Deriving Better Parameters for Crowd Simulation During Emergencies Using Game-captured Data

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Introduction

Crowd simulation plays an important role in many different disciplines, including games, feature films and construction. (Reynolds 1999) introduced steering behaviours in his seminal paper and similar outcomes were obtained by a method based on social forces proposed by (Helbing & Molnár 1995). These models represent agents as particles that are directed by attractive and repulsive forces that, when combined, can produce believable crowd simulations. While these frameworks are mainly concerned with agents' movement, it is important to also take into account agents' behaviour as it affects how agents will react to the environment and other agents. This is of particular relevance when virtual crowds are employed for emergency simulation, as human behaviour under these circumstances differs substantially from a normal situation. Simulating crowd behaviour during emergencies is particularly challenging due to the scarcity of reference data that can be used to inform existing and new models. Footage captured from controlled experiments or real locations has contributed to improve existing models thanks to advances in computer vision and machine learning. Unfortunately such footage is rarely available for real emergencies, and experiments that put participants in danger would be unethical.

Methodology

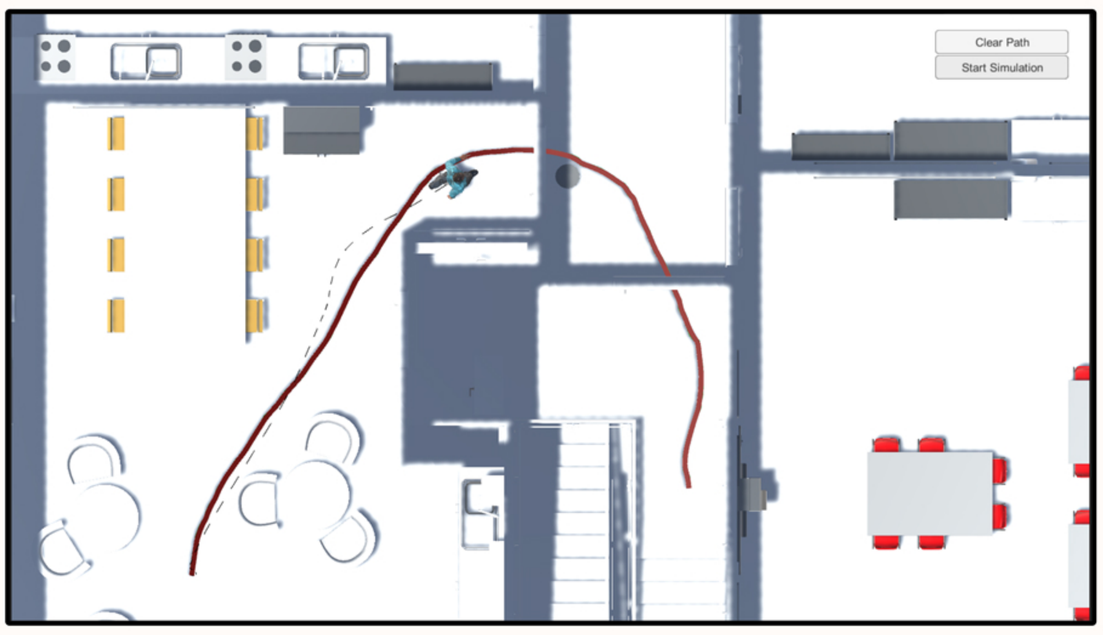
A solution that would allow us to record participants' responses to an emergency while avoiding putting them in danger is to use a virtual environment. Our work is inspired by (Li et al. 2014), as we will take advantage of gaming technology to create an immersive emergency simulation and elicit a reaction from players as close as possible to the one in real life.

The parameters we are going to mesure are:
- reaction times
- exit selection
- path taken to exit

Participants will have a top down view of the environment and will be able to draw what they consider the optimal path towards the chosen exit. They will be presented with two scenarios:

simulaton begins with the trigger of the emergency

simulation has already started and some agents have moved towards the exit

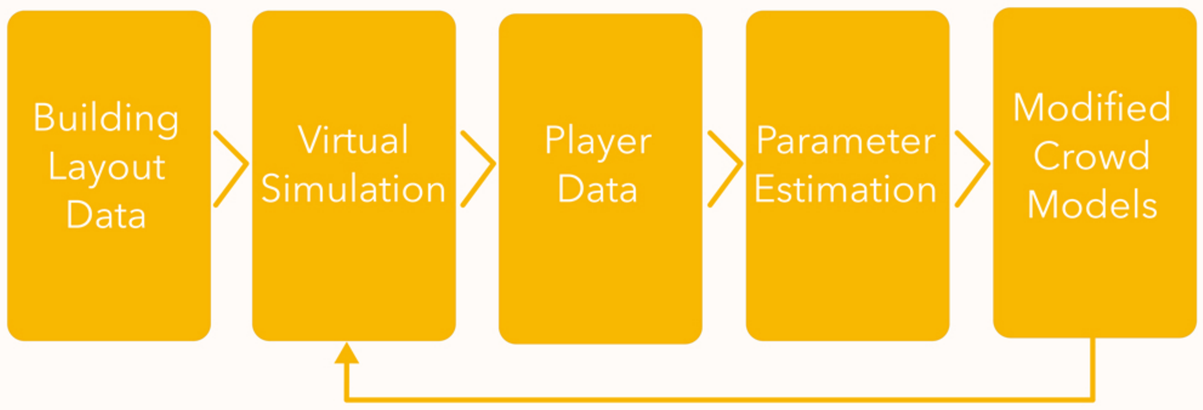


We are interesed in determining whether participants will make different choices when noticing clogged exits or how they react to hazards like smoke.

Participants will be divided in two groups: the first one will play the two scenarios in order, while the second group will play them in reverse order. Our assumption is that by playing the second scenario first participants will have better insight on what the best escape strategy might be.

We are also keeping track of general parameters like the time taken for all agents to reach the exit and the number of agents that safely left the building. These parameters will also act as a score mechanism that will motivate the player to make optimal choices.

We are aware of some limitations with our approach, as participants will have full knowledge about the environment. Nonetheless the assumption holds when considering situations such as offices or production plants where occupants have good knowledge about the layout of the building and designated escape routes



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Acknowledgements

We would like to thank Alberto Venditti and Yates Buckley from UNIT9 for their feedback, and Ting-Chih Wang for her help with the poster design. Skanska provided us with the 3D building model.

Research Funded by EPSRC