Evasion maneuvers: One behavior fits all?

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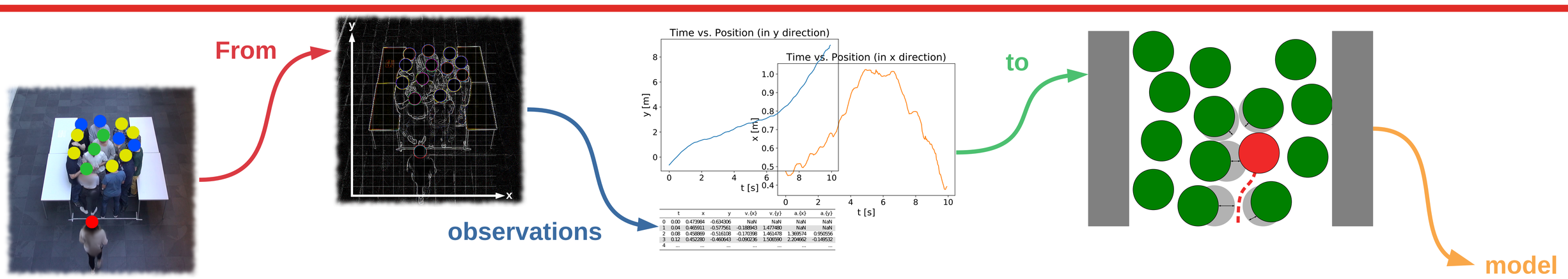


Research question

- **How to model and simulate evasion behavior of pedestrians based on empirical observations?**
- **Therefore, we conducted two controlled experiments in October 2018.**

Key findings: Experiment "Evasion behavior"

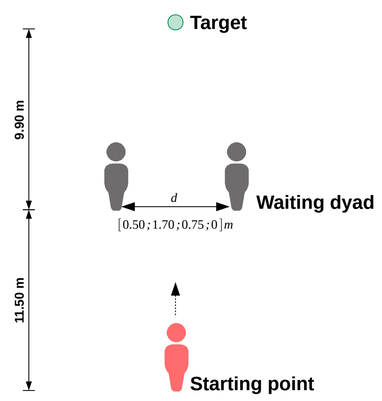
- Quantified evasion distances to validate models: (0.67 ± 0.05) m
- PCA and random forest revealed that dyad distance, size and shoulder width of participants are a good predictor for evasion behavior.

Key findings: Experiment "Motion through dense crowd"

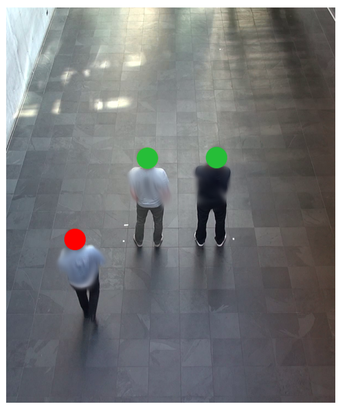
- Trajectories of participants at a density of 5.31 persons/m^2.
- Speed distributions: inside (0.68 ± 0.31) m/s, outside (1.35 ± 0.23) m/s
- For waiting crowd: Distribution of distances to original positions.

Experiment: Evasion behavior

Experiment setup



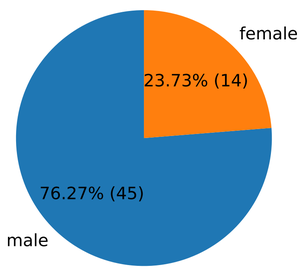
Schematic setup



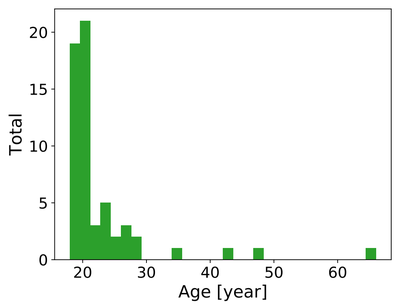
Real setup

Test persons

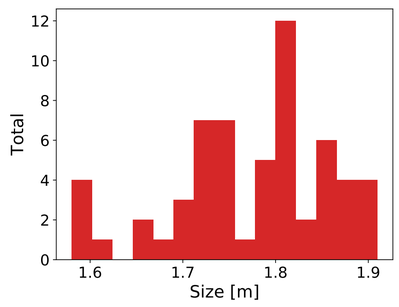
- 59 participants



Gender



Age



Size

Analysis of evasion distance

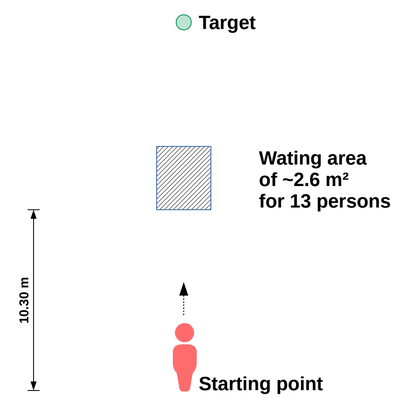
- 135 runs
- 4 different distances d: [0.50; 1.70; 0.75; 0] m
- Extracted evasion distances:

d [m]	Evaded [%]	Evasion Distance Mean [m]	Std [m]
0.00	100	0.75	0.27
0.50	97	0.66	0.28
0.75	67	0.69	0.27
1.70	18	0.60	0.25

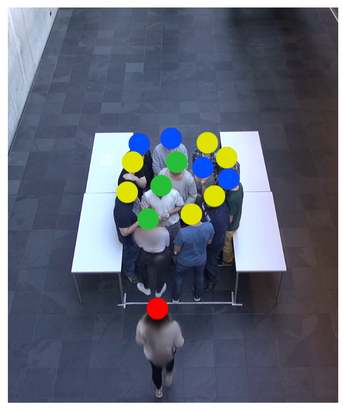
- Further analysis: PCA, random forest and logistic regression

Experiment: Motion through dense crowd

Experiment setup

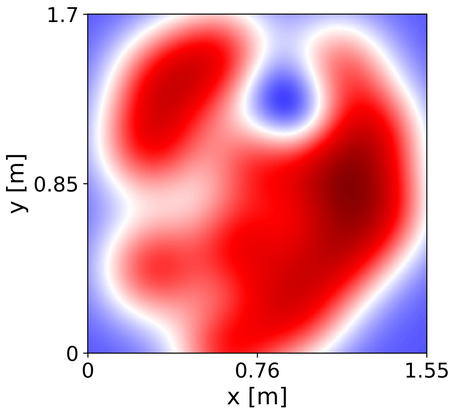


Schematic setup

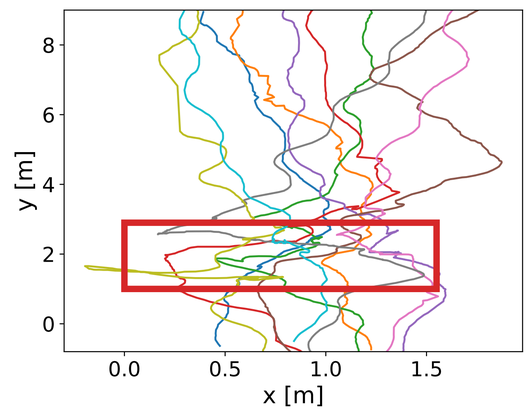


Real setup

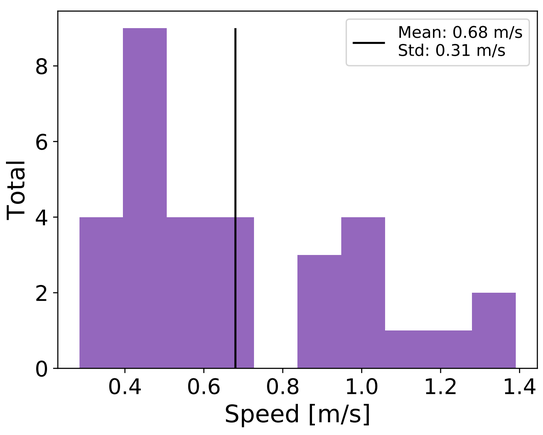
Analysis of motion through dense crowd



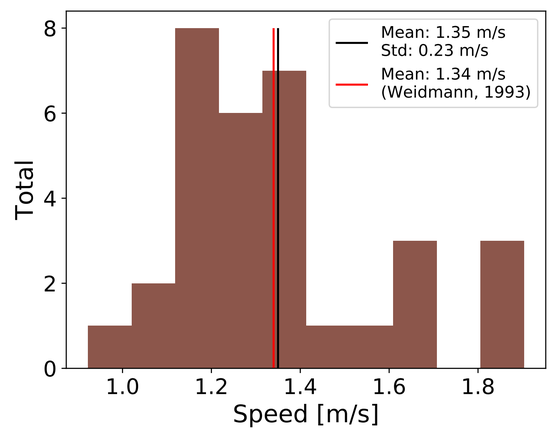
Heatmap



Some trajectories



Speed (inside crowd)



Speed (outside crowd)

Conclusion

Observations can only be explained by **different** behaviors.

Outlook

Implement observed evasion behaviors in the simulation framework Vadere.

The experiment was approved by the ethical review committee of Technical University Munich (www.ek.med.tum.de).

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