Automation and human relations with the private vehicle: from automobiles to autonomous cars

Introduction

Automobiles – self-moving but not self-driving vehicles – have been part of everyday life for increasing numbers of people since the early twentieth century, when affordable models began to be mass produced. Now commonly known simply as cars, automobiles were designed to make people's lives more efficient, reducing travel times by giving them access to independent and flexible private transport, unrestricted by the schedules and limited destination points of public transport systems. In contrast, autonomous vehicles, or self-driving cars, are a recent innovation, still rarely encountered in the everyday by very many people, although meeting semi-autonomous cars on the road is becoming more likely even in Australia, with fully autonomous cars under development.

Arguably, automobiles, or cars, have been associated with the concept of automation from the time they were first deployed on public roads. John Urry (2004: 26) notes that the term 'automobility' captures a 'double resonance of "auto"' in relation to the term 'autobiography' and the 'humanist self', alongside the linked terms 'automatic' and 'automaton' used to describe machines possessing a capacity for movement. Urry (2004: 26) argues that '"[a]uto" mobility thus involves autonomous

humans combined with machines with capacity for autonomous movement' on roads

(2004: 26). Clearly, however, there is a difference between the capacity for movement

of a traditional car and that of an autonomous car, with a range of semi-autonomous

levels, including the so-called 'automatic', in between. Across this continuum of

autonomy, a range of different human-car relations are likely to develop, the exact form

of the relation being dependent on the temporal and spatial context in which human and

car interact. This article draws on the work of Don Ihde (1990) and the four classes of

human-technology relation he defines – embodiment, hermeneutic, alterity and

background – to frame much of its argument. While Ihde (1990) discusses relations

between traditional cars and human drivers, the extended analysis below examines how

increasing levels of automation change human-car relations, as well as a person's

awareness of the road and surrounding environment. This involves a consideration of

how humans interact and communicate *with* cars, but also *through* cars as media.

The two sides of automation

Urry (2006) argues that to explore automobility fully one must consider the broader

physical and cultural environment, as well as the core relation between cars and the

humans that travel within them. However, this paper retains a focus on the details of

driver relations with cars, drawing on the way in which an extension of Urry's analysis

of the word automobility (2004) highlights two polarised goals associated with

automation. The first concerns the creation of an automatic system that doesn't need to 'think', but is nonetheless able to complete a task with minimal, or without any, human direction and engagement. This conception links with the idea of the automaton, the object that moves itself according to a fixed plan. Although the environment may influence its movements, this type of machine is designed to perform a sequence of moves repetitively, often leading to the completion of the same task time and time again.

The second goal is that of autonomy, through the creation of machines capable of self-direction, such that they can complete tasks flexibly in a changing environment. Such machines might be termed 'thinking' and therefore as able to 'make decisions'. While the application of these terms to machines is contested (in particular, when a machine's abilities are compared with those of a human), broadly, an autonomous machine is embedded or situated in the world, able to sense its surroundings and also capable of responding (or, some might prefer, reacting) to the world somewhat 'intelligently'. The machine's intelligence may well be nothing like that of a human, but it is nonetheless able to make decisions relevant to the task at hand. From this perspective, the ultimate goal of autonomy is to create machines that can cope with the real world on their own without causing harm to humans, animals or other machines, or to themselves, while completing a task or tasks as flexibly as the constantly changing world requires. The designs of cars incorporate aspects of both these forms of

automation, with automatic systems that make life easier for drivers (such as automatic gearboxes and anti-lock braking systems) a feature of many vehicles, while more recent developments embrace a move towards the creation of semi-autonomous and autonomous, or self-driving, cars.

'Being at one with' cars through embodiment relations

Don Ihde is concerned with understanding the various ways in which humans 'interact' with their environment 'by means of technologies', and his framework of four relations is broadly differentiated based on where the human's attention is focused (Ihde, 1990: 72). In an embodiment relation, for example, a technology becomes an integral part of the way that a person is able to experience their surroundings. Ihde (1990: 73) argues that in this relation the technology itself withdraws, such that it is 'barely noticed, if at all'. The first examples of embodied technology usually discussed (including by Ihde) are glasses, hearing aids and canes, all of which help people to negotiate the world more easily by extending their awareness of the surrounding world as they require. These technologies can be considered 'monosensory devices' (Ihde, 1990: 74). In contrast, relations with technologies that enable 'whole-body motility', such as automobiles, are considerably more complex (74).

As Ihde notes, relations with cars involve more than embodiment relations (as discussed in detail below), although ideas of embodiment seem to be integral to the

pleasure that some people take in driving (1990: 74). Development of an embodiment

relation is supported by a 'symbiosis of artifact and user within a human action' (74),

the action in this case being driving. In common with the monosensory examples, the

driver of a car experiences their surroundings through the car, although the exact form

of the experience depends on the car being driven. For example, as Ihde notes, a sports

car gives 'a more precise feeling of the road' than a vehicle with softer suspension (74).

The car's affordances therefore alter the way in which the driver 'experiences the road

and surroundings *through* driving the car' (1990: 74). Unlike relations with

monosensory technologies, driving a car involves sight, hearing and touch. The person

driving sees what lies ahead, but also 'feels' the road surface and their movement along

that road through the seat, with their feet and hands, judging the state of the road, the

car's steering response, ability to accelerate or brake, the sound of the engine and the

speed of the air rushing past. The car can be thought of as mediating between the driver

and the external world, shaping their perception of the road's physical characteristics –

surface quality, slant and curve – and the surrounding environment. While some cars

cocoon the driver, smoothing bumps in the road and dulling external sounds, others

transmit these sensations more directly.

Employing Ihde's idea of an embodiment relation suggests that, at least when

things are going well and the car is operating smoothly, the driver's experience of the

car itself withdraws, so that the human's focus is on their motion through the

surrounding world and the other road users it contains. This analysis runs contrary to Urry's (2006: 23) argument that drivers become separated from the environment, since 'the car is a room in which the senses are necessarily impoverished'. Rather than being 'impoverished', from the perspective of the embodiment relation, a driver's sense of the environment may simply be altered, even enhanced, during the process of driving, albeit depending on the level of attention paid by the driver as well as the type of car being driven.

The way in which the human's body appears to be extended by the car's body and its abilities could lead to an analysis of human-car interactions as creating a form of cyborg (Haraway, 1991). However, as Tim Dant (2004: 62) argues, it might be better thought of as an 'assemblage' – the 'driver-car' – which is temporary, and therefore more clearly able to come apart and reform as required than a closely interknit cyborg, such that its components (i.e., driver and car) can change flexibly. The emphasis on easy separation and reconfiguration also supports Dant's (2004: 62) focus on the way in which a person always retains a boundary within the vehicle, although they are nonetheless focused on feeling the world through their body and the action of driving. Recognising the individual components of the assemblage, even as they are brought together through action, emphasises other affordances in the car that do not support an embodiment relation, but rather are hermeneutic in nature and draw the driver's attention to the car itself.

Cars as information providers in hermeneutic relations

Alongside people's engagement with the world through the car in an embodiment relation, a car's dashboard also communicates information about the outside world that the human cannot sense for themselves, or which adds to their sensation. This includes (in modern vehicles at least) a temperature gauge for the engine and also possibly for the outside environment. Through the act of reading the gauge on the control panel in a car 'you *hermeneutically* know' how hot or cold the engine is, or how hot or cold it is outside the car (Ihde, 1990: 85). In this hermeneutic relation, the person's focus is on the technology itself, and the car can be recognised as a device that communicates with them, as well as a medium through which the external world is sensed by them.

In a car, some ways of knowing about the world are supported by a combination of embodiment and hermeneutic relations. This is particularly true of judging the speed at which one is travelling. This is experienced through the technology – the sound of air rushing over the body of the car, the feel of the steering, of the road and the pressure of a foot on the accelerator – but also by reading the speedometer and the precise information it conveys. Ihde (1990: 93) notes that the division between embodiment and hermeneutic relations is not clear-cut. While the perceptual focus in embodiment relations is on the world experienced through the technology and the focus in hermeneutic relations is on the technology itself, nevertheless, both relations involve

interpretation on the part of the human (Ihde, 1990: 93). In addition, technology can be used in a double sense, 'simultaneously both as something *through* which one experiences and as something *to* which one relates' (Ihde, 1990: 93), and I would argue this is often true of driver-car relations. Although Ihde introduces this idea without immediately moving to consider technology as an other (or quasi-other, as he would prefer), the idea of relating *to* the car highlights the potential of recognising the machine's alterity.

Cars as others in alterity relations

In discussing alterity relations, Ihde seeks to provide 'an analysis of the positive or presentential senses in which humans relate to technologies as relations to or with technologies, to technology-as-other', hence his use of the term 'alterity', which he notes has been borrowed from Emmanuel Levinas (Ihde, 1990: 98; Levinas, 1969). In stating this, Ihde's aim is to move beyond the idea that a person's focus can move to the technology itself when it malfunctions or breaks. However, it is worth noting that interruptions in the smooth flow of driving due to mechanical issues do raise awareness of the car in a way that may cause people to become angry with the vehicle, addressing it directly and questioning its behaviour in a way that signals their experience of, and response to, the car's alterity (Coeckelbergh, 2017: 187). In a less negative way, the car's response to a driver's actions may also indicate when the driver has

'malfunctioned' by, for example, selecting the wrong gear, or taking a corner too fast. These instances may draw attention to the car as an other that requires human care and attention, and accentuates the act of driving as a human responsibility not just for driving itself, but also to the particular car in the driver-car assemblage.

Ihde (1990: 98) recognises two ways in which people interpret technologies as alterities, both of which he notes can be thought of as 'problematic'. The first is anthropomorphism, which can encompass anything from drawing 'serious artifact-human analogues' to embracing 'trivial and harmless affections for artifacts' (98). Some people's affection for their cars is clear. They may give it a name, talk to it fondly, discuss its 'personality' and feel guilt on its sale (or worse if they send it to its destruction). Ihde differentiates this type of anthropomorphic response from the second means to interpret technologies as alterities, which he calls a 'phenomenologically relativistic analysis', such as comparing driving a '"spirited" sports car' with riding 'a spirited horse' (99). His use of scare quotes shows his unease, or maybe recognises the potential for unease in others, in making this comparison, as does his subsequent discussion of the differences between horses and cars. This leads to an acknowledgement of the 'quasi-otherness' of technology, 'stronger than mere objectness but weaker than the otherness found within the animal kingdom or the human one' (Ihde, 1990: 100). Contrary to Ihde, it may be better to argue that the otherness of technologies such as non-autonomous cars is different from, as opposed to

weaker than, that of humans and other animals. The 'being' of technologies, including cars, need not be framed as quasi- or seemingly humanlike or animal-like to warrant attention in relations with humans. Instead, technologies can be positioned as others with which humans might usefully develop entirely new ways to relate. This is particularly relevant as conceptions of the agency of cars, and therefore their otherness, are more easily and widely acknowledged as their autonomy increases towards the advent of the self-driving vehicle.

Relations with increasingly autonomous vehicles

The analysis above of driving as a combination of embodiment, hermeneutic and alterity relations, within which human and car enter a complex symbiotic relation, is concerned with non-autonomous vehicles. Yet, even in this situation, where it is the human action of driving that supports the development of the relation, it can be argued that automation in cars plays an important role. For example, there are a number of things that even the simplest of cars does automatically and without human intervention. Combustion and the related creation and transmission of power from pistons and cylinders to wheels might be considered a wholly mechanical attribute of the car, but increasingly the details of fuel mix and ignition timing are controlled by system-wide sensors and computer programs. Drivers now rely on cars that automatically change the mix of fuel and air as the engine warms (a manual choke being something that classic

car drivers still learn to manage, also often a feature of motorcycle driving and lawnmower use). At this level, the automation of the car's abilities to self-manage production of power probably add to the strength of an embodiment relation with that vehicle. The driver is encouraged to overlook the engine's needs, to concentrate on the details of driving, so that they can monitor their surroundings and the actions of other road users more closely from the beginning of the journey.

The same positive effect on embodiment relations might also be true of easing gear changes with synchromesh (a feature those in my father's generation learnt to do without, perfecting the art of double-declutching to match engine speed to gear speed in neutral before engaging a new gear). The automatic gearbox might help drivers to become even less focused on the car and more on other road users and events. There are other automated systems that may also reduce the load on the driver's attention, such as automatic windscreen wipers and lights. With these systems, there is a move away from the automation of the car's internal processes, with the introduction of environmental sensors. The car is beginning to sense the state of the surrounding world for itself and act accordingly (although its actions may not be recognised as 'intelligent' by the driver).

Another example, anti-lock braking systems (ABS), remove the need for drivers to cadence brake on slippery surfaces, because the car itself senses when a wheel locks and skids on braking. In this case, while ABS systems might benefit the embodiment

relation between car and driver in terms of supporting the car's withdrawal and allowing the driver to concentrate on steering, arguably, people might become less aware of slick surfaces through their loss of connection with the details of this driving experience. They might become less adept at noticing icy, greasy or oily conditions, and therefore unprepared to negotiate them safely by slowing down, even with the help of ABS. This problem is further exacerbated by the 'dry spell' effect, when the first rain makes oily or dusty road surfaces unexpectedly slippery following a long dry period (Rowland et al., 2007).

The introduction of cruise control, allowing the driver to set the speed of travel and relying on the car to keep to that speed, still requires drivers to remain aware of the road conditions at all times. The car's withdrawal has reached a level where the human is able to focus entirely on steering and braking as circumstances require. Even keeping this in mind, the lack of direct control over the accelerator may reduce the driver's sense of changes in the road surface and slope. It therefore seems reasonable to suggest that at this point the driver's embodiment relation with the car, and therefore their perception of the environment through the car, may begin to be reduced. This effect becomes more noticeable as cars are developed with semi-autonomous autopilot systems that control speed, steering and braking at least on some roads, with the sense of embodiment at its lowest in autonomous self-driving cars within which the driver effectively becomes a passenger. It is worth noting that in such vehicles the hermeneutic relation might not be

affected, with outside temperature gauges and other indicators such as direction and speed of travel still operating as before, but the engagement of people in the car with that information will be as passengers and not as drivers.

Currently available models of semi-autonomous car require drivers to monitor the car's progress constantly, so they are ready to take control should conditions require. The Mercedes 'Drive Pilot' system, for example, requests a driver response at regular intervals, more or less frequently depending on the type of road (Golson, 2017). In this case, each request for acknowledgement would seem likely not only to draw the attention of the driver into a closer embodiment relation with the car and driving process, but also to reinforce the idea of the car as an alterity, capable of driving itself albeit with human oversight. In the case of Tesla's 'Autopilot' system the sensation may be even more marked, since the driver is required to maintain a constant grip on the steering wheel even as the car steers itself along the road, a sensation described as feeling 'as if a pair of ghost hands were on the wheel' (Reese, 2016). Driver relations with these semi-autonomous cars therefore encompass embodiment, hermeneutic and alterity relations, with the balance between the three changing as the car's autonomy comes into play and reinforces the sense that the car is an other.

Mark Coeckelbergh (2017: 187) notes that because of their apparent agency and supported by their ability to take control of the driving process, as cars become increasingly autonomous they are more and more likely to 'be experienced as a quasi-

other'. He remarks that people might be encouraged to 'give a personal name to their car' and also 'talk to the car' (Coeckelbergh, 2017: 187). The alterity of cars might become even more noticeable in a future where humans interact directly with a car at the start of a journey, to communicate their destination, possibly a preferred route and maybe also places to stop on the way, leaving the rest of the driving process up to the car. Although both Ihde and Coeckelbergh favour the term 'quasi-other', recognition of the car's capability to drive itself makes it less easy to accept the sense in which the prefix 'quasi-' invokes ideas of 'supposed' or 'superficial' otherness. Instead, the car in this relation may be better thought of as a technological other that communicates for itself, acting as an active agent in the world in its own right. Rather than recognition of its otherness being reliant on the human tendency towards an anthropomorphic response, or what Ihde would term a 'phenomenologically relativistic analysis' (1990: 99), the car overtly reinforces the idea of its capability to act in the world without supervision.

Regarding cars as agents may raise the question of whether an actor-network theory (ANT) approach (Latour, 2005), which regards drivers and cars as nodes that participate in a network or system, might be a better way to theorise driver-car relations. The difficulty with ANT, as is the case for other object-oriented approaches (Harman, 2002), is that it has a tendency to flatten the ontological distinctions between nodes in the network. In contrast, this paper is concerned with the specific differences in the

ways that drivers and cars sense and respond to the world, in particular as cars become increasingly autonomous. The contention is that noticing the ontological differences between humans and cars is a key part of analysing driver-car relations and driving as a process.

The 'absence' of self-driving cars in background relations

For autonomous cars not requiring the constant supervision of the human driver, alongside a recognition of the car as an other that may be most obvious at the beginning and end of a journey, it is also reasonable to suggest they may move into what Ihde would describe as a background relation (1990: 108-112), at least during the period of travel itself. For example, this seems to be the case for Volvos equipped with the new 'Drive Me' capability, which will be trialled this year on selected public roads in Sweden (Gitlin, 2017). This project is focused on enabling the move 'from a supervised automation situation to an unsupervised automation situation', freeing drivers not only from driving, but also fully 'delegating control to the car' and thus removing the need for a person to monitor its actions (Trent Victor interviewed in Gitlin, 2017). In this situation, the driver effectively becomes a passenger, able to shift their attention to become wholly engaged in tasks other than driving, such as working, reading or eating (as is shown in a promotional video for the project).

In discussing background relations, Ihde moves to consider technologies that

'become a near-technological environment itself' (1990: 108). Machines designed to function in the background include 'automatic and semi-automatic machines' (1990: 108) and, thus, the background relation is one that might well be applied to humans travelling in self-driving cars. Allowing for giving the vehicle initial instructions as to destination, and maybe also preferred route, the self-driving car does not require any further 'focal attention' from its passengers, and once moving should function 'as a barely detectable background presence' (Ihde, 1990: 109). It would seem that this relation involves the almost complete withdrawal of the car from the human's perception, but Ihde suggests that rather than withdrawal, what happens in this case 'is phenomenologically distinct as a kind of "absence"' (1990: 109). Importantly – and this makes sense given that people will still be aware of the car as an entity within which they travel – the car could be described as 'a present absence', which 'becomes part of the experienced field of the inhabitant, a piece of the immediate environment' (Ihde, 1990: 109). In addition, there is 'a layer of background noise' – for a car, the sound of the engine (although this may be greatly reduced with electric power) – 'which signals the absent presence' of the technology (Ihde, 1990: 109). I would argue that, for a self-driving car, the sense of movement might also act as a further signal of its presence and operation.

With this 'present absence' the autonomous car takes on a new role as a mediator and medium for communication. Rather than being a technology through

which the driver learns about the road and environment in an embodiment relation, or reads information hermeneutically as the car communicates this directly through the dashboard, the autonomous car becomes a place where people consume information and content unrelated to the road. Although cars have always been spaces within which people talk, listen to the radio and to their own music, as the level of automation increases towards self-driving autonomy, the balance of information provided through and by the car changes. Rather than being primarily about involving the driver in a conversation about the road, the car might be better described as an entertainment capsule within which people can consume video, play games or switch-off entirely and sleep.

As a car becomes more autonomous, the act of driving is less clearly a human activity, becoming increasingly technological. The human moves from directly controlling the driving process to being out of the loop of the task as cars move from being semi-autonomous to autonomous. Additionally, the related loss of an embodiment relation between human and car distances people in these cars from their surroundings. There is, therefore, a huge shift in responsibility, not only for the action of driving, but also in relation to connectedness with events surrounding the car. If the self-driving cars of the future are to be completely autonomous, as manufacturers suggest (a future feature stressed by Tesla and Volvo as they market their systems, for example), then people may never have to re-engage with the active driving process and their lack of

connection with driving may not be an issue. However, currently, the semi-autonomous cars discussed above (from Tesla, Mercedes and Volvo) drive themselves only some of the time, which means that drivers, while they may be less aware of what is happening around them, will be required to take back control either at planned points (for example when moving from a highway to a side road) or, potentially, in a moment of crisis needing immediate corrective action.

In discussing a technology's move from background to foreground, Ihde (1990) considers what happens when the loss of power in a hurricane requires people to find alternative means to power lighting and refrigeration. When this occurs, although the technology that normally supplies them with power is brought into the foreground of people's minds, it is essentially no longer an operational technology. It has, in fact, moved to being wholly absent and thus needs to be replaced (even if only temporarily). The situation is somewhat different for self-driving vehicles in situations where the human driver is called upon to take control, whether to deal with a change in road type, or to deal with an emergency. In this case, the car as a technology is not only brought to the foreground of the driver's mind, but also continues to be a key presence as a participant in the re-formed driver-car assemblage. In this case, the car becomes something with which a person must move from being in a background relation as a passenger, to being a driver in an embodiment relation, potentially having negotiated a sense of the alterity of the machine at the point when it interrupts whatever they are

doing to signal its need to move out of a background absent presence.

This move across relations with technology may not be easy to negotiate, as shown by a recent study into how well people take back control of steering from an autonomous car (Russell et al., 2016). It seems clear that managing any changes in responsibility between human drivers and self-driving cars – theorised here as a change in human-technology relation to draw out the stages in the handover – should be a key consideration in the design of these technologies. Indeed, Volvo's 'Drive Me' project emphasises how important it is that 'the person in the driving seat knows what's expected of him or her' (Gitlin, 2017), in particular when they are freed from continually supervising the car when it is in autonomous mode, but are nevertheless required to take back control for driving when the vehicle moves from the chosen test route onto another road.

Conclusion

Engaging in a detailed analysis of human-car relations framed by Ihde's four classes – embodiment, hermeneutic, alterity and background – provides a rich explanation of the ways that humans can be understood to communicate with and through these vehicles across a continuum that spans from non-autonomous to fully self-driving cars. At one end of the spectrum, in a non-autonomous car, the agency of the driver is guided by communicating with the car as they drive, but also by the information about the

environment that is conveyed through the car as a medium. At the other end of the spectrum, the car becomes a space within which drivers become passengers, no longer engaged with the car, or the process of driving through a changing environment; rather, they are expected to take the opportunity to use the car as a space within which to rest, work or be entertained by a variety of media. In between these two examples lie various types of semi-autonomy. While some cars share the task of driving with humans (as is the case for vehicles with cruise control), others may take full responsibility for self-driving some of the time, requiring humans to take back responsibility at other times. As this article has discussed, while human relations with increasingly autonomous cars might be thought of as simpler than those with non-autonomous cars, since self-driving cars may eventually move into a background relation with the people they transport, any requirement to negotiate a move from background to foreground may be difficult to manage effectively and requires careful interface design. Understanding human-car relations through the lens of Ihde's theory helps to explain why handing responsibility for driving from car to human may be so complicated, involving a need to negotiate not only situational awareness, but also awareness of the precise way in which the embodiment relation with the car works to support the process of driving safely.

This article has considered the relation between humans and cars from the perspective of drivers, who become passengers in self-driving cars. In future, it will be important to extend this research to consider people who always were passengers, as

well as other road users and their responses to the variety of cars, non-autonomous and autonomous, that they may travel within or meet on the roads. The move from creating automobiles to autonomous vehicles offers a range of different examples of automation in action, some of which are overtly recognised by drivers, passengers and potentially other road users, whereas others are less obvious even imperceptible. The question of how easily automobiles and their human drivers, and autonomous cars and their passengers, will share the road alongside other road users is a key question to consider, since the introduction of self-driving cars is likely to occur over an extended period of time.

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