

# Garbage Collection MAS Critical Review

# Our Approach

---

Progressive evolution of  
intelligent agents

Incremental improvement through  
implementation milestones

Let's have a look at  
what we have achieved  
what we have to improve

# Goals and Achievements

---

- 1 Scouting Coordination ✓
  - 1.1 TSP-based single cycle ✓
  - 1.2 Equidistance (GP GP) ✓
- 2 Harvesting Coordination
  - 2.1 Ranking garbage (Voting)
  - 2.2 Garbage assignment (Contract Net) ✓
  - 2.3 Idle HarvesterAgents (Coalitions)
- 3 Vehicle Coordination
  - 1.1 Avoiding collisions (GP GP)

(+ 1 million bugfixes)

# Performance Measure

---

Balancing benefits and waiting time

$$b \times \frac{\text{Benefits}}{\text{Steps}} - w \times \Sigma(\text{Waitingtime}^2)$$

$$b = 0.5$$

$$w = 1$$

# Outlook and Improvements

---

- A Avoiding collisions
- B Idle HarvesterAgents
- c Ranking garbage

# Avoiding Collisions

---

## **Current implementation**

Vehicles make random steps  
until situation is resolved

# Avoiding Collisions

---

## **Problem**

In narrow dead ends or one-way streets  
this can lead to a deadlock

# Avoiding Collisions

---

## **Solution**

Coalition formation between vehicles  
about to collide

Ranking according to vehicle's importance

Important vehicles get preference,  
other have to wait



# Idle HarvesterAgents

---

## **Current implementation**

HarvesterAgents without assignments  
only make random steps

# Idle HarvesterAgents

---

## **Problem**

Idle HarvesterAgents accumulate near recycling centers

This can lead to collisions with other vehicles

# Idle HarvesterAgents

---

## **Solution**

ScoutAgents and idle HarvesterAgents  
form coalitions

HarvesterAgents follow ScoutAgents to be as  
close as possible to newly detected garbage

# Ranking Garbage

---

## **Current implementation**

New garbage is being harvested in the order in which it is discovered

# Ranking Garbage

---

## **Problem**

Garbage assignment order is random

HarvesterAgents might collect garbage that earns few benefits

Valuable garbage is left to wait

# Ranking Garbage

---

## **Solution**

Based on performance measure

Rank pending garbage by letting  
HarvesterAgents vote

Determine importance of each garbage  
by number of interested HarvesterAgents

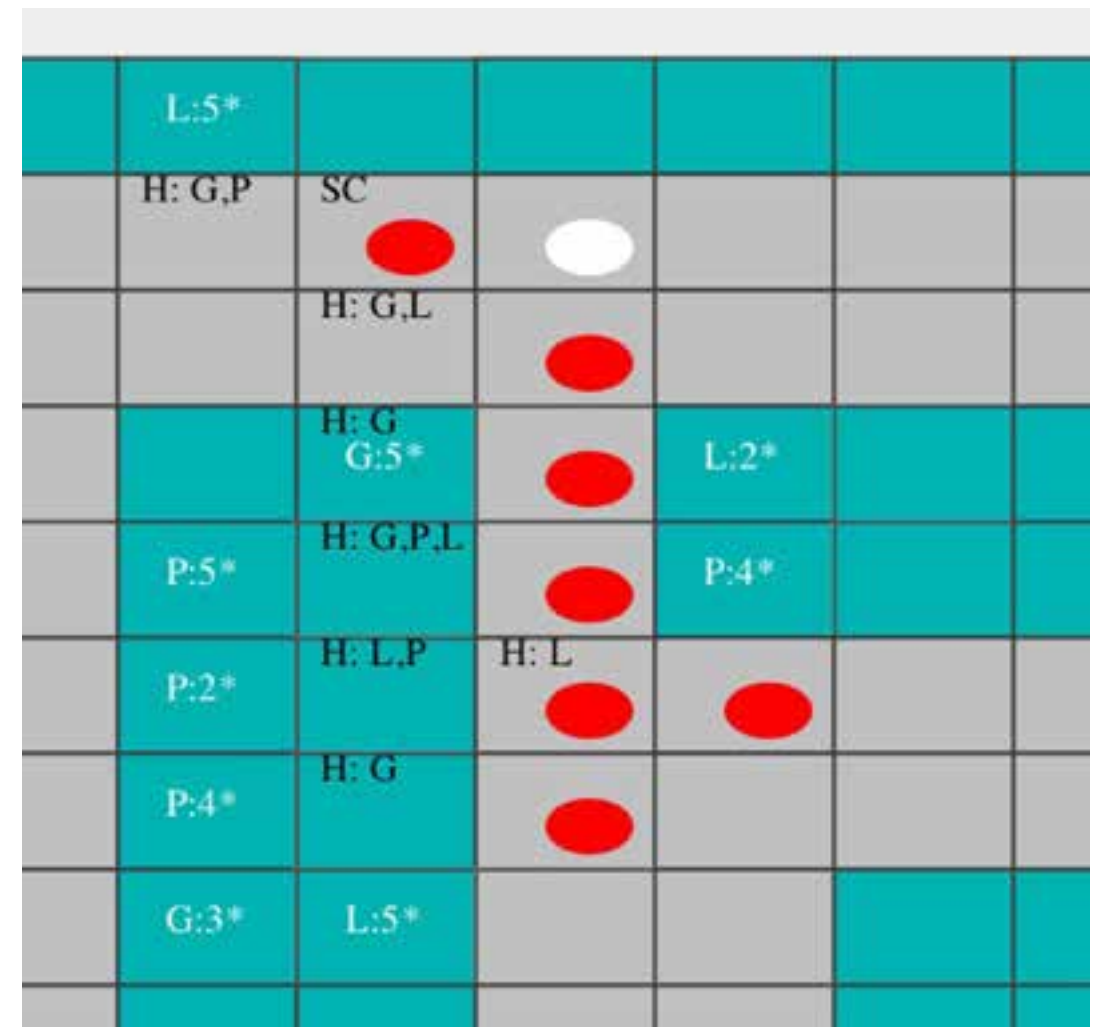
# Summary

---

The bottleneck in our implementation are **collisions**

They only occur randomly

But are very difficult to resolve with our rudimentary solution



# Tests

---

## Two different maps

- 1 Jordi's map
- 2 Custom map

## Two different HarvesterAgent heuristics

- 1 Recycle garbage in closest recycling center
- 2 Maximize benefits per step



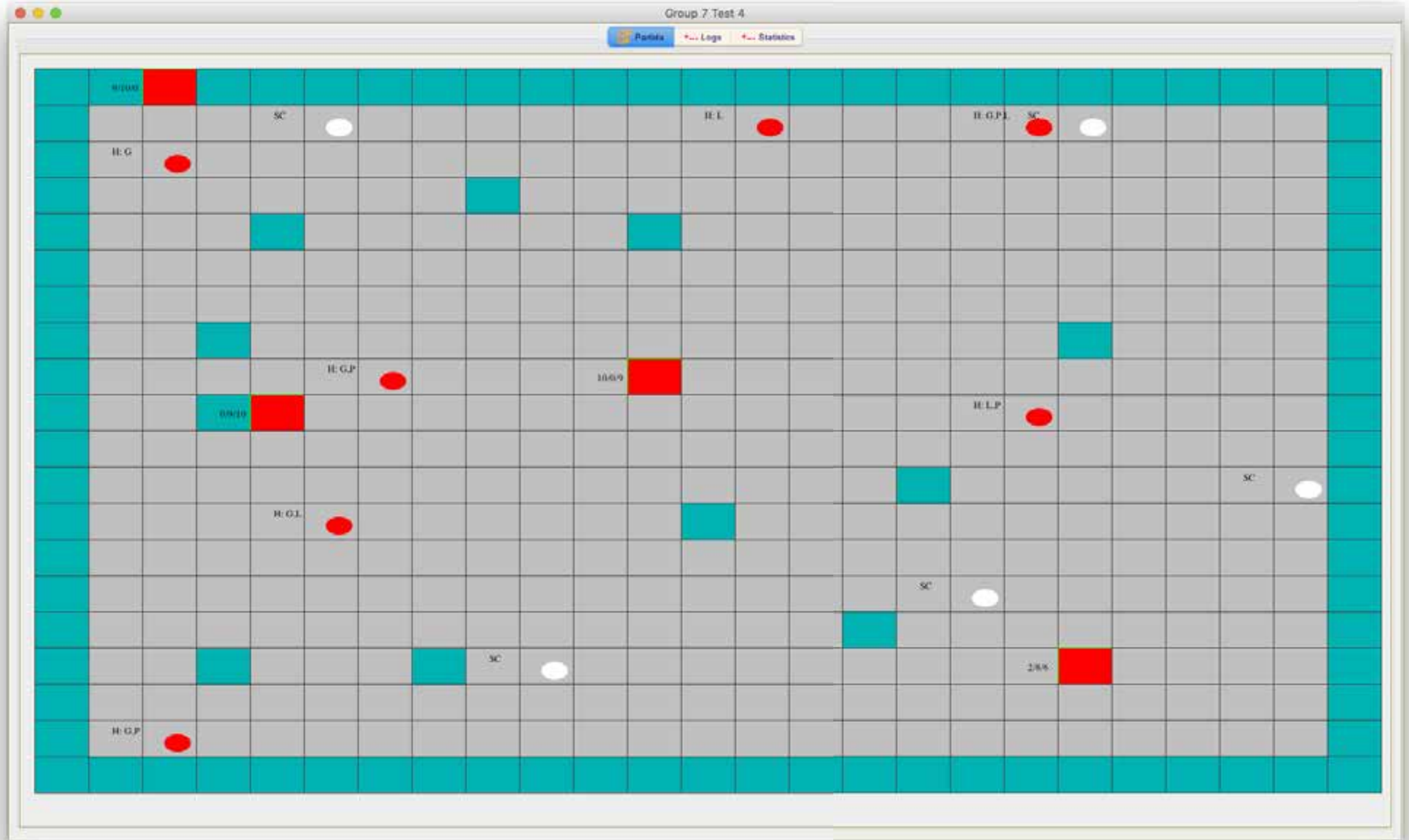


# Jordi's Map

---

TOTALS	closest	best
Benefits	2113	2454
G generated	491	508
G discovered	460	492
G collected	254	257
AVERAGE	closest	best
Benefits/Step	3.52	4.09
Steps until discovery	40.72	35.70
Steps until harvesting	115.04	92.69
RATIOS	closest	best
G discovered	0.869	0.936
G collected	0.517	0.506

# Custom Map



# Custom Map

---

TOTALS	closest	best
Benefits	3265	3755
G generated	577	555
G discovered	569	539
G collected	415	427
AVERAGE	closest	best
Benefits/Step	5.44	6.26
Steps until discovery	16.95	16.94
Steps until harvesting	84.31	46.06
RATIOS	closest	best
G discovered	0.950	0.875
G collected	0.719	0.769

## **Group 7**

Sebastian Berns

Helen Byrne

Johannes Heidecke

Sara Hoeksma Palazuelos

Maritza Prieto