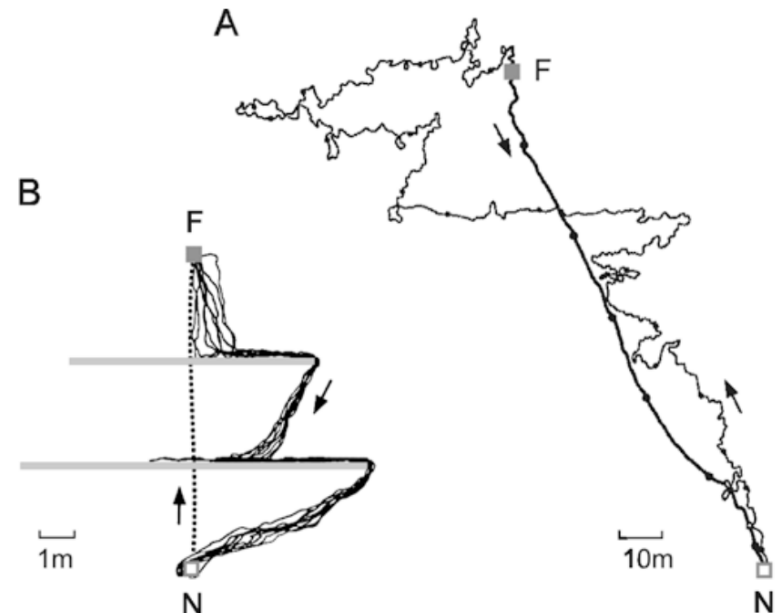


Desert Ant Behaviour: Simulating Movement and Navigation

W. Vollprecht und G. Wiedebach

1. Introduction

- Our aim: Creating an adequate model of ant behaviour:
 - Finding food
 - Navigation by global vector
 - Navigation by landmarks



1. Introduction

Navigation: Global vector

- Ants in our hemisphere create paths through pheromone tracks
- Harsh environment in deserts
→ no pheromone tracks
- Path integration
 - Polarized light from sun → biological compass
 - Step counter



1. Introduction

Navigation: Local vectors

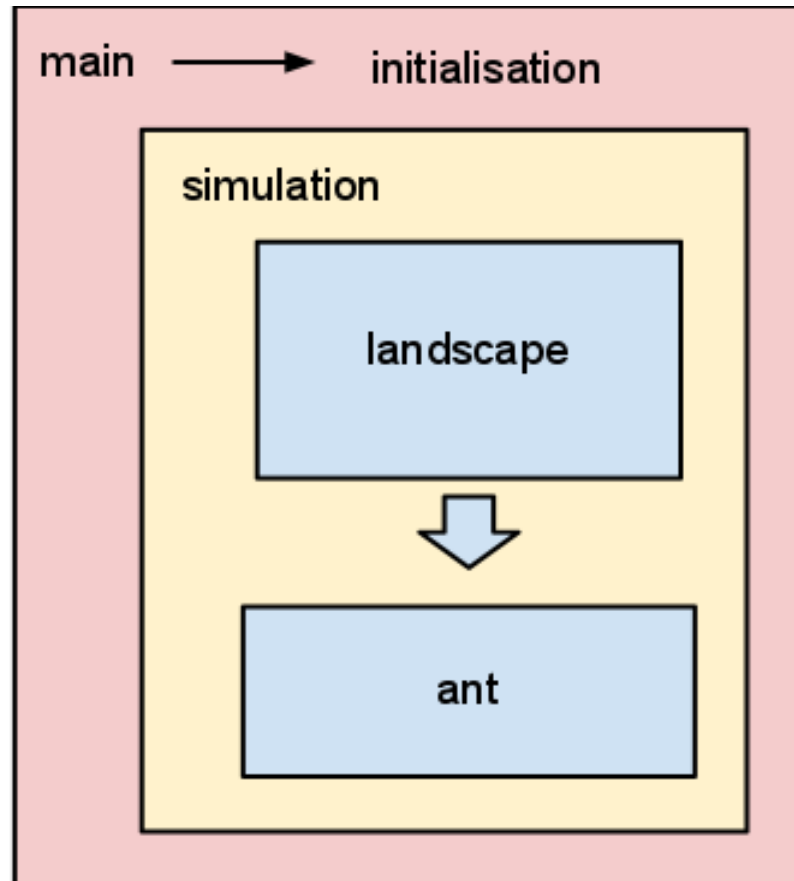
- Experiments show: ants navigate by landmarks
- Inhibits navigation by global vector

1. Introduction

What we want to measure

- How efficient is navigation by landmarks/global vector?
 - Steps needed for finding food
 - Steps needed for return
- How do landmarks influence the efficiency of the food finding process?
 - Path should be shorter after some runs

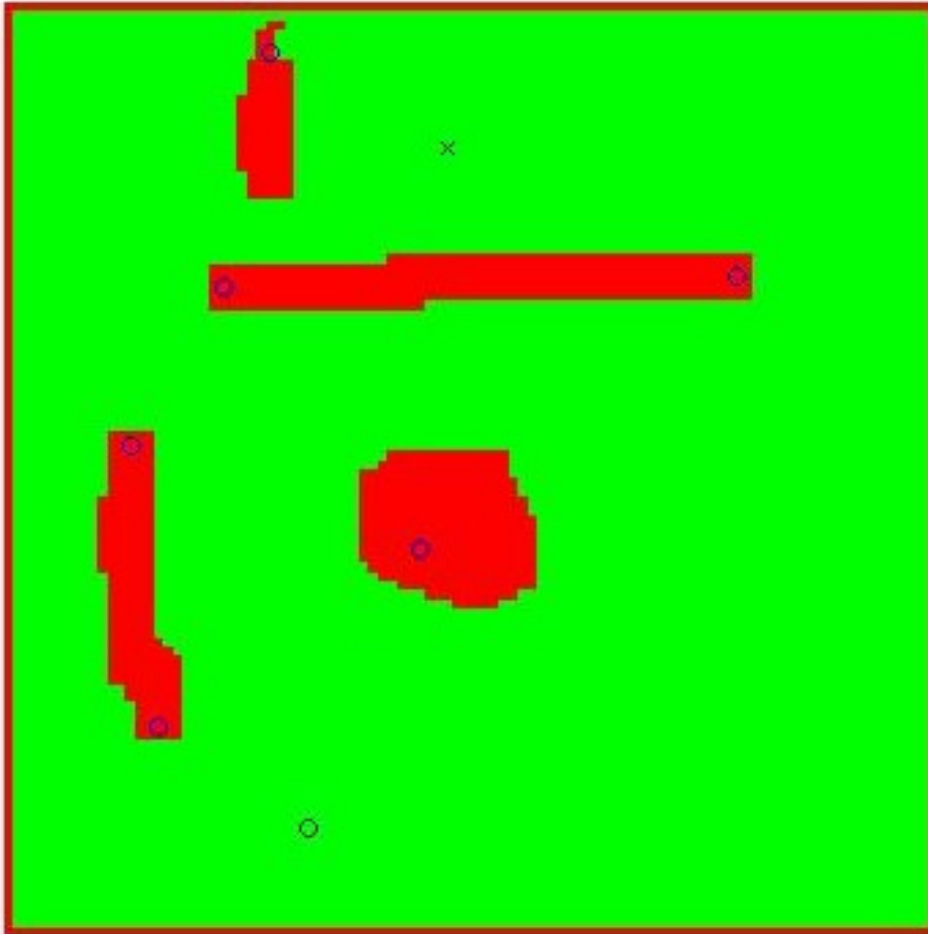
2. Model & Implementation



2. Model & Implementation Simplifications

- Fixed boundaries
- Only global vector when homing
- Detection radius to detect food/landmarks/nest

2. Model & Implementation Landscape

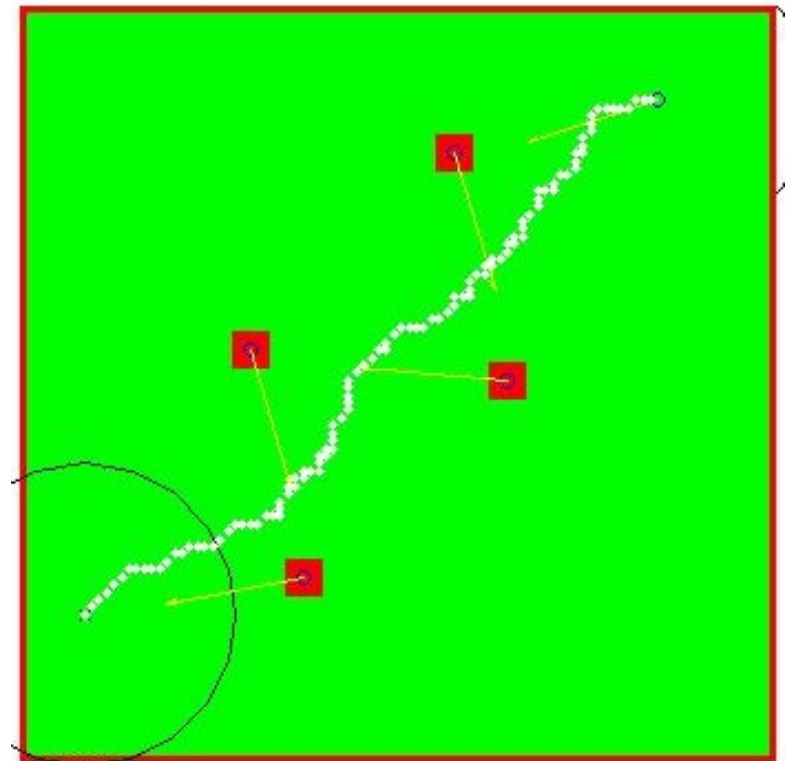


- Nest
- Feeder
- Landmark
- Obstacles

2. Model & Implementation

Ant: Properties

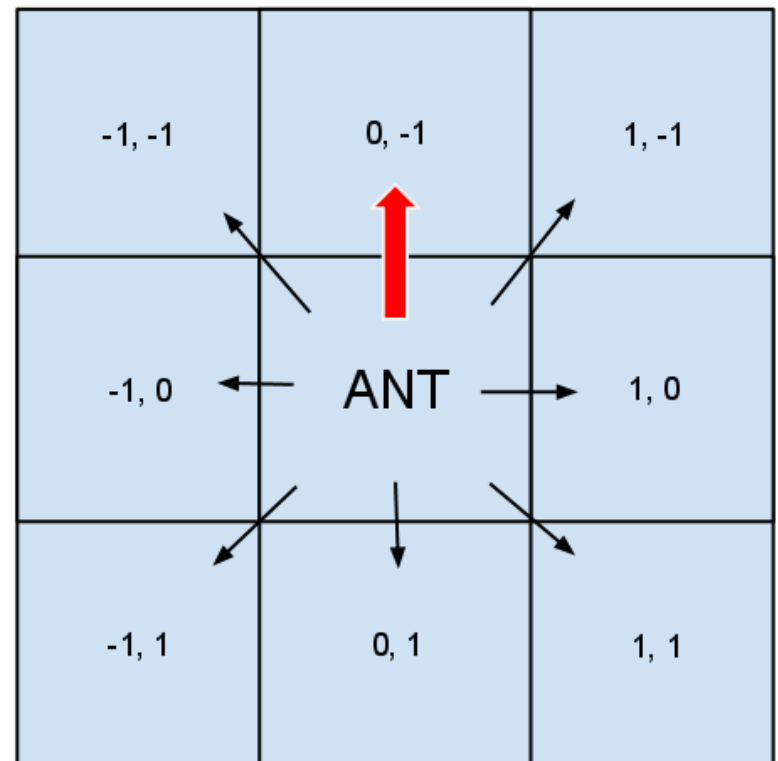
- Position
- Local vectors
- View radius



2. Model & Implementation

Ant: Move

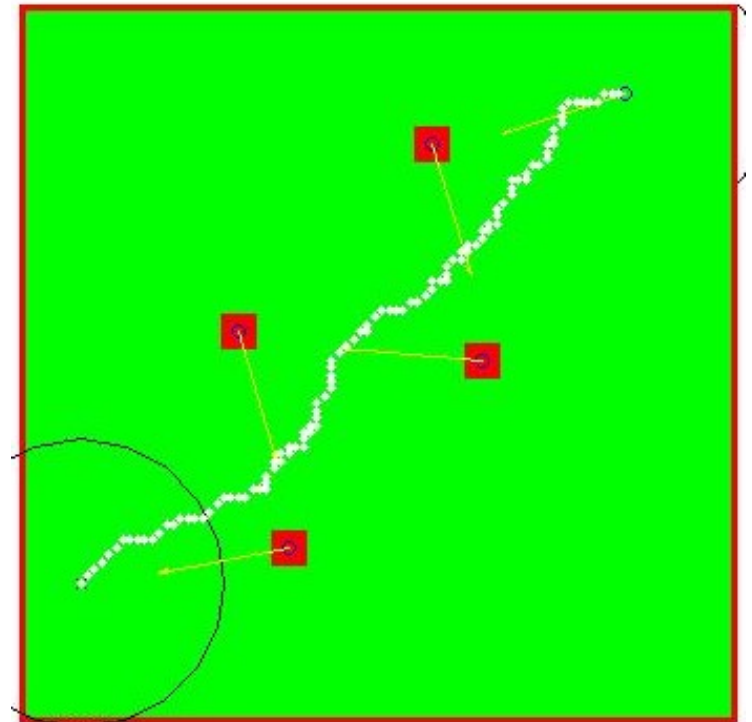
- Method gets a general direction
- Checks for obstacles
- Sets new position
- Updates global vector



2. Model & Implementation

Ant: Find Food

- Runs randomly in search for food
- After first run: Uses landmarks to find food faster
- Local vectors point to next landmark



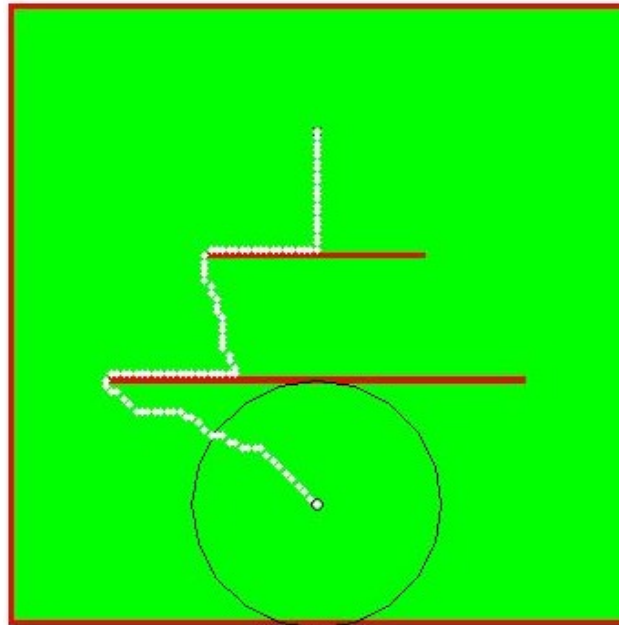
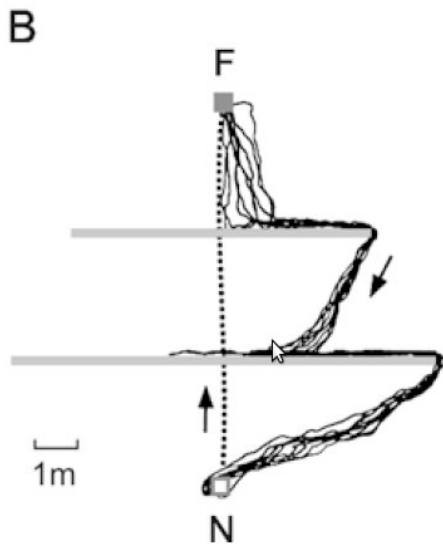
2. Model & Implementation

Ant: Return to nest

- Uses global vector to return to the nest

3. Results & Discussion

3.1 Did we create an adequate model?

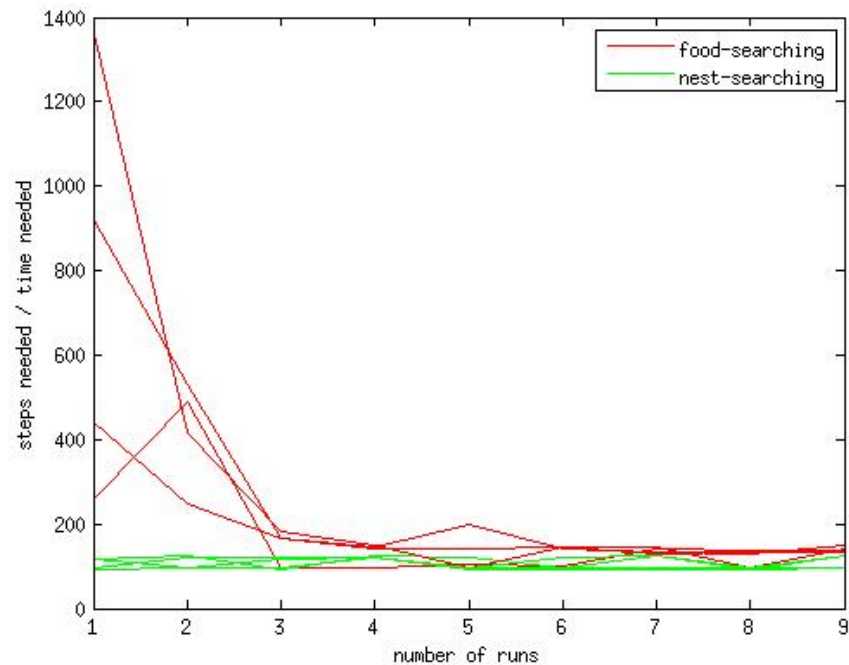
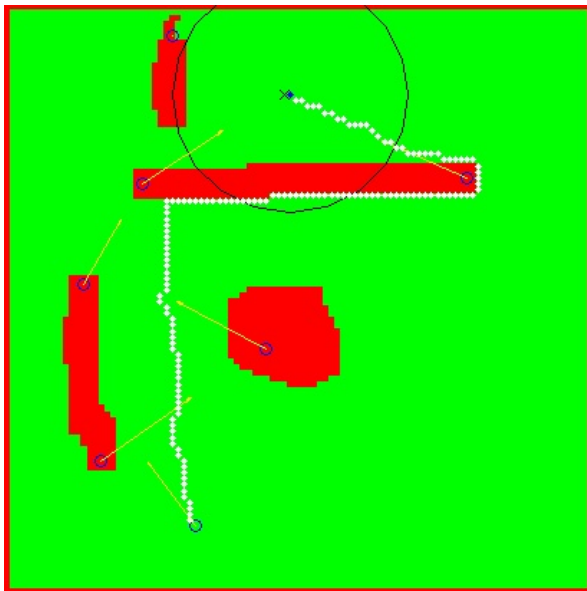


Path integration experiment

Figure taken from: R. Wehner. Desert ant navigation: how miniature brains solve complex tasks, 2003

3. Results & Discussion

3.2 How efficient is navigation by local or global vector?

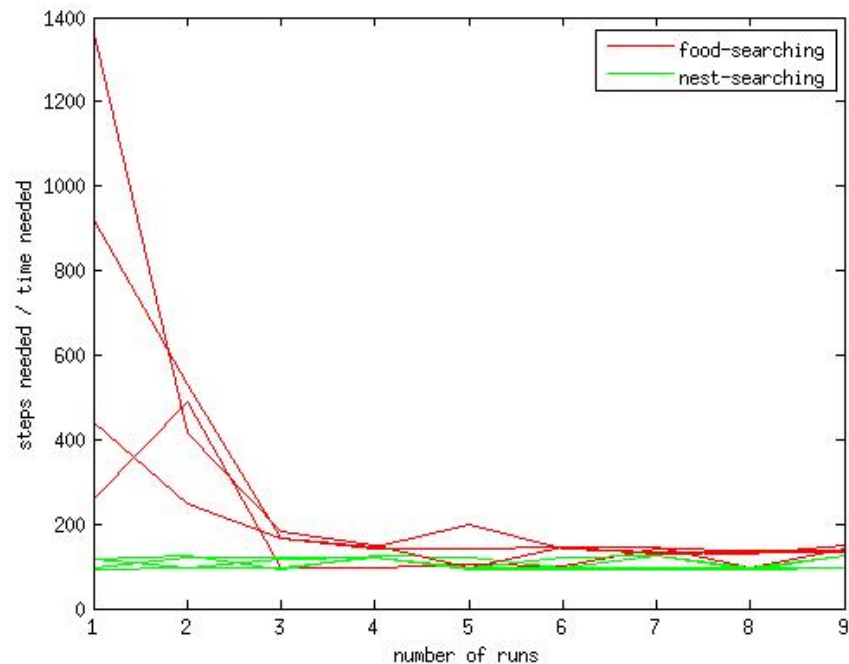


Path improvement experiment

3. Results & Discussion

3.2 How efficient is navigation by local or global vector?

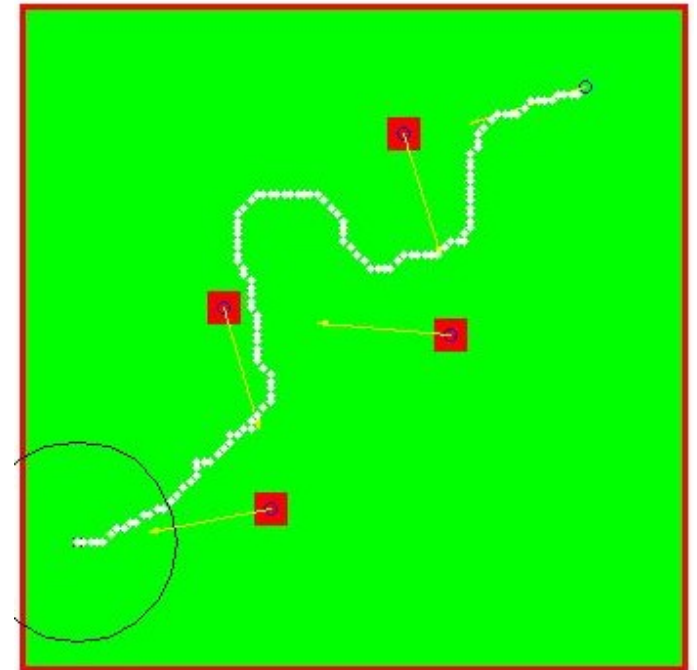
- global vector better
- first runs are most important
- on some maps no improvement



3. Results & Discussion

3.3 How do landmarks influence the efficiency of the food finding process?

The "perfect" route is rarely found.
(Mapdependent)



4. Summary & Outlook

- We are satisfied with our results.
- There should be more testing:
 - collecting data
 - recreating experiments
- Aspects to improve (two examples):
 - local vectors
 - "foresight" of the model

References

- R. Wehner,
 - Path integration in desert ants, 1998
 - Desert ant navigation: how miniature brains solve complex tasks, 2003
- Wikipedia: http://en.wikipedia.org/wiki/Ant_colony_optimization_algorithms