ROBOT ALGORITHMS

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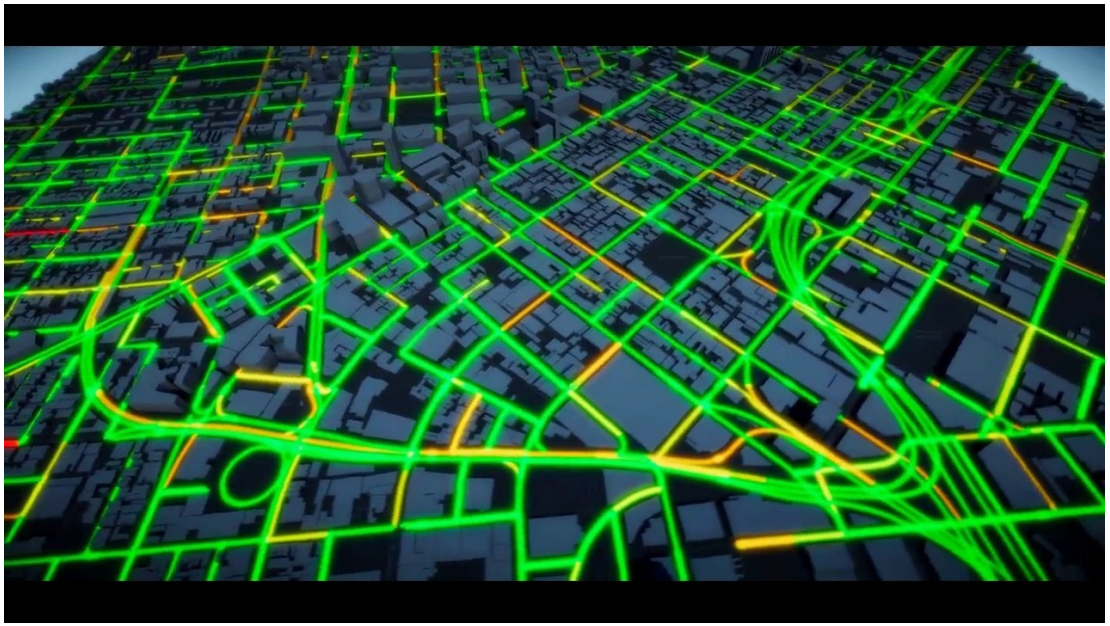
ROBOT ALGORITHMS – PROJECT GOAL

- Algorithmic foundations of the behavior of team of robots
- Robots have restricted capabilities
- Robots collectively have to solve a common task
  - e.g., gathering, dispersing, covering, exploration, shape formation, building nest, etc…
- Analyze the developed methods
  - theoretically and
  - experimentally

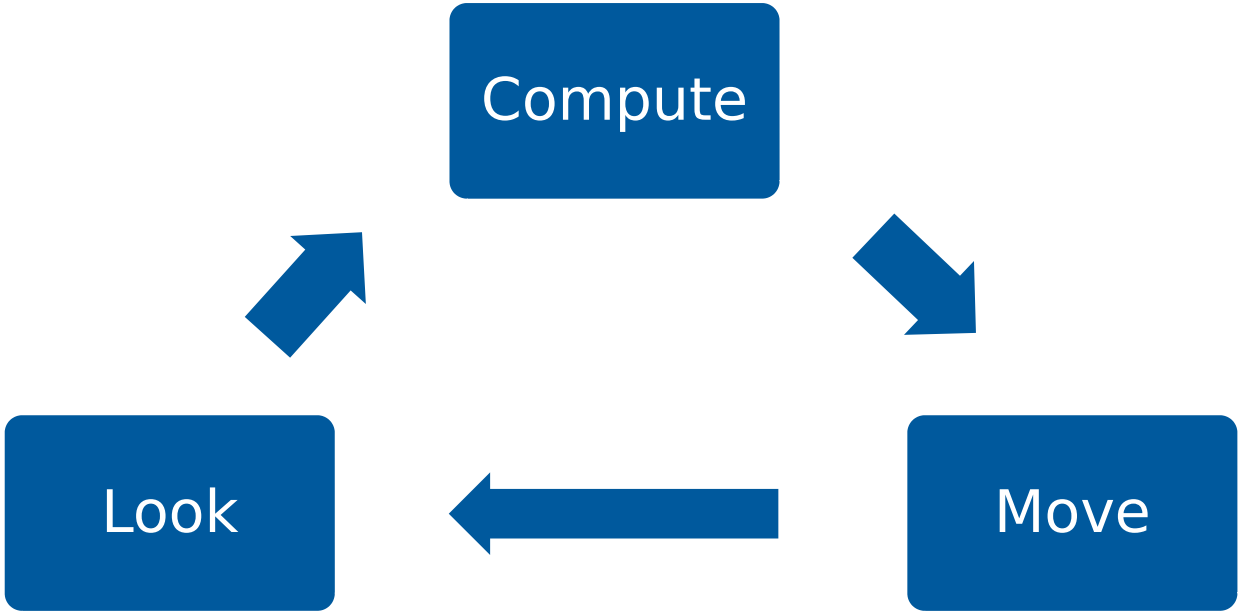
https://ssr.seas.harvard.edu/

FILLING, DISPERSING

- n robots
- Area represented by a graph of n vertices
  - Unknown, connected
- Robots enter at “Door” vertices
- Robots can move to neighboring vertices
- Robots have to occupy all vertices

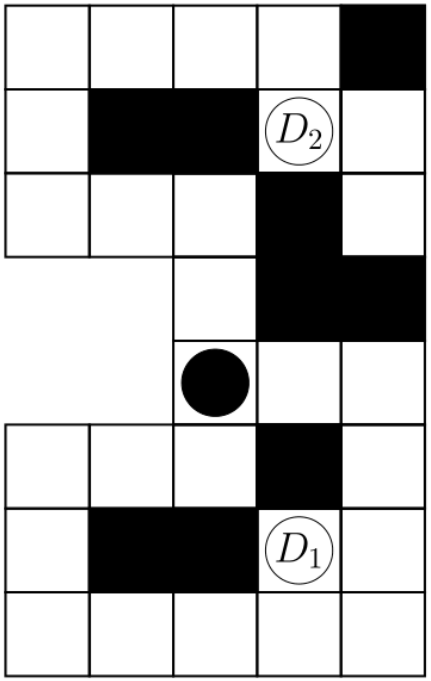


LOOK-COMPUTE-MOVE

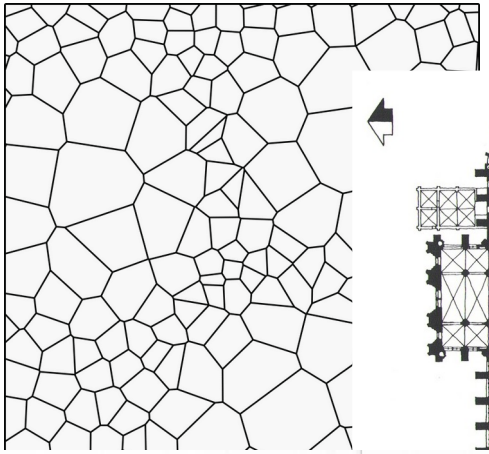


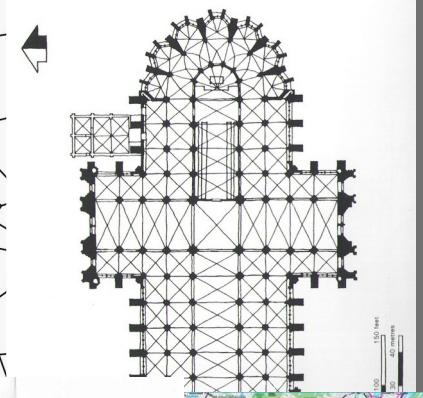
FILLING, DISPERSING

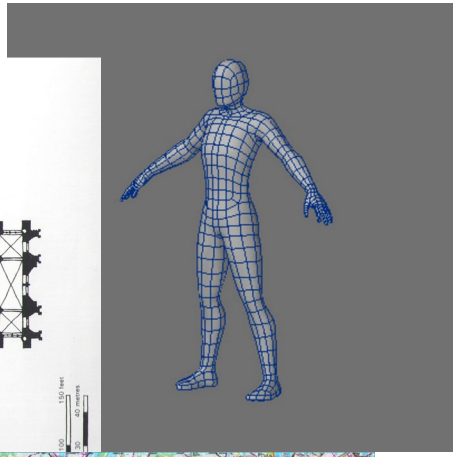
- Orthogonal

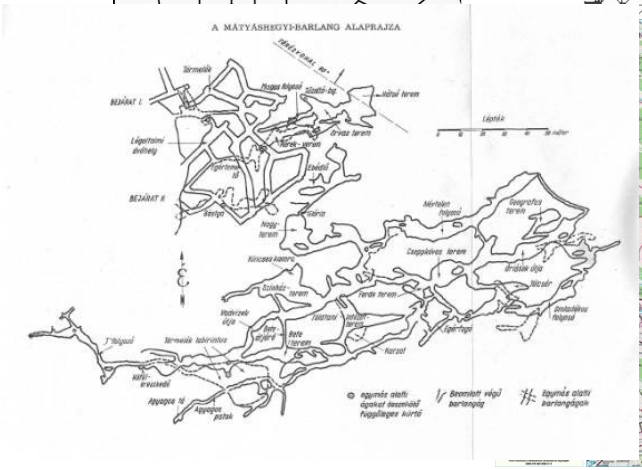


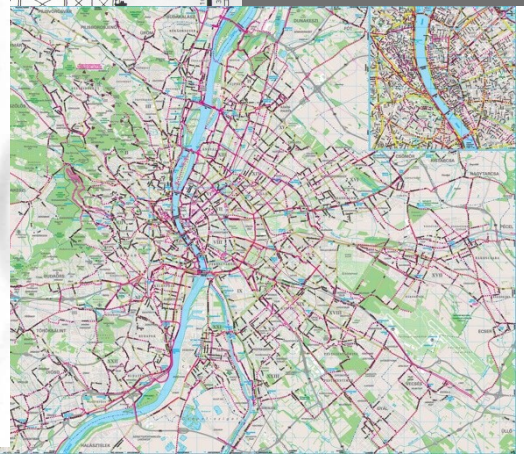
Arbitrary











STATE OF THE ART – COLLISIONLESS DISPERSION

Method	FSYNC / ASYNC	Doors	Visibility range	Comm. range	Memory bits	Area (Orthogonal/ Arbitrary)
BFLF, DFLF [Hsiang et al. 2004]	FSYNC	Single	2	2	2	O
TALK [Barrameda et al. 2013]	ASYNC	Single	2	2	4	O
MUTE [Barrameda et al. 2013]	ASYNC	Single	6	-	9	O
MULTIPLE [Barrameda et al. 2008]	ASYNC	Multiple	3	-	4	O
Single Door [Hideg, Lukovszki 2017]	FSYNC	Single	1	-	13	O
Multiple Door [Hideg, Lukovszki 2017]	FSYNC	Multiple	1	-	13	O
VCM [Hideg, Lukovszki 2018]	FSYNC	Single	1	-	$O(\Delta)$	A
MD-VCM [Hideg, Lukovszki 2018]	FSYNC	Multiple	1	-	$O(\Delta \cdot \log k)$	A

COLLISIONLESS DISPERSION BY LUMINOUS ROBOTS

Method	SYNCH/ ASYNC	Doors	Visibility range	Runtime #async rounds	Persistent memory bits	Colors	Area (Orthogonal/ Arbitrary)
PACK [Hideg, Lukovszki 2020]	ASYNC	Single	1	O(n^2)	O(log Δ)	Δ+4	A
Mod-PACK [Hideg, Lukovszki 2020]	ASYNC	Single	1	O(n^2 log Δ)	O(log Δ)	O(1)	A
BLOCK [Hideg, Lukovszki 2020]	ASYNC	Single	2	O(n)	O(log Δ)	Δ+4	A
MD-BLOCK [Hideg, Lukovszki 2020]	ASYNC	Multiple	2	O(n)	O(log(Δ+k))	Δ+k+4	A

First asymptotic bounds for dispersion in the ASYNC model.
Only termination in finite time has been proven in previous works.

Attila Hideg, Tamás Lukovszki: Brief Announcement: Asynchronous Filling by Myopic Luminous Robots.
Accepted: 27th International Colloquium on Structural Information and Communication Complexity, SIROCCO 2020, June 29 - July 1, 2020.

Attila Hideg, Tamás Lukovszki: Asynchronous Filling by Myopic Luminous Robots.
Accepted: 16th International Symposium on Algorithms and Experiments for Wireless Sensor Networks, ALGOSENSORS 2020, September 9 - 10, 2020.

THANK YOU FOR YOUR ATTENTION!

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