

Experiments on Human Clogging at Bottlenecks

PhD Thesis Outline, Anna-Katharina Raytarowski

Clogging
here: Blockage of an exit
due to an assembly of
people in front of the exit

Can lead to
stumbling and
falling,
slows down the
evacuation
process

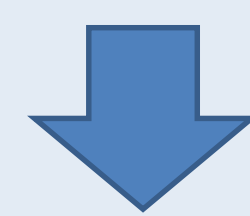
Person stumbling
while exiting
through a narrow
bottleneck

Experiment at the University of
Melbourne, Australia, 2017



PhD Project

- Why and when does clogging, stumbling and falling occur?
- Is there a possibility to reduce it?
- Influence of variables such as pressure between participants and between participants and door frame, full body movement and acceleration, motivation, luggage
- Part of JUMPA (Jülich University of Melbourne Postgraduate Academy) program → strong cooperation with University of Melbourne



Experiments with participants at bottlenecks for different
motivations and setups

Inertial Measurement Unit (IMU)

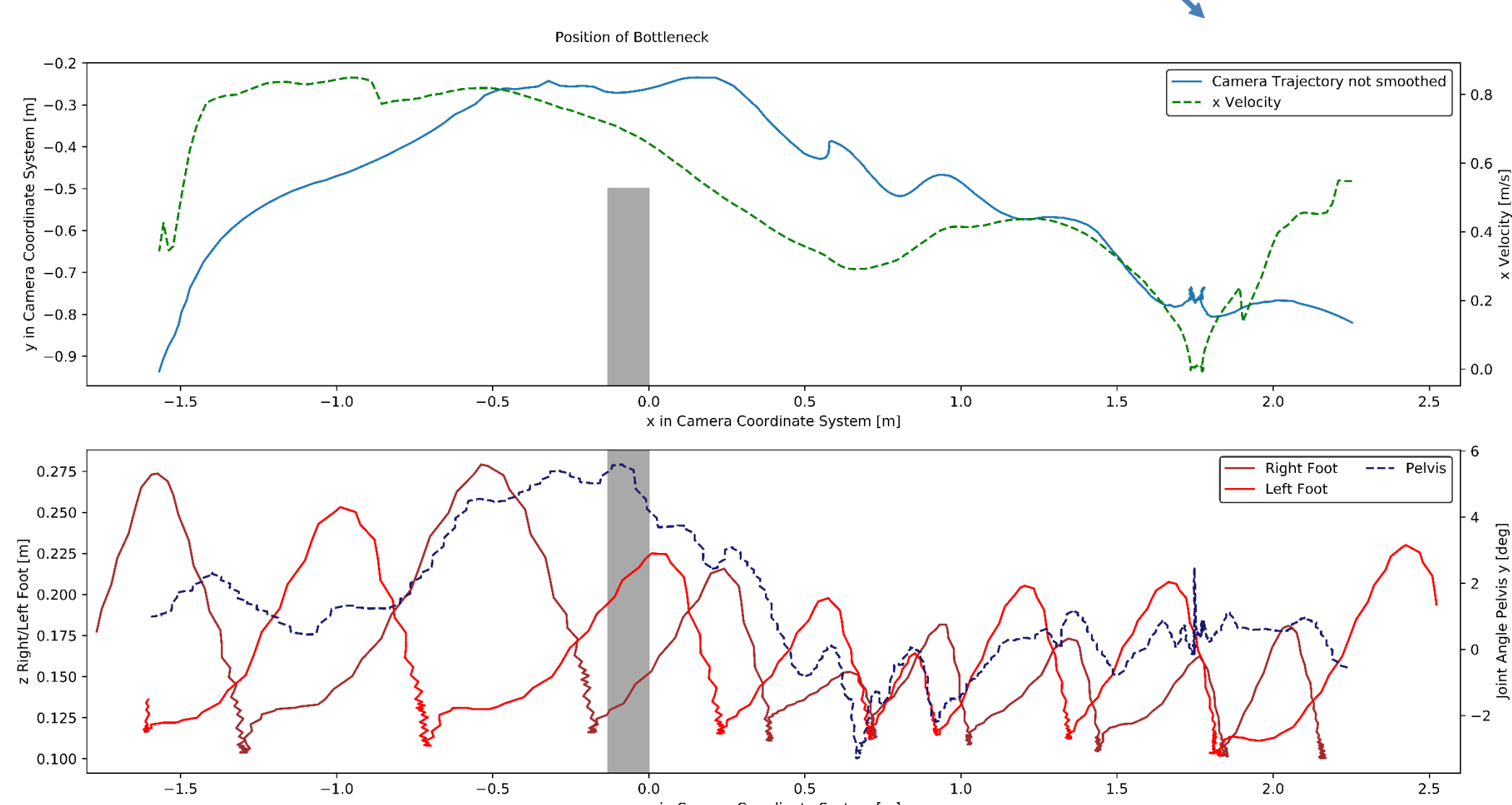
Captures 3D motion
(movement, acceleration,
velocity, angles for various
parts of the body) for
single persons

Camera System

- Tracks movement of a group of participants
- Allows the calculation of velocity, density and flow
- Colored hats allow tracking

Pressure Sensors

- Will be attached to participants and door frame
- Should be small & flexible
- Acquisition process still ongoing



First Results for IMU:

Plot of internal/external hip (Pelvis)/shoulder rotation (right y-axis) & height of left and right foot sensor (left y-axis) ↔ distance to exit in camera coordinate system



Colored hats for tracking via
camera system visible in the
setup

Setup at University of Melbourne, Australia