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Collective behavior of mice passing through an exit under panic

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11 HIGHLIGHTS

- 12 ·A series of experiments with mice escaping through exit with different width are conducted.
13 ·The procedure that potentially reduce suffering or distress to the animals are adopted.
14 ·The process of mice flow is divided into three stages based on the temporal evolution.
15 ·The frequency of time intervals obeyed different distributions for different exit widths.
16 ·The relationship between the group size and the group flow rate is analyzed.

17
18 ABSTRACT

19 Collective movement of animal under emergency situation has attracted growing
20 attentions among researchers. Study of collective behavior of mice has received
21 increasing attention in the field of evacuation. However, its rules still need to be
22 confirmed with adequate explanation. In this paper, collective behavior of mice
23 passing through an exit under panic was investigated. The results showed that the
24 total evacuation time decreased with exit width increasing in a certain range. Based
25 on the different tendency of the curve in temporal evolution, the process of mice flow
26 was divided into three stages. The density of mice near the exit peaks at a certain
27 horizontal offset and starts to decrease over time. With the increase of the exit width,
28 the duration of the higher density state decreased. We found that the frequency of
29 time intervals obeyed a lognormal distribution or an exponential decay for different
30 exit widths. In addition, the relationship between the group size and the group flow
31 rate was analyzed in different scenarios. The phenomena found in our experiments
32 show the collective behavioral characteristics of mice. Our analysis in this paper will
33 deepen our understanding of crowd dynamics under emergency situation.

34
35 1. Introduction

36 The existence of biological population is common in nature, such as ant colony,
37 bird flock, wildebeest group, fish school, and pedestrian crowd. The characteristics of
38 collective behavior of biological population are attracting growing attentions among
39 researchers. Scientists in human public safety fields have devoted themselves into
40 providing evidence for previous hypotheses or predictions about human behavior in

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