All too unfamiliar? A study to investigate the human factors that cause incidents in hire cars

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ABSTRACT

Many studies have attempted to understand why driving hire cars can be dangerous. Many attribute the cause of incidents to a lack of familiarity with the driving environment *or* hire vehicle. This study hypothesises that it is a lack of familiarity with both vehicle *and* driving environment that are the cause. Using Klein's Critical Decision Method (CDM) to draw out the mental models of five expert drivers who have been involved in incidents either at home or abroad, this paper delves deeper into the underlying causes and examines the effects of applying existing mental models to unfamiliar scenarios. A summary analysis into the causes behind each incident is provided along with a case study for two of the most insightful interviews. The insights from the interviews are used to create recommendations for safer driving practices within the hire-car industry.

Introduction

If you have ever hired a car in your home country or abroad, you may have been involved in an incident that left you wondering why it happened. It is alarming but, perhaps, unsurprising that, in 2018, road traffic collisions were cited as 'the most frequent cause of death among travellers' (Thompson and Sabik, 2018, p. 188). This problem is set to get worse as the global car rental market is expected to grow by around 7.5% in the next 25 years (Mordor Intelligence Website, 2018).

In his opinion piece 'Hire Car Syndrome', Bernard Dixon invites us to investigate the myriad of human factors that drivers face when driving an unfamiliar vehicle (Dixon, 1995). Using Dixon's invitation as a point of inspiration and departure, this paper intends to explore the reasons why expert drivers may be involved in minor incidents while driving a hire car at home or abroad.

Is it the lack of familiarity with the hire car or the unfamiliar driving environment that can lead to incidents? This question is the primary focus of this investigation and has led to the following hypotheses:

1. expert drivers' lack of familiarity with a hire car causes minor incidents.

2. expert drivers' lack of familiarity with a driving environment causes minor incidents.

For the purposes of this investigation, an 'expert' driver is defined as someone who has been driving for five years or more. The findings from this investigation can be used to create a set of high-level guidelines that hire-car companies can use to try to help their customers to enjoy an incident-free experience while hiring a car. While similar studies have sought to generate

recommendations for drivers, this study's purpose is to generate recommendations for hire-car companies.

Methods

A qualitative study was chosen at the most appropriate research method. This author prefers qualitative studies because of the depth of insight that they can deliver. A feature of qualitative studies is that a limited number of participants can uncover an exceptionally high number of insights.

The Critical Decision Method (CDM), as outlined by Klein et al., was selected as an appropriate means of eliciting the mental models and decision-making strategies of participants (Klein at al., 1989). This method recommends conducting semi-structured interviews that cover the following five steps:

- **step one:** select incident.

- **step two:** obtain unstructured incident account.

- **step three:** construct incident timeline.

- **step four:** decision point identification.

- **step five:** decision point probing.

The information provided by participants in each interview was then transcribed and analysed to try to establish the underlying reasons for each incident.

Participants

Selection criteria for participants was as follows:

- aged between 21 and 65 at the time of the incident.

- fluent in English.

- not disabled.

- have 5 years or more of driving experience at the time of the incident.

- have been involved in a minor incident (no serious injuries, fatalities or trauma) either in the country they learned to drive in or abroad.

Participants were not paid for their involvement in this study and were required to sign a consent form.

As this was a student project, it was decided that a minimum of four participants would be acceptable – at least two who had been involved in hire-car incidents in the country that they learned to drive in (Participant Group A) and at least two who had been involved in hire-car incidents while driving abroad (Participant Group B).

Participants were recruited to take part in an interview by placing invitations at the author's place of work, on Twitter, and by word of mouth.

Five participants were interviewed for this study – two from Participant Group A and three from Participant Group B. Participants' ages ranged from 22 to 65 at the time of the incident and four males and one female took part. All participants speak English as their first language and are from English-speaking countries.

Equipment

30-minute interviews were scheduled with each participant. The interviews were conducted using Zoom video conferencing software and recorded using Zoom's built-in recording feature.

The recordings of each interview were manually transcribed and analysed using nVivo – a qualitative data analysis software tool.

Procedure

The interviews took place in July 2019 and were conducted online or in person.

After the interviews were completed, the data were transcribed and incident timelines (Klein at al., 1989) were created. This was done to gain a better understanding of how each of the incidents played out and to identify and plot the decision points that occurred during each incident.

The transcripts were then coded using NVivo. The process of coding was used to break down and categorise the data so that it could be used to create mental model diagrams. These diagrams were used to build up an understanding of how participants' mental models influenced the incidents that participants were involved in and to establish any common themes.

Norman's definitions of mental models (Norman, 1983) and action slips (Norman, 1981) were fundamental to the analysis. In particular, Norman's sub-categorisation of some action slips as 'mode errors' and some as the 'faulty activation of schemas' (Norman, 1981, p. 1) is particularly relevant to the findings of this study. A 'mode error', as defined by Norman, is an 'erroneous classification of the situation' where an action 'entirely appropriate for a situation is being performed, except that this is not the current situation' (Norman, 1981, p. 7). In minor cases, errors of this kind can be corrected or reversed; in more serious cases, they can lead to disastrous – even fatal – consequences.

Results

Almost all of the incidents analysed by this study were the result of action slips or mode errors where incorrect schemas, mental model elements or, as Norman terms them, 'organized memory units' (Norman, 1981, p. 3) are applied to inappropriate situations or where inappropriate schemas are triggered. In one case (Participant 5), we see an example of where no schema is available for the situation that this participant was faced with and so they have to seek out the required information on how to reverse the hire car using their smartphone.

Due to the constraints of the page limit for this conference, case studies for two participants' incidents and how their mental models and decision-making were connected to those incidents are outlined below.

Participant 2: action slip caused by inappropriate schema being triggered

Participant 2 is male and from the United Kingdom. He was in his early 30s when the incident took place and was renting a hire car in London. At the time of the incident, he had been driving for seven years. The incident timeline below (Figure 3) shows how the incident played out and the decisions that were made during it.
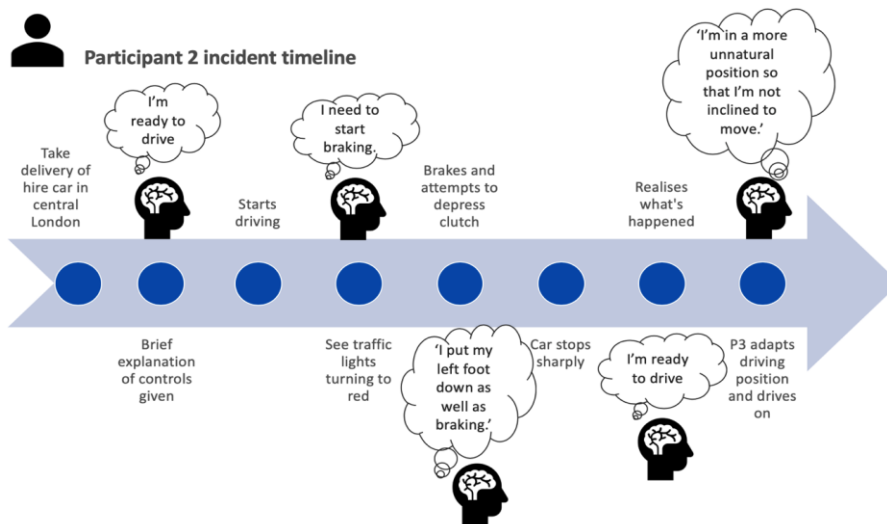

Figure 3: Participant 2's incident timeline and decision points

From early on in the interview, Participant 2 talked about his lack of familiarity with cars with automatic gearboxes.

The all-too-brief onboarding process from the hire-car company did nothing to disrupt Participant 2's mental model of car controls nor does it prompt him to create a new one. This led to an action slip, which did not cause an accident but left Participant 5 quite shaken.
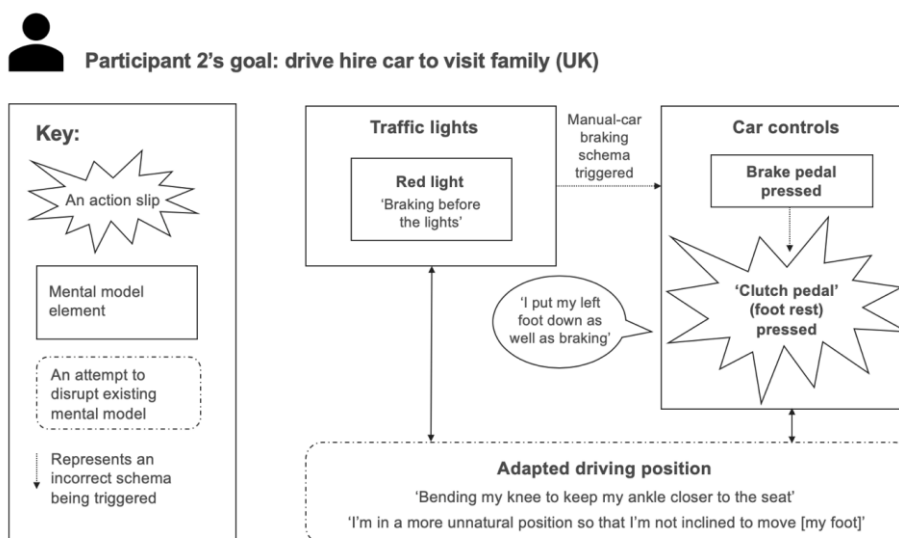
Figure 4 shows how the action slip was caused.

Figure 4: Participant 2's mental model of traffic lights and car controls

The incident appears to be the direct result of an incorrect schema step being triggered. When Participant 2 sees the traffic lights turning to red, procedural knowledge kicks in and he starts to slow down. He will have performed this action many times before and it is almost automatic. All is going well until he attempts to use the clutch pedal as part of the action sequence of his braking schema.

Once Participant 2 realizes what has happened, he does something quite curious. He attempts to work against his faulty braking schema by adopting what sounds like a rather uncomfortable driving position. As he says himself, he adopts a 'more unnatural position' in an effort to stop his left foot from reaching for the absent clutch pedal and inadvertently touching the brake pedal. Assuming that Participant 2 has driven a number of automatic cars since this incident took place, it would be interesting to know whether he still has to resort to similar methods in order to prevent such an action slip from occurring.

Participant 3: mode error causes 180-degree spin

Participant 3 is male, from the United Kingdom and was in his late 20s when the incident took place. At the time, he had been driving for around five years. He had hired a car while on holiday in Canada and was taking a friend to visit his friend's parents' farm. He was driving along a straight gravel road when he started to lose control of the car. He attempted to regain control of the car by applying the brakes and this caused the car to go into a 180-degree spin, missing the ditches on either side, before stopping. No-one was injured.
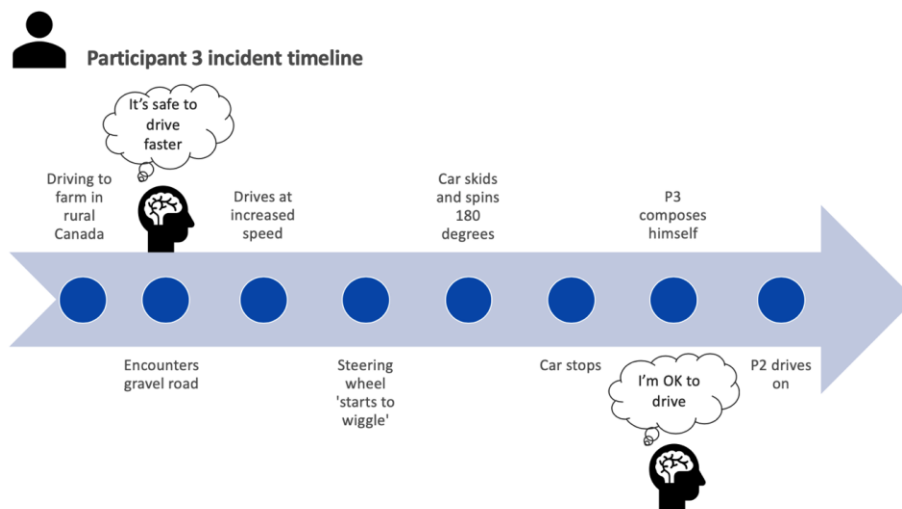

Figure 5: an incident timeline of Participant 3's incident

Participant 3 went on to explain that he had no experience of driving on gravel roads before the time of the incident and it seems that the decision to drive 'a little bit too fast' on this unfamiliar road surface is a key factor in understanding why the incident took place.

Later on in the interview, Participant 3 is asked to describe the hire car that he was driving. As part of the description, he states that it was a front-wheel drive car and he felt that that

made have been played a part in why the incident took place. Without being prompted, Participant 3 then described a similar incident that also resulted in losing control of the car that he was driving. He puts the cause of the incident down to the fact that both cars were front-wheel drive cars.

Participant 3's previous incident experience in a front-wheel drive car coupled with the fact that he chose to drive 'a little too fast' on an unfamiliar road surface is curious. As suggested by Figure 6, this incident seems to be the result of at least two mode errors caused by Participant 3's attempt to apply existing mental models to an unfamiliar car in unfamiliar driving conditions. Assuming that he knew that the hire car was a front-wheel drive car, he seems to have made the decision to drive as if he were driving a 'safer' rear-wheel drive car. Perhaps the fact that the 'road was long and straight' triggered another inappropriate schema – that of it being safe to drive faster? Perhaps this is ultimately what led to him losing control of the hire car? It is notable that Participant 3 goes on to ponder whether the 'longness [sic] and straightness of the road made me impatient and I picked the speed up' and one wonders whether his commented about the 'sluggish' nature of the hire car also acted as a trigger to drive faster.
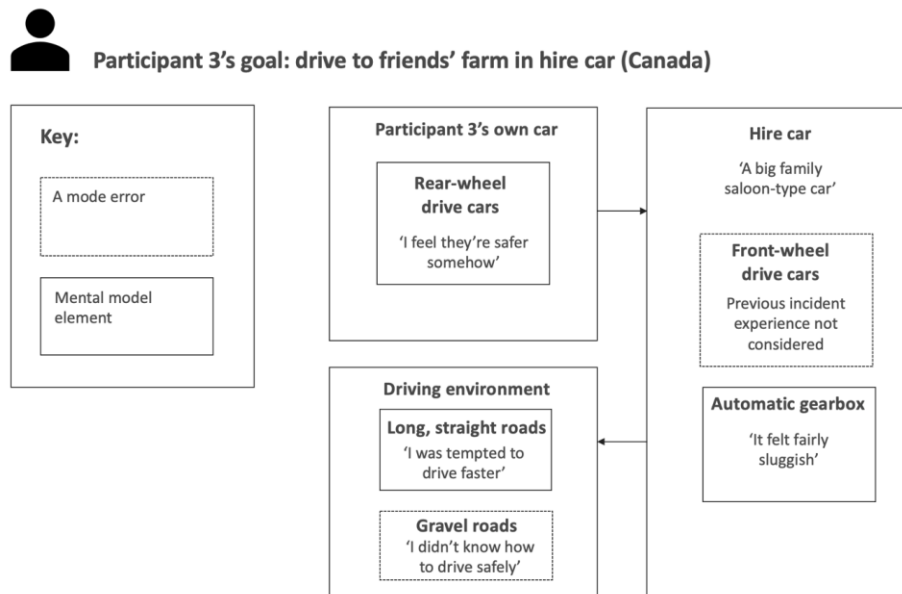
Figure 6: how Participant 3 attempted to apply an existing mental model to an unfamiliar car in unfamiliar driving conditions

Discussion

The results of this qualitative study support both hypotheses established at the beginning of this study:

1. expert drivers' lack of familiarity with a hire car causes minor incidents.

2. expert drivers' lack of familiarity with a driving environment causes minor incidents.

A lack of familiarity with a hire car *and* the driving environment are significant risk factors. There is a slightly stronger argument to attribute incidents to a lack of familiarity with a hire car but, bearing in mind the small number of participants interviewed for this study, this is not statistically significant. It is interesting to note that there were more participants for

Group B (people driving a hire car in an unfamiliar environment) and so more opportunity to identify incidents related to a lack of familiarity with driving environment.

The findings from this study confirm that a broader investigation into the causes of incidents in hire cars is justified. The call to action put forward by Dixon 24 years ago is still valid and requires further investigation with a broader range of participants.

The investigations carried out by Al-Balbissi, Tay and Choi (Al-Balbissi, 2002) do not go far enough in fully exploring the deeper reasons behind hire-car incidents. Al-Balbissi concludes that it is the age (under 30); lack of university education; behaviour; and inexperience of rental-car drivers that result in a higher accident rate. Al-Balbissi sees no cause to further investigate the human factors that could be linked to a lack of familiarity with vehicle or environment. This study finds that age and lack of education have little bearing on the likelihood of a hire-car driver being involved in a minor incident as all participants hold university degrees and ages ranged from 22 to 65 at the time of the incidents discussed.

A more profound analysis that uses a qualitative approach such as the Critical Decision Method (CDM) to draw out the mental models of participants provides richer, more meaningful data and this study encourages and recommends this approach for future studies.

Recommendations for hire-car companies

This study has identified several recommendations that hire-car companies and manufacturers of automated vehicles could use to reduce the number of incidents on roads around the world.

1. Give hire-car customers the opportunity to select the exact make and model (or at least the make – due to shared design patterns and features) of car that they will drive. All participants in this study encountered problems because of their lack of familiarity with the vehicle they were driving.

2. Assess customers' levels of comfort and experience with different styles of car, including size, gearbox type, tyres (winter or summer), and whether the car is front-wheel drive or rear-wheel drive. All participants encountered problems because of their lack of familiarity with these.

3. Give hire-car customers a quick-reference guide to the highway code (or equivalent) relevant to the country in which they will be driving. Two participants mentioned that a better knowledge of the local driving laws and conditions may have helped them to avoid the incidents that they were involved in. This echoes the findings of Wu (Wu, 2014).

4. Give hire-car customers the opportunity to undertake onboarding or training activities and a test drive in a safe-but-representative environment prior to receiving their hire car. This would have better prepared each driver. The study by Malhotra et al. suggests that this training would not lead to 'ironic' behaviour that would work against drivers' intentions (Malhotra et al., 2018).

5. Allow hire-car customers to find out what the driving conditions might be like before hiring a car. One participant highlighted that he would have chosen a different car if he had realised that the roads would not be snowy despite the fact that he was staying a ski resort. Knowing more about the likely weather conditions may have influenced another participant's decision to drive at all.

6. Provide labels and anti-affordances to car controls within hire cars and vehicles with any degree of automation, such as an automatic gearbox. This study showed that, even when told, participants forgot about the differences between the hire car and cars they were used to driving.

7. Be aware that the introduction of any form of automation (including the automation of transmission) within a vehicle can reduce the arousal level of drivers. This could render them unable to take control of a vehicle when their intervention is needed to prevent an incident. Full automation is safer than partial automation as it creates a more reliable mental model that does not need to be disrupted.

These are the recommendations identified by the findings of this study. This study used only a very limited number of participants. Broader and more in-depth studies using many more participants could go on to identify more and to further improve the driving safety of hire-car drivers as the hire-car industry continues to grow.

References

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