Gao-qi He, Yi Jin, Qi Chen, Zhen Liu, Wen-hui Yue, Xing-jian Lu, 2016. Shadow obstacle model for realistic corner-turning behavior in crowd simulation. *Frontiers of Information Technology & Electronic Engineering*, **17**(3):200-211. http://dx.doi.org/10.1631/FITEE.1500253

Shadow obstacle model for realistic corner-turning behavior in crowd simulation

Key words: Corner-turning behavior, Crowd simulation, Safety awareness, Rule-based model

Corresponding author: Gao-qi He
E-mail: hegaoqi@ecust.edu.cn

ORCID: http://orcid.org/0000-0001-8365-0970

Motivation

- Human crowd is a fascinating phenomenon in the real world. The simulation of human crowds has recently drawn increasing attention from experts in various types of fields.
- Current crowd simulation models are still inconsistent with the empirical observations because of the complexity of human behaviors.
- Corner-turning behavior is one of the problematic issues that have not been studied in depth. Although several studies on this topic exist (Watt,1993; Snook, 2000; Rojas *et al.,* 2013), only a few have considered the effect of human psychology and individual differences in this issue.

Main idea

- Inspired by the observations that people tend to enlarge their viewing range to select a safer route when turning a corner, we present shadow obstacle (SO) model, which can generate a more realistic corner-turning behavior.

- The proposed model can be easily integrated into current local behavior models.

Method

1. Introduce the concept of shadow obstacle and design the corner-turning rules according to the observation that people tend to enlarge their view range when turning a corner. The rules can
   (1) Determine whether the agent is turning the corner or not;
   (2) Compute the best velocity direction.
2. Establish a full crowd simulation framework by combining global navigation, local behavior, and physical collision together.
3. Carry out various experiments based on the proposed framework.

Major results

- Our model can generate more realistic corner-turning trajectories.

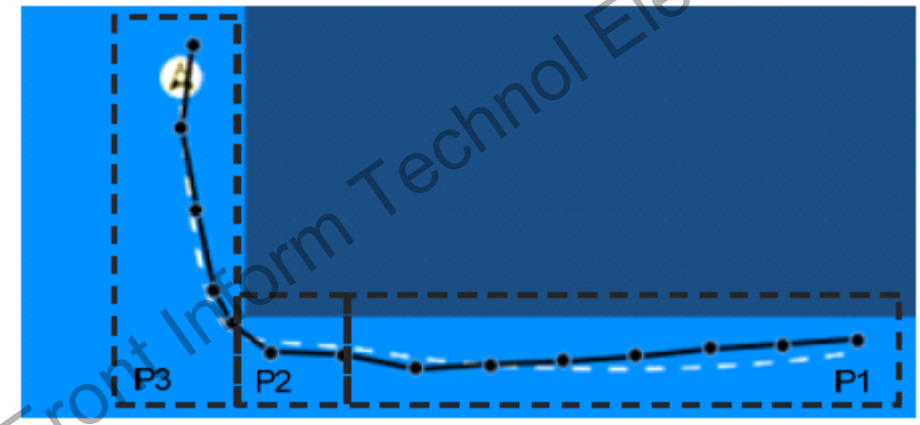
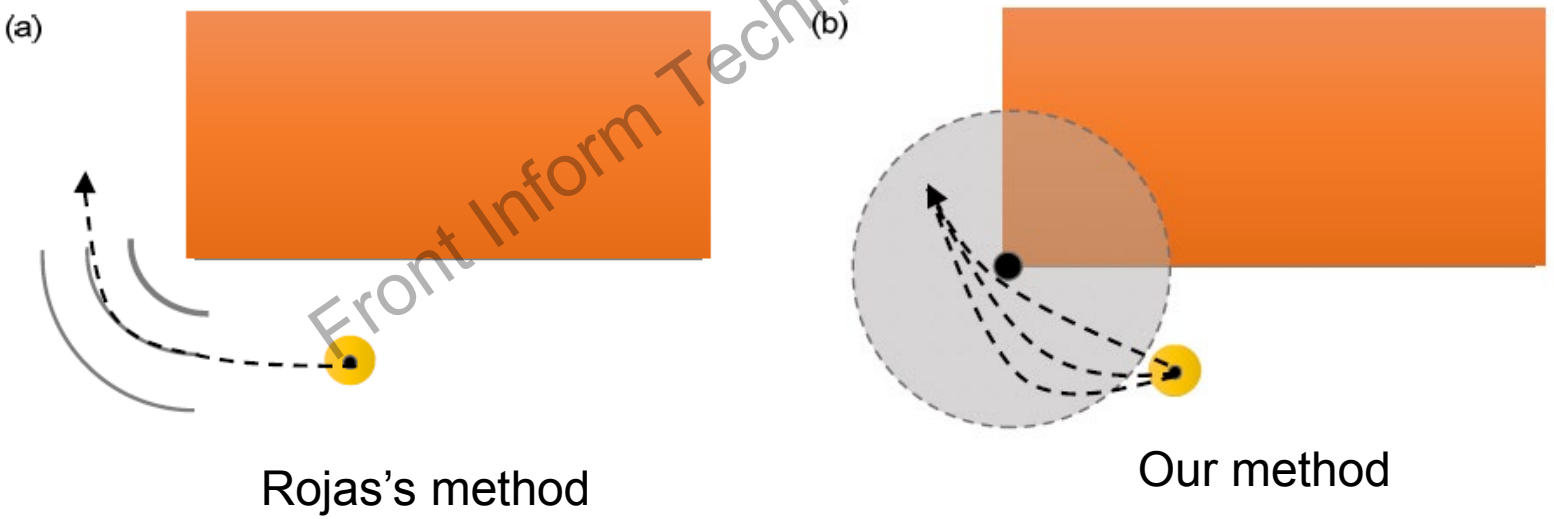


Fig. 9 Comparison of the trajectory reported in Hashimoto *et al.* (2013) (black) with the trajectory generated by the SO model (white)

Major results (Con'd)

- Compared with Rojas's method, Our method takes human psychology and individual differences into account and the trajectories generated by our method are diverse and more natural.



Rojas's method

Our method

Conclusions

- Inspired by the observations in a recent survey, this paper presents a novel model, the shadow obstacle model, to generate the realistic corner-turning behavior in crowd simulation.
- We implemented our model using a rule-based approach, and a corresponding framework was established to perform the full crowd simulation.
- We demonstrated the believability of our model through a series of simulations, including the comparisons with the real data and the parameter analysis of the proposed model.