10 years of pedestrian research on FNSPE

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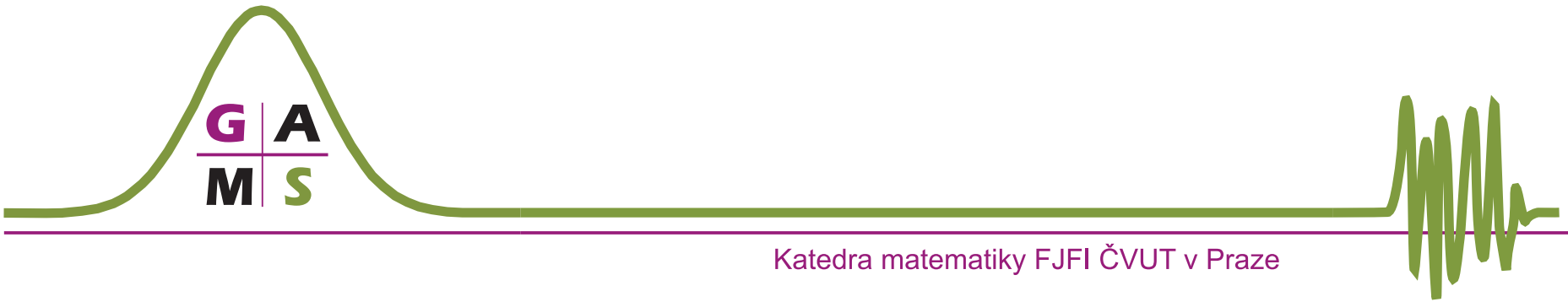
SMPS



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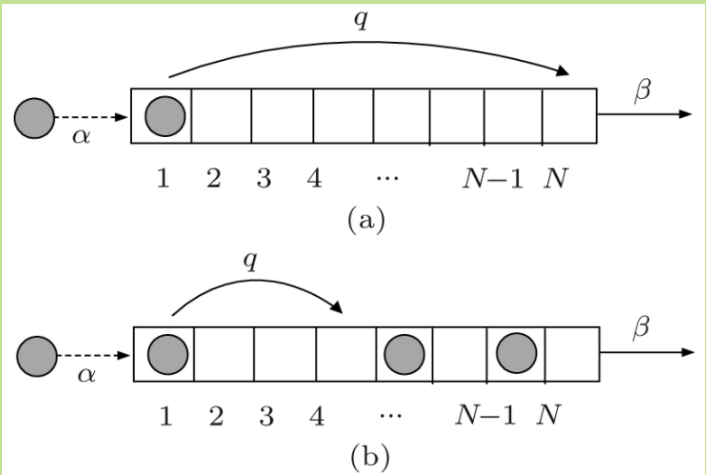
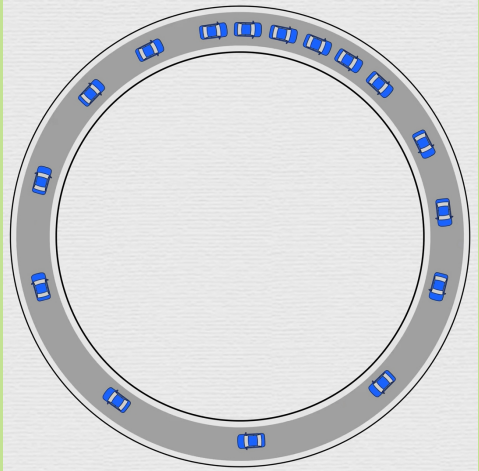
Program

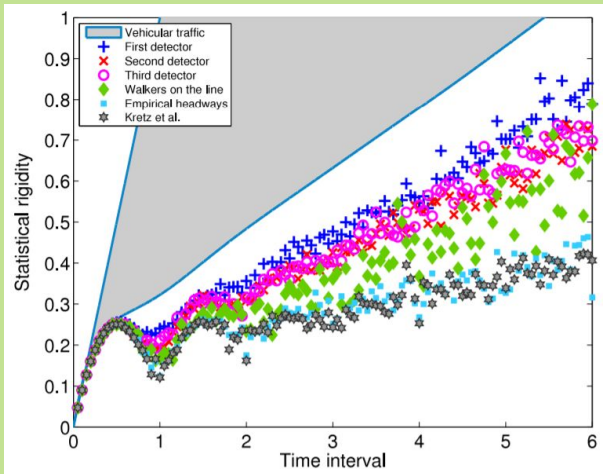
Outline

State of the art at 2010

- eigenvalue distance analysis [M. Krbálek]
- analytic solution of TASEP [P. Hrabák]
- vehicular dynamic models on circle [K. Kittanová]





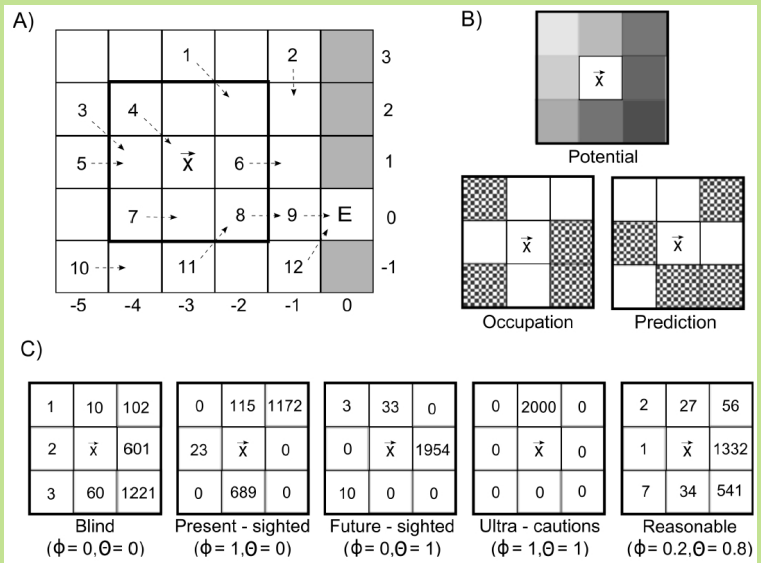


Obsah

Initial model

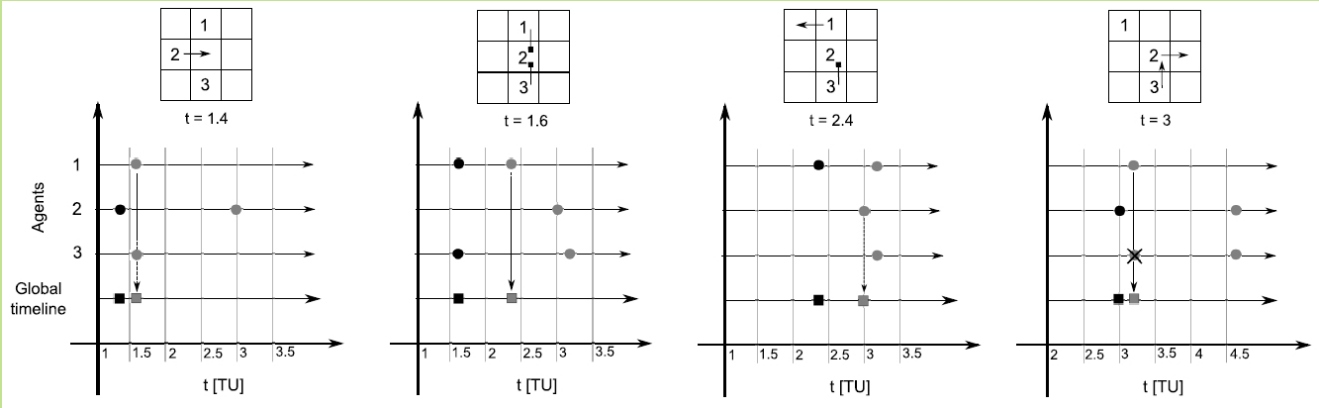
- discrete space (square lattice)
- adaptive time span
- concept of heterogeneous agents
- probability driven jump to neighboring cell
- conflict solution system using bonds

Jump probability

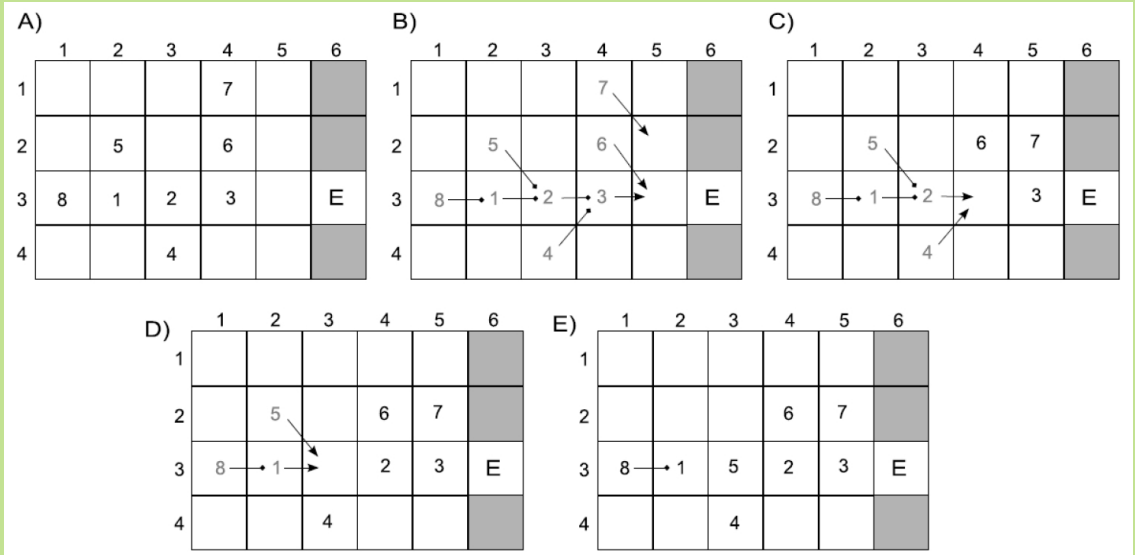


Initial model

Adaptive time span



Conflict solution



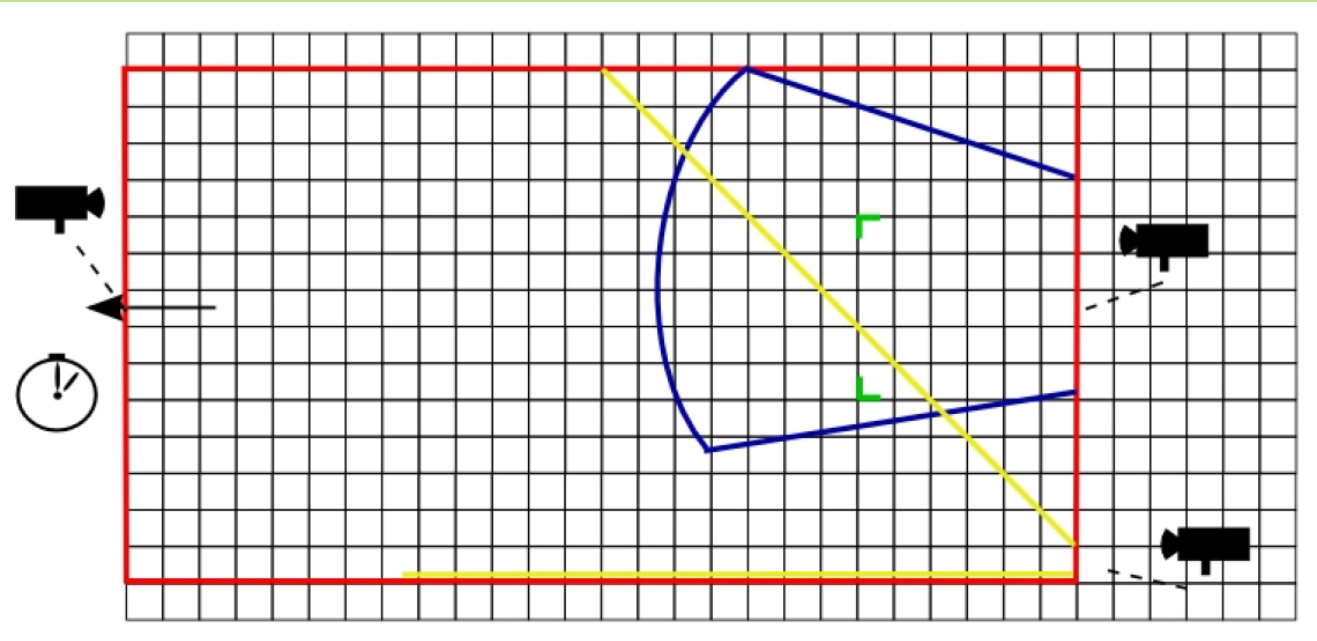
Obsah

Origins

Motivation

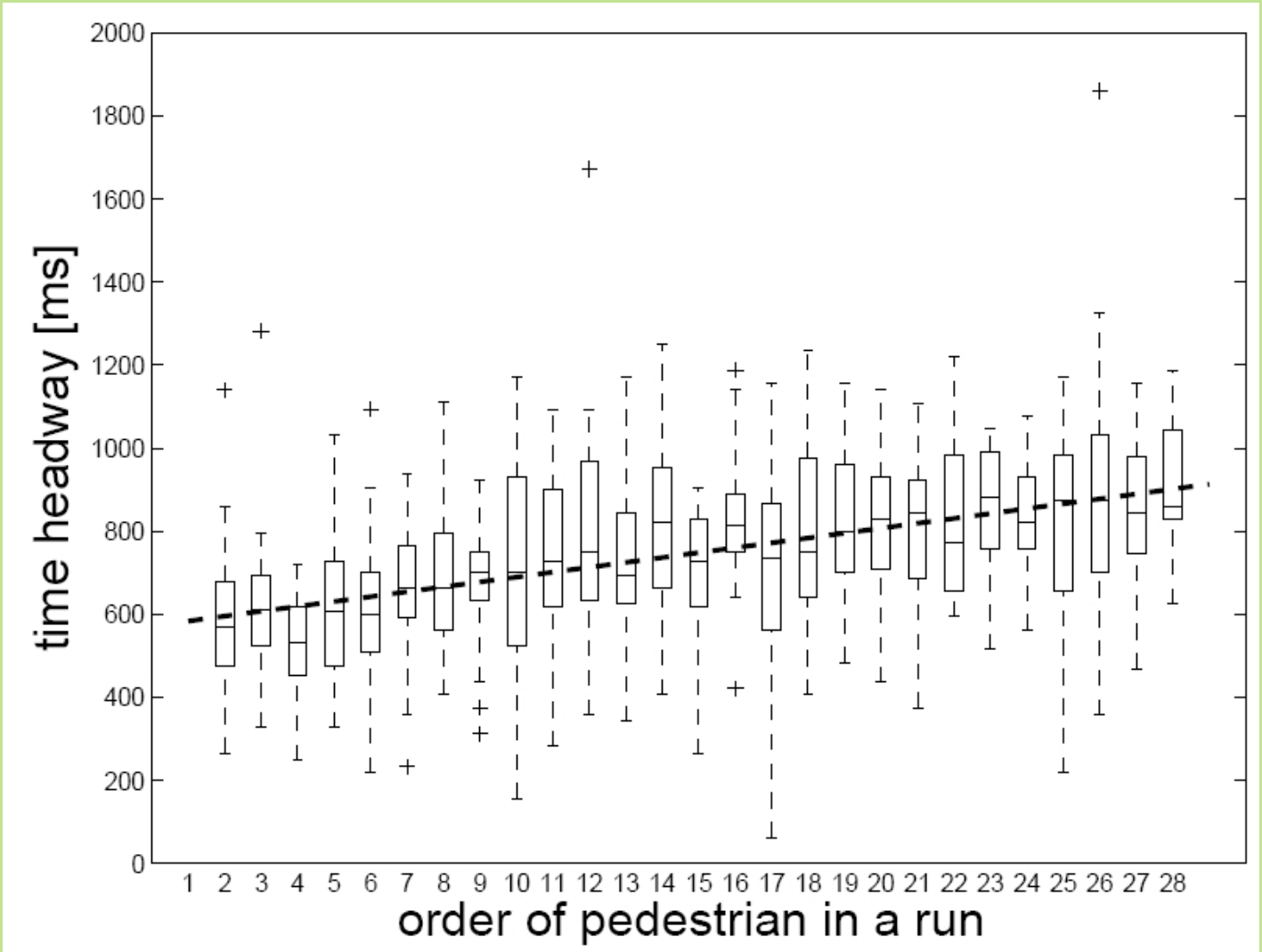
- .. to get data for calibration
- .. to evaluate fundamental quantities
- .. to learn how to organize experiment

E1



Shots

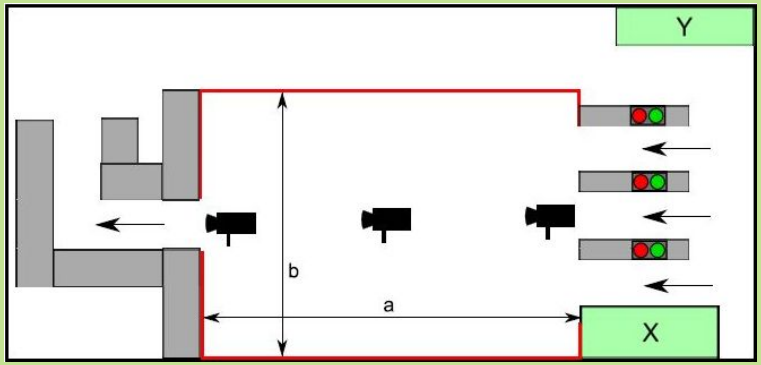
Results


time headway [ms]
0
200
400
600
800
1000
1200
1400
1600
1800
2000
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
order of pedestrian in a run

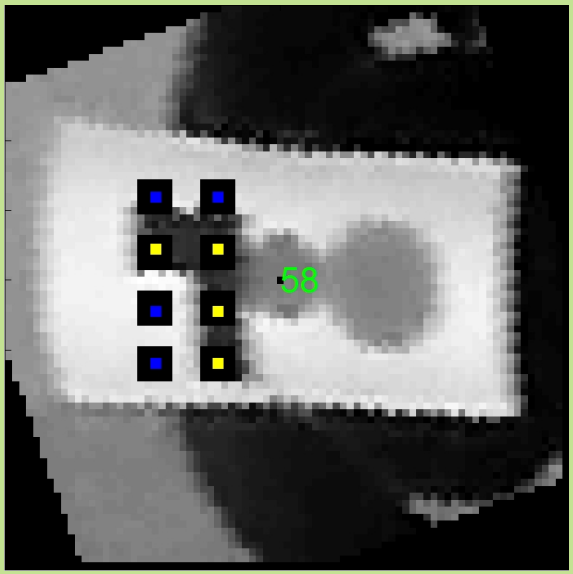
Artificial room

Pedestrian labeling + roof monitoring system

Improved room

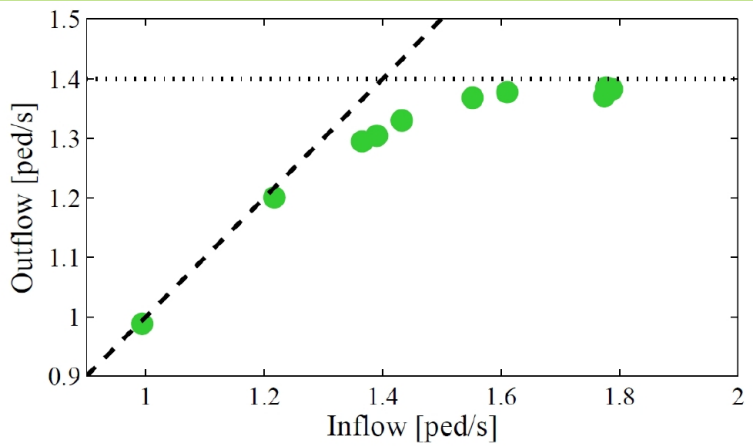


Improved detection

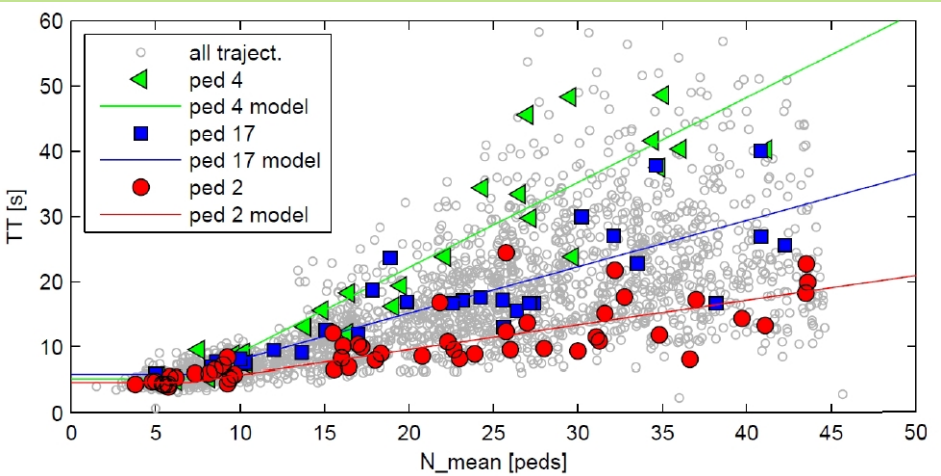


Observations

Phase transition

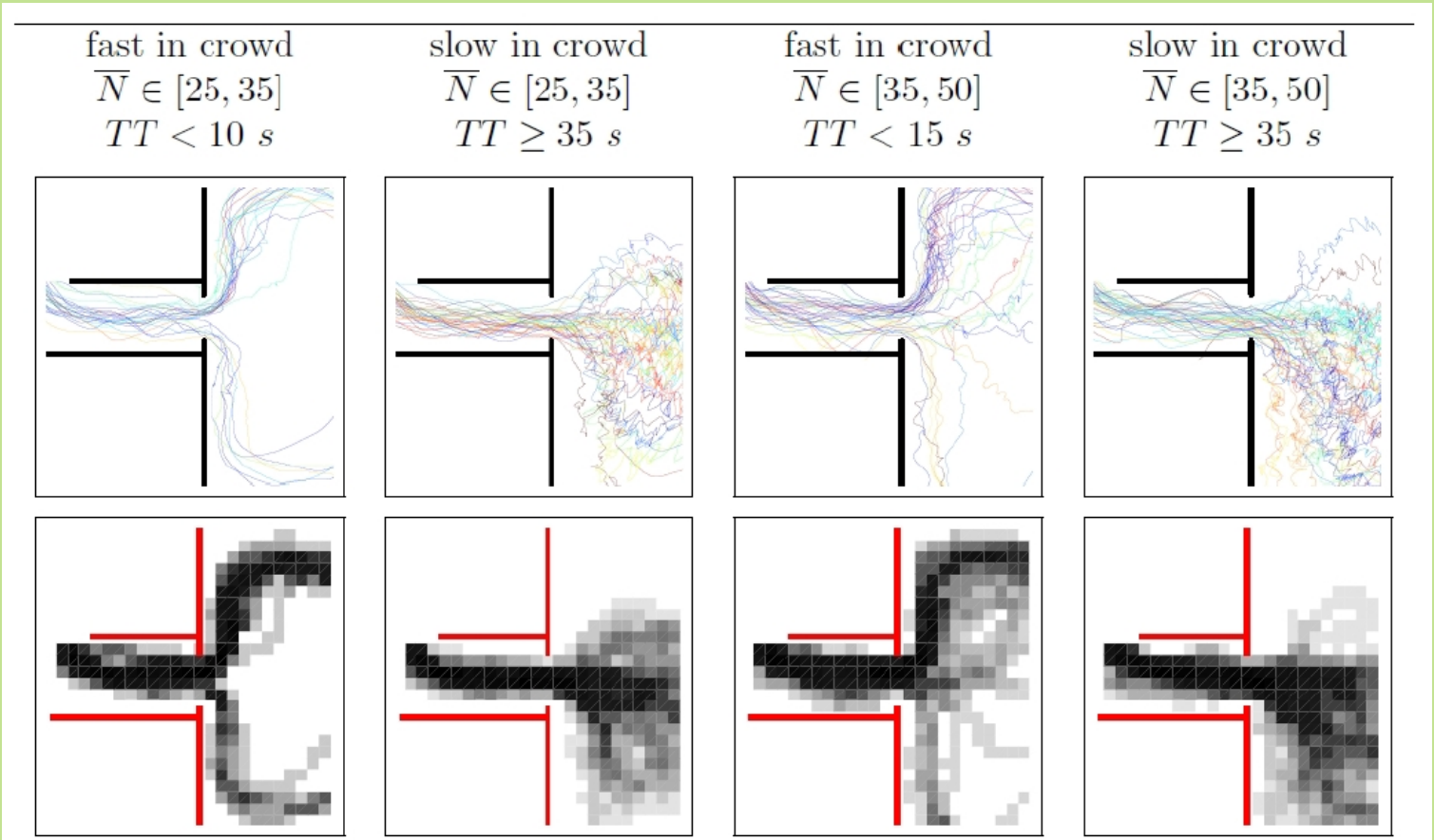


Heterogeneity in velocity and aggressiveness



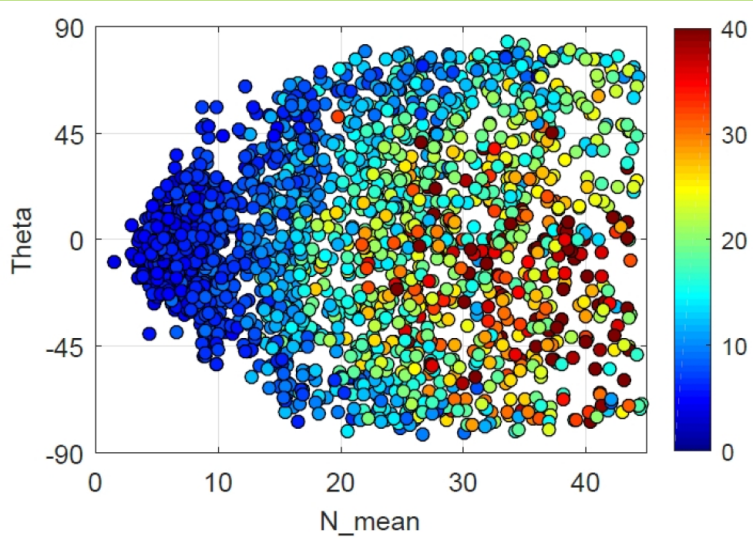
Observations

Spatial distribution

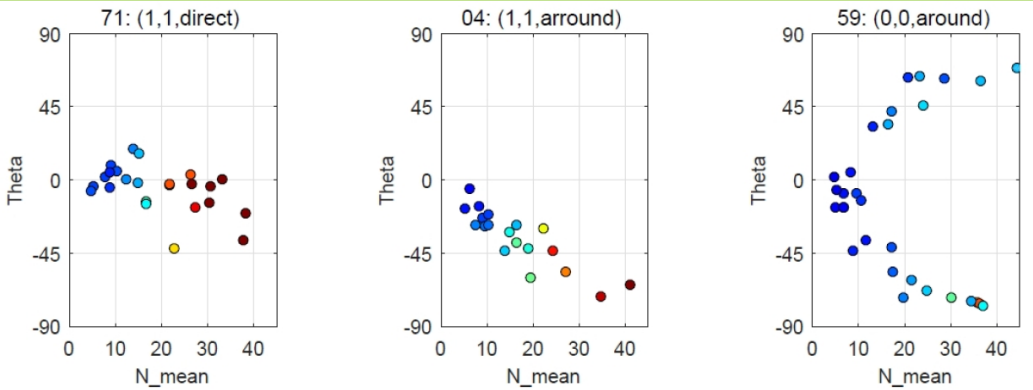


Observations

Pedestrian strategies – global



Pedestrian strategies – individual

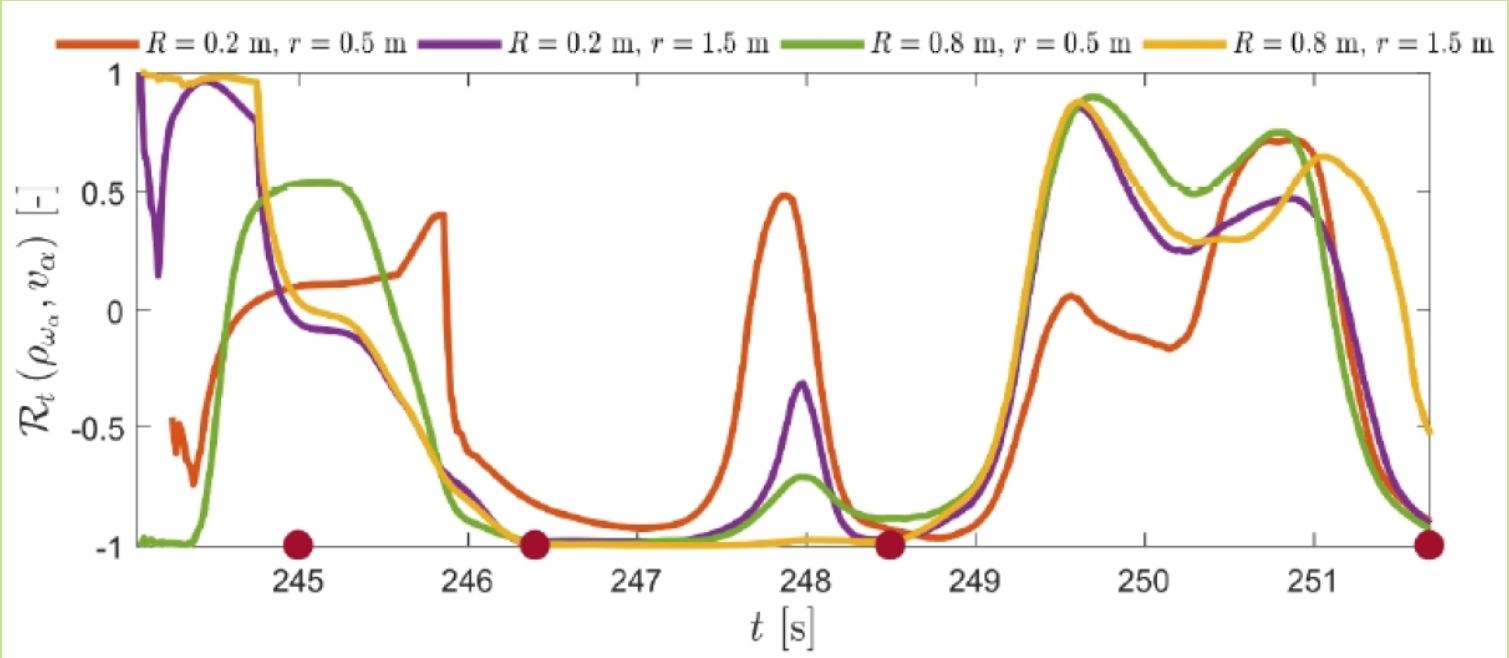


Observations

Local Behavior

- why trajectories look like that?

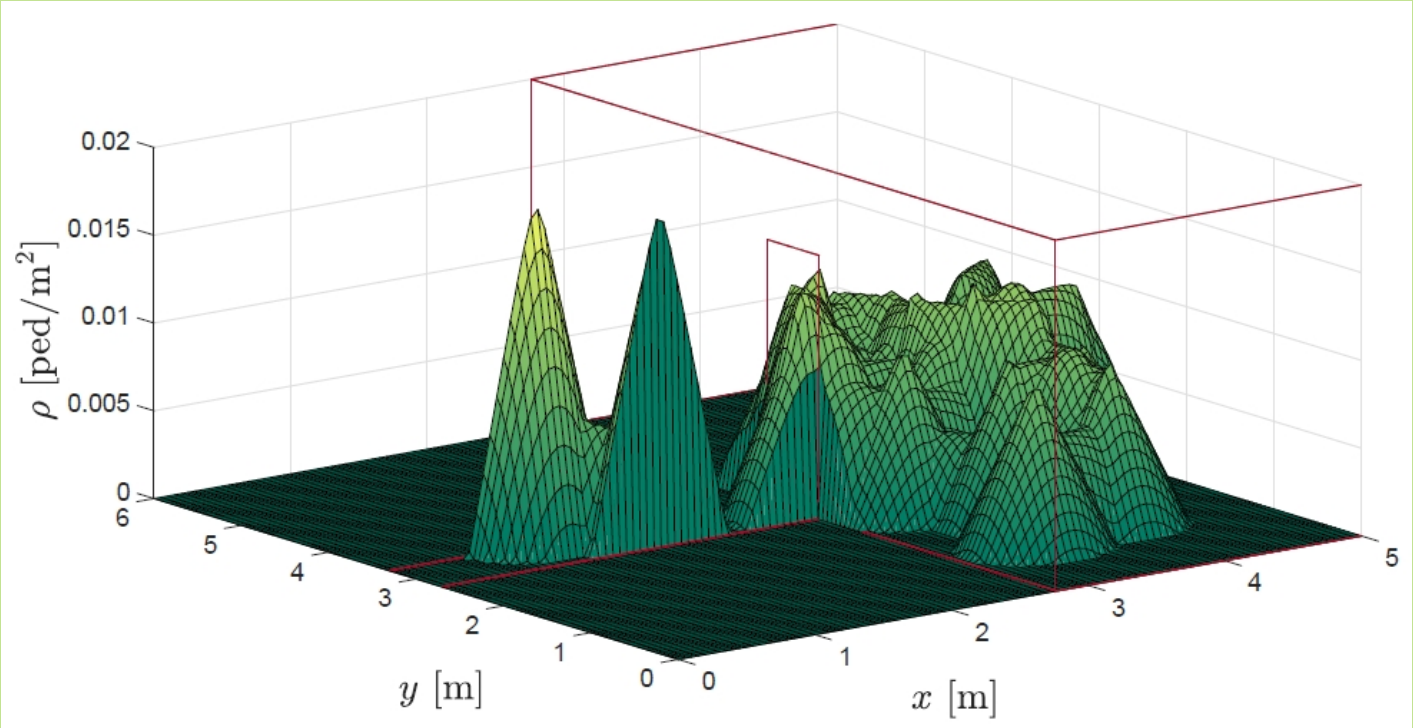
Velocity-density paradigm



Density definition

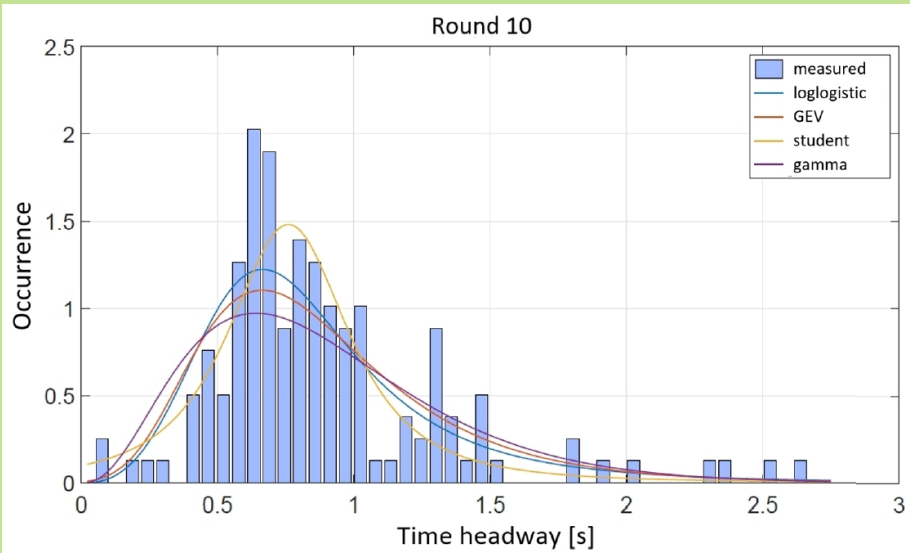
Pedestrian distribution

$$\rho_B = \frac{N}{|B|} = \frac{\int_B p(\vec{x})\,\mathrm{d}\vec{x}}{|B|} = \frac{\int_B \sum_{\alpha=1}^{N} p_\alpha(\vec{x})\,\mathrm{d}\vec{x}}{|B|} = \sum_{\alpha=1}^{N} \frac{\int_B p_\alpha(\vec{x})\,\mathrm{d}\vec{x}}{|B|}$$

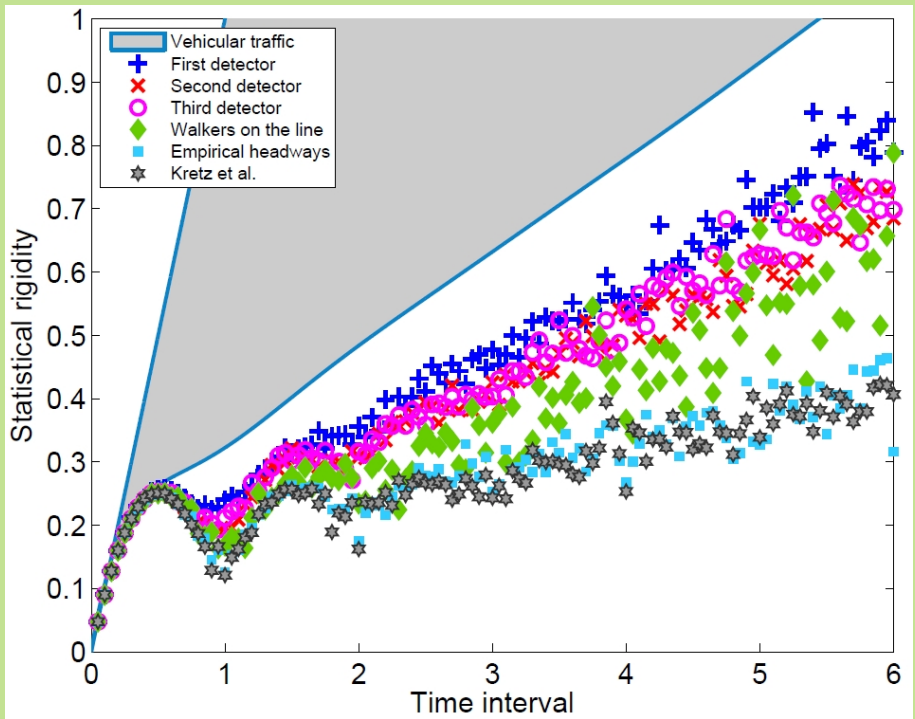


Time headway analysis

headway fit

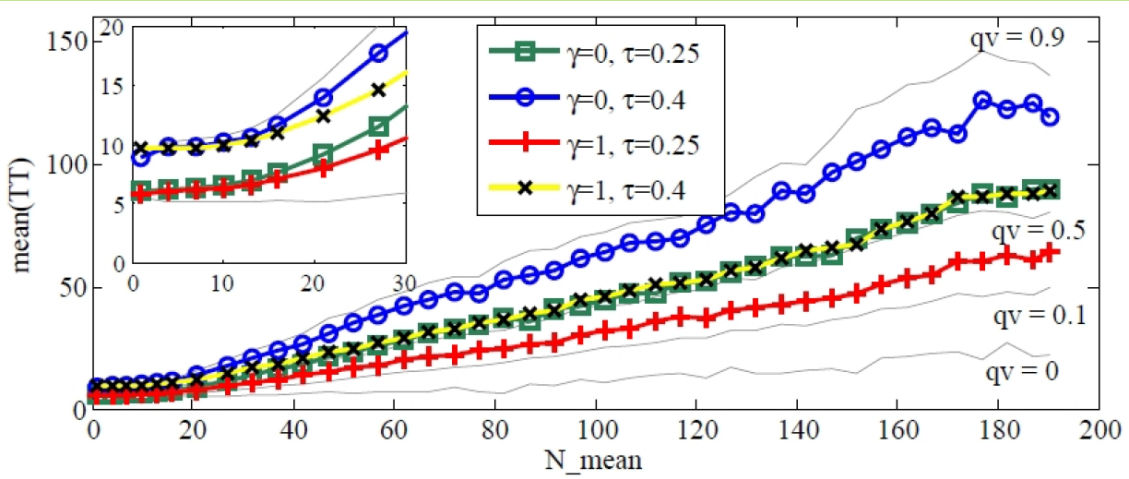


Contribution to analytic study

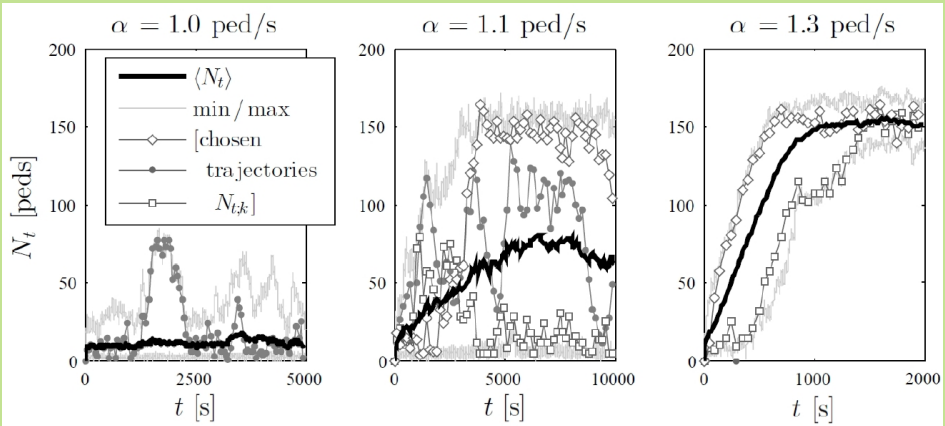


Model studies

Heterogeneity



Phase transition



Obsah

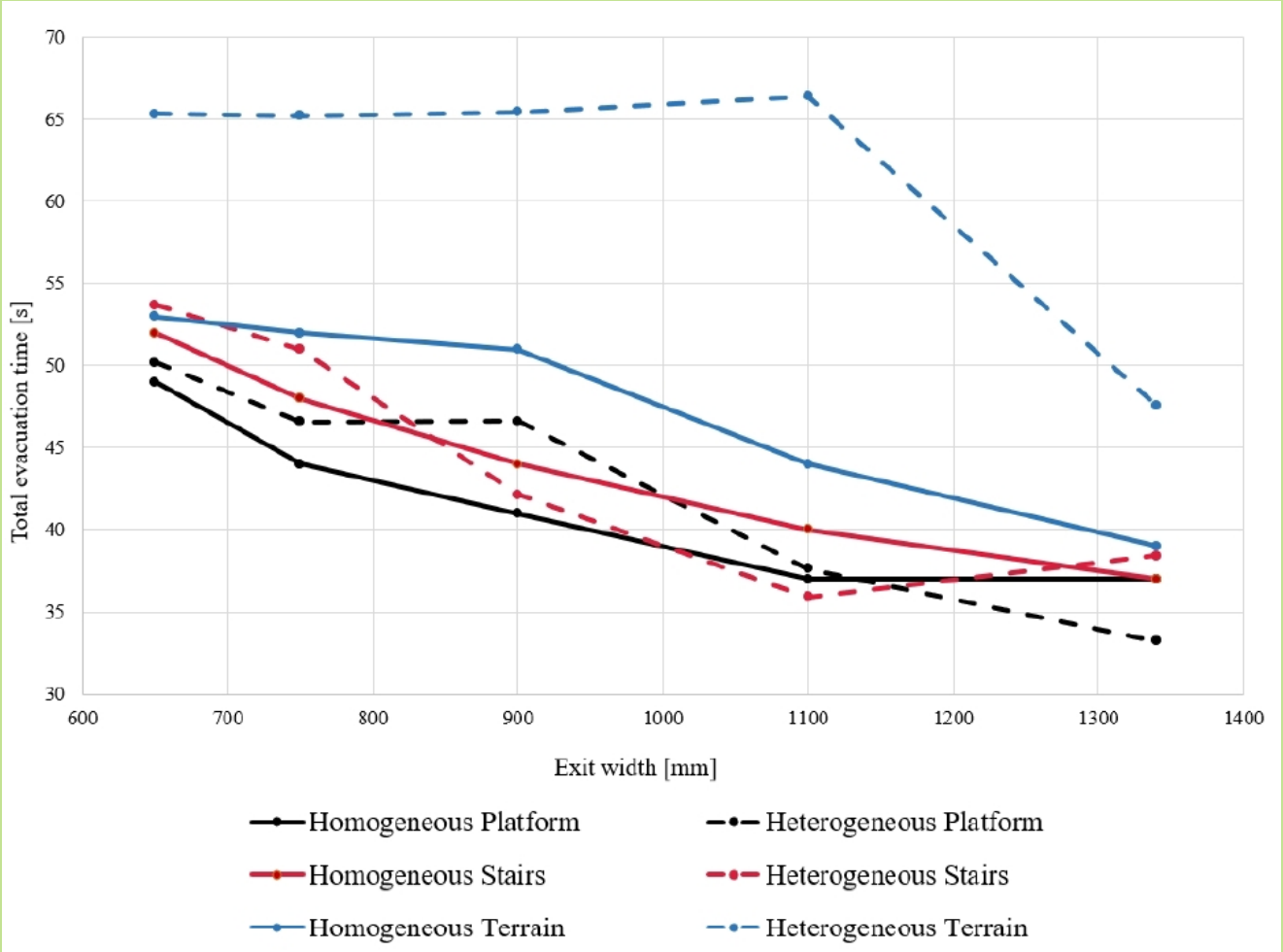
Experiment description

motivation

Visualization

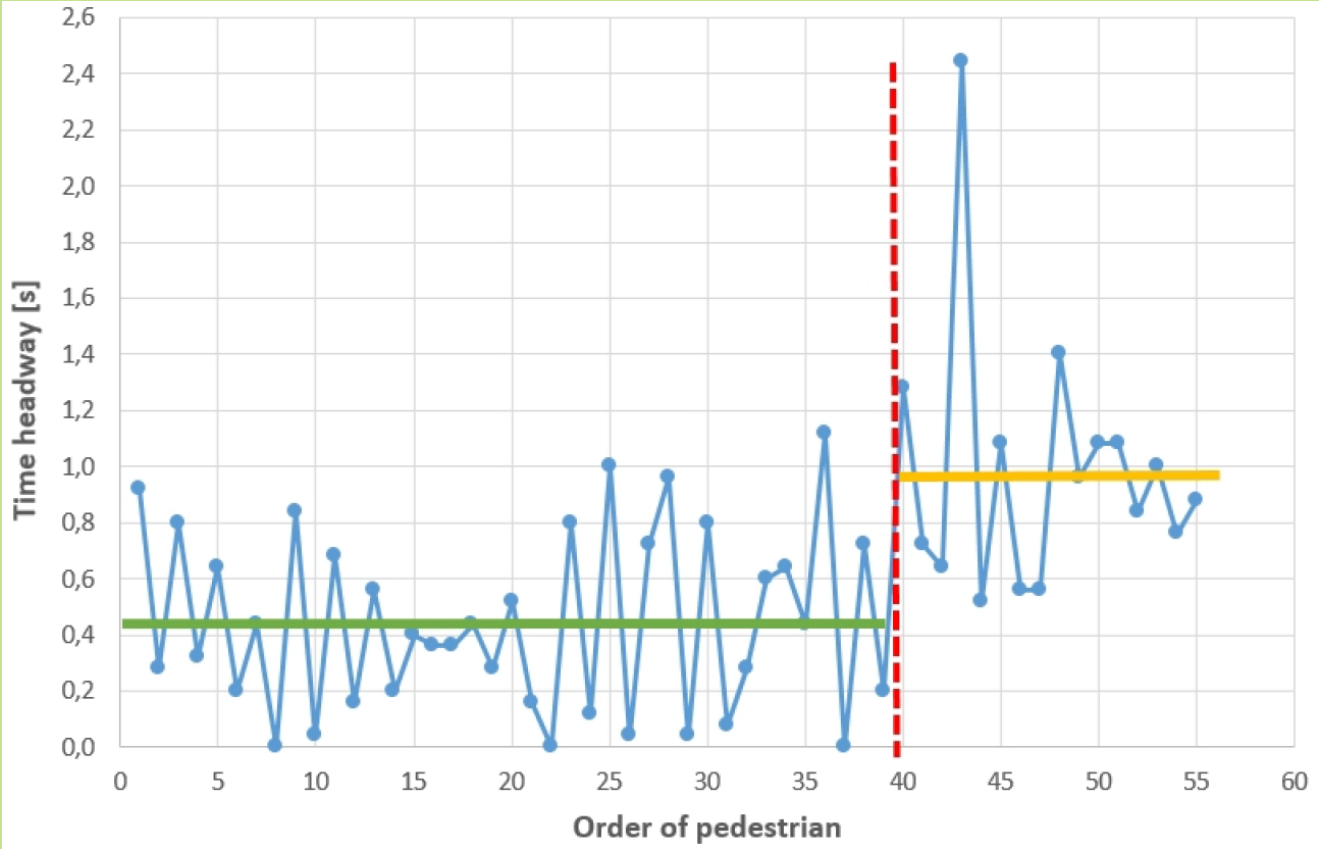
Engineering results

Effect of parameters



Analytic results

Headway analysis



Obsah

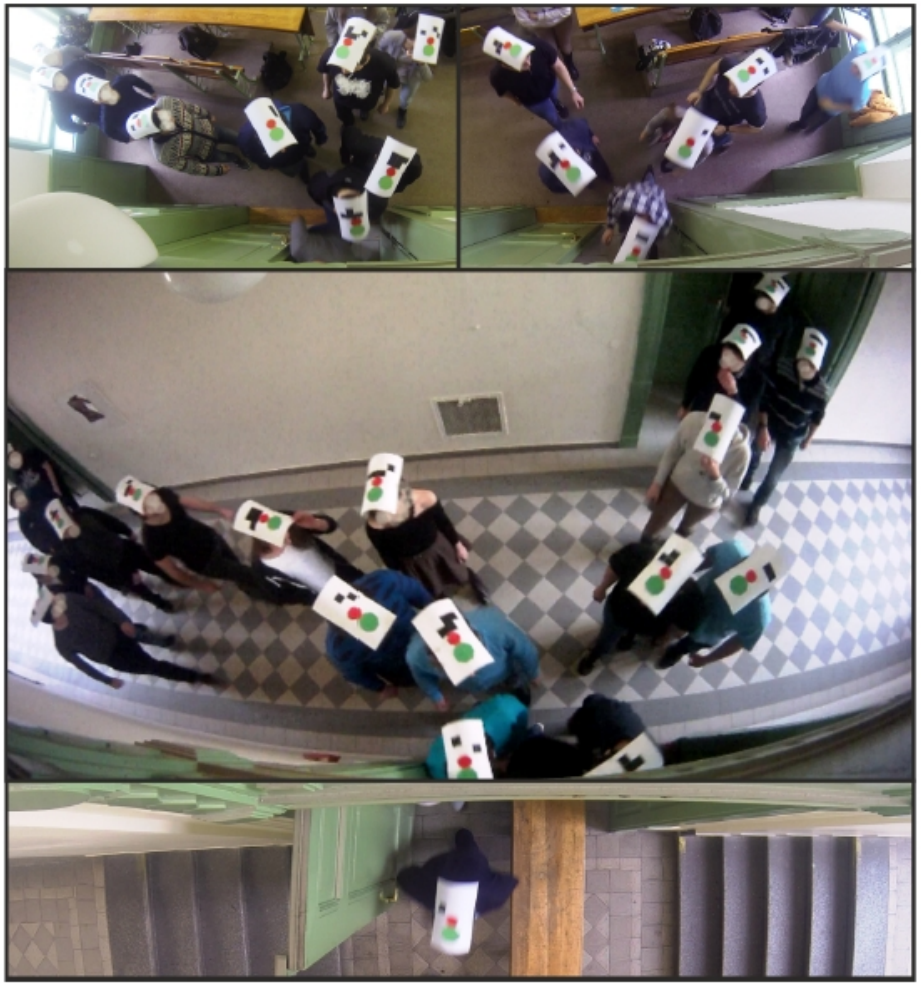
Experiment E5/6

Geometry, monitoring

- Peter - wifi monitoring
- Jakub - kinect monitoring
- GAMS - cameras

$\Rightarrow$ passing time data only

Illustration



Experiment E5/6

Hand calculations

The flow estimation is based on building a mass transport Markov process on the considered network. The state of each node is characterized by the actual number of pedestrians in the corresponding room $N_i(t)$. The expected number of pedestrians in the room is given by:

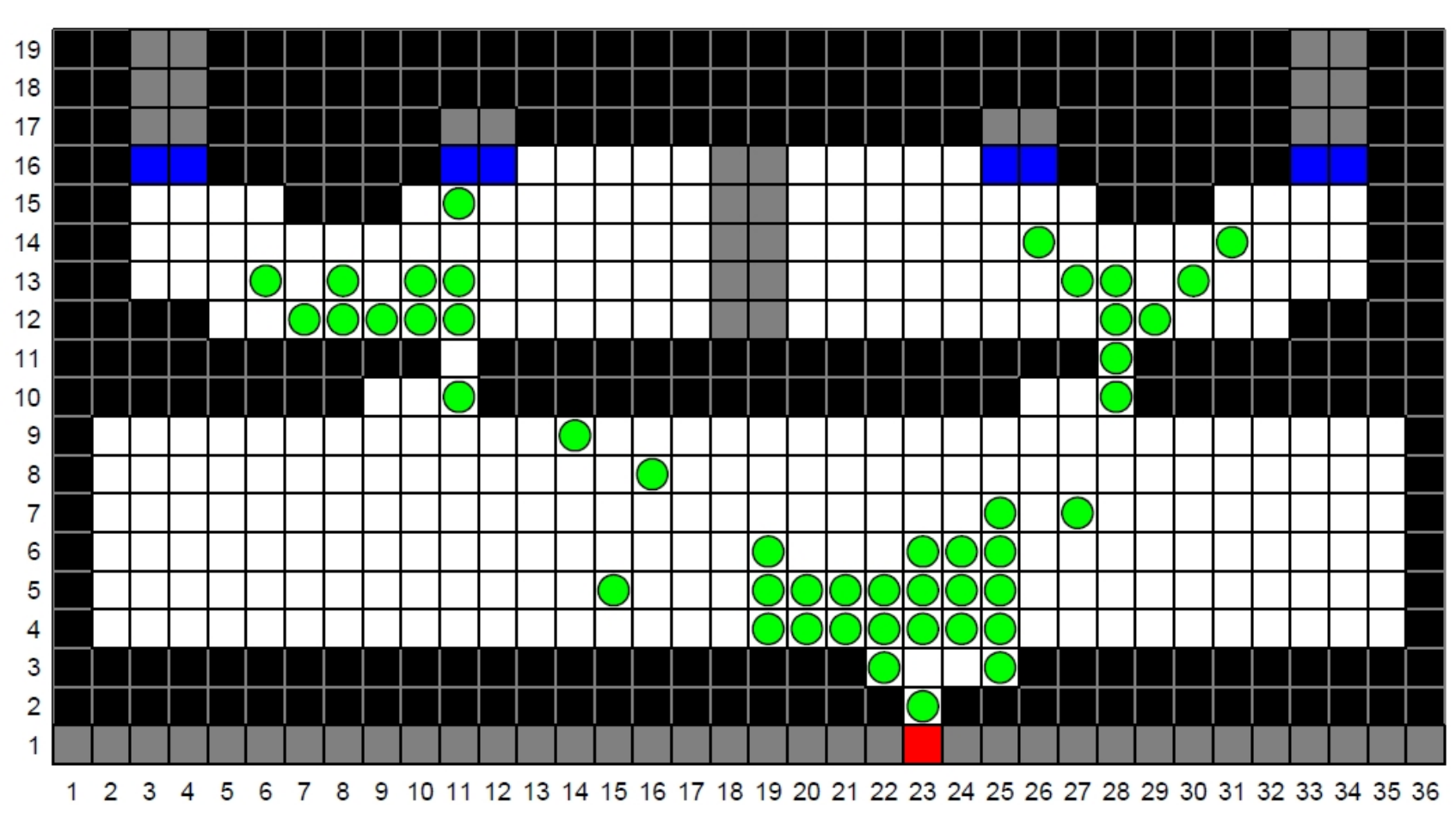
$$N(t) = N(t-1) + (J^{\text{in}}(t-1) - J^{\text{out}}(t-1)), \text{ where } J^{\text{out}}(t) = J^{\text{out}}(N(t)).$$

Furthermore, the cumulative inflow to the cluster in front of the bottleneck is given by

$$J^{\text{in}}_{\text{parent}}(t) = \sum_{children} J^{\text{out}}_{\text{child}}(t - TT_{\text{child}}),$$

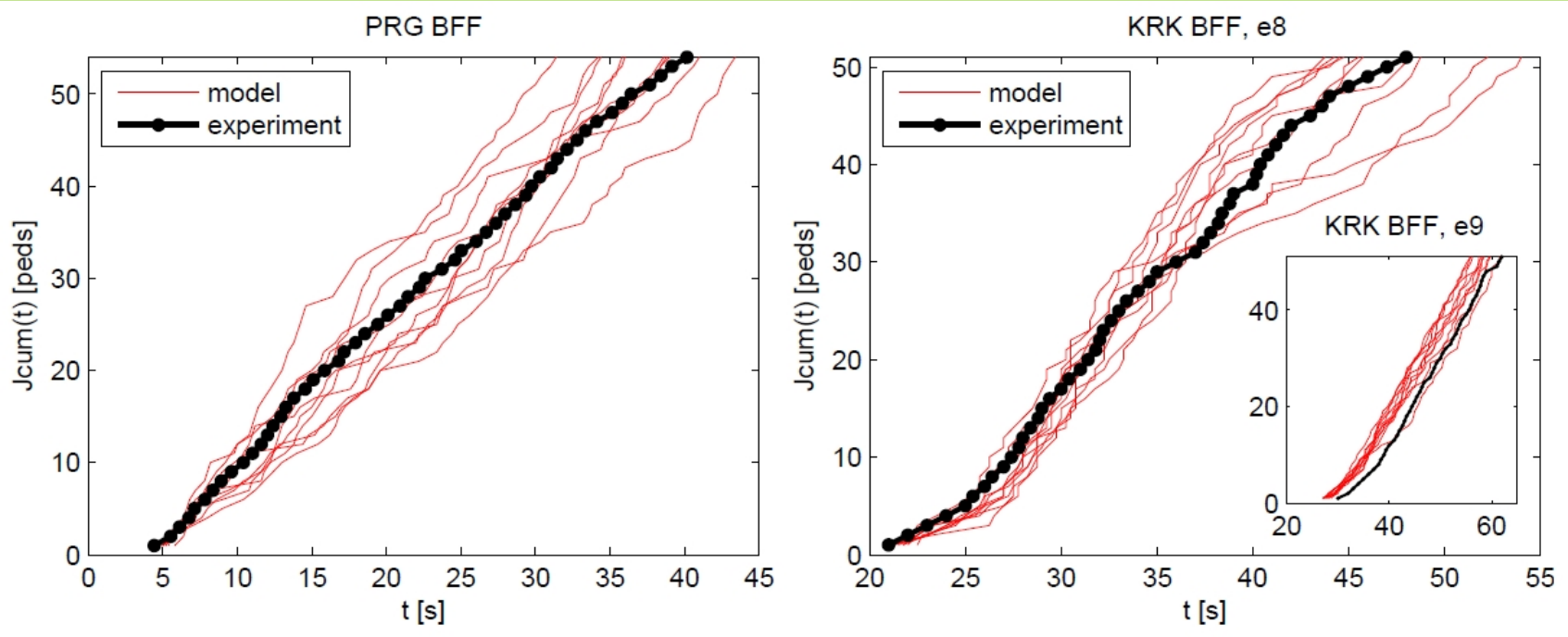
Experiment E5/6

Model approach



Experiment E5/6

Results



Obsah

Thank you for your attention!

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