# Background Research

## Flocking for multi-agent dynamic systems: algorithms and theory

* 3 Qualities of flocking
  + Centering: stay close to each other
  + Collision Avoidance
  + Velocity Matching
* 3 scalable algorithms
  + Gradient-based algorithm with velocity consensus protocol
  + Algorithm including the group objective
  + Algorithm including “obstacle” agents (might be able to use as simulator for other cars or lanes of road)
* Effective flocking does not require a leader but can be used
* Use weighted graphs with position-dependent adjacency elements
* Each agent has a certain interaction range
* Ideally want every point to be equally distances from all of its neighbours on a proximity net G(q)
* Deviations from an ideal alpha-lattice can be measured using deviation energy
* To avoid fragmentation, provide additional term in the flocking algorithm that acts as a moving rendezvous point i.e. gives navigational feedback (could be used to simulate a leader car)
* Split-rejoin or squeeze maneuver?
  + Probably beyond scope but use to integrate/combine multiple convoys after an accident or something

## Truck Platooning Evaluations

* 63-65% of all miles driven by large transports in amenable to platooning
* 5.3 to 17% fuel reductions depending on following distance/position in platoon

## US Department of Labour

* Truckers experience most fatalities of all occupations, accounting for 12% of all worker deaths, as well as more nonfatal industries

## Lorry Technology Trials

* Trials to start soon for platooning in groups of 3, reduces fuel cost, congestion, improves air quality

## Report to Congress

* Almost ¼ of crashes involved rear ends
* Running off road/out of lane is the next largest
* Speeding, fatigue, and unfamiliarity with roadway are also large factors