An Information Processing Based Model of Pre-evacuation Behavior for Agent Based Egress Simulation

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Motivation: Pre-evacuation behavior is generally ignored in computational models of egress. [1, 2]

Purpose:

- Describe a method of computationally modeling this pre-evacuation behavior in an agent based simulation.
- Demonstrate some of the effects that this can have on evacuation.

Pre-evacuation Behavior Breakdown [3]

Phase 1: Perception

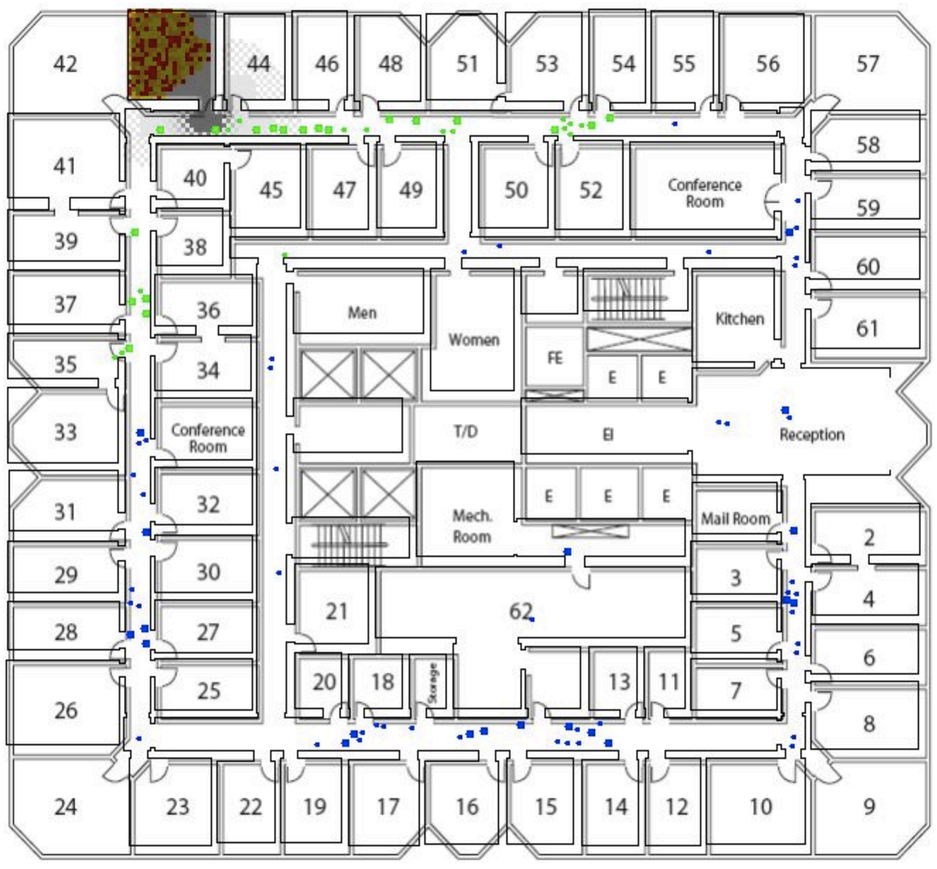
Passive processing of information from the environment

Phase 2: Interpretation

Active search for information about level of threat and need for evacuation.

CUE

Source of information about the environment and unusual situation.
Each cue can be described in terms of its ambiguity, consistency and source and it is this description that determines its effect.
Eg. Fire, Smoke, Fire alarm, Messages.



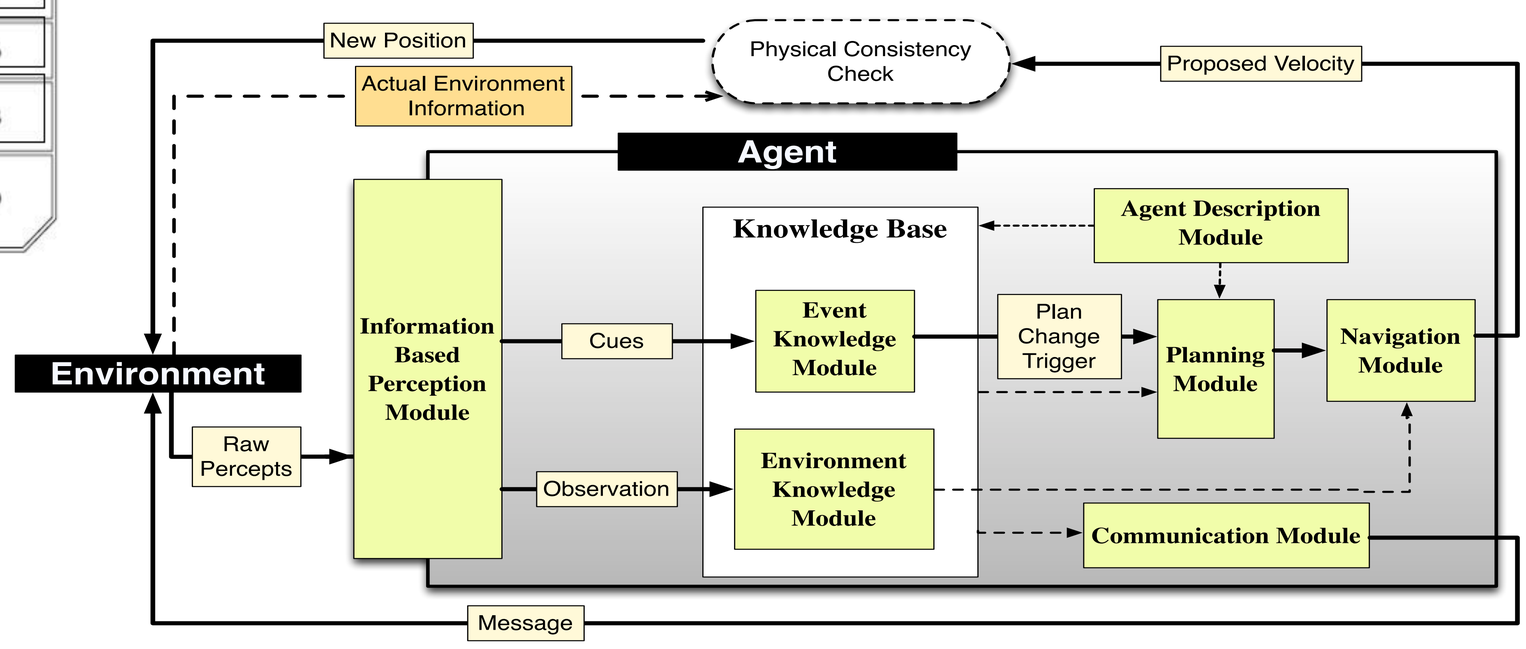
Modeling Event Identification and Pre-evacation Behavior

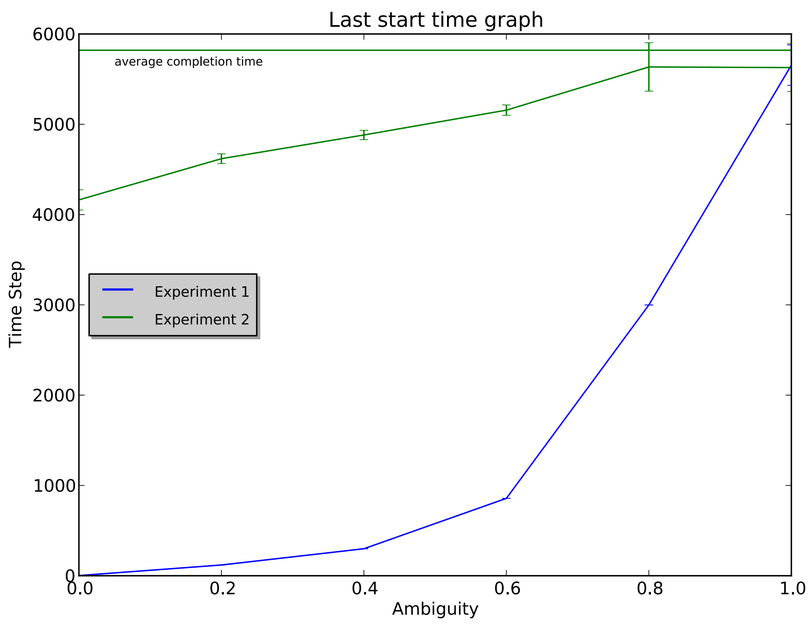
A **phase-bucket** associated with each phase with pre-determined information threshold.

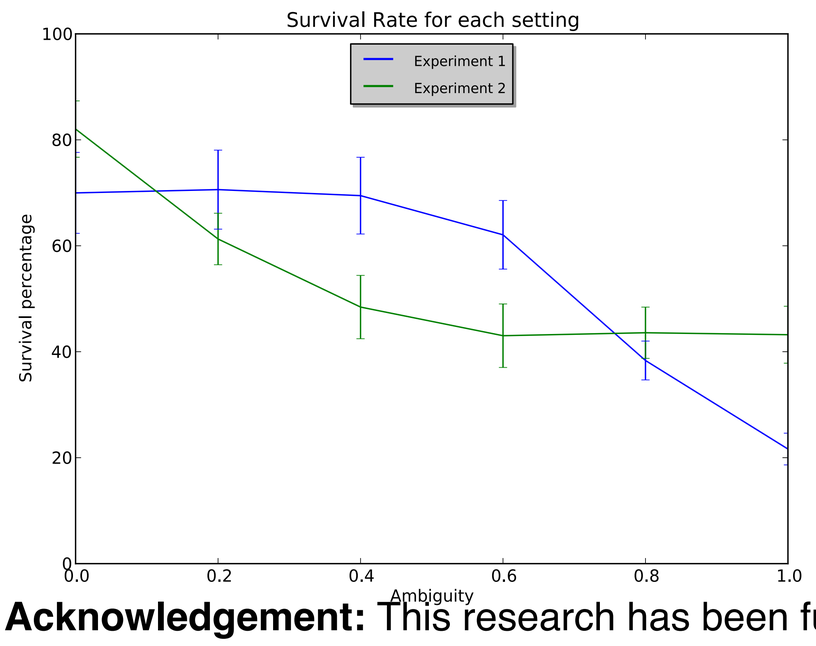
Each cue adds information

An overflowing bucket triggers a state and strategy change.

Messages also contain information of inaccessible links.







Experimental Setup: 2-floor environment from World Trade Center, Los Angeles with fire and smoke model and 200 Agents.

Experiment 1: Simulations with fire alarm ambiguity from 0.0-1.0

Experiment 2: Simulations with message ambiguity from 0.0-1.0

Observations

- There is a significant drop in number of survivors as the ambiguity of the alarm increases.
- More ambiguity results in later evacuation start.
- Effect of difference in ambiguity of fire alarm can be much more profound due to instant reach.

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References

[1] Proulx, G. (1995). Evacuation Time and Movement in Apartment Buildings. Fire Safety Journal, 24, 229-246.
[2] Santos, G.; Aguirre, B. E. (2004). A Critical Review of Emergency Evacuation Simulation Models.
[3] Kuligowski, Erica D. (1999). The Process of Human Behavior in Fires. NIST Technical Note 1632.