A Systematic Approach to Develop a Computational Framework for Counter-terrorism and Public Safety

The Canadian Network for Research on
Terrorism, Security and Society (TSAS)

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Outline

- Introduction
- Overview of the Approach
- Simulations Examples
- Future Directions

Introduction

Introduction

- Framework of Government of Canada to build resilience against terrorism
  - Prevent, detect, deny and respond
- Our research focuses on “respond”.
  - Rapid response in an organized manner to save lives, reduce personal injuries, and mitigate the damage
  - Require careful plans and protocols with local law enforcement and emergency management authorities
  - Response to a wide variety of terrorist threats: Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) threats
  - Incorporate currently available technologies

A quick and proper response to terrorism is important.

THE REVOLUTION IS COMING. JUNE 2.
ROGERS

VANCOUVER 24 hours
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You know the honeymoon is over when... 5

FRIDAY MAY 29, 2009 Vol 5 No. 40

Today's weather: We all shine on. High 20C. Low 11C

sports

BC Lions are gearing up for the new season

in news

World Partnership Walk set for Stanley Park Sunday

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Good gig if you don't win

A judicial recount scheduled for Monday will confirm the fate of the hotly contested provincial riding Delta South.

But even if the courts uphold what is for now a 32-vote victory by independent Vicki Hunnington over Attorney General Wally Oppal, the high-profile B.C. Liberal MLA won't be hard up for cash.

Departing MLAs will get almost $9 million in retirement benefits or severance payouts, according to calculations done by the Canadian Taxpayers Federation. CTF B.C. director Maureen Bader says that most, that will include 15 months of salary at base pay, which for an MLA, is equivalent to $101,859 – factoring in two cost-of-living increases to a legislated $88,000 salary.

For Oppal and most others, that will mean a $127,324 severance, or "transition allowance," Bader says. "This is way in excess of anything anyone can get in the private sector," Bader contends. "That's what makes it reprehensible."

–IRWIN LOY, 24 HOURS

Plane down in park

–SABRINA MARINELLI, 24 HOURS

MOCK DISASTER: Vancouver emergency crews created a scenario for a multi-agency exercise in which a plane crashed in Stanley Park yesterday.

There were flames, bodies and blood in Stanley Park yesterday.

In what resembled a deadly crash, debris from a downed plane and a crushed car was scattered across Brockton Oval as part of a mock disaster exercise. Lying among the wreckage were eight blood-soaked actors displaying various injuries from broken bones to gaping gashes.

"It allows us to prepare ourselves [to] see how good we are in dealing with this situation," said Vancouver Fire & Rescue Services Capt. Gabe Rimer of the annual exercise.

Once crews cleared the rubble, the actors who feigned injury were taken by helicopter to St. Paul's Hospital where emergency room staff took over treatment.

Striking paramedics were baffled as to why they were benched for yesterday's disaster scenario.

B.C. Ambulance Services informed workers the agency simply would not participate in the event, according to Bi Chute, director of public education for the Ambulance Paramedics of B.C.

"It's totally insulting to the organizers and I think it's totally insulting to paramedics," he said.

BCAS spokespeople did not return calls by press time.

–EMMA MANKIW, 24 HOURS

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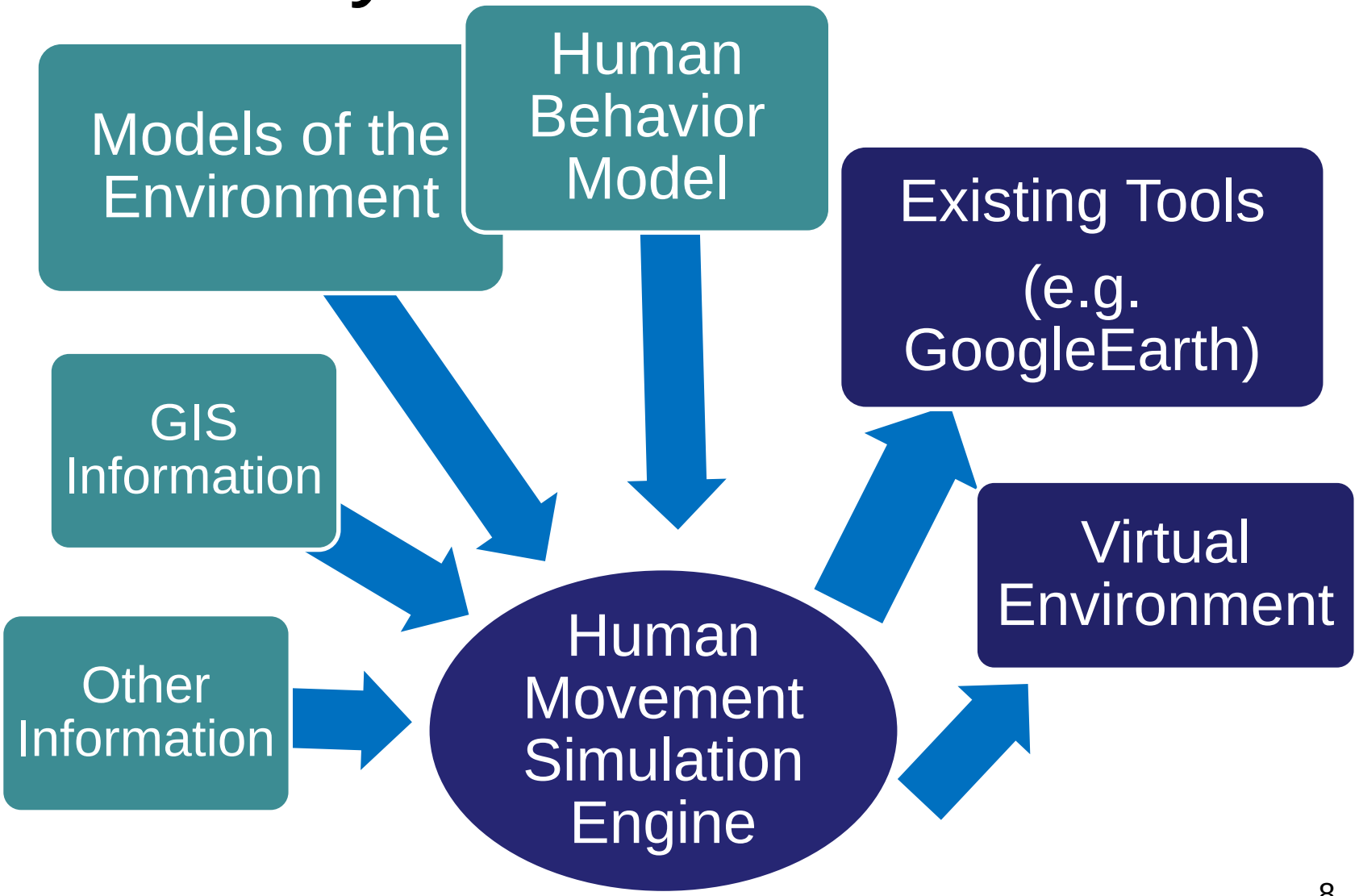
Paul M. Torrens & Aaron W. McDaniel (2013): Modeling Geographic Behavior in Riotous Crowds, Annals of the Association of American Geographers, 103:1, 20-46

GENIUS: Research Goals

- GENIUS: a computational framework for counter-terrorism
- Develop a decision support, response planning and risk assessment framework.
- This framework allows the user to
  - explore the spatial-temporal features of the environment,
  - create a flexible human movement simulation and visualization system, and
  - perform risk analysis through the studying of different potential scenarios.

System Overview



Integration of Simulation and VE

Human Movement Simulation Engine

Virtual Environment

Simulation

+

Virtual Environment

Human Movement Simulation Engine

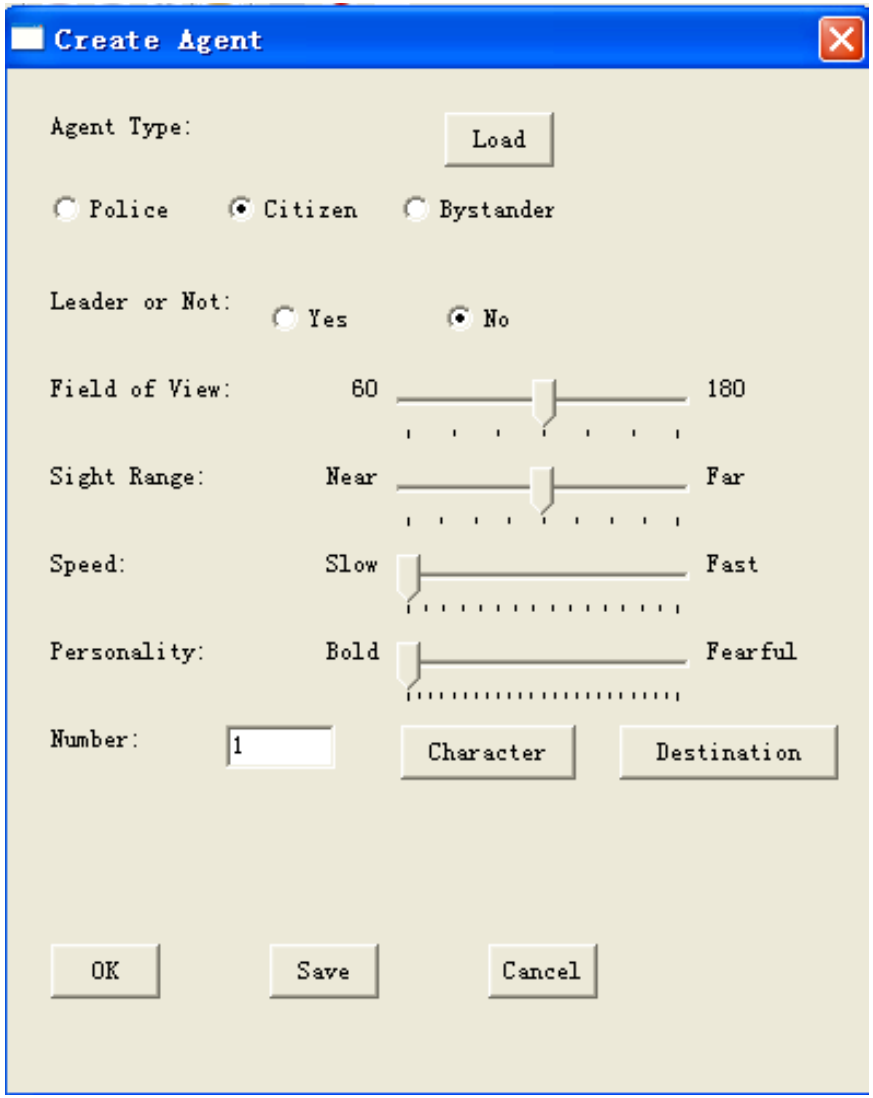
- Swarm Intelligence and Agent-based Simulation
  - Parametric Model
    - Parameterization of variables that affect agents' behaviours
    - Easy to develop different human models (e.g., old people, young children, angry rioters, etc.)
  - Interactions among
    - Agents
    - Events
    - Environments

    →Agents respond to events. (e.g., bomb explosion, toxic gas, etc.)

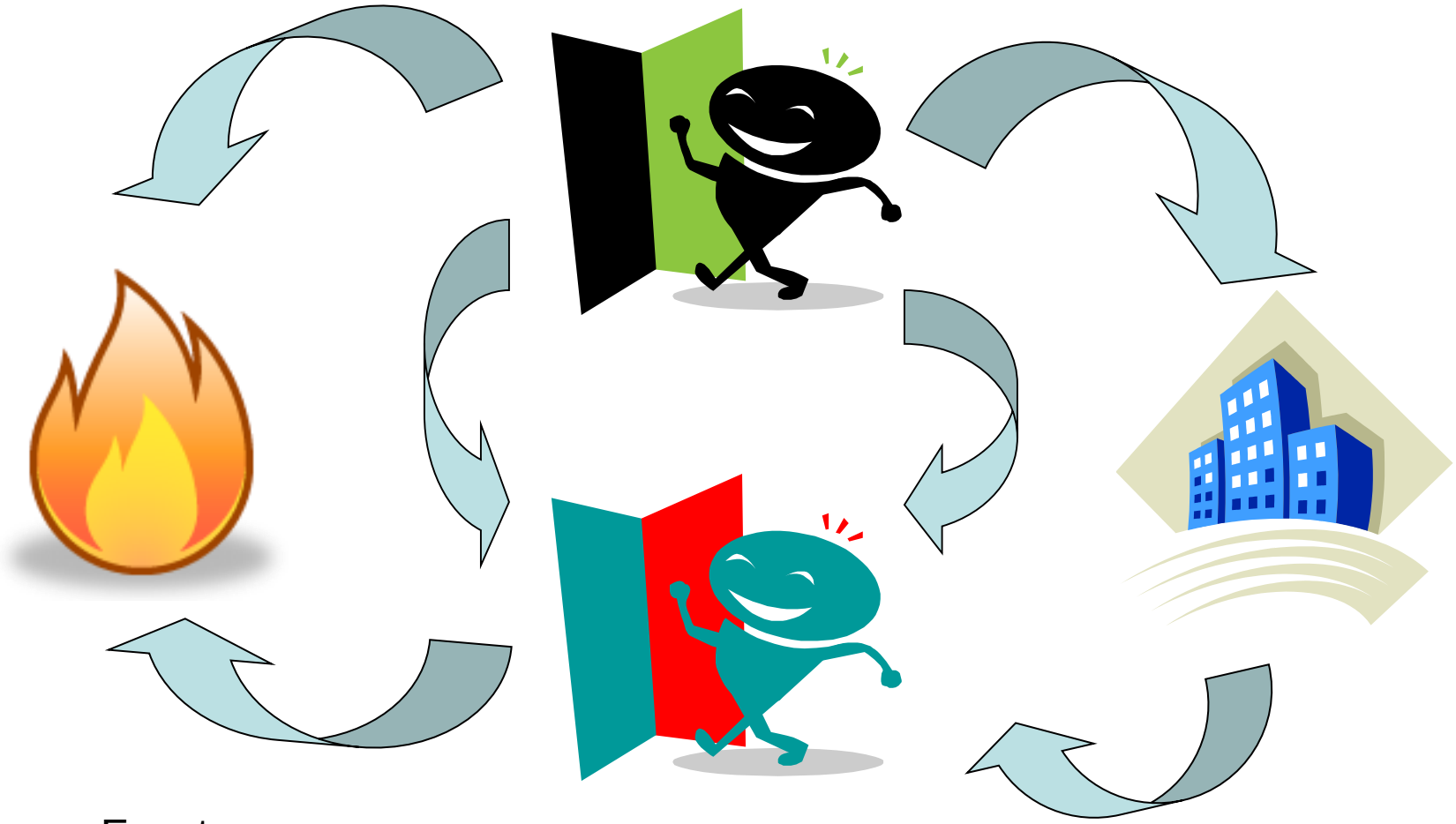
    →Agents' behaviours are restricted by their environments.

    →Events can influence the environments. (e.g., damage or pollution)

Parametric Model



Interactions

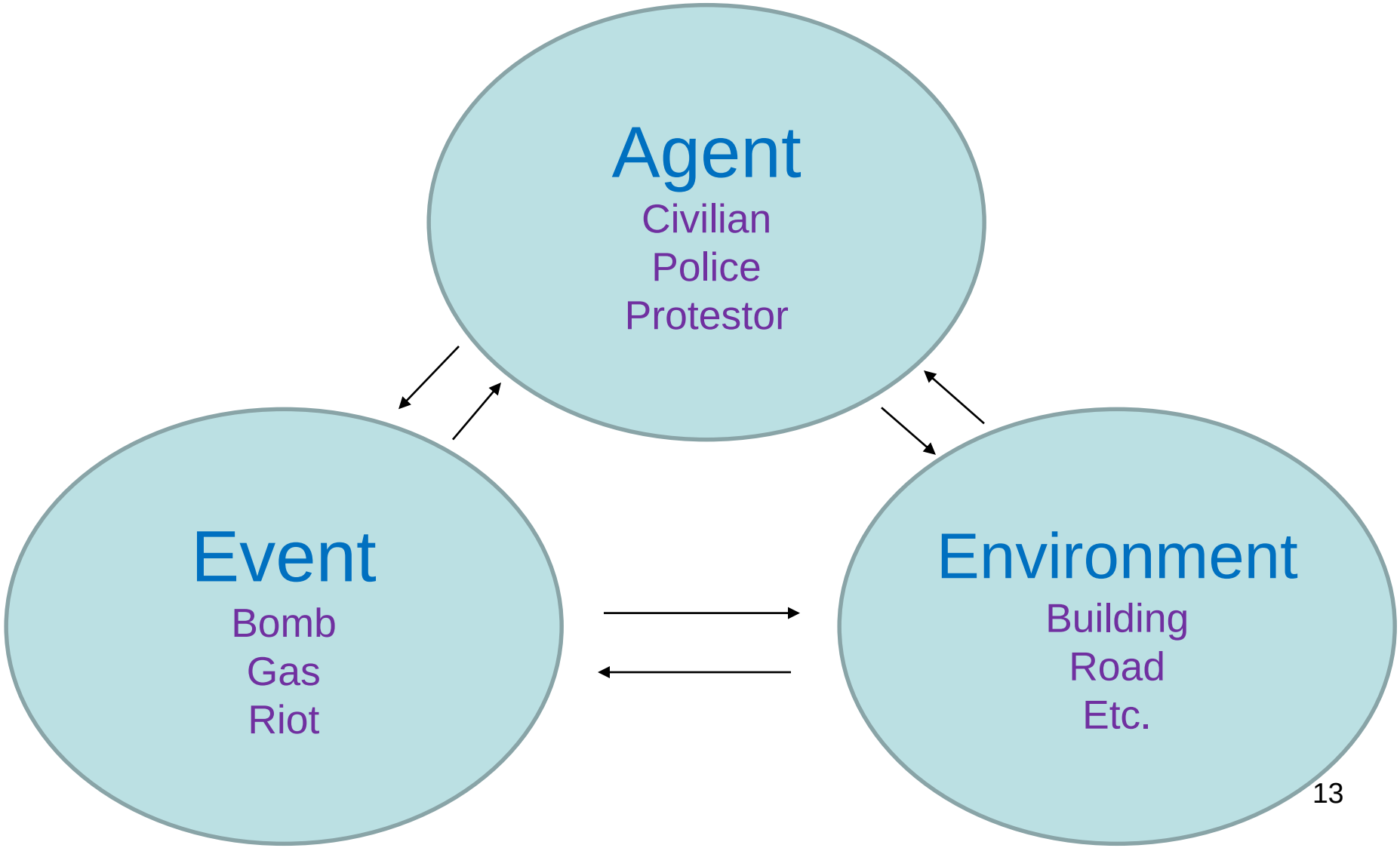


Events

Agents

Environment

Human Movement Simulation Engine



Virtual Environment (VE)

- VE is a computer-generated environment that simulates either a real physical environment or a artificial environment.
- With the currently technologies, it is possible to create a very realistic, immersive, and interactive virtual environment where users can feel presence.

Virtual Environment (VE)

- Applications of VE
  - Entertainment (e.g., video games)
  - Visualization (e.g., architecture, biology, chemistry, etc.)
  - Therapy and rehabilitation (e.g., therapy for social phobia, physiotherapy for post-stroke rehabilitation, etc.)
  - Virtual tourism
  - Training (e.g., flight simulators, virtual military training, etc.)
  - Research tools

Virtual Environment (VE)

VE is used as a research tool.

Virtual Environment (VE)

- Benefits of Using VE
  - Realistic
  - Affordable
  - Interactive
  - No ethics issues
  - Easy and quick to change
  - Possible to create any scenarios
  - Familiar
  - Available with advanced technologies

Virtual Environment (VE)

- To build a virtual environment with a interactive control, we used commercially available equipment:
  - Kinect for Windows (real-time movement sensing)
  - UNITY 3D (game/simulation engine)
  - Autodesk Maya

Virtual Environment (VE)

An example of a realistic virtual environment

Youtube link: http://youtu.be/tlkMP_ESf6k

Simulation Examples

1) Westgate Mall Shooting (September 2013)
2) Boston Marathon Bombing (April 2013)

Westgate Mall Shooting: No Police

This video demonstrates the Westgate Shopping Mall Shooting without police officers.

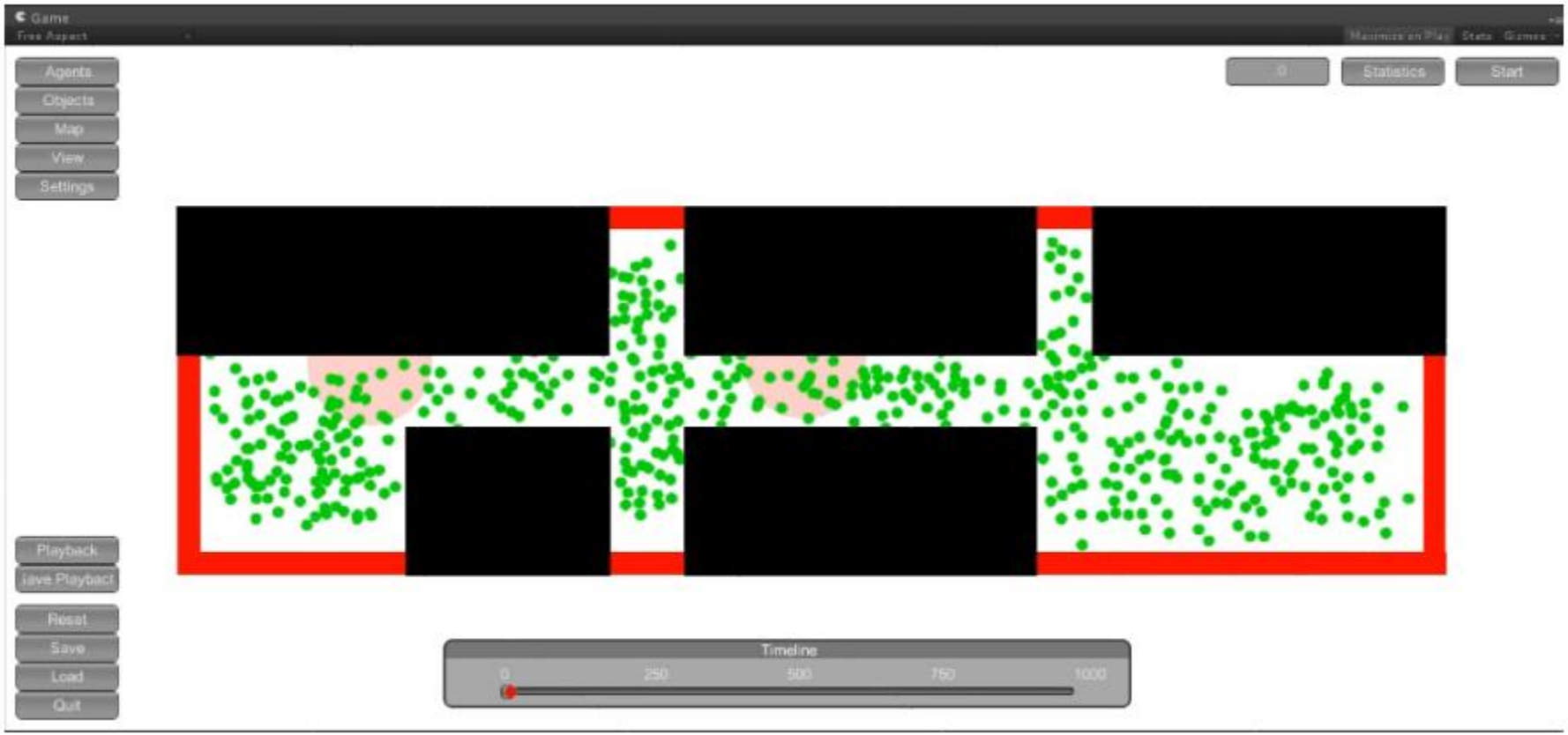
Youtube link: http://youtu.be/fzOsm9h55m4

Westgate Mall Shooting: With Police

This video demonstrates the Westgate Shopping Mall Shooting with police officers at strategic locations.

Youtube link: http://youtu.be/TdE2Z9T-niw

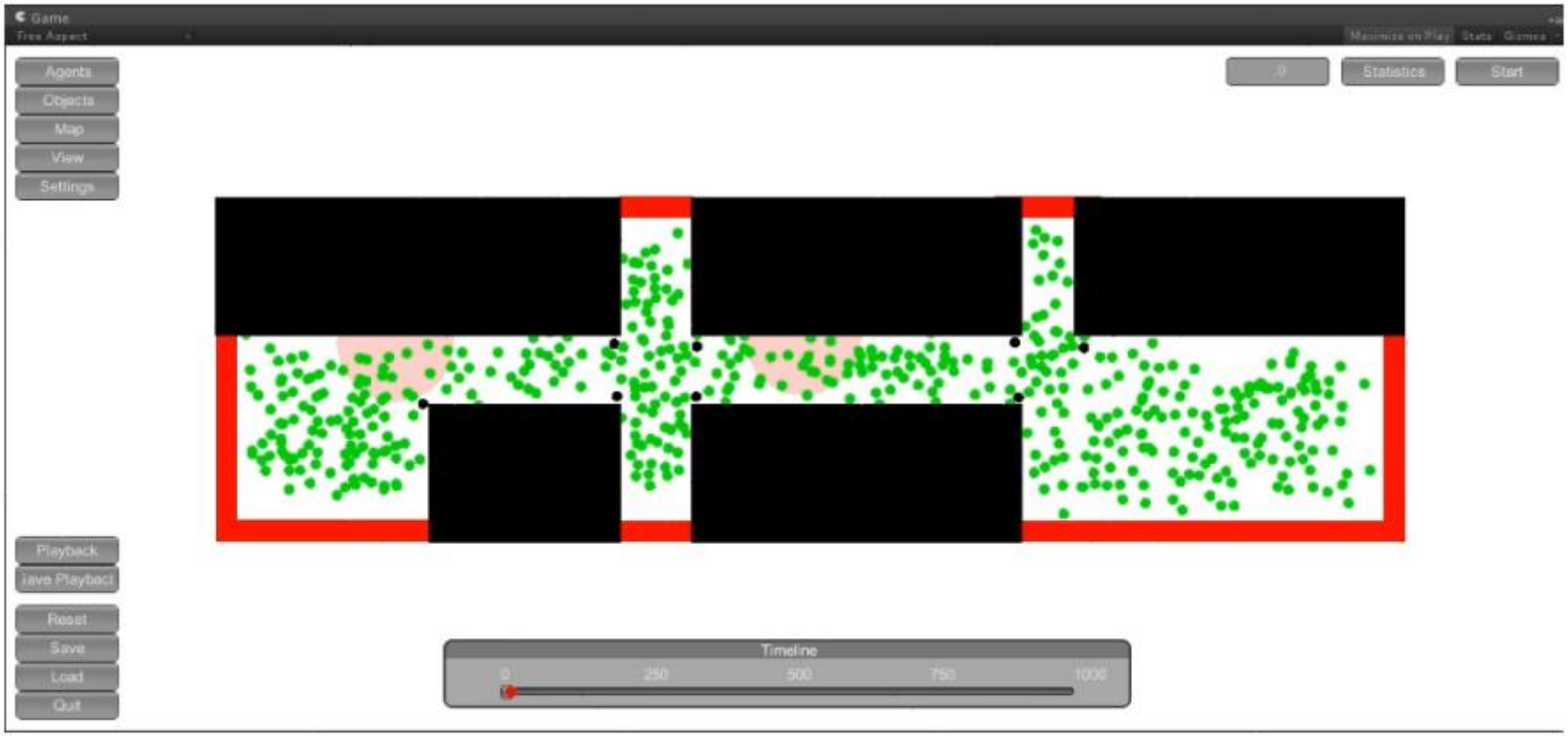
Boston Marathon Bombing: No Police



This video demonstrates the Boston Marathon Bombing without any police officers.

Youtube link: http://youtu.be/jij5gfxFOqY

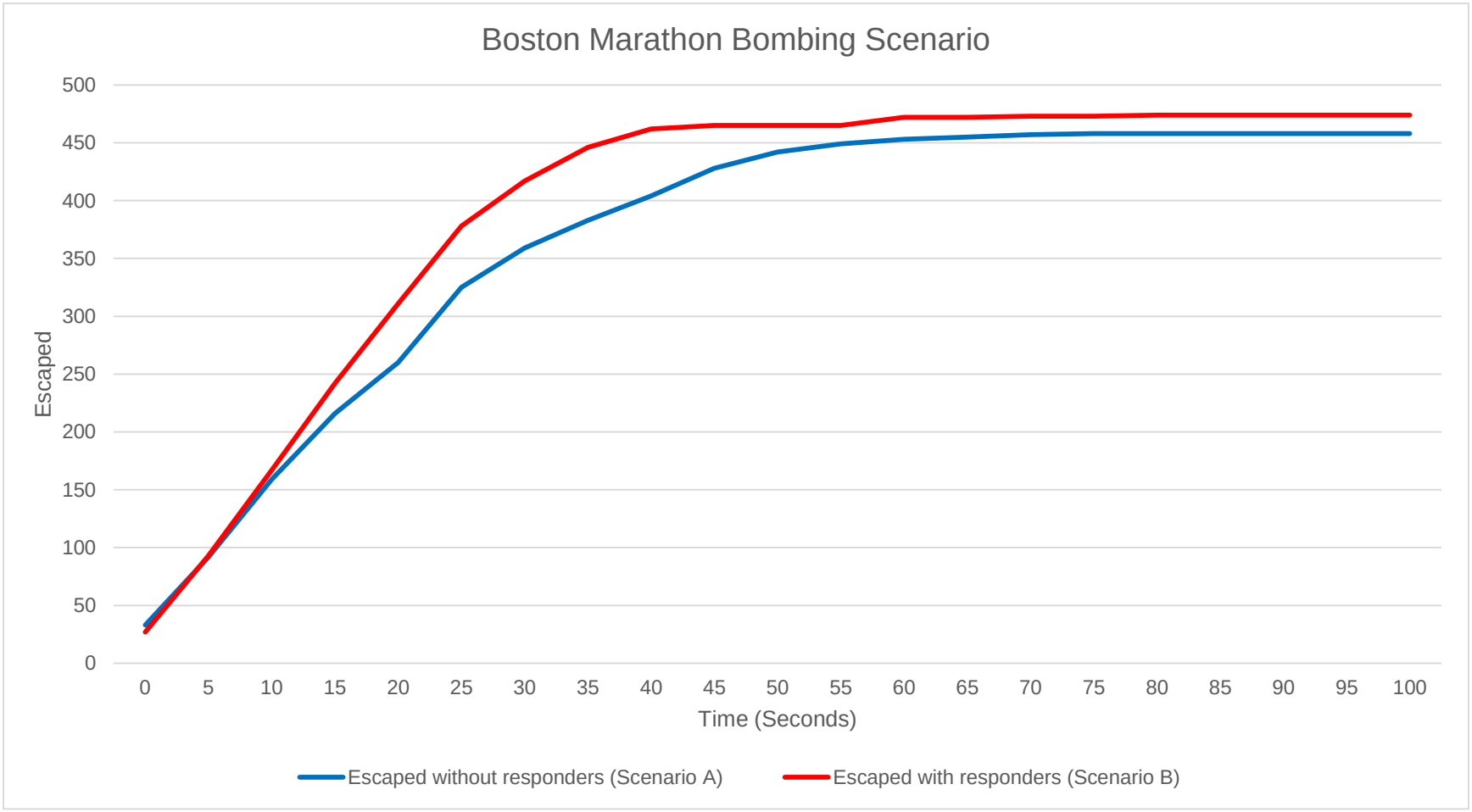
Boston Marathon Bombing: With Police



This video demonstrates the Boston Marathon Bombing with police officers at strategic locations.

Youtube link: http://youtu.be/04DrCgl8pmw

Boston Marathon Bombing: Comparison



Comparison between two scenarios: one without emergency responders and the other with emergency responders

GENIUS: User Interaction

This video demonstrates a navigation in the virtual environment using a Microsoft Kinect device. This feature of the simulation system can be used for training purposes.

Youtube link: http://youtu.be/DTNqk3LhPuI

GENIUS: Simulation

This video demonstrates a 3D simulation that shows a bomb going off in the crowd.

Youtube link: http://youtu.be/IqkurYqvFUg

Summary

- Our framework and simulation tool can be used to study emergency preparedness with any possible scenarios including terrorists' attacks.
- The use of interactive/immersive virtual environments is affordable, (relatively) easy, time-saving, and flexible for training purposes as well as research experiments.

Future Directions

- Research partnership
  - To perform a pilot study on our framework
  - To test our framework with real-world problems
  - To get expert review

- Incorporating new technologies
  - Oculus Rift
  - 3D scanner → 3D modelling
  - Augmented Reality
  - Natural interactions
  - Mobile computing

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Discussion / Question?

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