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# Resolution of conflicts in cellular automaton evacuation model with the game-theory 

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## Highlights

1. The cost in the game is related to the distance to the exit and the number of players.
2. The prisoner's dilemma games and the stage hunt games are played near and far from the exit.
3. The controllable parameter $n$ is used to control the regions for two kinds of games.


#### Abstract

The floor flied cellular automata model coupled with game theory is used to simulate the evacuation from a room. In the improved model, the evacuees are divided into two kinds. One is patient and another is impatient. The patient evacuees try to avoid physical contacts, but the impatient evacuees vie for the empty target cell by paying the effort. During the evacuation, the payment of the impatient evacuee for the empty target cell is not always the same. In the improved model, the cost paid by the defectors is a function of the distance between the target cell and the exit and the number of evacuees playing the game. The controllable parameter $n$ is introduced to describing the intensity of competition for the target cell by the defector. If $n$ is small, the competition is fierce, otherwise, the competition is relatively mild. As the same time, the asymmetric rules of changing evacuees' strategies are introduced. There are two kinds of games in the room. One is the prisoner's dilemma game played near the exit, the other is the stage hunt game played far from the exit. The regions of two kinds of game depend on the controllable parameter $n$. For a big value of $n$, the region for the prisoner's dilemma game is small, but the region for the stage hunt game is large. The influences of the evacuation time are investigated in both of no changing and changing the strategy. The instantaneous and total fractions of the CD and DD games are analyzed in the both cases of no changing and changing the strategy. Meanwhile, the specific flow rates are compared with the others' experiments.


Keywords: Game theory, Evacuation, Cellular automata.

## 1. Introduction

Up to now, many models have been developed to simulate pedestrian flow ${ }^{[1-25]}$, for example,

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