Empirical study of the influence of social groups in evacuation scenarios



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Introduction

- Effects of inhomogeneities in pedestrian dynamics
- Joint studies of the Universities of Wuppertal and Cologne and the Forschungszentrum Jülich
- Two series of experiments with pupils of schools in

Wuppertal

- Fundamental diagrams
- Evacuation scenarios with different group parameters
- Preliminary results







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Teaching units

- Introduction into pedestrian dynamics
- Experiments: panic experiment (Mintz, 1951), density, ...
- Worksheets concerning Game of Life, cellular automaton, Nagel-Schreckenberg-Modell







Experimental set-up

- Square area of 5x5 m
- Starting area
- Exit door with 1,2 m
- Camera system filming from above
- Caps of different colours
- Colour = body size





Experimental procedure





Experimental procedure - Parameters

Composition:

- Groups of children (age 10-12)
- Youths (age 15-17)
- Mixtures
- Size of groups:
 - Individual
 - Pairs
 - Larger groups (4/6/8 persons)
- Strength of interaction:
 - Fixed or loose bond
 - Equitable partners or leader-follower-relationship



Analysis

- Extract the trajectories using PeTrack (Boltes et al.
 2008)
- Analysis of the effect of groups





Analysis – Evacuation times

Evacuation Times - Group with youths





Analysis – Evacuation times

Difference in evacuation times

 \rightarrow Increasing group size leads to a decrease in evacuation times

Cooperative behaviour

also slows down the

evacuation

 \rightarrow further analysis





Analysis – Density distribution

Pairs

← Exit \leftarrow Exit t = 4 st = 2 s \leftarrow Exit ← Exit



narrower distribution



Interpretation – first attempts

- Increasing group size leads to decreasing evacuation time
- Cooperative behaviour slows down the evacuation
- Density distribution: narrower distribution of persons

- Smoother stream of people owing to less conflicts in front of the door (subordination within the group)
- Larger effort to stay together



Outlook

- Entire analysis of the effect of groups size
- Analysis of influences of
 - Different ages and body sizes
 - Coupling strength
 - Relationship between group members (leader / follower)
- Time-dependent densities
- Further data from the second school



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Analysis – Photograph of the finish

- Image section of the door's end for each frame consecutively merged
- White boxes = common group, colour of the cap = body size





Analysis – Photograph of the finish





Groups of six

