

# Social and Spatial Behaviour in Shared Spaces

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intro

data

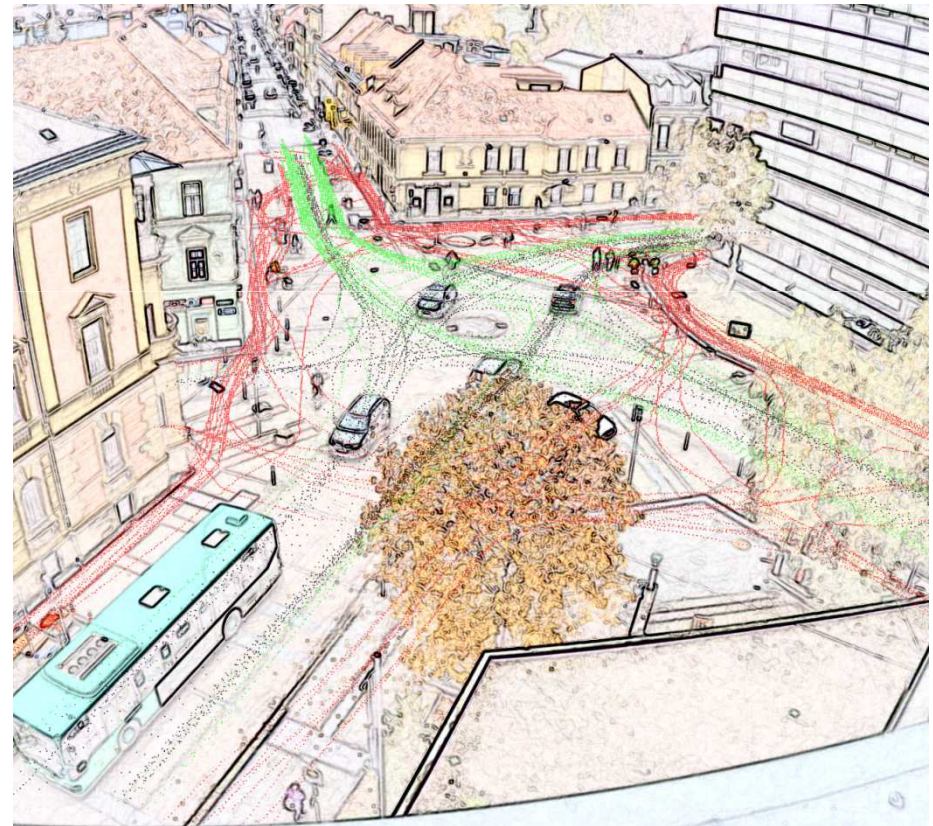
methods

results



# Vision

- Support Shared Space planning processes:
  1. Design
  2. Impact
  3. Visualization.
- Trajectory generation:
  1. Analyzing Videos
  2. Traffic Simulation

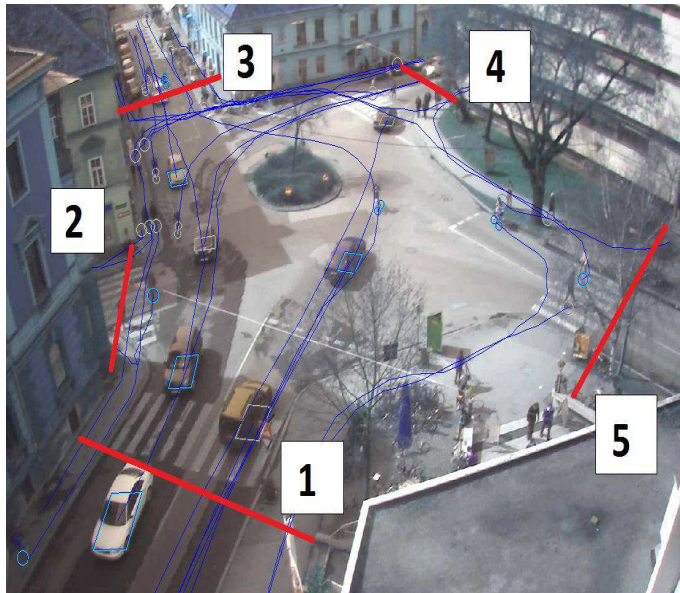


# Model Development

- Concept
- Design
- Implementation
  
- Acquisition & analyzing of data
- Verification
  
- Calibration
- Validation

# Data Acquisition, Sonnenfelsplatz, Graz, Austria.

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methods  
results



- Videobased
- Privacy protected
- Semi automatic

**Roundabout 2010**



**Shared Space 2011**

source: Schönauer et al. [5]

# Spatial Distribution

intro

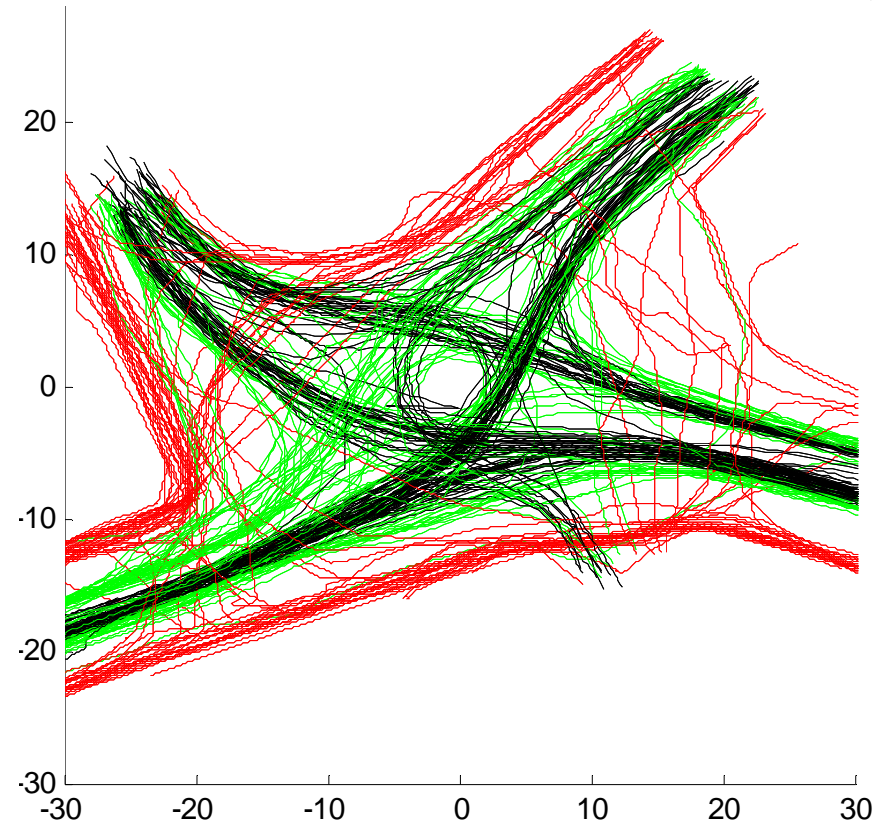
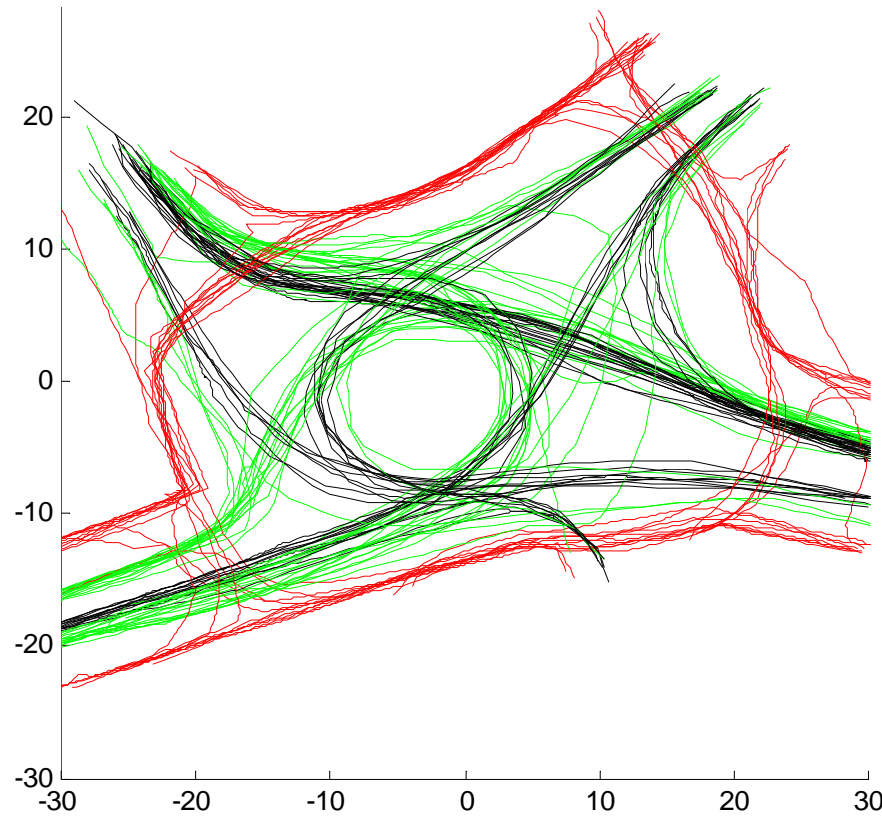
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**Roundabout 2010**

**Shared Space 2011**



**Pedestrians**

**Cyclists**

**Motorists**

source: Schönauer et al. [5]

# Speed Distribution

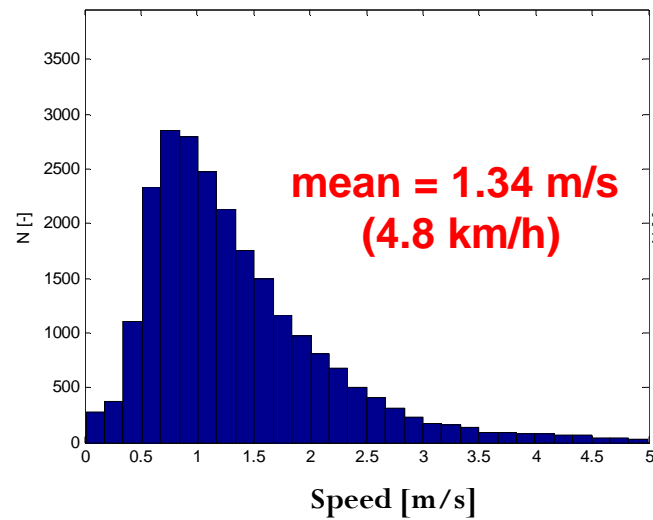
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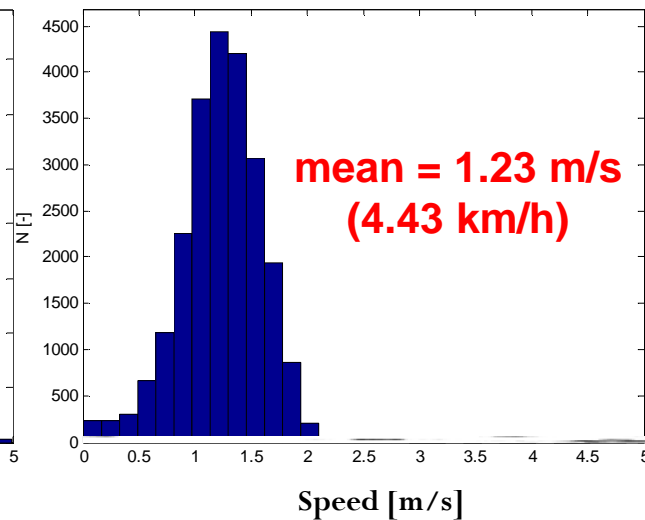
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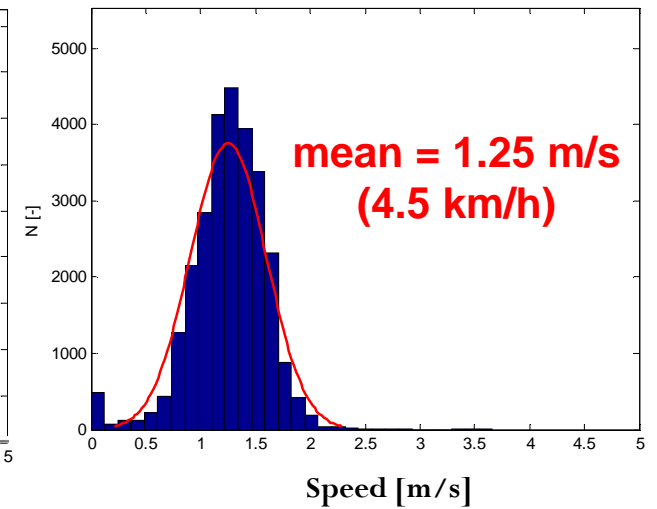
## Pedestrians



Roundabout 2010



Shared Space 2011



Shared Space 2012

# Speed Distribution

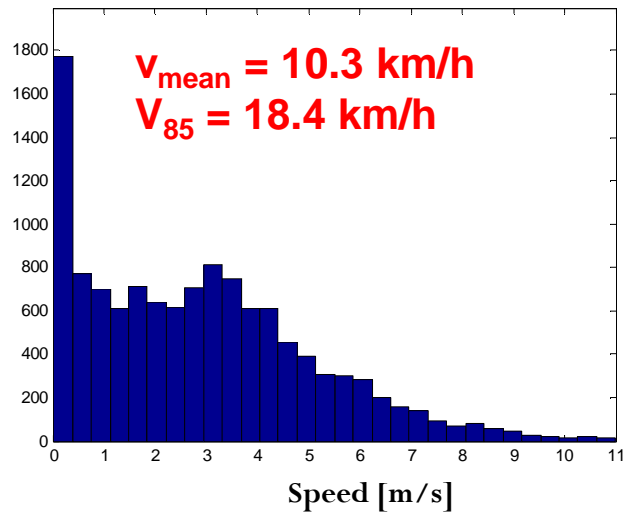
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data

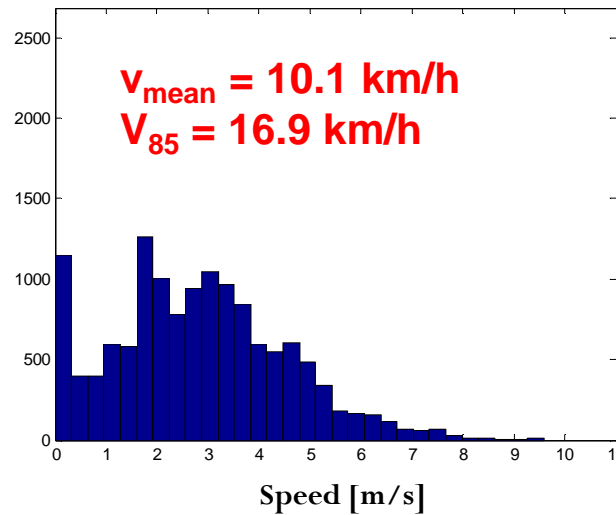
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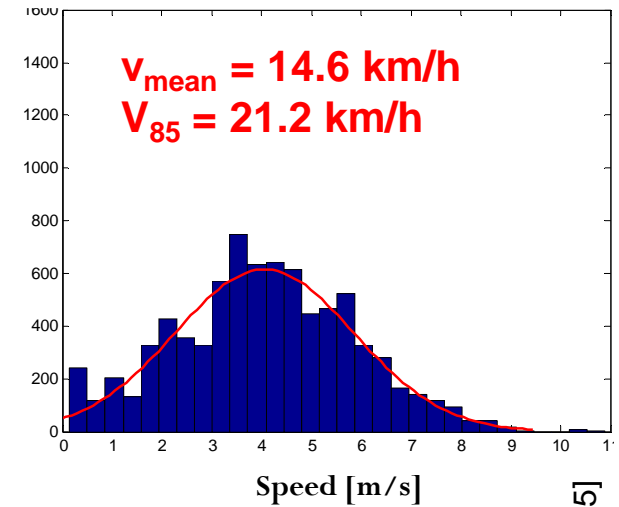
## Motorists



Roundabout 2010



Shared Space 2011



Shared Space 2012

source: Schönauer et al. [5]



# Measurable Phenomena

- Speed → more homogeneous  
 $\text{VAR}_{\text{pedestrian}}: 0.79 \rightarrow 0.37 \rightarrow 0.12$
- Mean values did rise for vehicle in a mid term perspective.
- Lower waiting times for cars.

# Spatial Distribution Of Speed

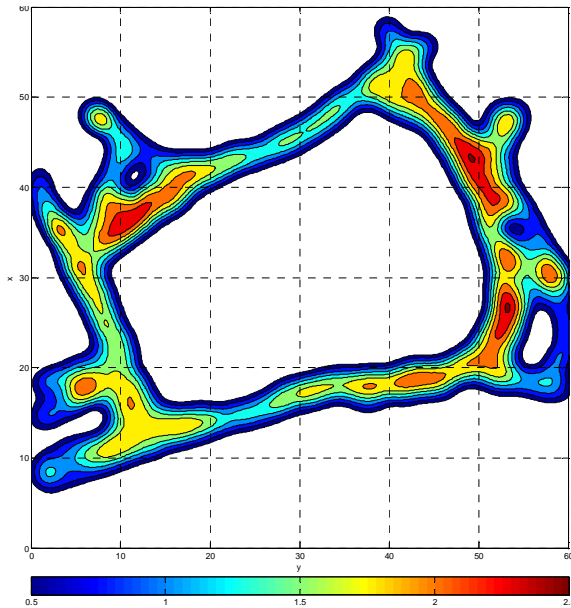
## Pedestrians

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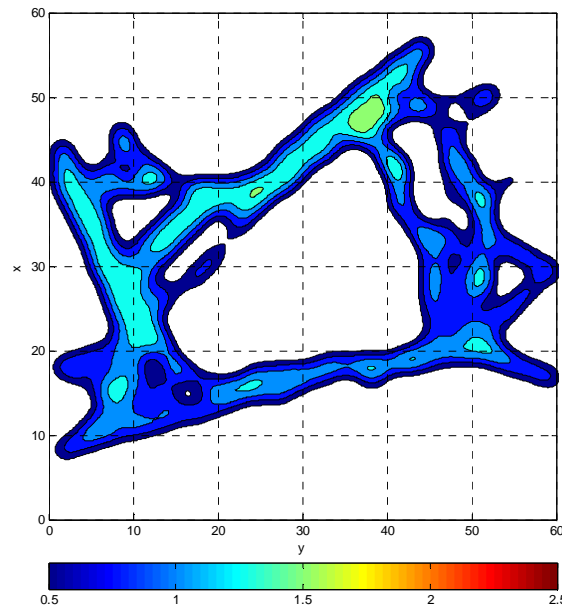
data

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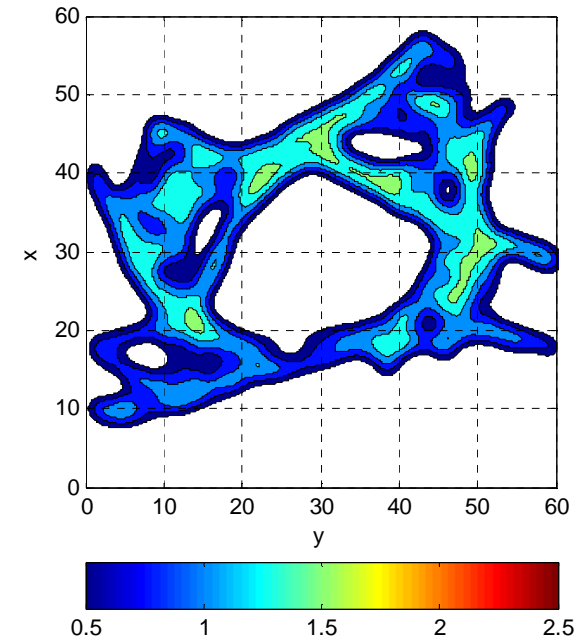
results



Roundabout 2010



Shared Space 2011



Shared Space 2012

source: Schönauer et al. [5]

# Spatial Distribution Of Speed

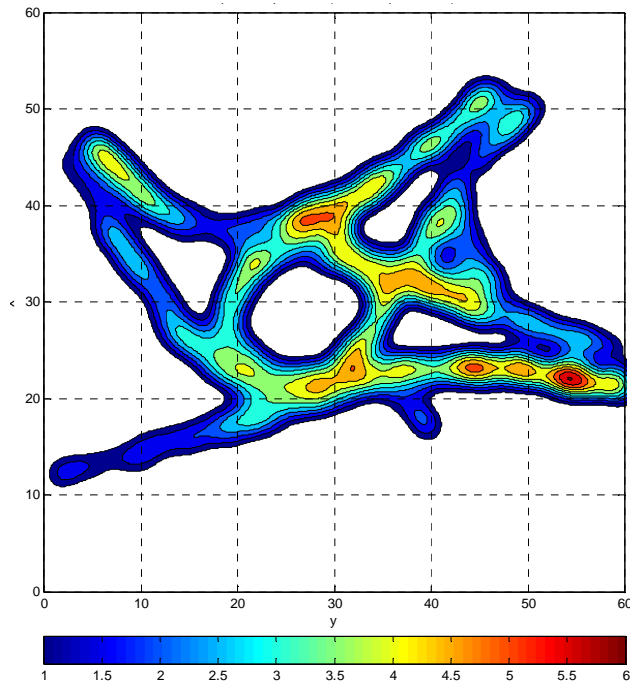
## Motorists

intro

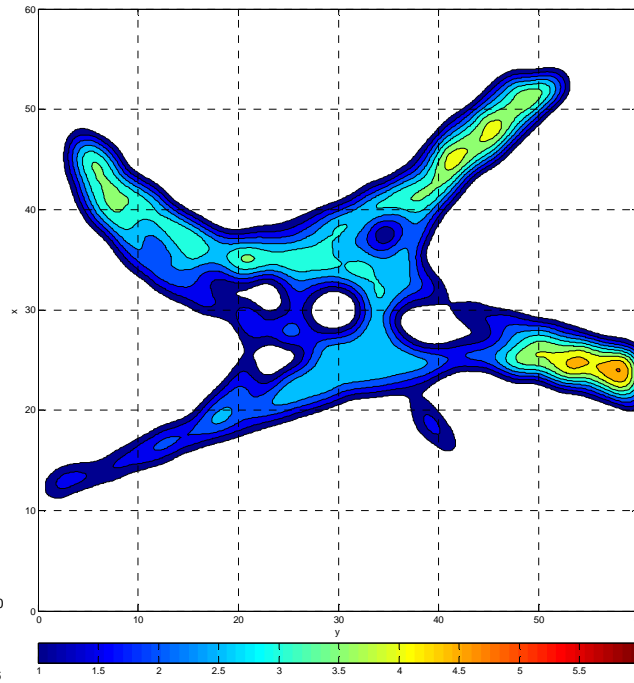
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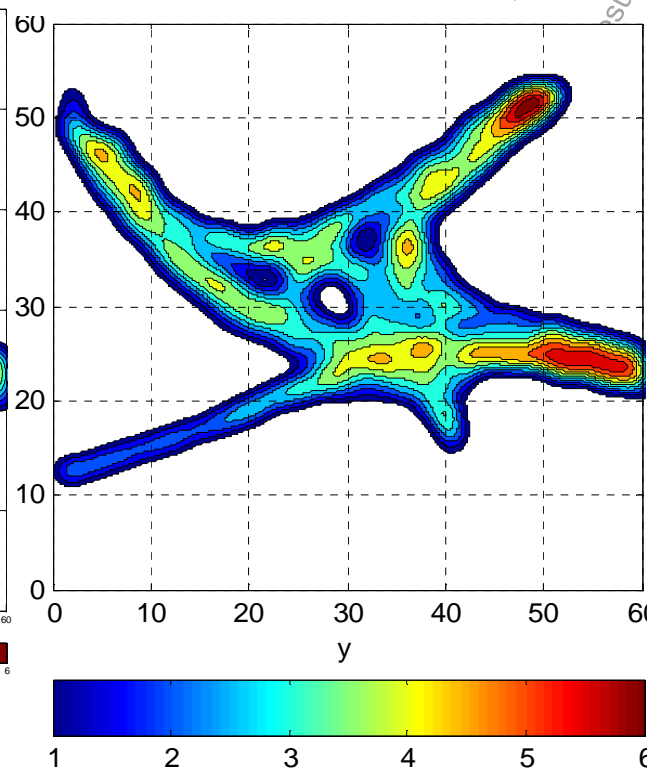
results



**Roundabout 2010**



**Shared Space 2011**



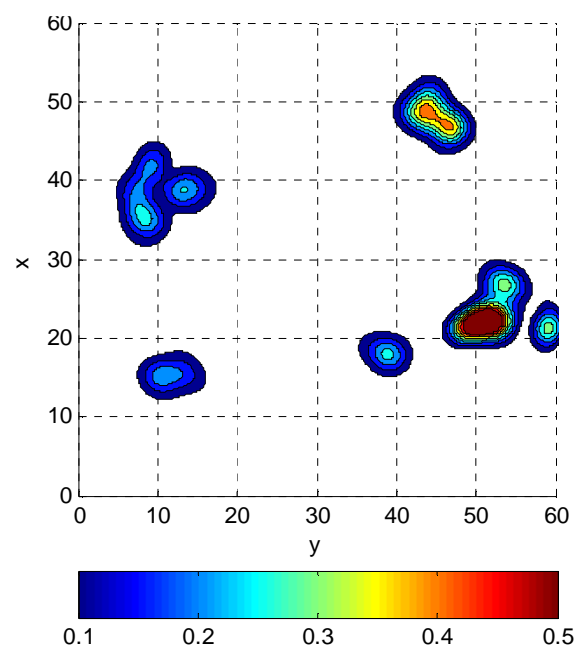
**Shared Space 2012**

source: Schönauer et al. [5]

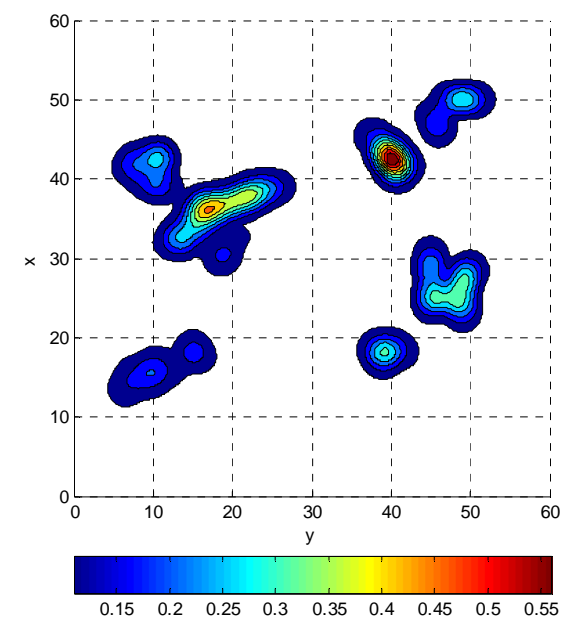
# Safety Aspects

*Where do the cars approach pedestrians at relatively high speed?*

## Pedestrians versus cars



**Roundabout 2010**



**Shared Space 2012**

source: Schönauer et al. [5]

# Simulation of Shared Spaces

- Modeling design details
- Simulation of pedestrians, bicyclists and motorized vehicles in one layer
- Choice of realistic speeds and tracks dependent on:
  - Infrastruktur
  - Traffic situation
- Modelling interaction
  - Traffic regulation
  - Social behaviour

from video footage resulting in 15 conflict descriptions. Figure 6 shows one of these interacting scenes, where a pedestrian wants to cross the road w

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# Tactical Model

Conflict detection



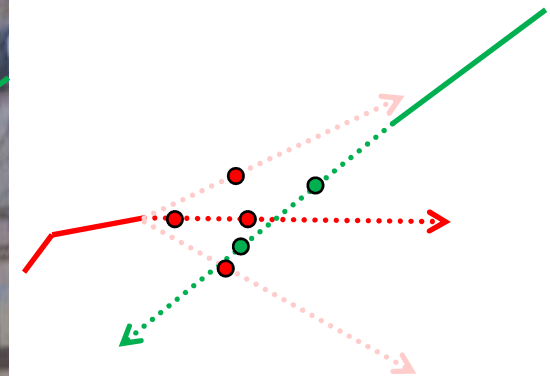
Classification



Solving the game



React to the best strategy



source: Schönauer et al. [2]

# The game

- Definition
  - Non- cooperative (no negotiation)
  - Perfekt information
  - Players solve games sequentielly
- Strategies:
  - Continue, no reaction
  - Brake, stop
  - Avoid left or right
- Solving of the game by the Stackelberg approach
  - Leader – Follower ansatz
  - Player optimize their own utility
  - Who is the „leader“?

# Utility Calculation

$$u_l(s_l, s_f) = \sum_{c=0}^n \theta_c \cdot U_{ci}$$

$u_{vij}$ , velocity component

$u_{Rij}$ , spatial relative vector

$u_{Tij}$ , time distance

$u_{Sij}$ , social utility for agents

$u_{Rij}$ , normative utility according to traffic regulations

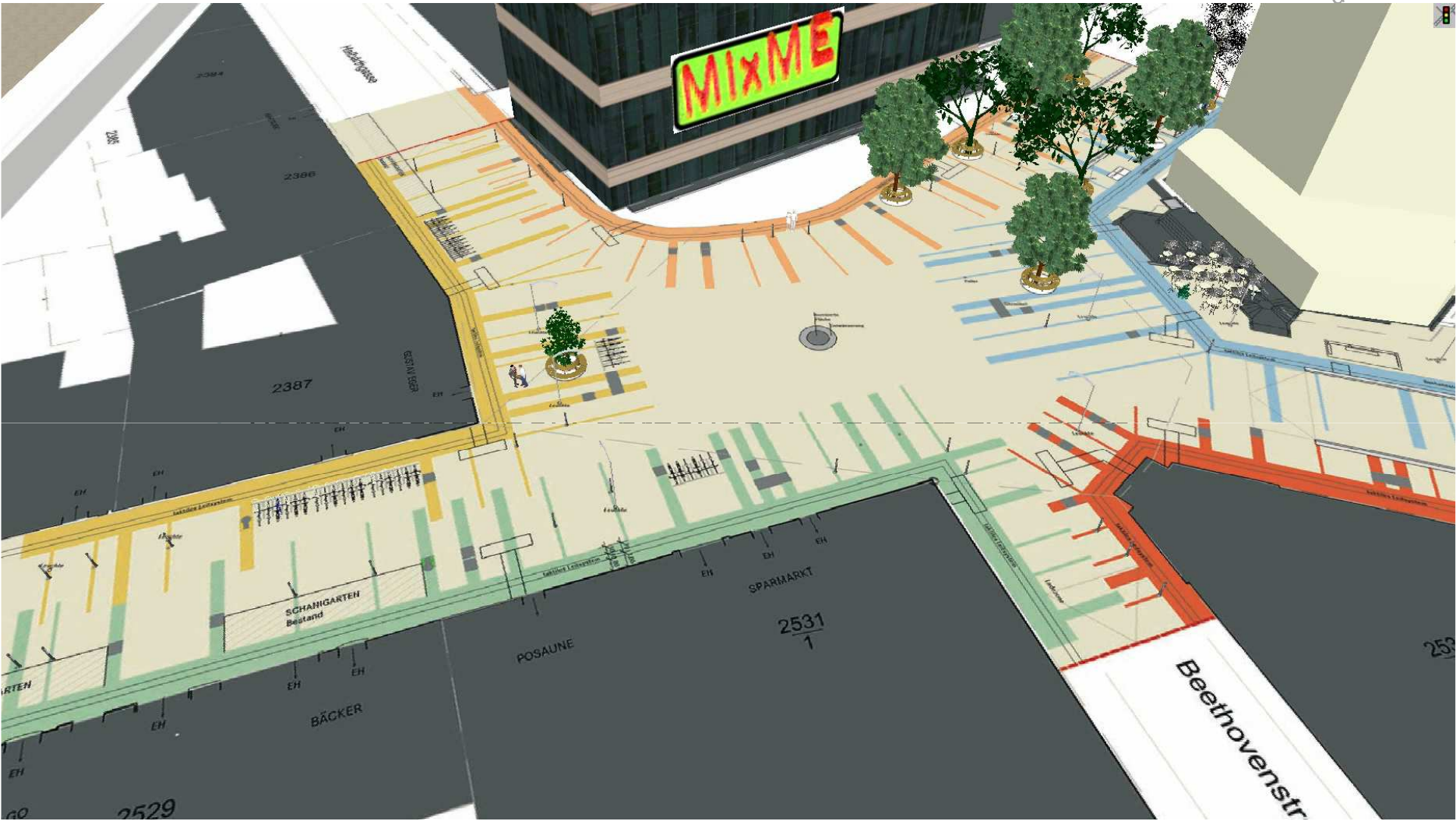
$u_{Rij}$ , saved detour utility

$u_{Rij}$ , energy loss disutility



# Results

- Implementation with VISSIM Interface
  - Demo
  - Includes complex scenarios (Sonnenfelsplatz)
  - System calculation performance is known.
- Interaktionen
  - Calibrated based on pedestrian / car trajectories.
  - Sensitivity analyses shows relevance of the variables used.
- Automatisches Tracking:
  - Speeds and tracks can be measured by automatic tracking within perspective related constrains



# References

- [1] R. Schönauer und H. Schrom-Feiertag, „Mikrosimulation von Mischverkehr – Konzept MiMiSim und Ausblick auf MixME“, in *15th International Conference on Urban Planning and Regional Development in the Information Society*, Vienna, 2010, S. 1157–1161.
- [2] R. Schönauer, M. Stubenschrott, W. Huang, C. Rudloff, und M. Fellendorf, „Modeling concepts for mixed traffic: Steps towards a microscopic simulation tool for shared space zones“, presented at the 91th Transportation Research Board Annual Meeting, Washington, 2012.
- [3] W. Huang, R. Schönauer, und M. Fellendorf, „Social Force based Vehicle Model for 2-dimensional Spaces“, presented at the 91th Transportation Research Board Annual Meeting, Washington, 2012.
- [4] R. Schönauer, Y. Lipetski, und H. Schrom-Feiertag, „Vehicle tracking data for calibrating microscopic traffic simulation models“, *Proceedings of SPIE*, Bd. 8301, Nr. 1, S. 83010F–83010F–9, Jan. 2012.
- [5] R. Schönauer, M. Stubenschrott, H. Schrom-Feiertag, und K. Menšik, „Social and spatial behavior in Shared Spaces“, *submitted to CORP 2012*, Schwechat, 2012.

## Projekt MixME fundend by:



## Project partners:



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