EXPLORING THE USER EXPERIENCE OF DRIVING AND RESEARCHING HOW DESIGN CAN HAVE A POSITIVE EFFECT

A mission framed around a very modern day problem, there are more drivers on British roads than ever before and improving the experience can impact millions. A topic that definitely interests me, researching this topic should be both educational and interesting.

VIEW THE PROJECT ————————

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AIMS & OBJECTIVES

I want to first find out what drivers consider to be problems, why they think they are a problem and perhaps what they think could be done about it. I will be going out and using appropriate methodologies to gather relevant information from the people using the products.

I also aim to test drivers' knowledge, to find out whether the systems in place to allow us to pass our driving test last over time. I will use a form of surveys to identify any issues or trends in this area.

I also want to find out what vehicle manufacturers are doing to combat the problem, what kind of technology they will be implementing and what they want to see in the future. This will be achieved through visiting a high-end car dealership and using online resources to learn about the company.

METHODOLOGIES

The methodologies used in this study are as follows;

FIRST-PERSON ETHNOGRAPHY

I tested a vehicle at a BMW dealership to review safety and comfort features they use.

SURVEYS

A form of which was used to test drivers knowledge of the driving theory.

INTERVIEWS

Needed in order to target a particular audience, I could approach people who I needed for information and get results from my exact target.

QUESTIONNAIRES

Used to reach a large number of people of different age and demographics, these helped me broaden my research and identify trends.

ONLINE RESEARCH

Used when it was impractical to complete studies for myself either due to time or equipment restraints.

INTRODUCTION

In order to start the investigation, I needed to get a clear understanding on the experience motorists currently receive when commuting, what problems they face and perhaps what they think could be improved upon most. I also want to obtain some information from both learner drivers and the instructors, allowing me to explore all avenues and have a well rounded view of the topic.

In today's society, the roads are filled with drivers of all ages, despite a recent decline in teenagers learning to drive. Because of this, I wanted to ensure data I gathered was not from one age group but rather addressed the drivers aged from seventeen all the way to over forty five and over. This allowed me to see the different problems people were facing and identify patterns between similarly aged drivers. For example; drivers aged over thirty often commented that other drivers are their biggest problem when commuting. Whereas drivers under twenty-five commented that roundabouts were an issue on multiple occasions.

A total of fifty-six people answered the survey consisting of six varied questions, all with the goal of giving some foundations to explore and further expand on. I made sure my questions were quick, easy and meaningful to ensure the data I captured was full and did not go to waste. Responses were both ample and diverse enough to give me a broader knowledge of the modern-day obstacles people were facing. Shortly after getting my responses in, I delved into research to either support or dismantle the claims.
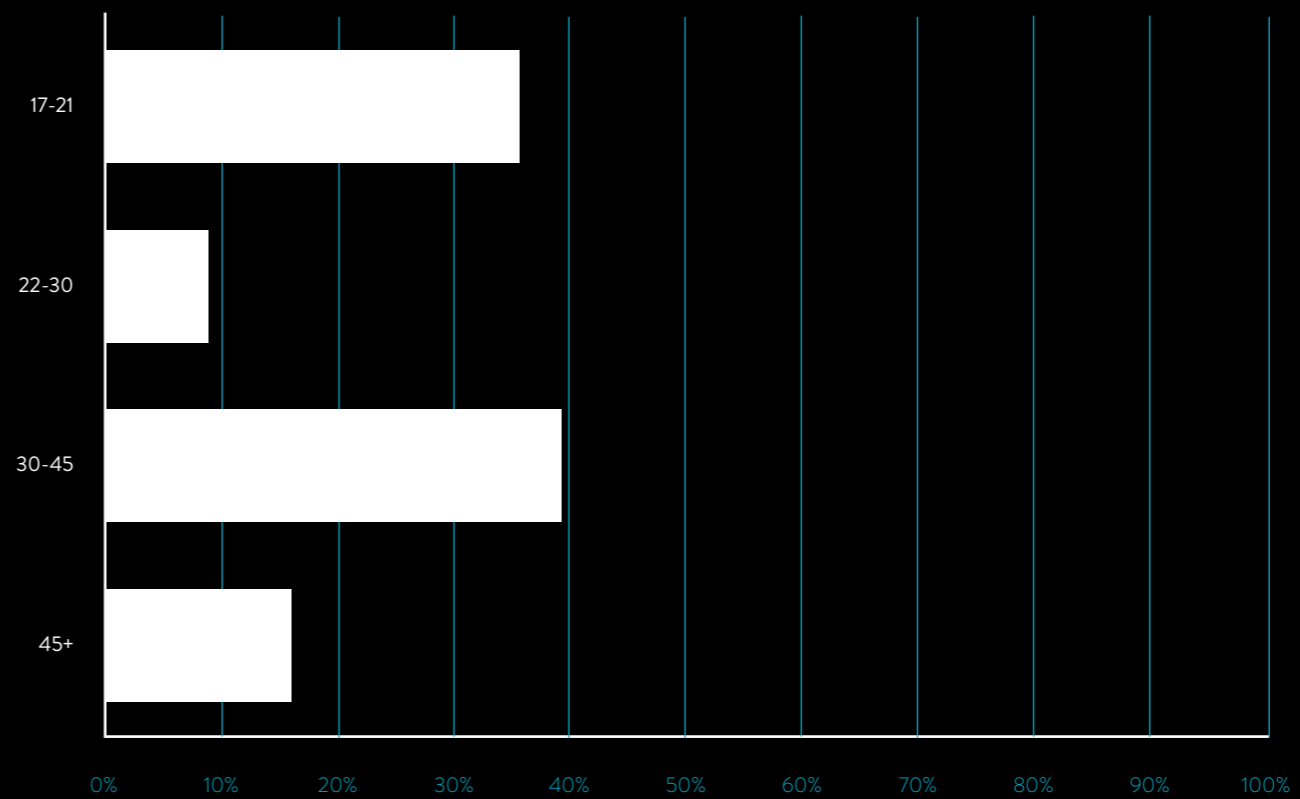
RESPONSES BY AGE

*Graph to show the different age groups my data came from.

EVALUATING THE APPARENT DANGERS OF LED HEADLIGHTS

HID or LED headlights are often complained about across the internet - forums are set up and people are often seen complaining about the technology. In my initial survey to drivers, fifteen people brought up that they did not like driving at night, some specifying that this was because of 'bright headlights'. This newer headlight technology is almost definitely here to stay, as it is a feature accompanying most newly released vehicles in 2020. "About 80 percent of vehicles still have halogen headlights, but many predict that number will go down as manufacturers switch to more advanced lighting" (Jirasek, 2017).

As for the concerns of the safety of these new lights, manufacturers of the systems build them in an effort to improve safety for drivers by improving visibility. There are some variations to what the big car manufacturers are using. For example, Laser light technology is a very new one and serves to be the best at illuminating the road ahead, but often is substantially more expensive to buy.

Realistically, these systems are designed and tested with safety in mind and companies do put a lot of effort in to ensure the new lights are not a danger for other road users. When completing my study at BMW Cardiff, I was told how the newer cars use a combination of laser and LED technology to get the best lighting without dazzling other drivers. Research online suggests headlight aim is a big issue with many people - drivers often do not know how to fix a problem with their aim, or just fail to identify a problem in the first place. This issue fairs well with my own research - I asked five drivers aged 17-20 if they know how to adjust their headlight aim, with only one able to demonstrate, but not one knew what setting it should be at.

Image: (Mughal, 2015)

THE CAUSES BEHIND PEOPLE USING A MOBILE PHONE WHILE DRIVING

An issue that has grown rapidly in the last decade, with new laws and clever cameras designed to try and combat the problem, is it stopping drivers? The biggest deterrent to using your mobile phone behind the wheel is hefty fines and penalty points on your license, however this is not enough for some drivers. Nearly half a million drivers are suspected of using their mobile phone whilst driving, putting themselves and other drivers in danger. (Petter, 2019) Found that "Those aged between 17 and 29 were twice as likely to use their phones on the road compared to other age groups and the most common time for drivers to be caught was between 5.30pm and 6pm."

I asked ten eighteen-year-old drivers if they had ever used a mobile phone whilst driving, all of which admitted to using it at least once in the past. The link between rush hour and high usage of a mobile phone could be closely related to many drivers in my survey saying they disliked driving in traffic. Driving in traffic can be very boring, this does lead people to wanting to distract themselves, most commonly through the use of a smart phone.

Even with the considerable penalties, a fall in police cars on the roads today makes it harder for anyone to be caught in the act, perhaps adding to this sizable problem. Some vehicles such as the BMW 8-series I used for investigation try and incorporate mobile phone functionalities into the car and display them in safer areas for the driver. How far this can go before it starts to actually encourage use behind the wheel is another question, a complex problem of which disregard for safety lies predominantly within. "Drivers on a mobile phone reduce their visual scanning of the road ahead, are more likely to weave within their lane on bends, and are slower to respond to hazards." (Crundall, 2017)

Image: (Vas, 2017)
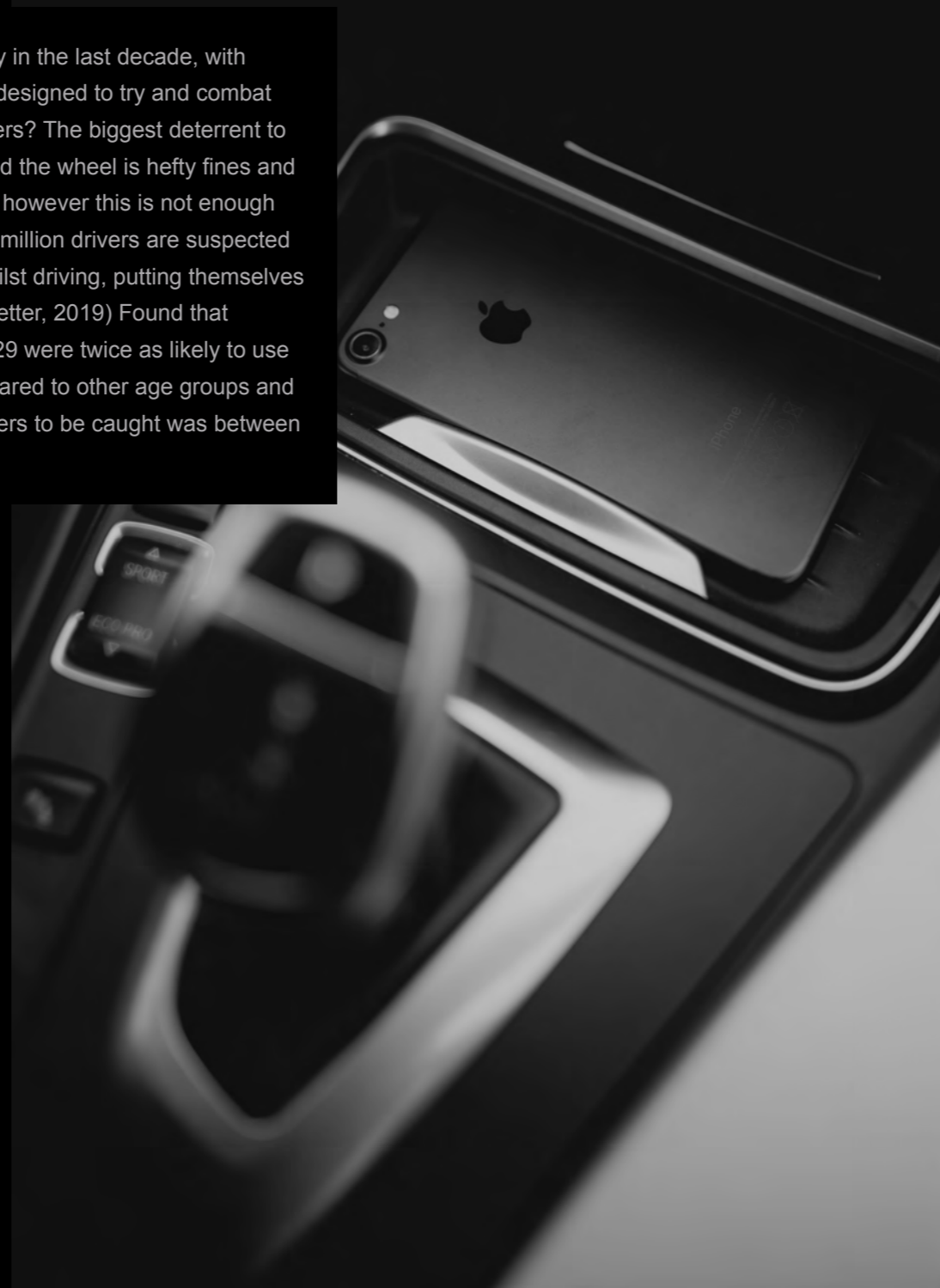
REVIEWING THE EXPERIENCE OF IN-CAR INFOTAINMENT SYSTEMS

With the technology that lies within a vehicle advancing drastically over the last few years, it is fair to say that in car infotainment systems have gotten a lot more time consuming to navigate through. The systems implemented into cars these days have gone from being able to simply adjust the volume of the stereo to allowing adjustment of the climate control, adjust equalizer settings, connect a phone, text friends, in-car navigation and much more.

All this does come at a cost; with more features and settings comes more distracting screens for drivers to turn their attention to. "Operating a car stereo whilst driving noticeably increased the level of workload on the driver and that in-car stereo use might thus be seen as a possible impediment to safe driving" Jordan (1998). My initial response to this was to assume that vehicle manufacturers knew what they were doing and would have found ways to prevent driver distraction for long periods of time. Thinking of things along the lines of voice control and gestures, hardly very advanced technology these days. Some online studies found that these systems were not helping the situation, and often actually further flawed the systems. From my understanding voice recognition often doesn't properly understand the user and requires further action to correct

the command, just exacerbating the situation. Not only do they not always work, even when they do, studies suggest the brain stays distracted both while using it and after the command is complete. As found by (Atiyeh, 2015) "A new AAA study commissioned by the University of Utah found that drivers using voice commands are distracted long after the car's robotic speech quiets down. For how long? Up to 27 seconds."

As for the actual usability of the systems, my negative view is very much based off what I've found online and experienced for myself in the past. To gain better and more up to date results, I visited a BMW dealer in Cardiff to take a look at the latest iterations of these systems. Whilst there I was allowed to take a look around a vehicle of my choice and assess the systems built into it. The car I chose was the range topping m850i with the latest version of the iDrive system, packed with all the features, some of which are not available in other models. Features included sat-nav, voice assistant, collision warnings, efficiency stats, media control and communications just to name a few. Despite the system having four ways to interact with it, hand gesture, touchscreen, voice control and a dial-button combination, I would hardly say the system was easy and intuitive to use.

Completing common tasks such as using the navigation system did take over 30 seconds, agreeing with a study by (Constantine, 2017) "using an unintuitive navigation system took up to 40 seconds for many participants, a ridiculously unsafe amount of time to take one's eyes off the road."

I found myself making mistakes such as tapping a letter twice, struggling to find the backspace button and feeling a little confused as to where I was in some instances. Other flaws in the system became apparent after ten minutes use, the catch phrase to activate the in-car voice assistant took 3 attempts to work. Also failing to navigate me to an address, bringing up suggestions completely unrelated to the original command, requiring further interaction with the system.

The biggest issue for me was the overcrowded nature of the system, it felt messy, unorganized and just lacked a good user experience. Despite all this, the system did pack in an assortment of safety features in an attempt to make the roads safer for the driver and other road users. Collision warnings for both the front and sides of the car, lane change warning and speed limit warnings were just some of these features, with the car actually being able to intervene with things like steering. Heads up display and digital dials helped to prevent the driver taking their eye off the road for extended periods of time as this can obviously be dangerous to themselves and other road users.

BMW are definitely taking steps forward in the safety side of driving but ultimately are still implementing unintuitive infotainment systems into their cars making them both distracting and frustrating.

Image: (Holyoake, 2017)

EXPLORING HOW ADVERTISING AFFECTS A DRIVER

Advertising to drivers on the road via billboards and other media is not a new thing, companies have been using the roads as a way to reach potential consumers for years. I wanted to explore how different types of advertisements could have an effect on the driver's emotions. For example, could seeing an advertisement for a product that was well suited to the driver have a positive effect on them, improving their mood and making that particular journey a little bit better? (Cottingham, no date) Informs us that "the occasional billboard has been shown to perk up a driver's attention, reducing fatigue."

Obviously, there are downsides to this, the sole purpose of an advertisement is to essentially distract the driver and pull their attention away from the road and towards the sign. To distract a fatigued driver for more than a split second could have devastating results for both them and other road users, of course, depending on a number of other factors such as placement and time of day.

The things that would usually make a great advertisement come to be deadly features when applied to the road, pulling people in with bright colours or interesting visuals and grabbing their attention does not exactly scream safety. But, with a contrasting argument of their ability to perhaps waken a driver from a fatigued state due to their appeal, there must be a middle ground that lies somewhere within. Regan, Lee and Young (eds.) (2008) Found that "Greater density of advertisements does seem to correlate with a higher crash rate, especially for changeable-message signs."

So, this would lead me to believe that more strategically placed advertisements that appear less often and are appealing to the average driver could positively affect the driver without putting them in danger.

Image: (Ovalle, 2018)

ADDRESSING THE IMMENSE CONGESTION ISSUE IN THE UK

Traffic was highlighted as the biggest downside to driving in my survey, online studies also found it can leave the driver feeling stressed, annoyed and generally not happy. The latest attempt to alleviate this problem is the iteration and development of 'Smart Motorways'. (RAC, 2020) Claim that "A smart motorway is a section of a motorway that uses traffic management methods to increase capacity and reduce congestion in particularly busy areas." Technology is used in conjunction with clever planning and research to try and utilise more of the available road space and optimise the 'Smart' capabilities. Cameras, radar and sensors are all used in conjunction with the control centre to try and keep traffic flowing smoothly and spot a breakdown as soon as possible. With the hard shoulder being used as a live lane, there are many concerns as to where broken down cars can stop and if there will be an increased risk of collision due to it being a live lane. In an ideal situation, the car would be able to make it to one of many refuge points where appropriate services can be called, and the brake down dealt with. Obviously, this is not always going to be possible, cars that are unable to make it to one of these points will be left amongst flowing traffic and emergency services will need to assist. (TheAA, 2016) Found that "Only 1 in 10 drivers feel safer on an all lane running motorway."

I wanted to find out if people around me even knew what a smart motorway was and the rules to obey when using them. I asked 12 people of mixed demographic in the city whether they knew what a smart motorway was, 9 of which did not. This could be a direct result of not having any smart motorways currently situated in Cardiff City, until the M4

is upgraded in 2022. Despite this, many drivers are likely to come across a smart motorway in the future and not knowing what they are and how to use them could have disastrous results. My studies suggest that education of these new implementations is lacking, with more plans in the pipeline and a rapid development of existing motorways, drivers need to be properly informed of the new systems. Even when the systems are used properly and rules are adhered to, safety still remains a big concern for motorists in the UK. Conflicting views online can give a considerable amount of uncertainty to the safety, (Highways England, 2019) states that "The first nine of the latest generation of smart motorways have reduced casualty rates by more than 25 per cent."

But yet many online articles can contradict this, saying they are actually far less safe than the conventional motorway. It appears that these conflicting views can cause confusion amongst drivers and make them question the statements the government are making on these new smart motorways. From what I can gather, these new systems are safer for the most part by reducing collisions and driver fatalities, however, they also put stranded drivers who have broken

down at a considerably higher risk. Safety aside, how effective are these roads costing millions of pounds, could the money be better spent in clever new ways instead of just trying to fix inadequate old roads with a few cameras and changing signs? Ignoring the 'extremely rare' glitch that left three lanes closed unnecessarily in June 2019, causing miles of traffic and delays. Well, the computer behind the whole system is restricted in some ways. It can try and prevent congestion before it happens by slowing cars down after detecting heavy build up, but is unable to react to a crash in the middle of the road, this has to be spotted by staff in the manned control room. "Reports show it takes an average of 17 minutes to find the breakdown with cameras alone." (TheAA, 2016)

Smarter systems that were able to detect crashes through the utilisation of artificial intelligence could possibly help reduce this time and make the roads safer for people who breakdown. Obviously, the main goal of these newer, more advanced motorways is to shorten journey time through reducing congestion. More than four thousand miles of previously unavailable tarmac will now be available to motorists when the smart motorway plans are completed.
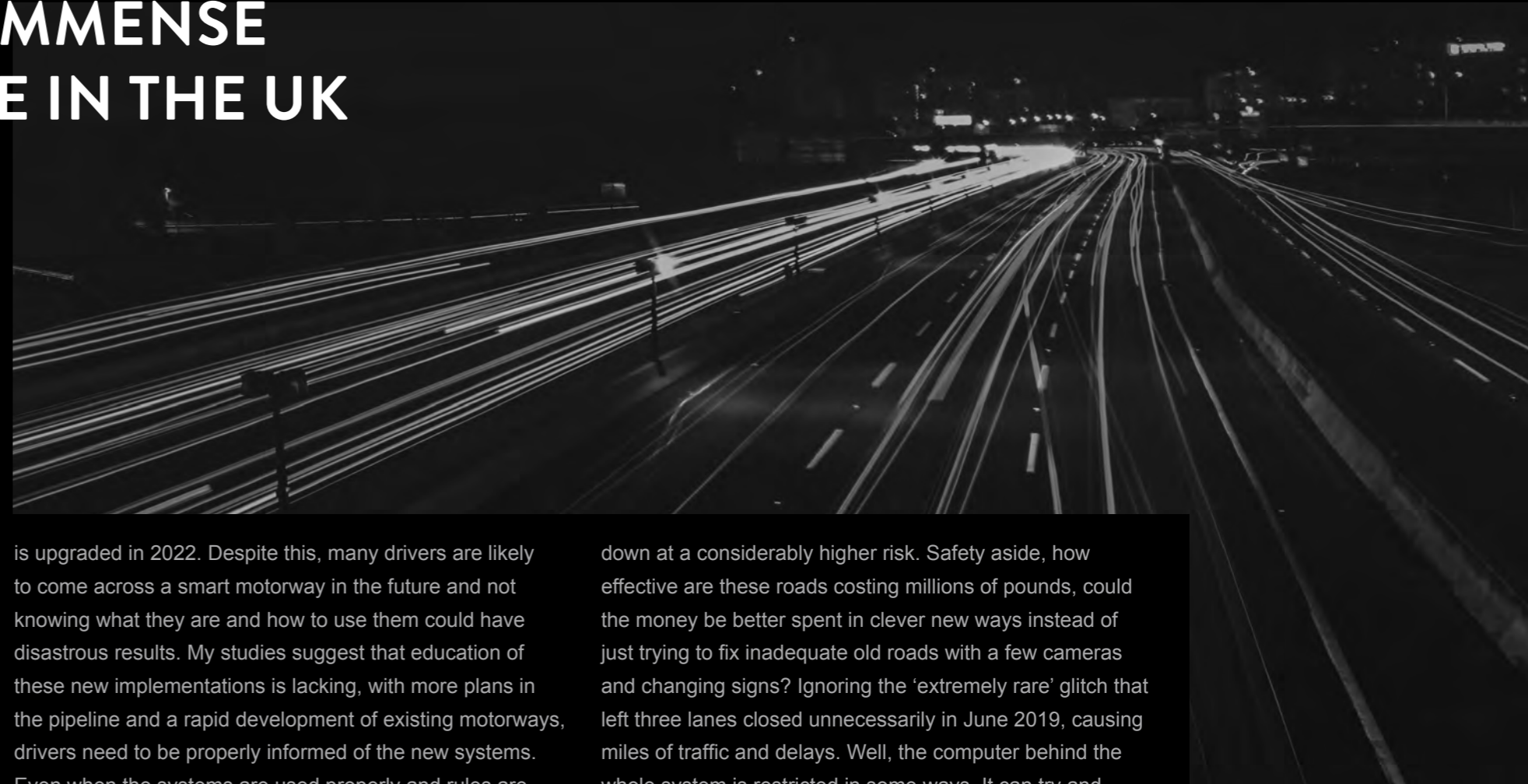
Image: (Overgoor, 2019)

SELF DRIVING CARS, THE SOLUTION?

Self-driving vehicles are a small glimmer of light in a very dark, dull world of congestion and long queues. Currently illegal in the United Kingdom, self driving vehicles are taking the car industry by storm. It has become regular and almost expected for new vehicles to be released with the feature, even if disabled pending new rules. This new technology is very much anticipated by many to take over the roads, predicted to be made legal in 2021 for British motorists. Autonomous capabilities seem to be closely linked with electric vehicles, they regularly appear together and it is not often you hear of a traditional fuel powered car being released with the feature. There are a few reasons behind this, some of which highlighted by (Srinivasan, no date) "autonomous technology integrates better with electric engines...these systems create a more compatible and

flexible platform for autonomous driving technologies." This is opportune since such vehicles have been rapidly gaining market share in recent years, going from rare, futuristic concepts to having a wide variety of electric vehicles on offer today. Despite electric vehicles still have a huge minority on the roads compared to their combustion counter parts, huge amounts of focus and money is being injected into the technology, with big name brands such as Ford now turning their attention to the EV. "Ford's plan for electrification is simple. We use our strengths: the capability, performance and technology our customers love, and transform them through the unique qualities of electric vehicles. Our new Mustang Mach-E is just the beginning" (Ford, no date) Ford, one of the oldest vehicle manufacturers and amongst the most recognisable brands

in the world, built their success on the mass production of combustion engine cars, now turning to electric. This is a huge indicator for the future of cars and how we use them could be changing in a drastic way, and not just for the select few. Despite many describing the technology as flawed, the computer based system can have favorable impacts on the traffic issues we currently face. With many hurdles such as snow and fog to overcome, the feature is not to be rushed and far more planning and testing will be needed before it becomes mainstream in the United Kingdom.

Image: (Mitnick, 2018)

Image: (Pixabay, 2017)

ASSESSING DRIVERS KNOWLEDGE OF DRIVING THEORY

In order to be granted a driver's license in the United Kingdom you must first pass a theory test, before being able to sit your practical. This test is designed to ensure anyone who wishes to drive on the road first possesses the necessary knowledge, such that improves safety. The kind of questions on this test can go from braking distances to what to do when approaching a horse on the road, all designed to prepare a new driver for possible driving scenarios. With this test being done before your practical, and, providing you pass, never again, I wanted to see how this knowledge fares with someone who has been driving for several years. In my initial survey to drivers, sixty percent of people who answered said they felt they would be able to pass their theory test if asked to do it again tomorrow. Forty percent felt they would fail to possess the necessary knowledge in order to pass. I decided to retake the test for myself, having taken

my original test three years ago, not so long relative to some other drivers. Despite scoring a particularly high score in my test three years ago, forty nine out fifty, I actually wasn't able to pass when tested again. With no prior research and not really being tested on my road knowledge since my original test, this does not come as much of a surprise.

I got eight people to take an official version of the theory test, an online version provided by the drivers vehicle standards agency. I managed to get three drivers who had held their license for over fifteen years, and five who'd had it for less than five years. Two of the three experienced drivers passed the test, only one of the five inexperienced drivers passed, interesting given that they had done their test far more recently. I asked all participants to try and answer all of the fifty questions to the best of their ability, without researching online for the answers. I did this as I wanted to know how good their driving knowledge was, and, if the time since their original test had an effect on their ability to pass, which it appears not to have. With a test consisting of a possible one-thousand questions, only fifty are randomly selected per test, with forty-three being the pass mark. Theoretically, you could pass your theory test knowing less than five percent of the questions the DVSA feel are important things to know. That leaves a driver possibly lacking some very important driving knowledge, some of which could help prevent dangerous situations or avoid an accident. My experiments and research have clearly outlined some issues with drivers knowledge, linking well with my survey where many people highlighted their struggles with lanes, roundabouts and signage.

DISCOVERING PROBLEMS
DRIVERS FACE WHEN PARKING

Parking your car after a journey is almost inevitable, whether it be bay parking or parallel parking, it is something we all have to be able to do as drivers. Problems with parking came up quite frequently in my survey, amongst other things, finding spaces and damage to cars were highlighted as key issues. In the city, car parks are advertised quite adequately, with some of the bigger, more popular ones having digital free-space indicators built into the signs. Interviewing drivers at the NCP multi-storey car park I use frequently, they felt these signs were useful, however, disliked that you would have to drive towards the car park before being informed.

This leads to frustration on some occasions, especially busy periods such as Christmas, as drivers would be turned away after crawling through the busy traffic. As for smaller car parks based outside of the city centres, the only way to tell if there is any available spaces is to actually go and look, many people, including myself have found themselves mindlessly driving around looking for non-existent free spaces. Inconsiderate parking was also an inconvenience brought up a lot too, people parking their car and taking up what could be another space for someone else. I managed to speak to three drivers who had parked what could be considered as uncharitable by others. Two of the drivers said they did it in order to protect their cars, telling me they are tired of people opening doors into their cars or pushing up against them and marking the paint. The third driver told me he likes to leave some extra room when parking as it helps him to get in and out of the space more easily. From my own experience, people do often ding my car door with theirs and rarely apologise or leave a note which can be frustrating, especially when you care about your car. (InsureTheBox, 2018) Found "almost one in five British drivers admitting to crashing into a parked car and driving away, parked cars being hit and damaged in some way is unfortunately a semi-regular occurrence."

Looking online, the only part-solution to this is to try and park further away from the other vehicles, decreasing your chance of people parking next to you. Reading through online forums looking at people who have had this issue occur, and seeked advice from others, a major issue I have found is that some people have a very poor attitude towards the problem. "The odd dink isn't going to make any difference to what it does or how it works" (Toad, 2011) This is not an isolated comment, I found several comments that would, in so many words, tell people to get over it. This lack of understanding and respect for people's property is definitely a problem, combined with tightly crammed carparks to maximise capacity, issues are inevitable.

Image: (Hurst, 2018)

THE FUTURE OF DRIVING

For many years now the big car manufacturing brands out there have been releasing concepts and visions of what they think cars will look like in the future and what they will be capable of. Most of the time, these concepts are built to essentially show off the capabilities of a company, a vision of what is possible, technology most of us do not yet get to experience. Autonomous driving, a feature slowly being implemented in today's society, was actually expected to be a feature of cars built in 1959. (Gringer, no date) "General Motors created the exhibit to display its vision of what the world would look like in 20 years, and this vision included an automated highway system that would guide self-driving cars." Many attempts to create the best self driving vehicle have taken place over the years, Japan attempted it in 1977, using cameras over the radio-controlled electromagnetic fields General Motors were using, a lot closer to what we use today. None other than Google are currently in the

race to build this feature into something that is useable in today's world of varying road layouts and complex road systems. Hydrogen powered cars could be the future of the motor industry, zero-emissions fuel cell vehicles boast some substantial benefits over the fossil fuelled counter parts. Little adoption of the technology today, with less than a handful of manufacturers taking interest in the technology. But, this could soon change, BMW hope to have a hydrogen powered version of one of their most popular cars buy 2022, as well as a company attempting to switch the London bus fleet to hydrogen powered iterations. "Jaguar Land Rover (JLR) has said the fuel might be more suitable than battery-electric power for its largest SUVs as it works to cut emissions." (Autocar, 2019). This could completely change how we fuel our vehicles, the process and systems will be different from what we know and are used to.

Seamless iteration of a driver's car and life is something we could be seeing in the future, technology we use in our homes in harmony with that which we use in our vehicle. This idea is already starting to be fitted into newer cars, things like Alexa and Google home being available not just in your home, but in your car too. The idea of this technology is to never feel like you're limited or lose out on your home systems, things like your calendar, shopping list and reminders all being available in your car, as if you never left the house. "For Mercedes, the vision for 2026 in terms of in-car tech is that it'll actually be quite difficult to define where in-car tech starts and finishes, thanks to connected cars that are synced with your online profiles, calendars and social networks." (Laird, 2016). This would be a huge feat for designers and car manufacturers, as discussed previously, managing to combine all this technology into an already feature-filled car without detrimenting the safety of a driver is a difficult task.

Image: (Tullius, 2018)

SUMMARY

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To summarize, there are several issues relating to the user experience of driving, many of which can affect the safety of drivers and those around them. With some clear indications of what needs to be achieved, how to get there is a problem that can be solved with some intelligent thinking. Because of this, my rephrased question will have a more focused narrative to target a more particular and apparent problem.

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RE-FRAMED QUESTION

How could design be used to improve upon driver safety?

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