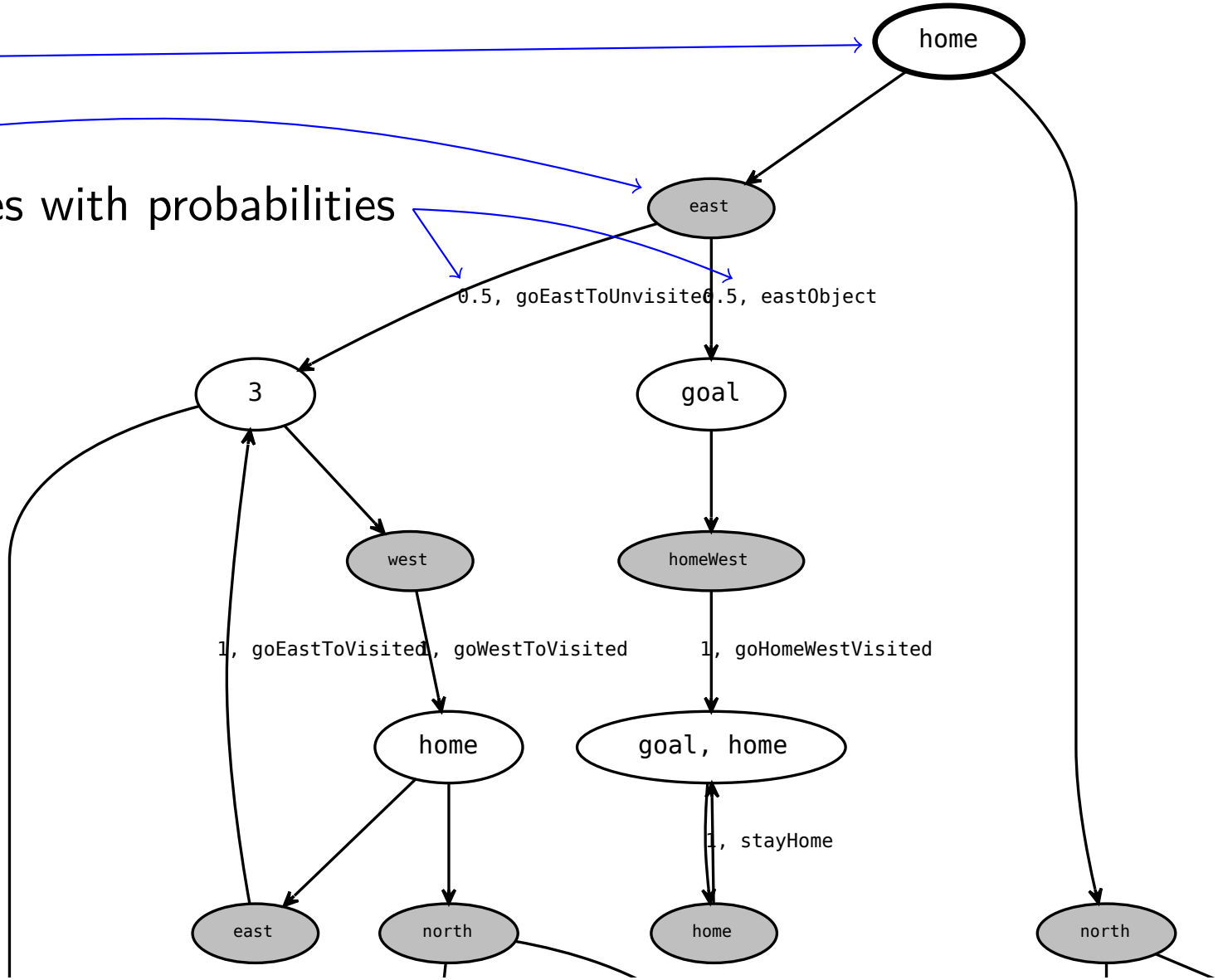
Transition System

- States
- Actions



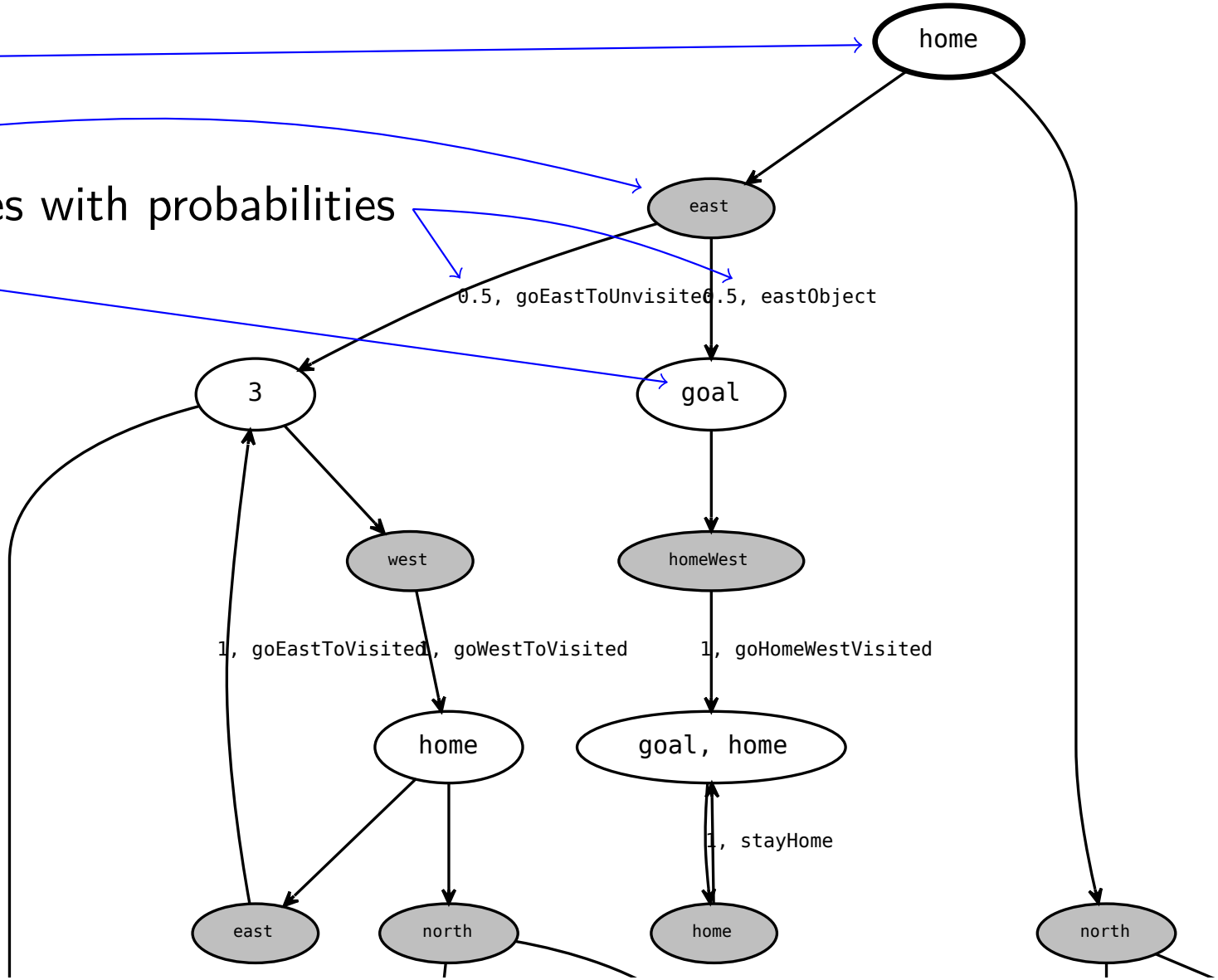
Transition System

- States
- Actions
- Reaction rules with probabilities



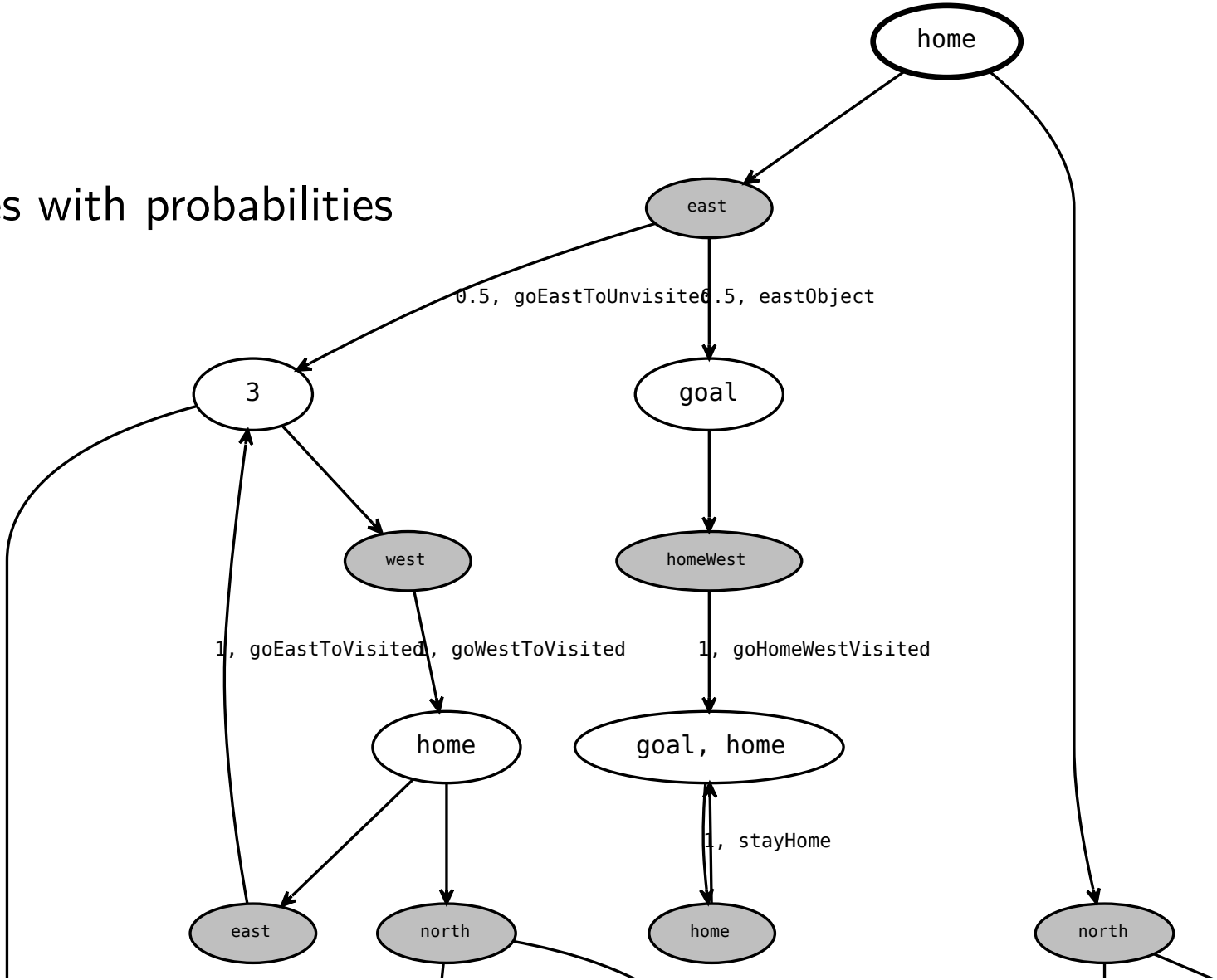
Transition System

- States
- Actions
- Reaction rules with probabilities
- Predicates

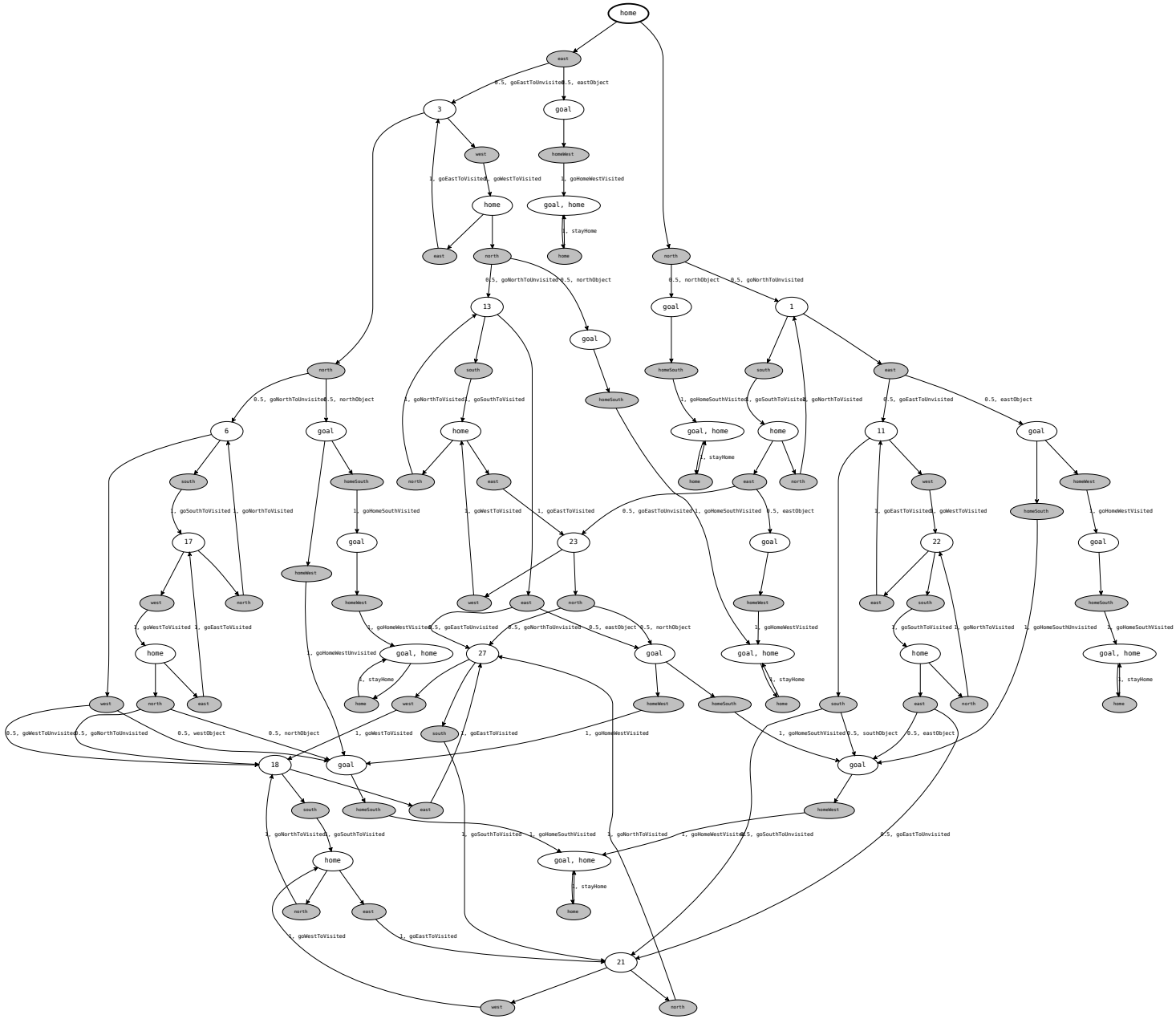


Transition System

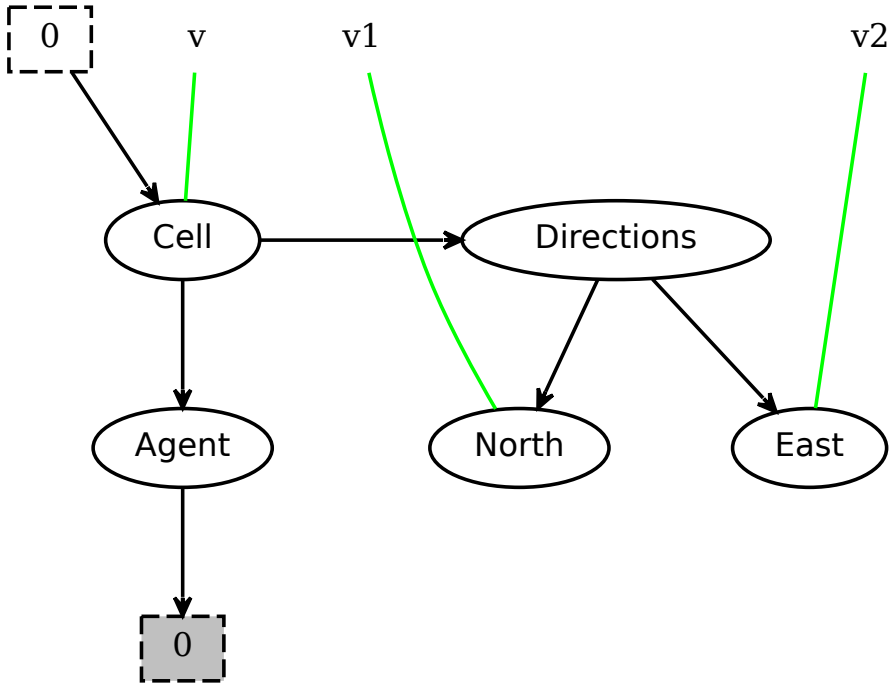
- States
- Actions
- Reaction rules with probabilities
- Predicates



Transition System

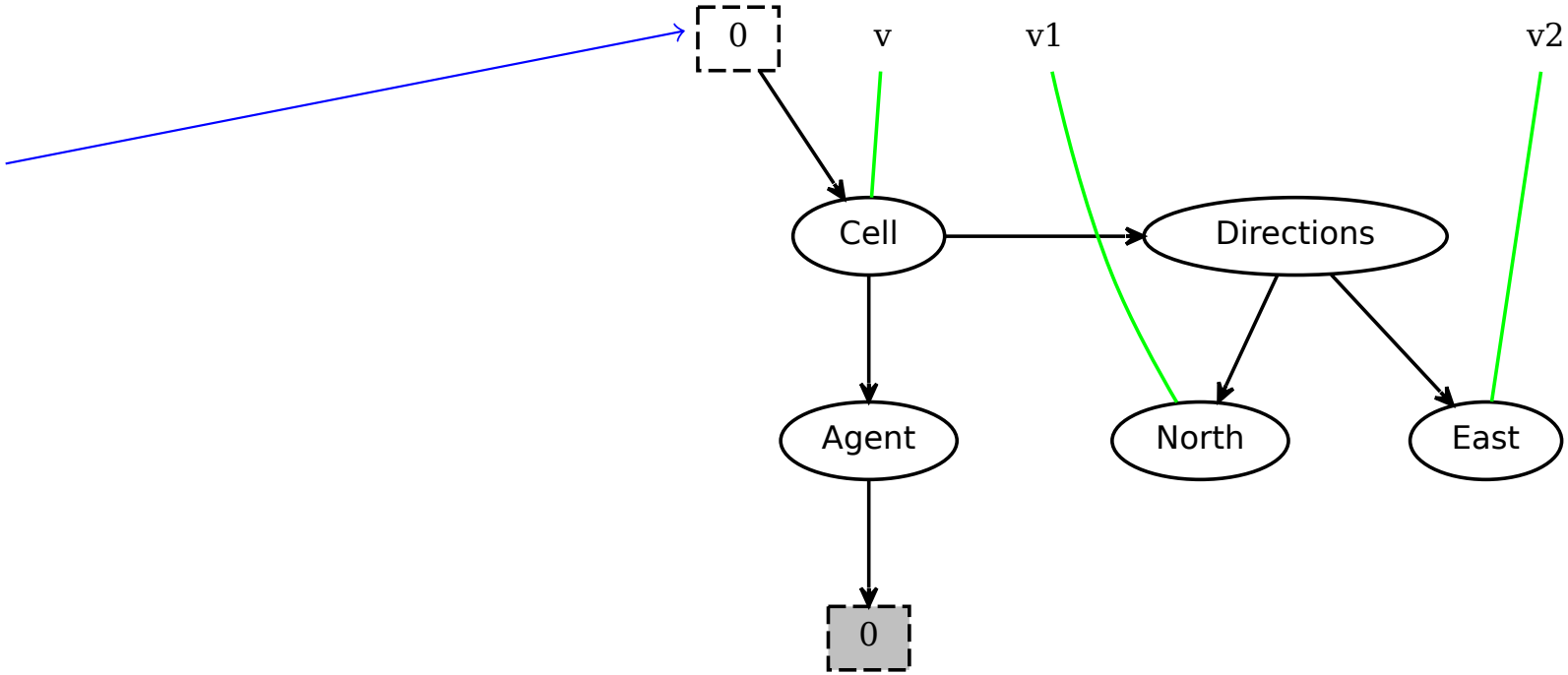


Bigraphs



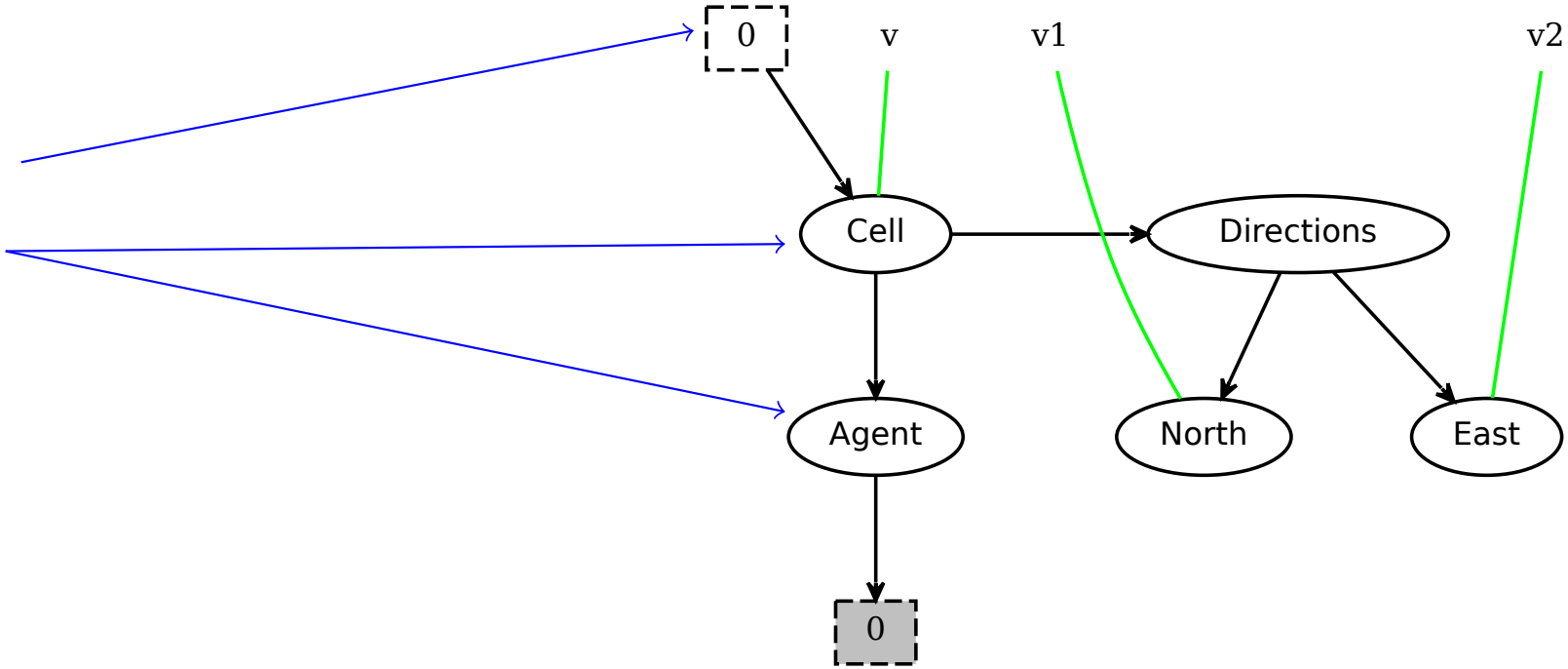
Bigraphs

- Region



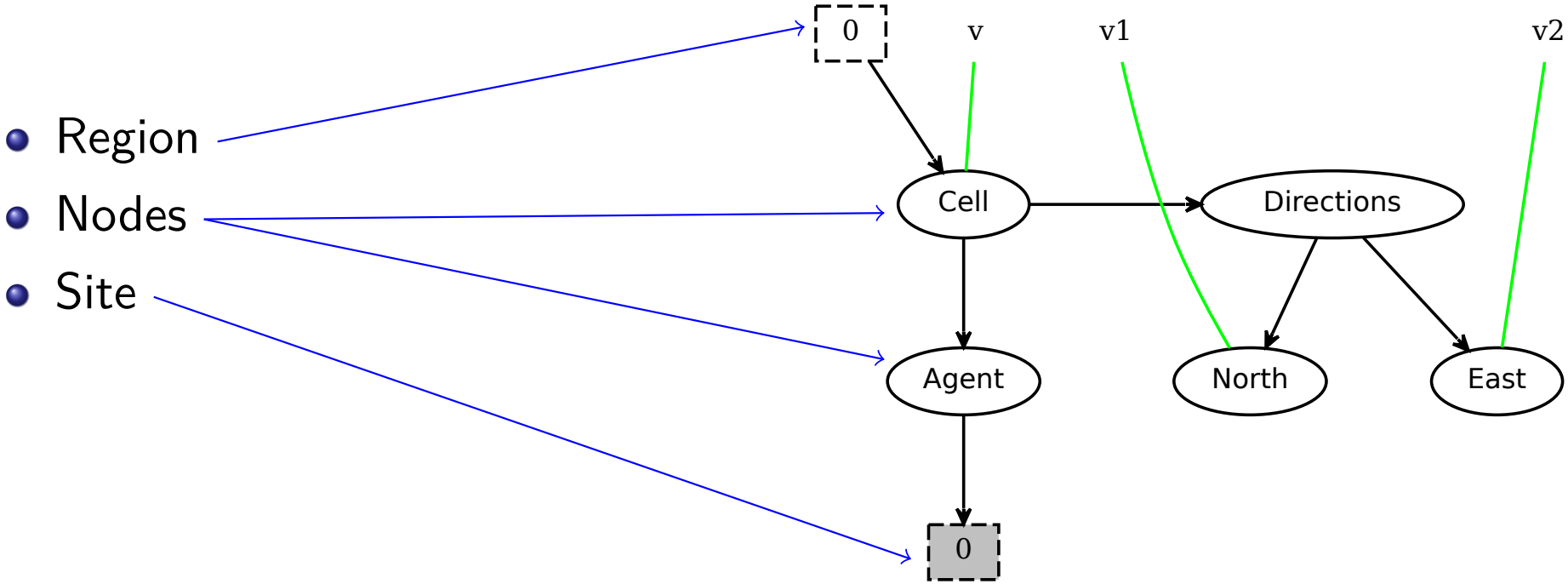
Bigraphs

- Region
- Nodes



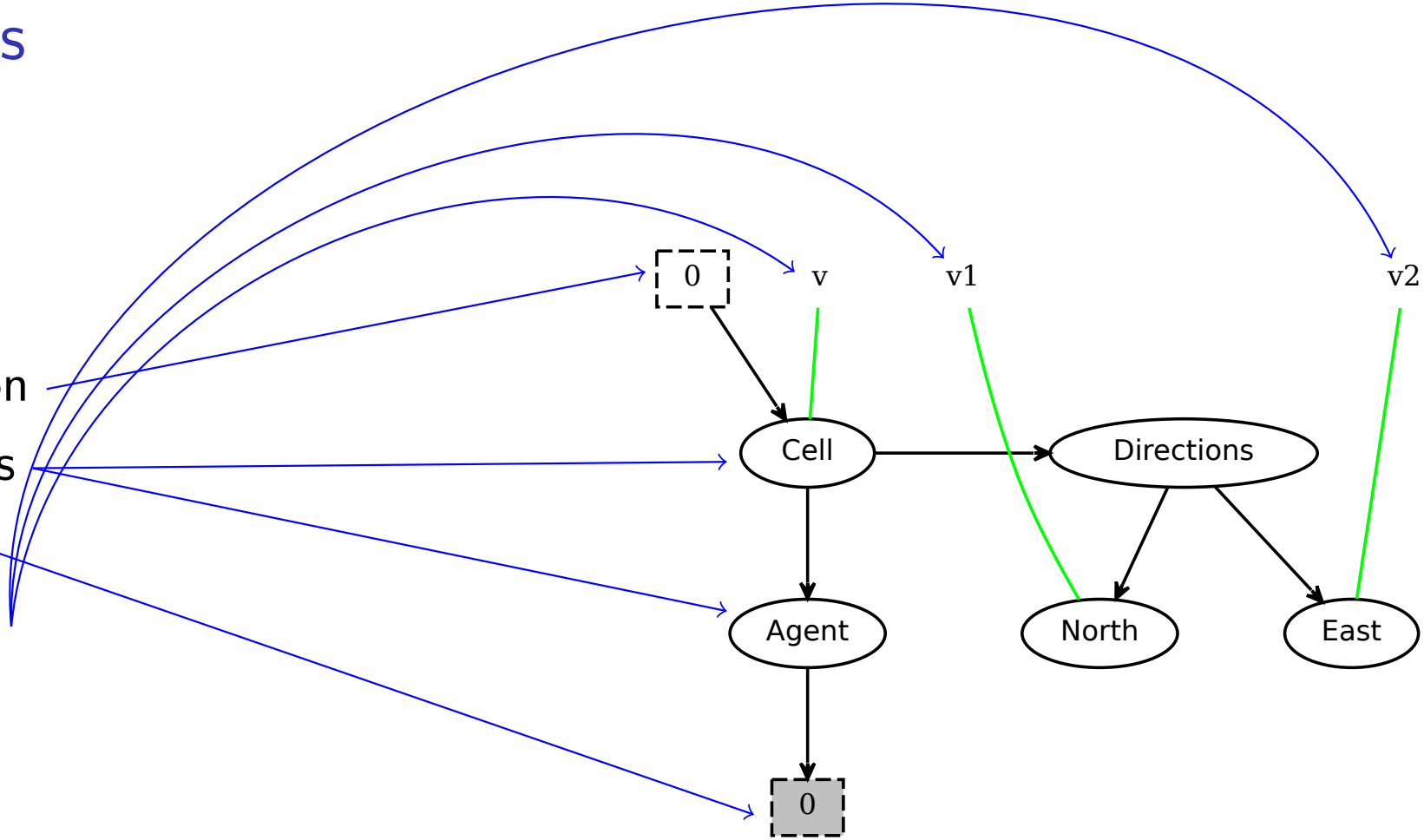
Bigraphs

- Region
- Nodes
- Site



Bigraphs

- Region
- Nodes
- Site
- Links



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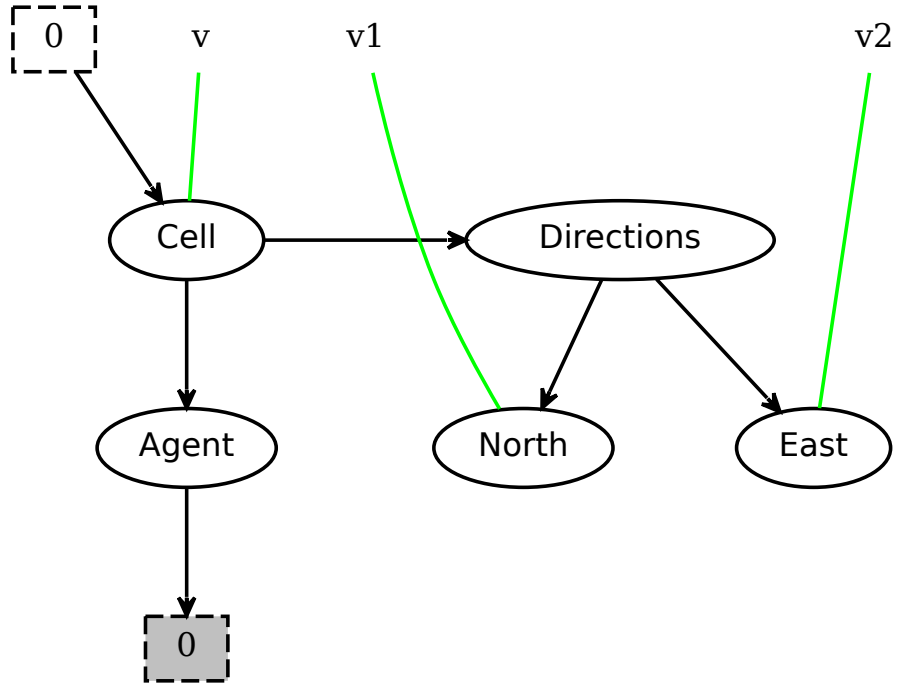


```
big home = Cell{v}.(Directions.(North{v1}
                              | East{v2})
                  | Agent);
```

A Tale of Schrödinger's Wall...

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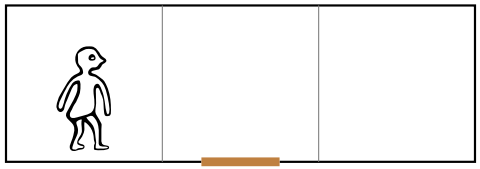

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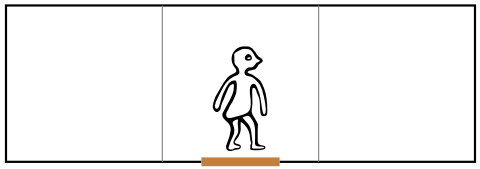

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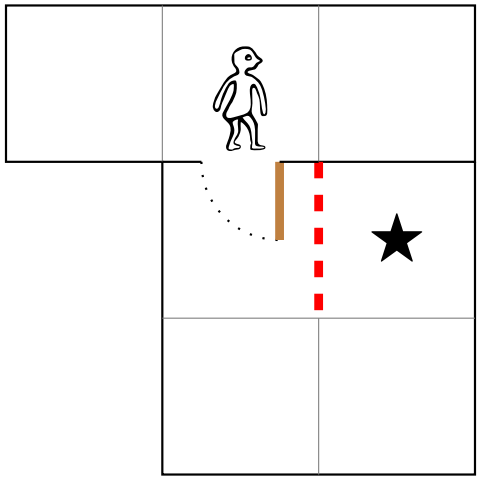

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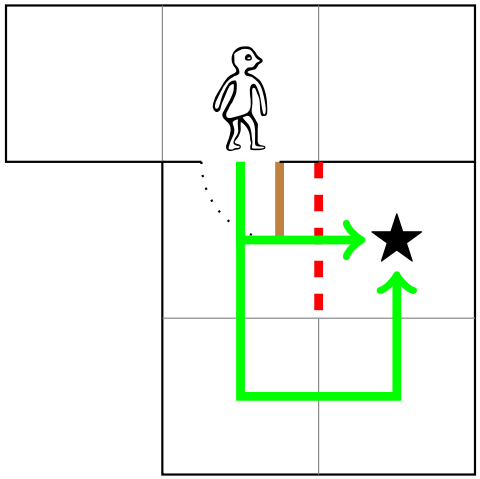
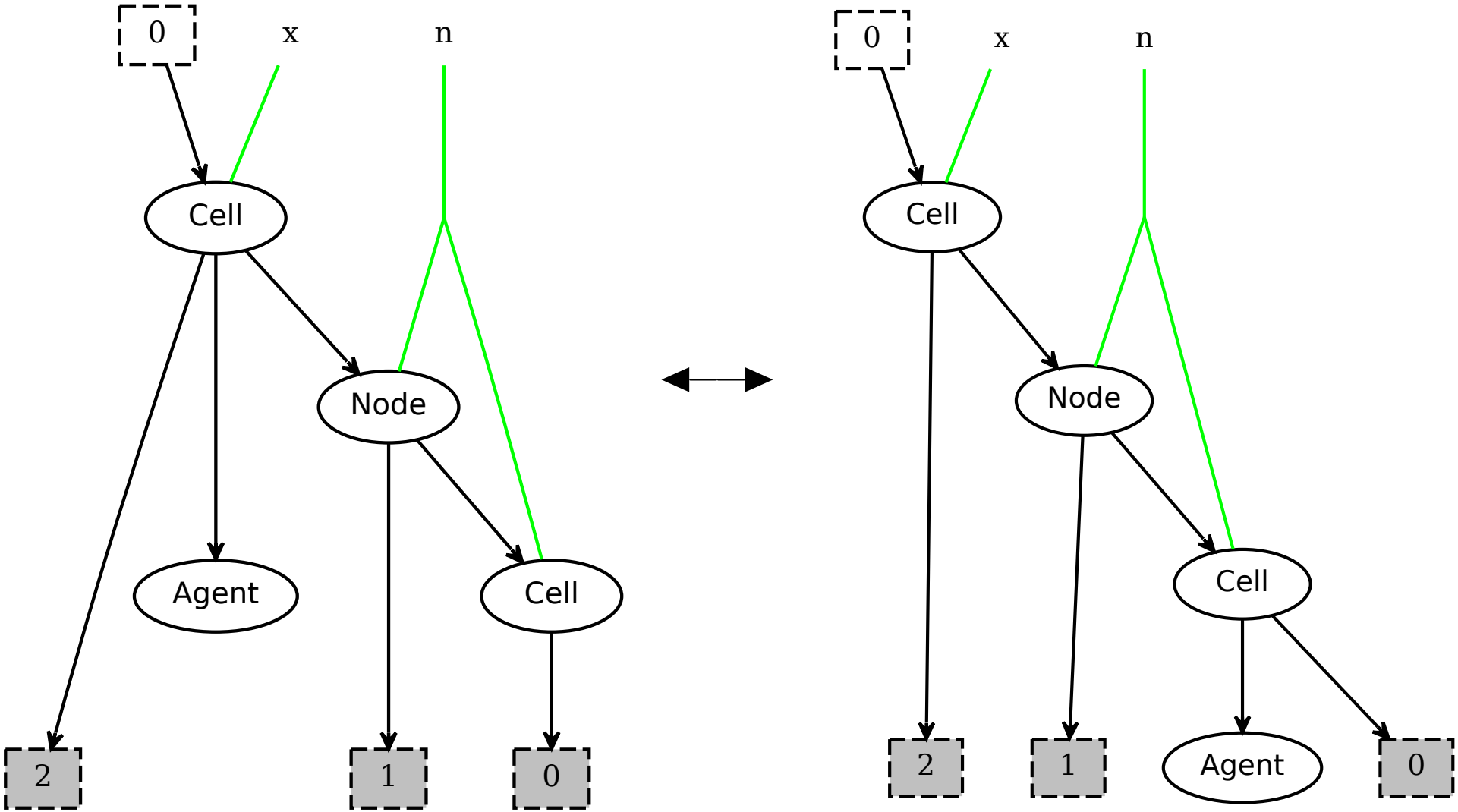


Reaction rules



Conclusions

+ A direct visual representation of the modelled situation
+ Easy to represent complicated spatial structures and uncertainty about them
+ Succinct and easy to modify
– Some simple ideas are impossible or hard to implement
– Not every aspect of a model can be exported for quantitative analysis
- More work to be done on probabilistic space