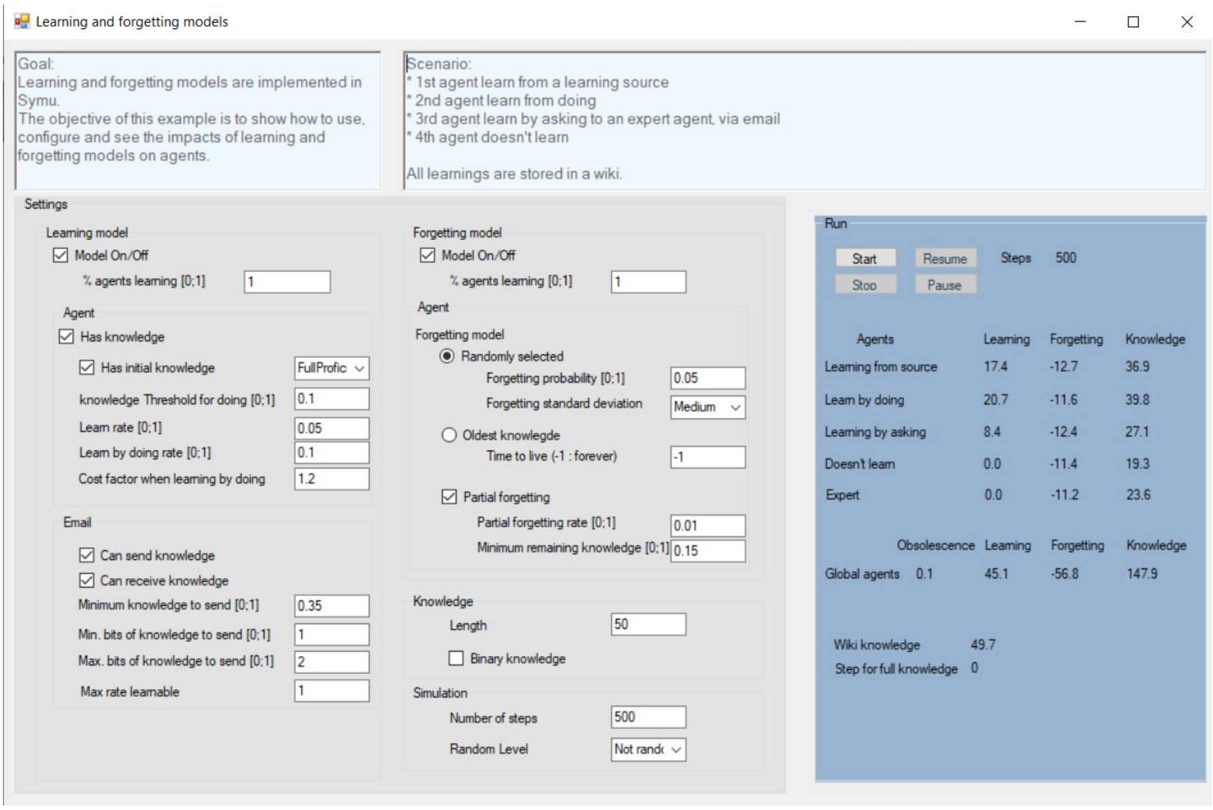
Knowledge, learning and forgetting models

Different models are implemented in this simulator. This example demonstrates the use of three of them: knowledge, learning and forgetting.



Goal:
Learning and forgetting models are implemented in Symu.
The objective of this example is to show how to use, configure and see the impacts of learning and forgetting models on agents.

Scenario:
* 1st agent learn from a learning source
* 2nd agent learn from doing
* 3rd agent learn by asking to an expert agent, via email
* 4th agent doesn't learn

All learnings are stored in a wiki.

Settings

Learning model
☑ Model On/Off
% agents learning [0;1] 1

Agent
☑ Has knowledge
☑ Has initial knowledge FullProfic
knowledge Threshold for doing [0;1] 0.1
Learn rate [0;1] 0.05
Learn by doing rate [0;1] 0.1
Cost factor when learning by doing 1.2

Email
☑ Can send knowledge
☑ Can receive knowledge
Minimum knowledge to send [0;1] 0.35
Min. bits of knowledge to send [0;1] 1
Max. bits of knowledge to send [0;1] 2
Max rate learnable 1

Forgetting model
☑ Model On/Off
% agents learning [0;1] 1

Agent
Forgetting model
● Randomly selected
Forgetting probability [0;1] 0.05
Forgetting standard deviation Medium
○ Oldest knowlegde
Time to live (-1 : forever) -1
☑ Partial forgetting
Partial forgetting rate [0;1] 0.01
Minimum remaining knowledge [0;1] 0.15

Knowledge
Length 50
☐ Binary knowledge

Simulation
Number of steps 500
Random Level Not rand

Run

Steps 500

Agents	Learning	Forgetting	Knowledge
Learning from source	17.4	-12.7	36.9
Learn by doing	20.7	-11.6	39.8
Learning by asking	8.4	-12.4	27.1
Doesn't learn	0.0	-11.4	19.3
Expert	0.0	-11.2	23.6

	Obsolescence	Learning	Forgetting	Knowledge
Global agents	0.1	45.1	-56.8	147.9

Wiki knowledge 49.7
Step for full knowledge 0

Knowledge model

Agents have the capacity to have initial knowledge, during the simulation (learning model). If an agent has initial knowledge, it is initialized randomly depending on the knowledge level. You can choose the level in a list from no knowledge to full knowledge.

Knowledge is defined by an array of bit of information between 0 and 1. The length of this array is a parameter between 0 to 100.

For example, the knowledge to use Symu can be defined as an array of 20 bits. If you don’t know anything about it, the array is filled with 0. If you have a full knowledge of it, it will be filled with 1.

Most of the case, the array will be filled randomly with 0/1 if the Binary Knowledge is chosen, or with float between [0; 1] otherwise.

Learning model

Agents have the capacity to learn new knowledge or information during the simulation.

There are different means to learn new knowledge: learning from a source of information, by interacting with another agent or by doing by itself.

This model is mainly defined by a rate of learning (learn rate and learn by doing rate). It defines how quickly an agent will learn new knowledge when interacting with other agents.

With a rate of 0.01, if an agent has initially a knowledge of 0.5, after a learning, its knowledge will be 0.5 +0.01 = 0.51.

Learning by doing

A special case is when an agent is doing by itself and gain knowledge. For that, agent must have a minimum of initial knowledge to do it by itself (knowledge threshold for doing) and it has a cost (cost factor), the associated task will take longer than if he already knew it, that is the cost of learning.

Message setup

Symu is a message-based system. So, every interaction occurs through a message, which have different medium. The learning is affected by the type of medium used to send/receive an information.

You can specify if an agent can send or receive knowledge. For example, a person can learn from a book. The book can be an agent that can send knowledge, but not receive knowledge.

A medium can send simple or complex information. It is defined as the number of bits it can send/receive. This note may be able to send you, for example, three bits of knowledge (for three models) about Symu and you will receive may be two of them.

It is useful if this note contains enough information (minimum knowledge to send) and if this information is learnable (maximum rate learnable).

Model of forgetting

The counterpart of learning is forgetting. Agents may forget knowledge or information if they are not solicited during the simulation. Using a bit of knowledge during a step is enough to be sure that this bit will not be forget today.

Forgetting has different modes: it could be random or based on the age of the information.

Randomly selected

You define a probability to forget, combined with the length of the knowledge, it will define the number of bits that will be forget during the day. If this rate = 0, agent will forget any bits of knowledge; if rate =1, every bit will be affected by the knowledge.

For example, if you don’t use Symu, with a forgetting rate of 0.1, you may loose 0.1* 20 bits = 2 bits of knowledge today.

Stander deviation define the level of randomness you want around the forgetting rate.

Oldest knowledge

If the oldest knowledge mode is selected, only the oldest knowledge is eligible to be forgotten. It is based on it’s TimeToLive parameter. If set to -1, information will last during the simulation, otherwise it is compared with the age if the information to decide to forget it or not.

Partial forgetting

Then you must define the how every bit of knowledge is affected. If partial forgetting is chosen, the partial forgetting rate define how much an agent loose at each step, otherwise, the bit is completely forgotten.

You can define the minimum level of information that left for each bit.

Models

Each model can be turn off or on. When the model is on, you can choose the percentage of agents that are impacted by the model. If 0 is chosen, any agent will be impacted, if 1 is chosen every agent will be impacted.