

JuPedSim

From Obscure Executables to a
Publicly Documented Library

Kai Kratz

deRSE2026 · Stuttgart · 2026

Who Am I?

A Software Engineer who curiously ended up dealing with Research Code



Ozaq
github.com/Ozaq

530+ contributions

A circular profile picture of a pug dog wearing a grey wizard hat and a blue scarf, standing in a grassy field.



Success - People Are Building On Top Of Us

Scientific papers



PNAS Nexus, , pp. 1–16

doi:

Paper

12th International Conference on Pedestrian and Evacuation Dynamics (PED 2025)
Prague, Czech Republic – September 9-12, 2025

PAPER

Crowd Dynamics in Historical Perspective: Reframing the Amritsar Massacre through Agent-Based Modelling and Social Psychology

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FOR PUBLISHER ONLY Received on Date Month Year; accepted on Date Month Year

Open Access Crowd Simulations Using a Humanoid Paradigm.

Thomas Chatagnon ^{*1} and Xiaoyun Shang²

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Dynamic Motivation: Integrating Psychological Theories of Motivation in Pedestrian Modeling for Bottleneck Scenarios

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12th International Conference on Pedestrian and Evacuation Dynamics (PED 2025)
Prague, Czech Republic – September 9-12, 2025

Comparative Analysis of Evacuation Strategies: Awareness and Pathfinding *

Álvaro Serrano¹, Giuseppe Vizzari², and Marin Lujak^{1,1}

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²Department of Informatics, Systems, Communication, University of Milano-Bicocca

12th International Conference on Pedestrian and Evacuation Dynamics (PED 2025)
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Crowd Simulations Beyond Evacuation Applications: A Use Case Study for Departure Scenarios at Major Events

Jette Schumann^{*1} and Hauke Schmidt²

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²D.LIVE GmbH & Co. KG, Germany



Publish About Browse

OPEN ACCESS PEER-REVIEWED

RESEARCH ARTICLE

Come together: A unified description of the escalator capacity

Christoph Gwendiger , Mohcine Chraïbi , Antoine Tordeux 

Published: March 6, 2023 • <https://doi.org/10.1371/journal.pone.0282599>

16th International Conference on Traffic and Granular Flow (TGF 2026)
Bristol, UK – June 16-19, 2026

Dynamic Motivation in Insights from Experiments for Goal-Directed Motions
Ezel Üsten

IAS Series
Band / Volume 64
ISBN 978-3-95806-773-8

PedAgent: a Large Language Model empowered intelligent pedestrian traffic management agent with a simulating-analyzing-optimizing chain of functions

Chuan-Zhi (Thomas) Xie^{*1} and Mohcine Chraïbi²

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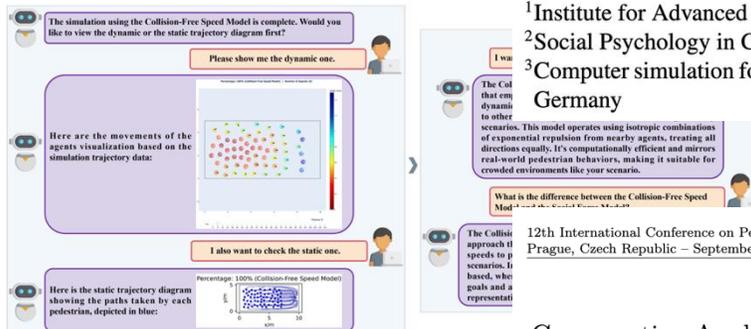


Figure 10: PedAgent simulation of bottleneck flow and comparison of two models' definitions, static and dynamic.

Where We Started

“Prospective PhD students refused to work with JuPedSim.
The people the software was built for wouldn’t use it.”

```
infile.xml - the config maze

<!-- 5 XML files for ONE simulation -->
<JPSgcfm project="JPS" version="0.4">
  <geometry>geo_building.xml</geometry>
  <person>persons.xml</person>
  <routing>routing.xml</routing>
  <traffic>traffic.xml</traffic>
  <trajectories>output.xml</trajectories>
  <parameters>
    <v0 mu="1.24" sigma="0.001"/>
    <bmax mu="0.25" sigma="0.001"/>
    <force_ped nu="0.3"
      disteff_max="2"/>
  </parameters>
</JPSgcfm>

<!-- geometry: 955 lines of vertices -->
<vertex px="0.0" py="0.92"/>
<vertex px="3.03" py="0.0"/>
```

18 memory leak fixes

7 segfault fixes

5 XML files per simulation

```
git log - hall of shame

$ git log --oneline # Greatest Hits

e56f772 Router hack
  "agents do not take the shortest
  path. Waiting for a fix."

6185284 DirectionGeneral()
  "in a U-Corner this is going
  to be crap"

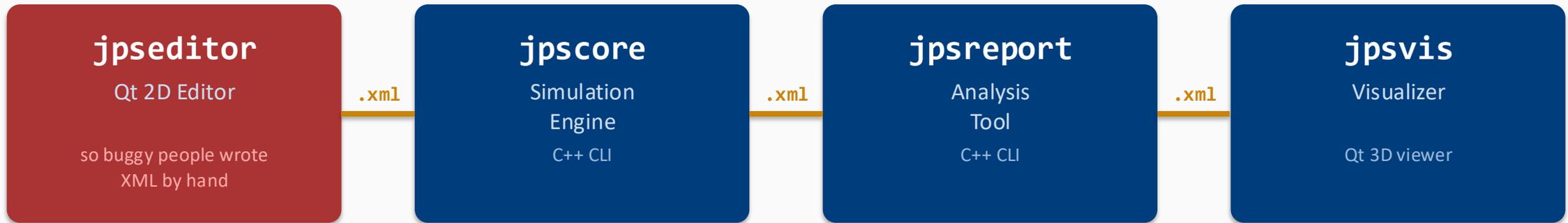
031afc3 deactivated removal of
  stuck peds since it occasionally
  yields segfaults

ff34c2b dirty fix for
  GetRiskTolerance

# 18 memory leak fixes
```

The Old Ecosystem

4 CLI tools, XML configs, bash scripts, everyone's own Python glue



The Glue Layer — maintained by each researcher individually

bash scripts

Complex pipelines for repeated simulations

Python scripts

Everyone's own set for data transformation

jpsreport scripts

Custom analysis wrappers per researcher

Being An Outside Voice

As an external with industry clout, I could say things insiders couldn't

BUILDING TRUST FIRST

- OSS contributions → C++ Q&As, GDB, testing
- Mohcine Chraibi organized a workshop on JuPedSim's future
- Invited as outside voice for honest input

THE DIFFICULT WORKSHOP

**“Focus on what you want to do,
not what you currently think you need to do.”**

Can you maintain a 2D GUI editor?

Can you maintain a 3D visualizer?

Do you need 3D simulation?

Be honest about your capabilities.

→ **Drop jpseditor, jpsvis, XML configs**

→ **Build a Python library with C++ core**

Biggest want from the researchers:

**“I want to code
in Python,
not C++!”**

— *every* domain scientist in the room



Mohcine Chraibi

github.com/chraibi

Workshop organizer

The Three Pillars

What the workshop decided

1



JuPedSim as a Python Module

C++ simulation core wrapped in Python.
Drop all CLI tools and XML configs.

2

Py

Python Replacement for jpsreport

Trajectory analysis in pure Python.
Velocity, flow, density, fundamental
diagrams.

Started
much later

3

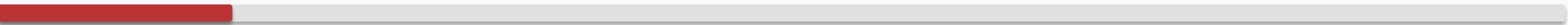


First-Class Documentation

Not an afterthought.
A **core deliverable** from day one.
API docs, examples, tutorials.

Setbacks

The first attempt at a rewrite failed



Jan — enthusiasm!

~12 months later — only stubs exist

1

**“Do your usual job
and also...”**

JuPedSim was an additional task on top of existing research work. No dedicated time, no protected priority. Always second fiddle.

2

**Organising from scratch
is its own skill**

The team had deep domain expertise but had never organised a software implementation project from zero. A rewrite needs project management skills the group didn't have.

Still working in industry — no chance to participate meaningfully.

The Long Slog

An opportunity arises — I join FZJ full-time to work on JuPedSim

Strategy: Incremental rewrite, not big-bang

More cumbersome, but delivers useful results sooner. Build trust through visible progress. Rebuild credibility after the failed attempt.

Year 1

Year 2

Year 3

3 years

The hard parts

- Long stretches with little visible progress
- Growing list of cut features
- Model/navigation combos that don't work — cut
- 3D simulation — finally cut
- Many “side quests” along the way

What kept us going

- Each increment is usable on its own
- Stakeholders see progress, trust grows
- Cut what doesn't work — don't mourn it
- Great helping hands from the team

“Never say it's done until it's DONE. I staunchly refused to submit to conferences — we talk about finished work, not work in progress.”

What We Built

From the old ecosystem to the new

jpscore

C++ CLI simulation engine + XML configs



JuPedSim

Python library with C++ core.
jupedsim.org

jpsreport

C++ trajectory analysis tool



PedPy

Python analysis library.
pedpy.readthedocs.io

First-class documentation

A core deliverable, not an afterthought



jupedsim.org

API docs, examples, Jupyter notebooks

pedestriandynamics.org

Unbranded field-wide theory documentation

Learning: Different Worlds, Different Rules

The difference is not technical — it's structural

Industry

- Ship product → revenue
- Dedicated teams, clear ownership
- Software IS the deliverable

Research Software

- Publish paper → career
- Software is a means, not an end
- “Do your usual job and also...”

We bridged the gap through documentation

Copy-pastable examples · Downloadable Jupyter notebooks · ~25% of total effort
Good docs prove the software works — they build trust faster than any demo.

Learning: Invest in the Interface

API design + distribution — make it trivially easy to use

Convenience Layer

Covers common cases.
Simple setup, sensible defaults.

Low-Level API

Full control over simulation.
Enables novel research workflows.

Past: convenience first → Now: flexibility first, convenience on top

```
$ pip install jupedsim pedpy
```

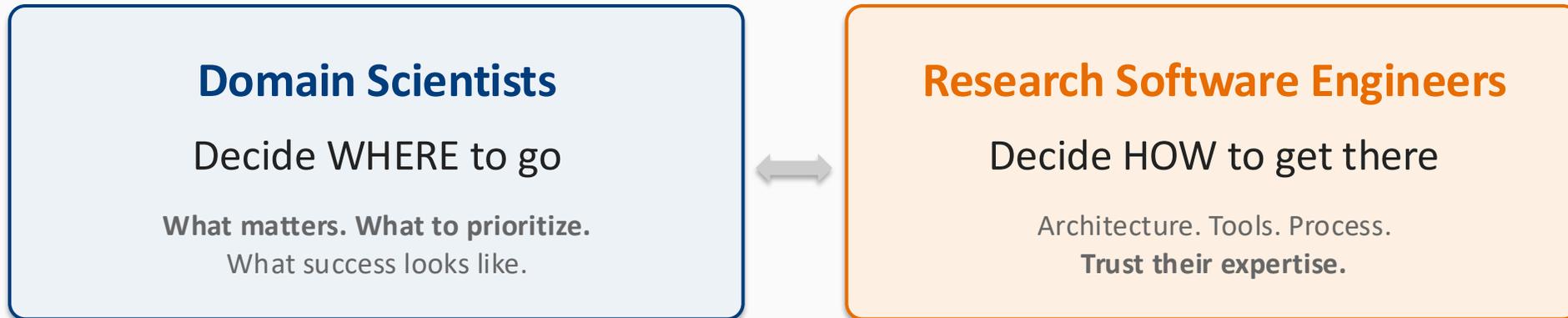
```
Successfully installed jupedsim-1.3.0 pedpy-1.2.0
```

Before: clone repo, build C++, write XML, run CLI — users gave up

After: pip install → open notebook → first simulation in 5 minutes

Your problem is most likely not technical — it's social.

— One Team —



Don't get hung up on technicalities. Understand each other first.

The workshop worked because the people who had to live with
the decision were the ones who made it.

Direction decisions can redefine what counts as “the model.”

Thank You & Questions

Slides and materials available at:
pedestriandynamics.org/academic_update

Contact: ozag@posteo.de