Evacuation Bottleneck
Simulating a Panic on a Cruise Ship

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Outline

Our Research Object

- ▶ Costa Voyager
- ▶ Capacity: 836 passengers
- ▶ 8 Rescue Boats
- ▶ In distress at sea in 2005

Source: http://www.shipspotting.com,
Picture taken by Roy Batty

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Our Model
Implementation
Results
Summary and Outlook

Input
Forces
Filled Exits

The Deck Plan

- Colormap
  - Allows any number of zones
- Scaling
- Greatly simplyfied

Source: http://www.kreuzfahrtberater.de

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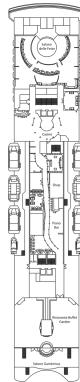
Configuration File

▶ Simulation parameters intialized from a file:
  ▶ Deck configuration
  ▶ Plotting options
  ▶ Physical and behavioral parameters
▶ Simple syntax makes automated generation easy

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Forces

- ▶ As described in Helbing's paper "Simulating dynamical features of escape panic"
- ▶ Three main forces act on agents:
  - ▶ Desired direction
  - ▶ Repulsion & friction between agents
  - ▶ Repulsion & friction from walls

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Filled Exits

- ▶ Rescue boats modeled with limited capacities
- ▶ If a boat gets full, agents need to be informed
- ▶ Two implementation approaches:
    - ▶ Instantaneous update
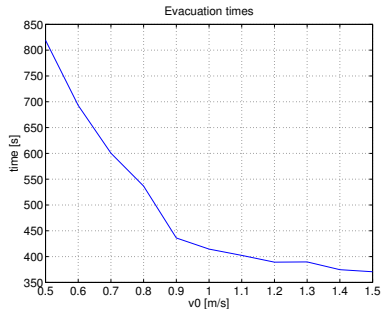   - ▶ Gradual circle-shaped spreading of information

- ▶ TODO

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Passenger Distribution
Panic Level
Outtakes

Distribution of the Agents to the Exits

- ▶ The distribution depends strongly on the geometry of the ship.
- ▶ There was no case where the agents really distributed over the exits
    - ▶ Weakness in the model
    - ▶ More realistic: go for the shortest individual evacuation time
- ▶ realistic update for propagation of information
- ▶ Video

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Effect of desired speed to the overall evacuation time

- ▶ We could reproduce the results from Helbing, Farkas and Vicsek for low panic levels
- ▶ High panic levels: problem!

Evacuation times

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All the things you don't want to happen

- ▶ Agents were stuck in Walls
  - ▶ Even the tiniest timesteps didn't help
- ▶ MATLAB does not behave as expected in batch mode
  - ▶ Simulation works in foreground, crashes in background
  - ▶ No error message, just silently writing crashdumps to home
- ▶ No reproducability even with fixed random seed in our group
  - ▶ Different versions of MATLAB

Some points to take away

- ▶ The basic results could be reproduced
- ▶ The model is not very well suited for multiple exits
  - ▶ There should be a heuristic to decide for a direction
- ▶ Use the power of Open Source Software (OSS)!

You ask – We answer

► Now it's your turn