ACTIVITY MODELLING FOR RISK ASSESSMENT AND EMERGENCY MANAGEMENT APPLICATIONS FOCUSSING ON PERI-URBAN REGIONS

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Description of project

With metropolitan areas expanding onto forested areas, combined with increased intensity of fires which may be due to climatic change, the risk to both safety and continuing functioning of near metropolitan (or peri-urban) communities and their people has increasing markedly.

To understand and quantify the risk, and allow testing of different evacuation policies a micro-simulation will be built. A transport micro-simulation simulates the behaviour of each vehicle and pedestrian in a road network. In a micro-simulation individual vehicles change lanes, obey traffic signals, choose their own travel speed. Micro-simulations can be animated to make a realistic looking movie. The simulation in this project will model the behaviour of individuals making decisions about evacuation and then leaving along roads in private cars before and during a bushfire. This requires data on:

- Where the people are. Activity based modelling will be used to estimate the journeys (to work, school, shopping etc.) and thus where people are throughout the day in a peri-urban community
- Where the fire is and how it moves. Existing fire models will provide smoke and fire-front spatial and temporal data.
- Where the roads and structures are. Leverage the capabilities of Geoscience Australia's NEXIS database of GIS data.
- How often and where the road system is blocked due to crashes or falling trees.
- How smoke and panic affects crash rates on rural roads.

Research approach

There are no COTS (Commercial Off The Shelf) micro-simulation packages that include random car crashes and obstructions due to fallen trees so a computer simulation using a synthetic approach will produced where

- Road networks are constructed of road segments where vehicles enter each segment and then either emerge at the other end, remain in the segment due to a crash or return to the entrance due to the road being blocked
- Formulas will be used to calculate the chances of a tree falling or a vehicle crashing
- Reporting is produced to animate vehicle movements for easy understanding by communities

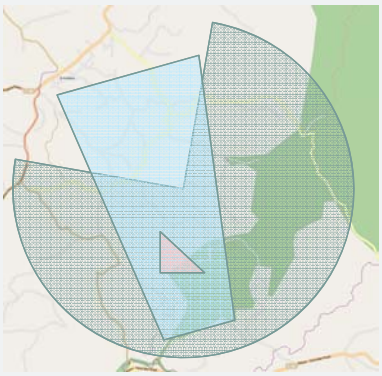
The simulation will need data on the activity and movement of people, the chances of trees falling down, how smoke affects driving and how panic affects driving. Existing data sources such as Census records and statistics on time use provides some data. As well as reviewing existing research into these areas, new data and understanding is needed to answer questions like:

- How many trees fall down as a fire approaches due to high winds on high fire risk days? One data source could be video taken after fires that shows fallen and damaged trees, and then counting them along with the species they might have been.
- How is the driving of people affected by the smoke of an approaching fire and the heat on the day? A driving simulator could help answer this question.
- We already a know a lot about fog, but how much does smoke affect the safety of driving due to visual obstruction. Or are the curves in hilly rural areas more important?
- What affects people's decision to evacuate? Known factors include: household composition, age, experience of bushfires, length of residence in the area and access to vehicles. The simulation will need to model these factors.

Possible outcomes

The research might:

- Guide further research into bushfire evacuation knowing which is more dangerous:
  - Smoke as a visual hazard
  - Smoke as a physiological hazard
  - Limited choices of exit roads
  - Roadside vegetation (trees falling!)
  - Congestion of roads
  - Curvature of roads
- Produce maps and animations to help communities understand how much risk there is under different:
  - fire scenarios
  - evacuation policies



- Help simulate urban traffic operations and management by including random crashes in micro-simulation studies.

About Me

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