



Shaping a Particle Swarm With a Shared Control Input Using Boundary Interaction

Shiva Shahrokhi, Aaron T. Becker

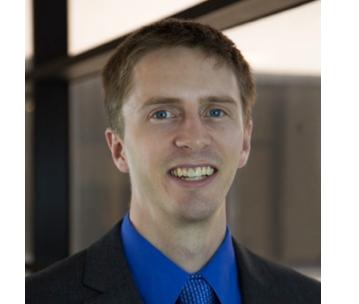
ssahrokhi2@uh.edu, atbecker@uh.edu

Department of Electrical and Computer
Engineering,
University of Houston

Website, C.V.

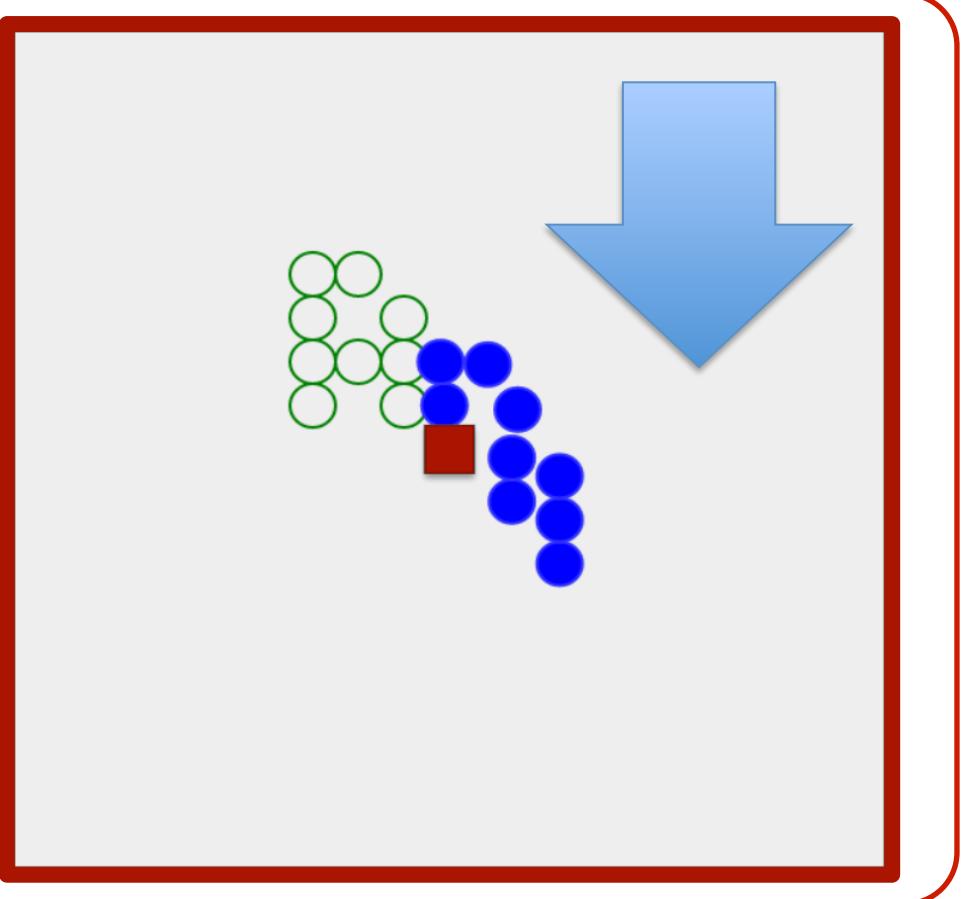


YouTube
channel



Global inputs: symmetry

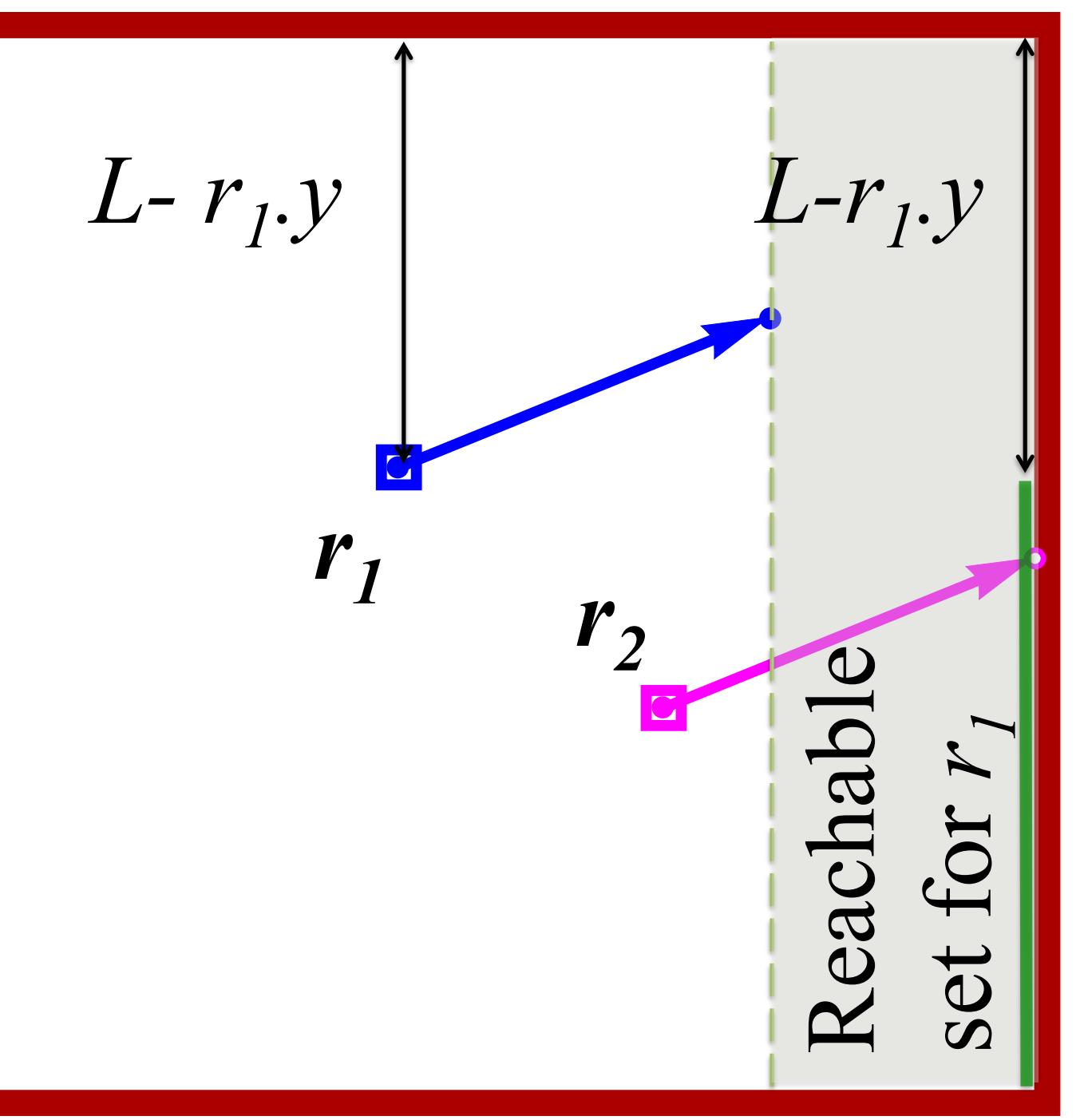
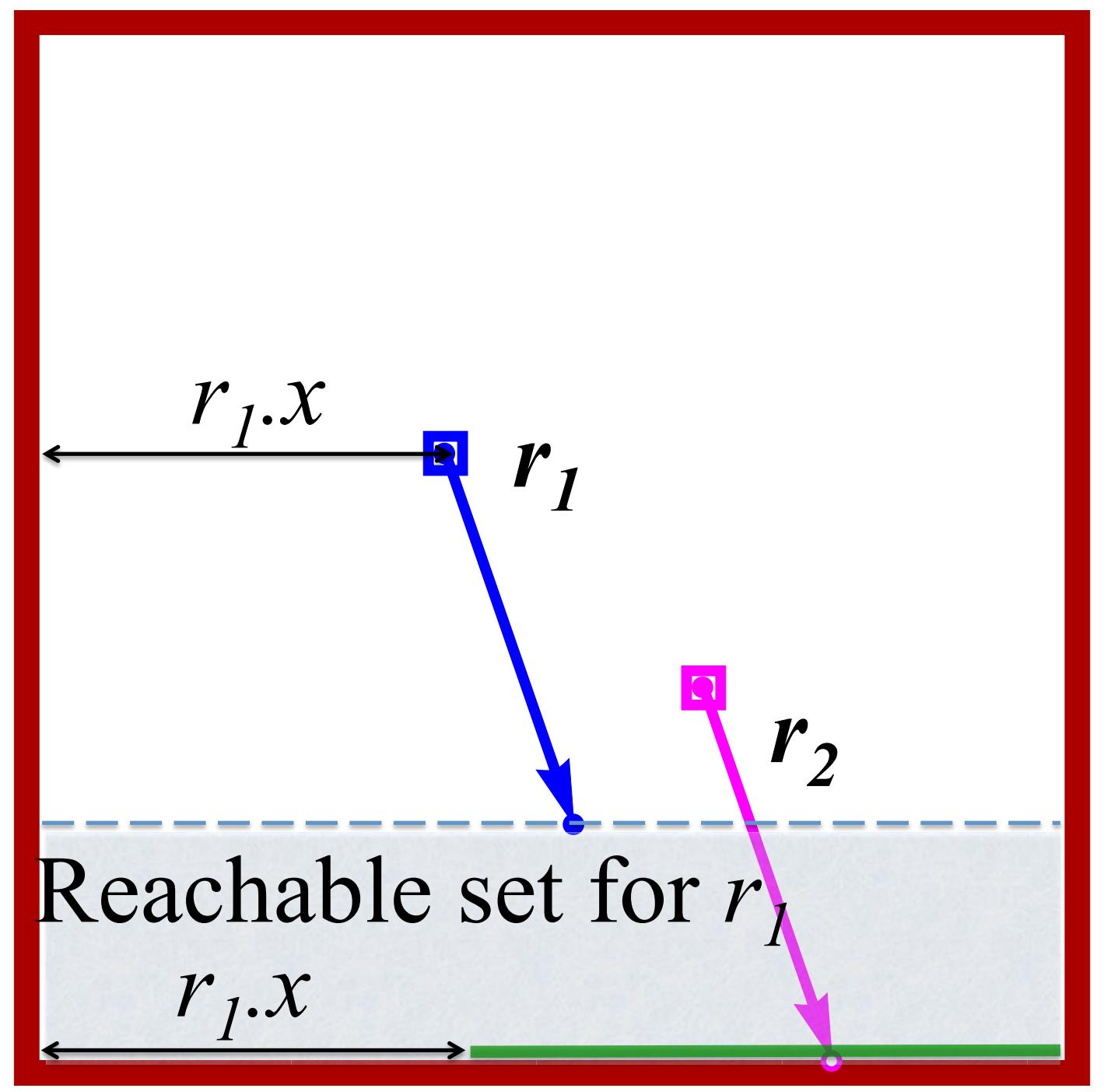
Global inputs: All robots get the same input



Symmetry: control 2 of $2n$ DOF
Previous work: used a single obstacle in the middle of the workspace

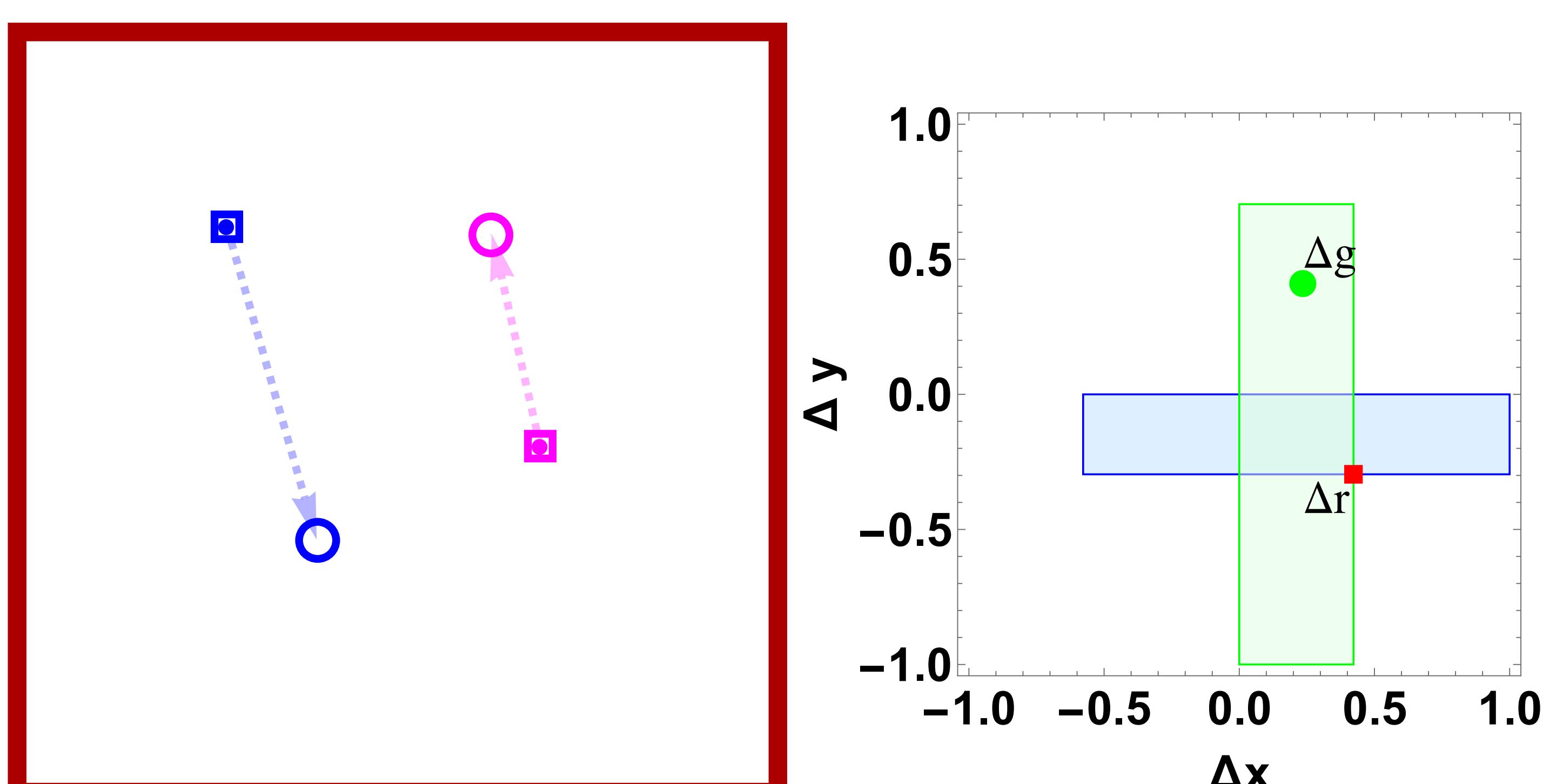
Constraints: this obstacle is impractical, especially in 3D

Using boundary interaction



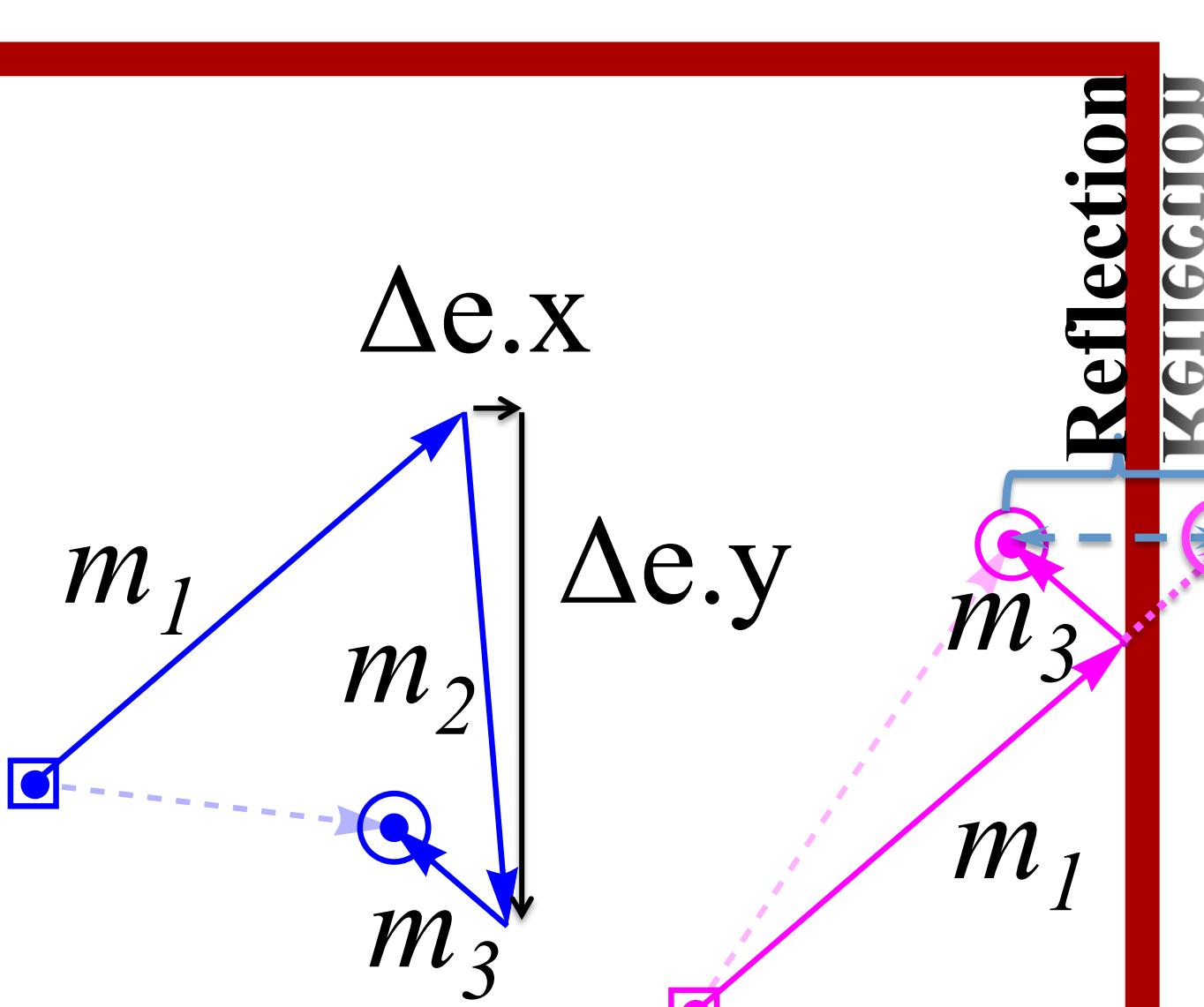
Another way to break symmetry is using boundaries: usually workspaces have boundaries.

If a robot is touching a wall, the other robot can go **anywhere** in the **reachable set** while the first robot is immobile.

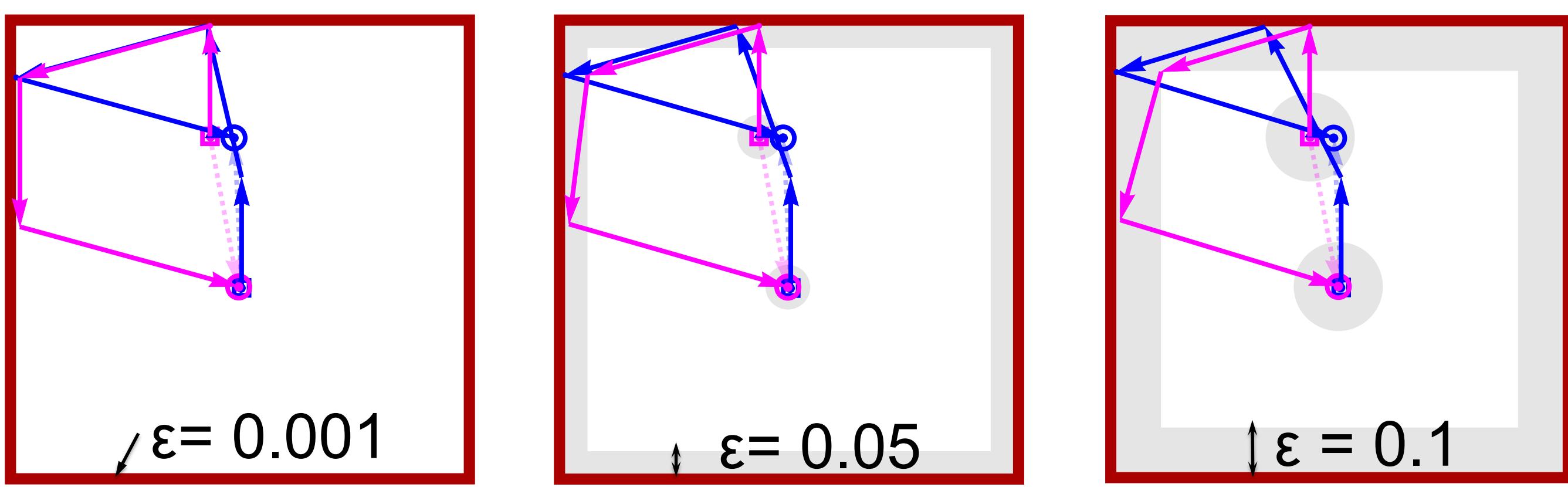


Δ configuration space shows reachable Δg by moving one robot to touch a wall and then adjusting the second robot.

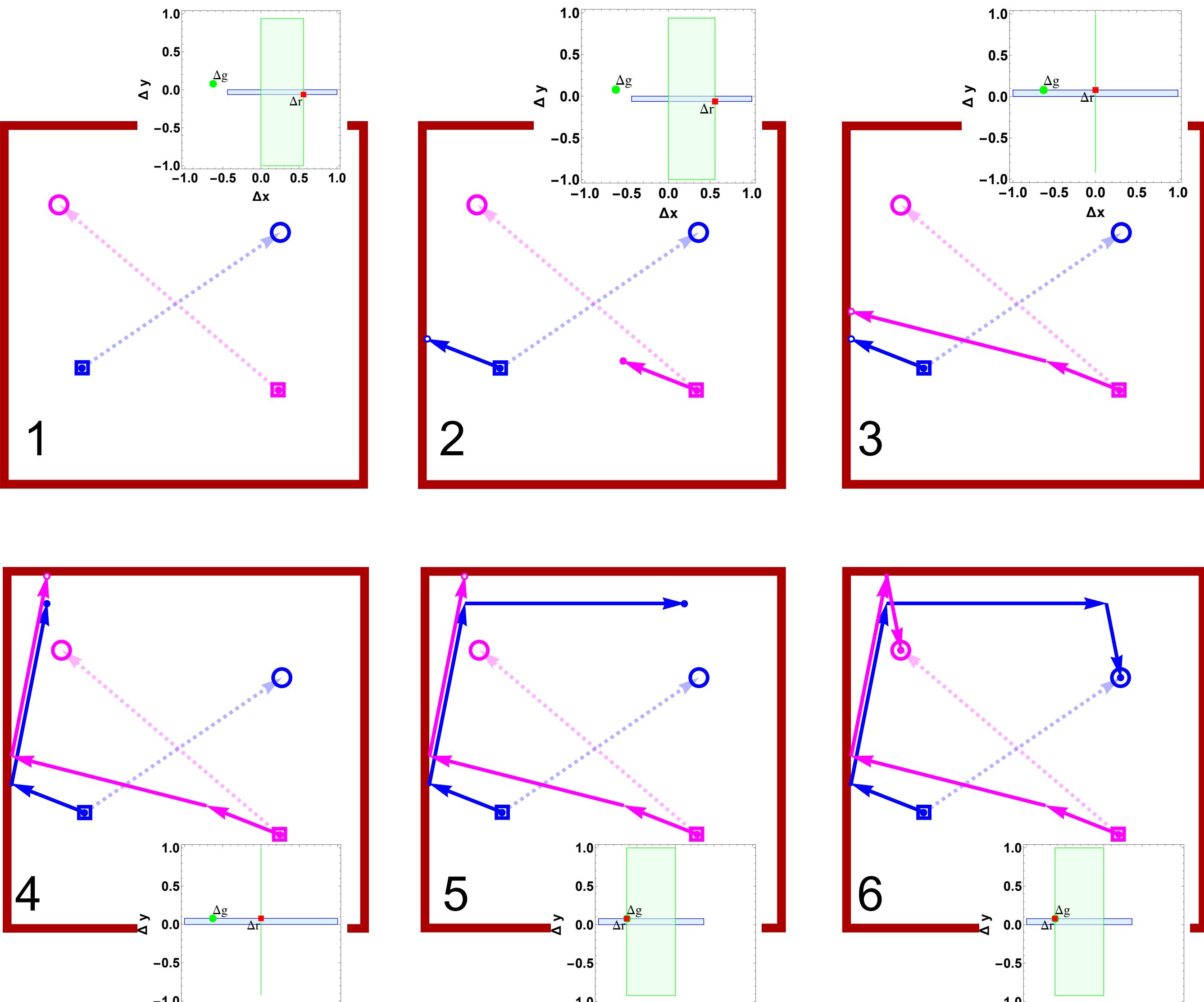
Best-first search algorithm



The shortest path when Δg is reachable is when the robot that collides with the wall moves toward the reflection of its goal.



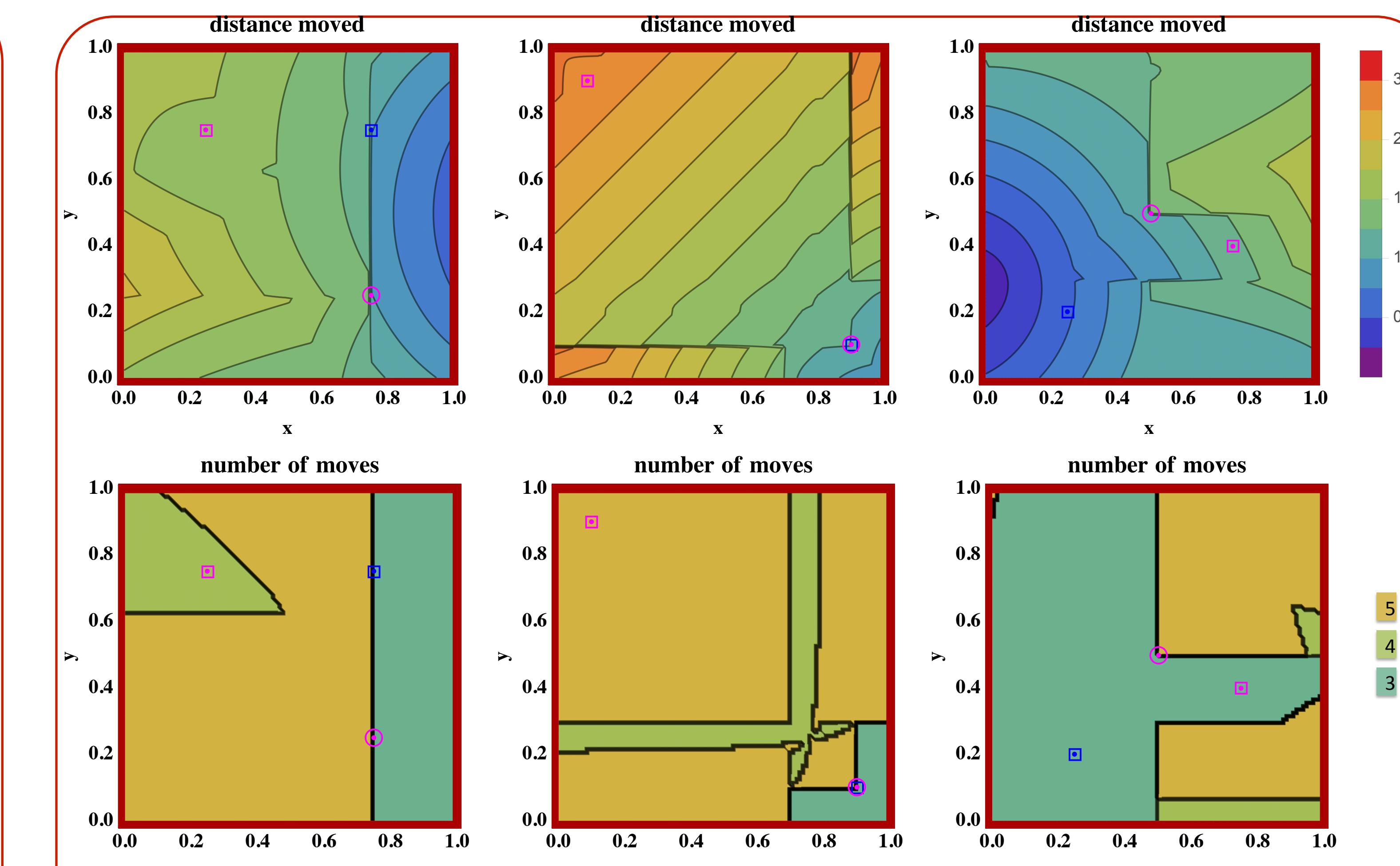
ϵ is used to ensure particles do not overlap



Sequence of moves to goal position:

An A*-like algorithm considers all potential paths to find the shortest one using best-first search

Results



Distance and number of moves for different goal positions of the blue robot when all the other positions are fixed

Current work: circular workspace

