**Introduction**

- This study employs game theoretic models to investigate the interaction of drivers’ manoeuvres on the road.
- Modelling interactions in this manner has helped understand behavioural norms observed on the road. Further application of this method can result in further novel findings with safety implications.

**Motivation**

- How drivers interact on the road has implications towards the safety of travel.
- It is important to understand and model these interactions to improve safety.

**Roundabouts**

This project explores the interaction of drivers at a roundabout. Incoordination of drivers’ decisions accounts for over half of accidents at roundabouts.

The game is modelled as a two-player sequential game. One driver makes their decision first, and after observing their action the second driver makes their decision. The explanatory variables include drivers’ trajectory with respect to one another at the roundabout. The interaction model is calibrated against observed driving behaviour at a real-life intersection. The model parameters give insight towards suitable measures to further increase roundabout safety.

**Signalised intersections**

In this study, game theory is used to model the interaction between two conflicting drivers at a signalised intersection. Drivers play games where they make a simultaneous decision to either drive through the intersection or wait at the stop line. The co-decision of the drivers determines their outcome.

The interaction is taken as a non-cooperative, non-zero sum game.

Behavioural models are calibrated against the decisions made in the games. The findings have implications towards the safety of fault and no-fault car insurance policies at signalised intersections, and peak and non-peak driving periods.

**Stop-controlled intersections**

This study investigates the interaction between through-route and minor-route drivers at a stop-controlled intersection. Drivers perform tasks in a driving simulator experiment, making choices at a stop-controlled intersection. The through-route driver first makes a choice to either slow down or not slow down as they approach the intersection. After observing their speed, the minor route driver chooses to either enter the intersection or yield to the through driver.

The observed choices are used to calibrate parameters in an interaction model. Understanding what these values mean will provide insight towards safety. The study also investigates the effect of intersection collision warning systems at unsignalised intersections. These devices aim to improve driver interactions at unsignalised intersections.

**Driver interactions under Tort Liability and No-Fault Car Insurance**

The accident prevention of tort liability insurance against no-fault car insurance has been an area of interest. In this research, game-theoretic models are used to investigate driver interactions under these different car insurance policy scenarios.

Subjects play games where asymmetric crash disincentives are used to reflect an environment with tort-liability car insurance. Under this car insurance policy, at-fault drivers are greater penalised in the event of an accident. Subjects also play games with symmetric crash disincentives to reflect a no-fault car insurance environment.

The observed behaviour in the games is used to calibrate interaction models. The calibrated values under these different insurance policy scenarios are compared to give insight towards their safety.

Payoff matrix for tort liability car insurance:

<table>
<thead>
<tr>
<th>Driver 2</th>
<th>Drive</th>
<th>Wait</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive</td>
<td>$P_1$, $P_2$</td>
<td>$T$, $S$</td>
</tr>
<tr>
<td>Wait</td>
<td>$S$, $T$</td>
<td>$R$, $R$</td>
</tr>
</tbody>
</table>

$T > R > S > P_1 > P_2$