

Behavior-driven Building Safety and Emergency Management for Campus Communities

Burçin Becerik-Gerber, University of Southern California
Award Type: IRG [2318559]



Project Challenge

Prior research highlights the need to integrate human behavior into building safety and emergency management for better campus safety. However, the unique context-dependent nature of emergency behavior (Fig. 1) challenges the generalization of models. Current crowd simulations often oversimplify human-building-emergency interactions. More complex and dynamic models are needed to create reliable simulation tools for building designers and emergency personnel.

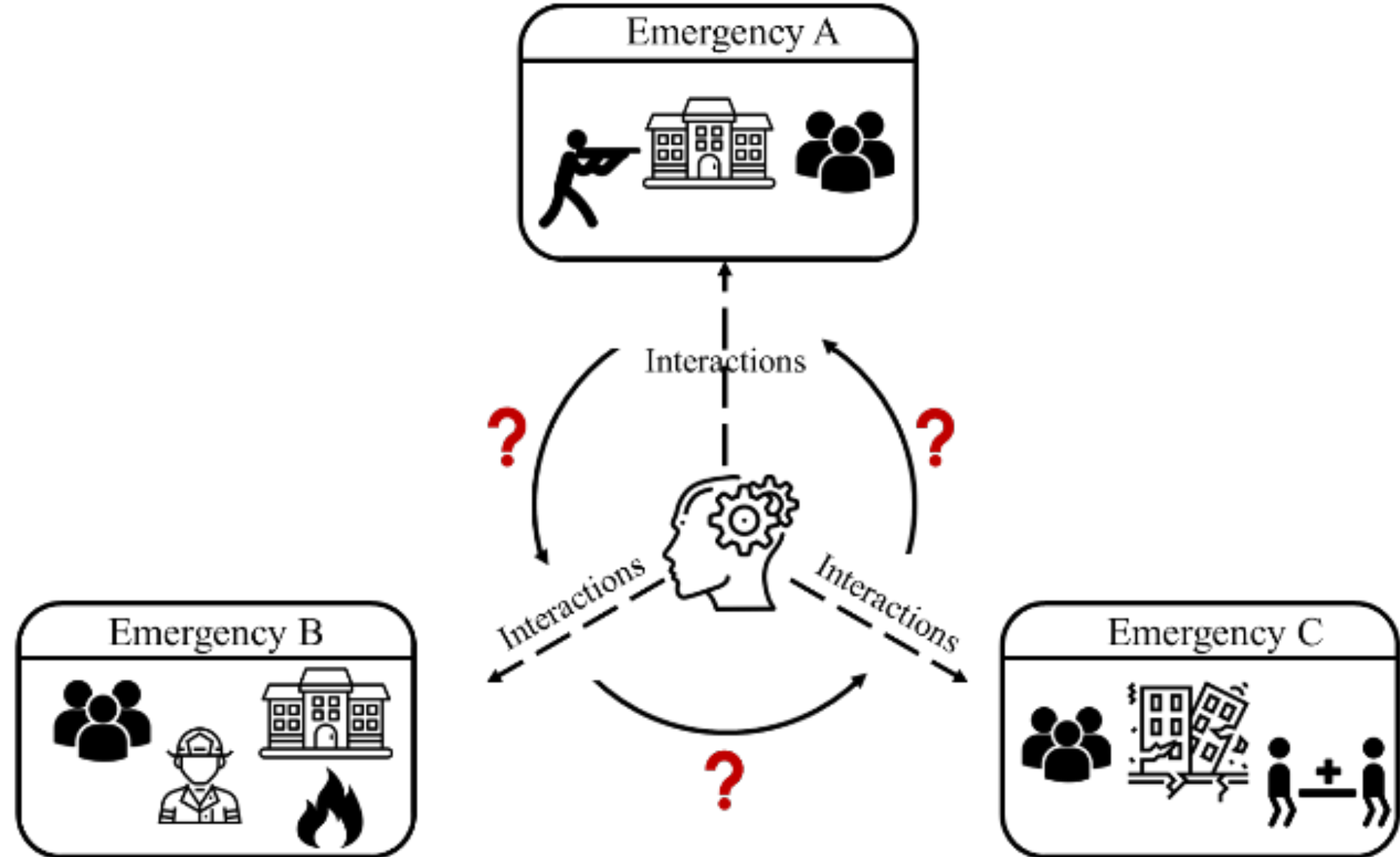


Fig. 1. Human behavior during emergencies

Intellectual Merit

This project advances human behavior modeling, utilizing empirical data (Fig. 2 and Fig. 3) and expert insights to address the lack of real-world data. It aims to improve agent-based simulations, moving beyond simple rules to encompass dynamic interactions, enrich public safety knowledge through occupants' diverse reactions and interactions with first responders, and contributes to social science by investigating individual differences and social interactions. The simulations will inform building design and help first responders assess intervention strategies.

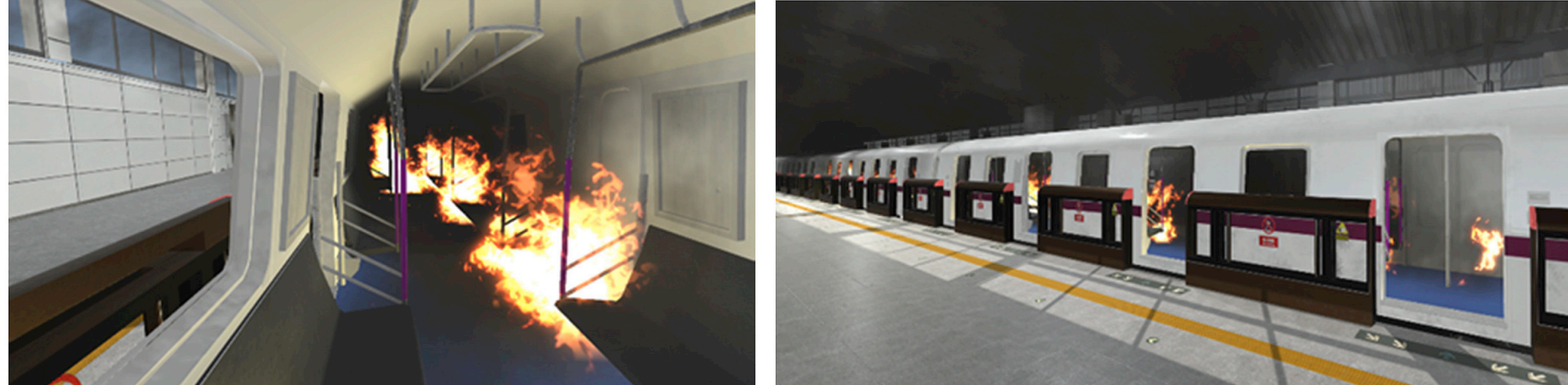


Fig. 2. Screenshots from a fire experiment



Fig. 3. Screenshots from an active shooter experiment

Major Outcomes/Progress

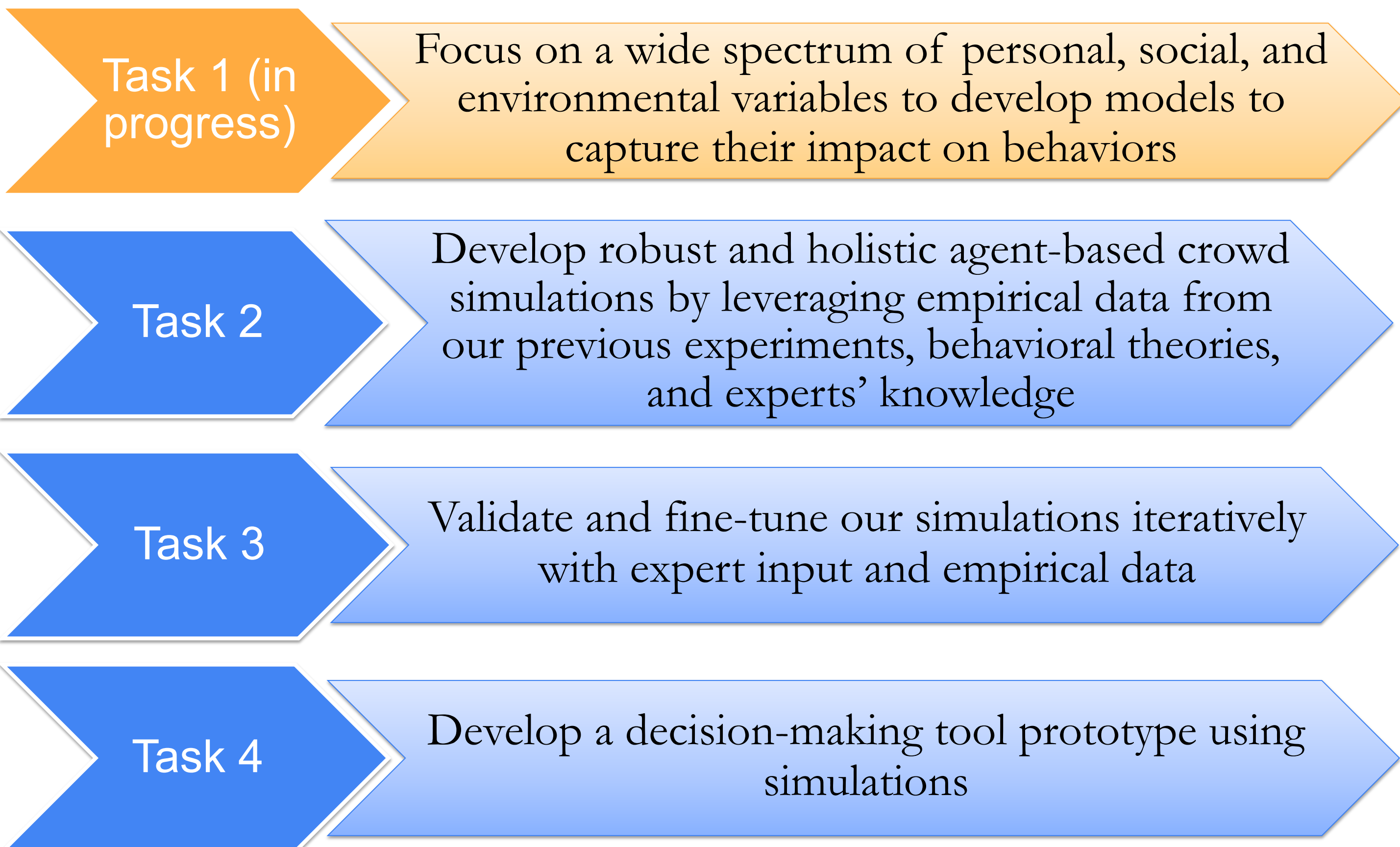


Fig. 4. Project tasks

Task 1 update:
We have conducted a study (Fig. 5) for investigating role of personal factors in shaping responses to active shooter incident using machine learning on data from 107 participants. The results indicate that propensity to run significantly determines overall response strategies, overshadowing vulnerability (corresponding to the time a participant is visible to a shooter), and pre-evacuation time. VR-based training enhances emergency responses more than videos. A good sense of direction and previous training reduce vulnerability and increase the likelihood of evacuation. Gender influences pre-evacuation times, with females evacuating more slowly, likely due to a higher risk perception. Also, we are employing a Stakeholder Advisory Panel (SAP) to advise the research team throughout the project. Through out first workshop at USC to be held on February 22-23, we will gather domain experts' feedback on current findings and facilitate discussions to explore what would be required for the technology to be successful in terms of needs, opportunities, and challenges.

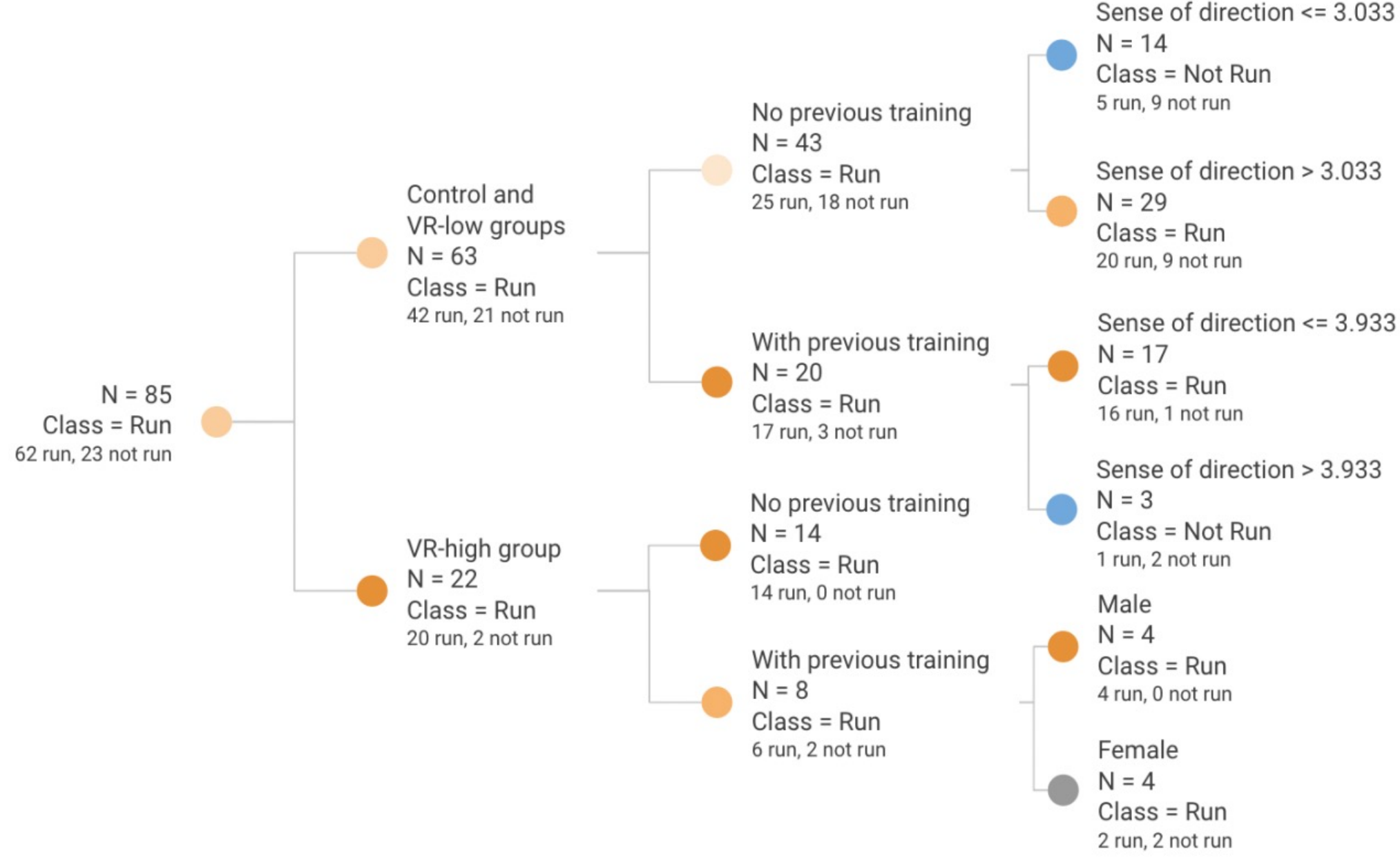


Fig. 5. Project tasks (decision tree as an example of results)

Broader Impact

Not only emergency personnel receive valuable information from simulating human behavior, but also community benefit from understanding human-building-emergency interactions to educate members. The work contributes to hazard mitigation and disaster risk reduction while also enhancing research and education by integrating findings into curriculum, publishing findings, delivering talks, and engaging diverse groups.

Future Goals

Workshop 1 will gather community input on needs and challenges, validate current research focus, and identify key behaviors for simulations. Insights from the workshop will guide the expansion of the behavior model to include more variables. Follow-up experiments will test the expanded models' performance. Our SAP will be engaged in continuous feedback on our research. A second workshop will be organized to share updates and continue discussions among experts and stakeholders.

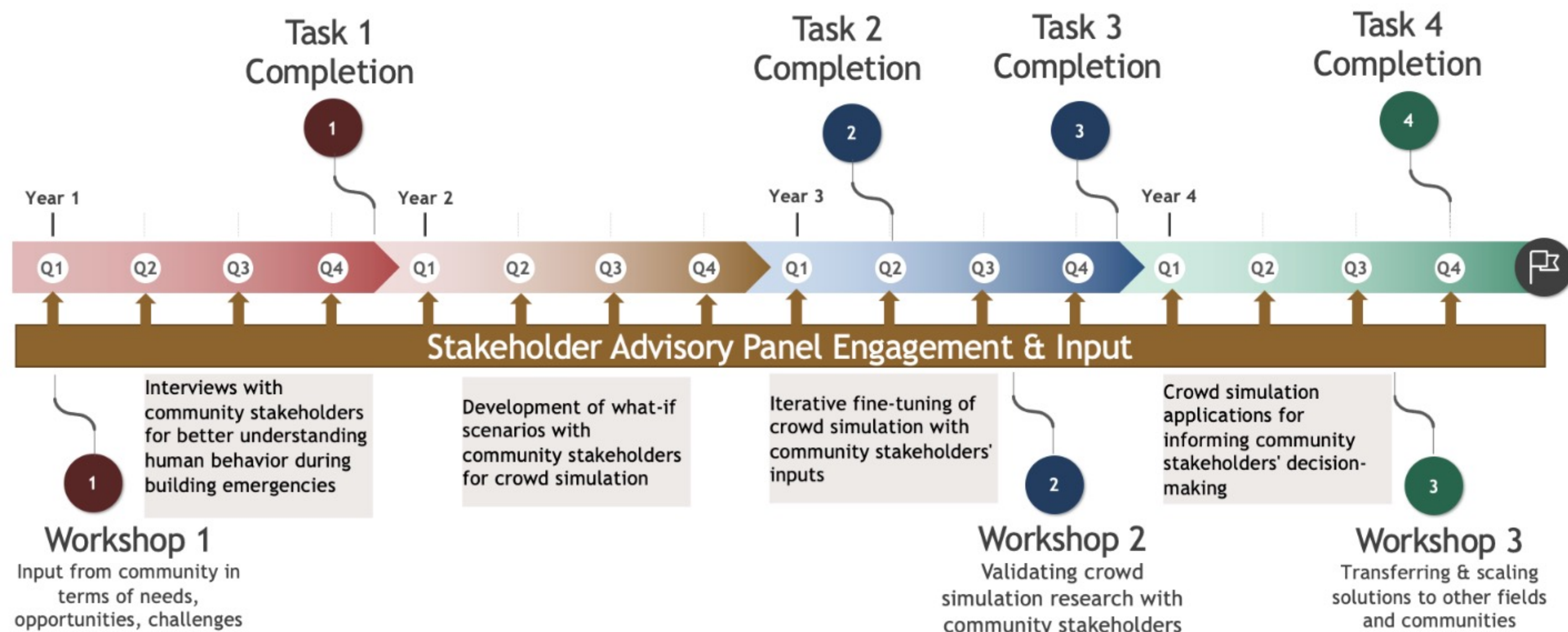


Fig. 6. Project timeline