



## Chapter X

# On MASim: A Gallery of Behaviors in Small Societies

## Abstract

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*In this chapter we overview our simulation environment (Multi-Agent Systems Simulations [MASim]) that we developed, with the intention of studying behaviors in smaller societies of agents. We will give a gallery of selected recorded behaviors and brief comments on each.*

## Introduction

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In order to give agents the ability to make decisions, each agent shall start with an inborn movement schema, which is a series of movements used to form an agent's default path or directional pattern. In addition, for the purposes of creating an atmosphere where the agents learn and adapt to their environment, all agents are randomly placed within the environment.

To represent an agent's decision-making ability, each agent shall utilize two types of memory: exploratory and associative memory. An agent's exploratory

memory can be thought of as a basic system of sensors used to map the agent's immediate surroundings, while an agent's associative memory can be compared to a set of unique environmental snapshots ascertained through the agent's sensory system. An agent's associative memory is its decision-making apparatus. It creates images of the environment and places significance on those images in an attempt to aid the agent's efforts in finding food. An agent's exploratory memory deals more with an agent's relative positioning, steering agents clear of cycles and traps. An agent shall utilize its exploratory memory until food is found, at which point its exploratory memory is ported to the agent's associative memory.

Each agent will navigate through a randomly generated environment consisting of colored squares, obstacle squares, food squares, and other agents. The colored squares serve as *fuzzy* map elements for each agent, meaning the agent will see the colors of the squares as pieces of a whole, rather than storing specific paths.

Square colors and agent's direction are stored in an agent's associative memory, once food is found, referred to, and executed on a recognition-scale basis, meaning the higher the agent's recognition of the square type the more chance that agent will attempt to move onto that square type. For example, if an agent has several nodes in its associative memory where move is defined as *north*, the agent will always choose the move that offers the highest or most recognition. This is what is defined as the agent's *emotional context*.

The goal of the MASim project is to determine whether the use of fuzzy logic benefits the agents in their efforts to coordinate and adapt to the random environment they are placed in. Therefore, in terms of applying the above statement to the actual simulation, the purpose behind the simulation is to determine what parameters or settings, applied through the agents and the environment, work best in demonstrating an upward trend in agent learning ability as it pertains to agent motivation, which in this case is finding food. Thus, the ultimate measure of a successful simulation shall be determined by agent confidence, which reflects the amount of *correct moves toward food* made using associative memory. For example, if an agent moves north onto a red square and that move exists in its associative memory, the agent will execute the next move as determined by its associative memory, which is, let's say for this example, west onto a yellow square. If the agent moves west onto a yellow square its confidence will increase, else confidence decreases, meaning when the agent moved west it did not encounter a yellow square.

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