Vitae System Based Agent Modeling and Simulation of Self-Evacuation and Rescuing Process under Survivability-Critical States in Underground Flooding

○Eishiro HIGO, Norio OKADA

1. Background

What actually happened on March 11, 2011 has revealed that, if such a catastrophic event should occur to people, their lives could be immediately placed on the brink of survival. Such a critical state for one's life will be called "survivability-critical state" in this paper. We need to improve existent risk management criteria for assessing disaster risks by considering all the worst possible case scenarios. Beside tsunami, there is an increasing need to prepare for such events such as flash floods, landslides, and underground inundations in urban areas.

2. Research Description

The Oike underground town in the center of Kyoto, Japan is taken as a case area. Many studies have been published on agent-based flood evacuation simulations, and sophistications of behavioral modeling made so far. However, few studies have given explicit consideration to evacuation in survivability-critical states. We address how to survive through the worst imaginable situation by making severe decision-making effectively, simultaneously followed by action-taking under survivability-critical states. If evacuees have enough sensibility to look around their environment (setting), they might be capable of quickly discovering a small niche or platform nearby as a substitute shelter. Moreover an evacuee needs others' help to survive under survivability-critical states if the hazard level is increasing.

Flooding conditions (as the assumed states of the hazard) are based on physical experiments conducted by Toda et al (2007) using the physical model of the Oike underground structure and by experimenting with people's walking speed and movement. Then a multi-agent simulation model was programed based on a multi-agent simulation software called KKMAS.
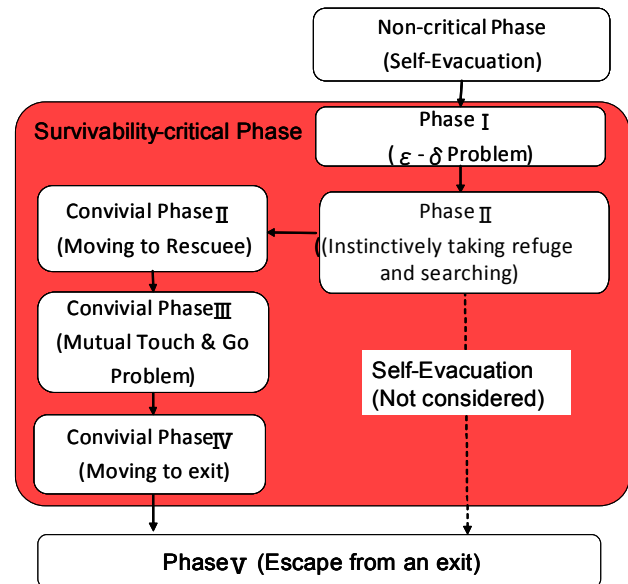
3. Major Outcomes

(1) Vitae system based agent modeling is proposed to simulate evacuation and rescuing process under survivability-critical states.

(2) Three functions, survivability, vitality, conviviality are specifically defined to operationalize the conceptual model.

(3) Countermeasures for worst scenarios are suggested.

(4) They include alternative locations of substitute shelters, effective use of tools and alternative priority of rescue.