Ants Game Design

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1 Introduction

This document will describe a design for the game *Ants* (this title is only a suggestion). Ants is a *Real Time Strategy* (RTS) game, in a similar mold to such titles as *The Age of Empire* or *The Settlers* series.

You play as the queen of an ant colony. As queen, you have complete control of the colony, and its development. You can choose between creating several different types of ants (described below), which serve the colony in different ways. It is your task to coordinates the colony's units, while balancing competing demands, to achieve a goal.

Ants is a three-dimensional game, played from an aerial perspective; in a similar style to the NeoAxis RTS Demo.

2 Setting

Ants will be played in two modes. *Conquest* mode is played on a randomly generated map where the objective of the game is to defeat all enemies. The *puzzle* mode of play will be where a specific objective must be achieved, such as navigating your queen across some sort of obstacle, such as a rivulet.

3 Game play

All games initially start with a nursery, several builder and forager ants. The nursery is where you, the queen lives, it is the only building that cannot be replaced. Destroying a colony's nursery results in the death of the queen and the destruction of the colony.

4 Maps

Maps will consist of different types of terrain. The map will initially be blackened, except for a small area around the nursery. The map will be revealed as ants from your colony explore. If an area of the map has not been explored by an ant from your colony for a certain amount of time it will become grey and

eventually black again. While the map is blackened its state can change, for example, an area of the map that had previously contained a food source could be replaced by a human foot print when next revealed. Characteristics common to all maps will include:

- Squares where ants cannot enter, such as steep gradients.
- Squares where ants can enter, but entry will result in the ants death, such as water.
- Food sources that the ants can harvest to produce energy.
- Building material sources that the ants can collect to construct new buildings.

Weather will also be associated with each type of terrain. Tropical terrains will frequently have rain, which causes the map to change by creating new rivulets and water bodies, which could cause buildings or ants in shallow regions to be drowned.

5 Generic Ant Characteristics

All ants will have such attributes as:

- *cost*: the energy required to create an ant.
- *health*: the individual ant's health, which when equal to zero results in the ant's destruction.
- *strength*: the ant's propensity to work, capacity to carry stuff.
- *vision*: the distance an ant can see. Vision relates to the ant's ability to detect percepts in its surroundings.
- *directional sense*: the propensity for an ant to move in the direction in which it is commanded.
- *pheromone intensity*: the concentration of pheromone an ant lays when moving.

5.1 Ant movement

Ants remain stationary until they are issued a command to move. Ants decide on a direction to move by a combination of directional sense and pheromone intensity. An isolated ant, one where the intensity of pheromone around it is zero, will move in the intended direction with a certain probability proportional to its directional sense.

When ants move they lay pheromones (in varying quantities) on the ground, thus marking a path by a trail of pheromones. Pheromone continually evaporates at the same rate across the map. For an ant to detect a trail it must have

been traversed by an ant within a certain amount of time. An ant encountering a previously laid pheromone trail can detect and decide with high probability to follow it, thus reinforcing the trail with its own pheromones. The more the ants follow a trail, the more attractive that trail becomes and the more ants follow it. The probability of an ant following a path increases with the number of ants that have previously traversed the path.

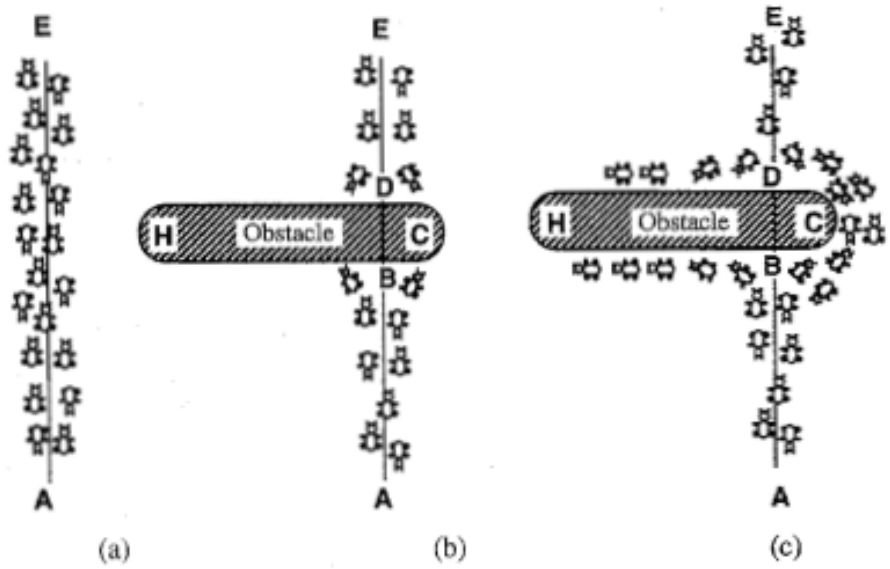

Figure 1: An example of real ants. (a) Ants follow a path between point A and E. (b) An obstacle is introduced; ants can choose to go around it following one of the two different paths with equal probability. (c) On the shorter path more pheromone is laid down [1].

Assume there is a path along which ants are walking, from the nest at A to a food source at E, and visa verse (see Figure 1 (a)). If an obstacle suddenly appears on that path, the ants will be cut-off from the pheromone trail. At position B, the ants walking from A to E have to decide whether to turn right or left (Figure 1 (b)). The choice is influenced by the intensity of the pheromone trail. The first ant to encounter the obstacle will have an equal probability of turning right or left, as there is no pheromone on either path. Because path BCD is shorter than path BHD, the first ant following it will reach D before the first ant following BHD (Figure 1 (c)). The result is that an ant returning from E to D will find a stronger trail on path DCB, causing it to favour this path. The quantity of pheromone on the shorter path will grow faster than on the longer one. The probability with which any single ant chooses the path to follow is quickly biased towards the shorter one, until eventually all ants choose the short path because all the pheromone would have evaporated from the longer path.

6 Ant Guilds

You can choose between creating ants from several different guilds. With more energy and time better ants from each guild can be created. Ant guilds include:

6.1 Foragers

Forage ants can be sent out across the map to collect the raw materials needed by the colony, such as food and building materials. Foragers are cheap to create and are able to carry several times their own weight in raw material.

Forager ants can be issued commands to collect raw material, by selecting one or more forager ants, clicking the *collect* button and then clicking on the raw material to be foraged. The forager ants will then navigate a path to the raw material, as described in Section 5.1, collect a certain quantity depending on their strength and then follow the same path to the storage building where they will deposit their raw material. The Foragers will then continually repeat these steps until all the raw material has been collected.

Figure 2: The honey ant; improved foragers could resemble this ant.

As the game progresses better foragers can be created. Improved foragers are able to see further and thus navigate more direct paths to raw material. Improved foragers can also carry more stuff, such as the Honey ant (see Figure 2), and therefore take less time to deplete the raw materials.

6.2 Warriors

There are several different warrior ants that can be used to do battle against rival colonies. Ants generally fight other ants with 'hand-to-hand' or 'pincer-to-pincer' combat. Warrior ants are robust units, however they have low intellect. Warrior ants can be directed towards an enemy, they will then march in single file towards the energy and fight pincer-to-pincer to the death.

As the game progresses better warriors can be created. Improved warriors can move more quickly and are more effective killers.

6.3 Builders

Builder ants use the building materials collected by foragers to construct new building. Examples of the type of buildings that can be built include:

- *Defences*, such as walls and watch towers that can be used to protect the colony from predators, other colonies.
- A *storage building*, that are need to store building supplies and food. A storage building allows the colony to collect a positive balance of energy that decreases very slowly, whereas without a food storage building the colony's energy decreases more rapidly.
- A *barracks* for housing and training warrior ants.

References

[1] An System: Optimization by a Colony of Cooperating Agents. Marco Dorigo, Vittorio Maniezzo, and Alberto Colorni. IEEE Transactions On Systems, Man, And Cybernetica-Part B: Cybernetics. Vol. 26, No. 1, February 1996.