CIFE Seed 2011-12 Projects

A Computational Framework for Egress Analysis with Realistic Human Behaviors

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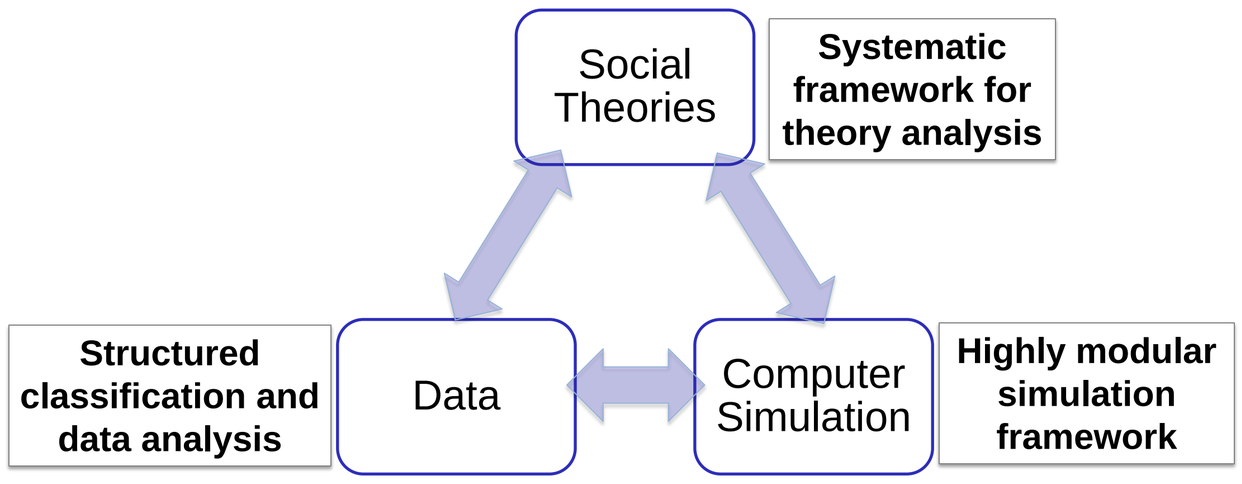
Motivation

- **Human and social behaviors** play an important role in emergency evacuations.
- **Oversimplified assumptions** in current computational models.
- There is a dire need to **"improve the realism and accuracy of crowd behavior movement**, in addition to improvising visual aesthetics [in existing commercial tools]."[1]

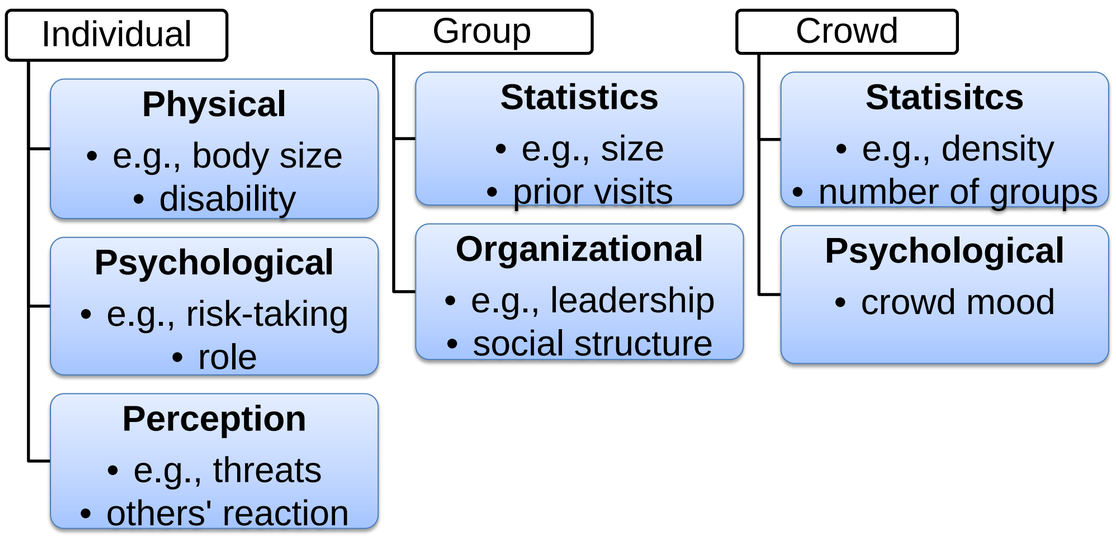
Research hypothesis



THEORETICAL FRAMEWORK

Multi-level analysis of social theories

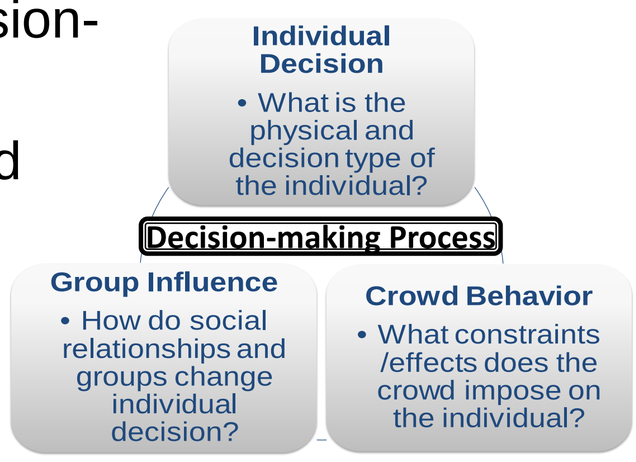
- Establish model parameters according to multi-level variables from theory analysis.
- Translate mechanisms into behavioral rules and functions.



A simplified organization of occupants and environment features

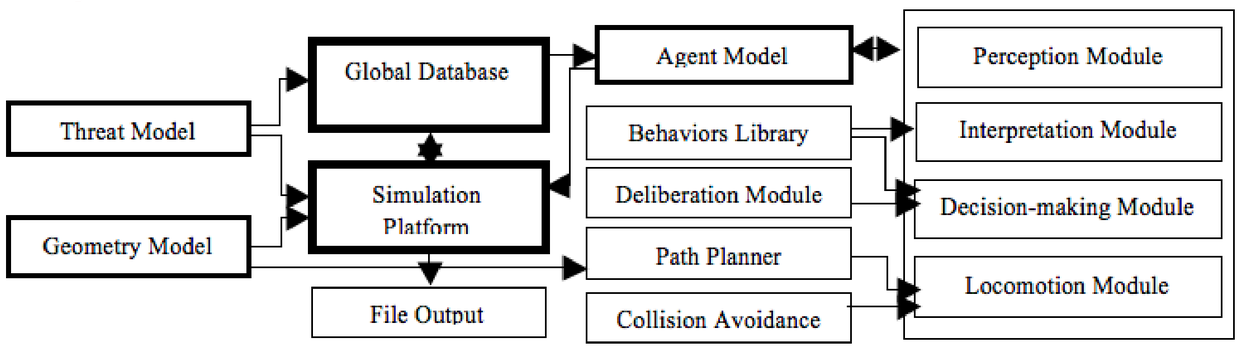
Generalization of different social theories

- Develop a staged decision-making process.
- Relate group and crowd factors to individual decision, based on the occupant's type and environment.

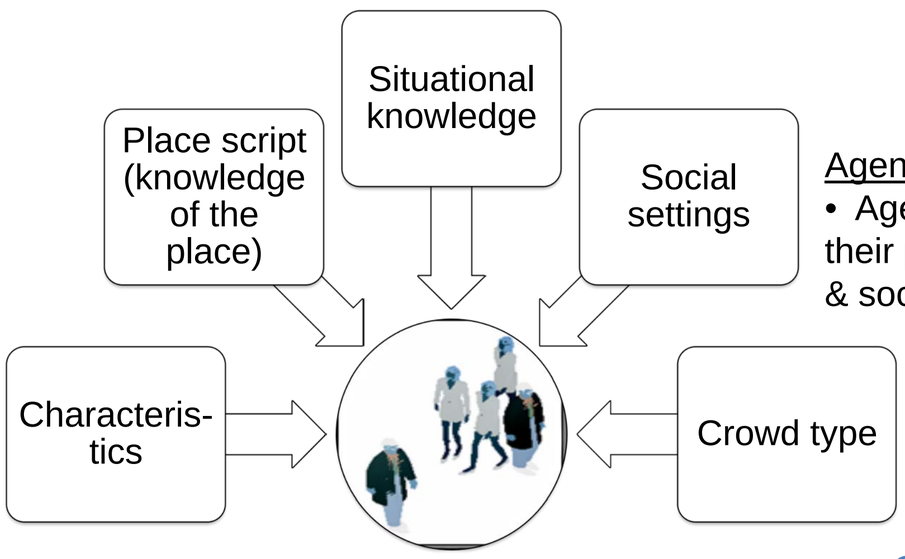


COMPUTATIONAL FRAMEWORK

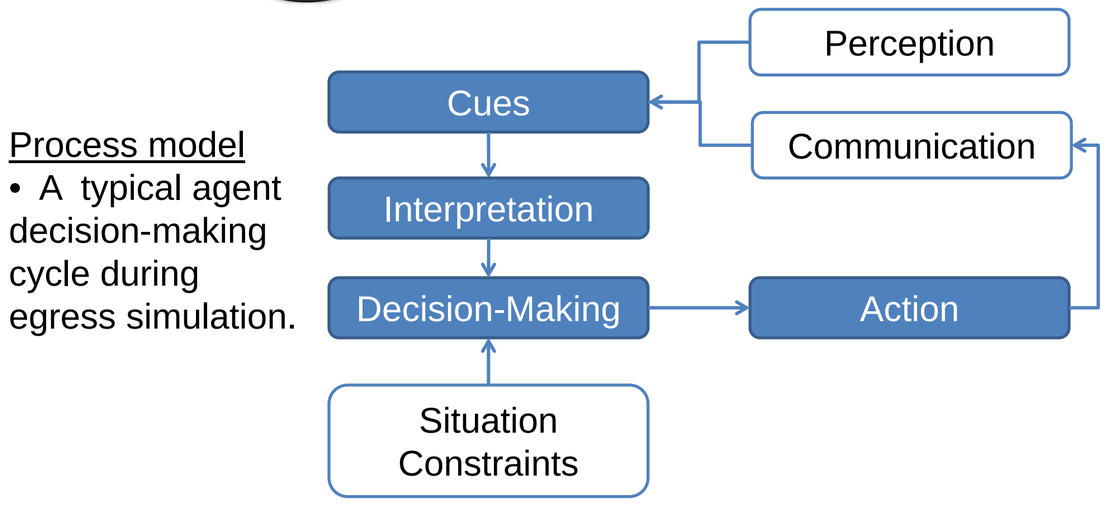
System architecture



Agent representation and process model



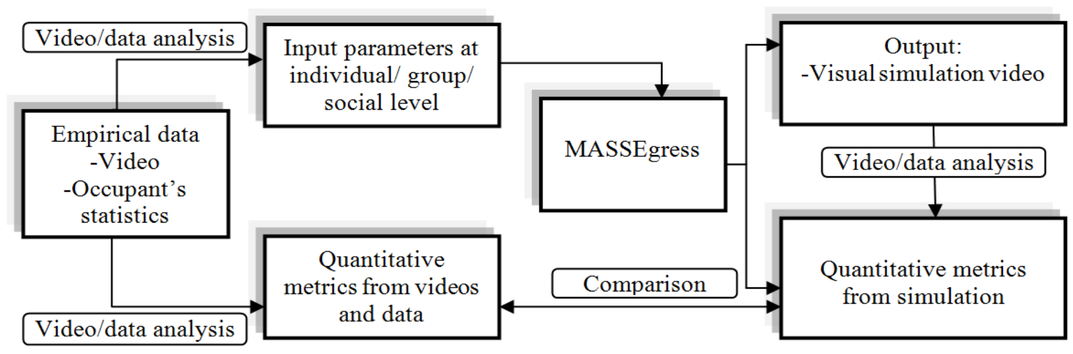
Agent representation
- Agents are defined by their physical characteristics & social background.



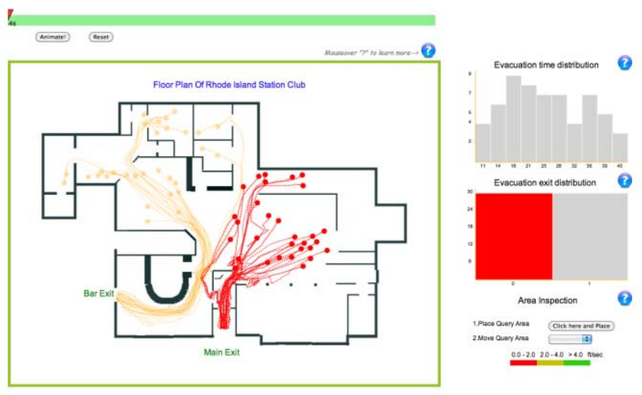
Process model
- A typical agent decision-making cycle during egress simulation.

VALIDATION AND VISUALIZATION

- Collect datasets includes videos and statistical data from industrial partners and University event management team.
- Design visualization tools to explore simulation results and develop statistical techniques to identify overall crowd patterns and congestions.



Validation process



Interactive visualization tool

RESEARCH IMPACTS

- Bridge the gap between the social behaviors in egress and current egress simulation practice.
- Develop a tool for theories implementation and validation.
- Assist facilities managers in developing a range of solutions to crowd problems by addressing different scenarios and unique occupants' characteristics .

References:

1. Challenger, W., Clegg W. C., and Robinson A.M. (2009). Understanding Crowd Behaviours: Guidance and Lessons Identified, Technical Report prepared for UK Cabinet Office, Emergency Planning College, University of Leeds, 2009.
2. Pan, X., Han, C. S., Dauber, K., and Law, K. H. (2007). "A Multi-Agent Based Framework for the Simulation of Human and Social Behaviors during Emergency Evacuations," AI & Society, 22, 113-132.