Older People Driving a High-Tech Automobile: Emergent Driving Routines and New Relationships with Driving

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ABSTRACT Advanced vehicle technologies (AVTs) (e.g., lane departure warning, blind spot monitoring) are sophisticated computer and electronically mediated communications that provide information to users, and, at times, assume control over parts of the driving task (e.g., automated braking). This article examines how AVTs are refashioning older people’s embodied relationships with driving, including driving routines, skills, sensuous dispositions, and modes of control that are considered integral to driving. Results from interviews with 35 older drivers driving a high-tech car call attention to the opportunities and challenges that entanglements with AVTs can present for aging drivers.

KEYWORDS Phenomenology; Technology; Users and gratifications; Aging; Embodiment

Introduction
Drivers aged 65 and older are the fastest-growing segment of the Canadian driving population and are said to account for 3.25 million drivers, or 14 percent of the driving population (Turcotte, 2012). Concurrent with the greying of the driving population,
sophisticated computer and electronically mediated communication systems are now common within today’s automobile. Canada’s federal transportation agency, Transport Canada, has adopted the term “advanced vehicle technologies” (AVTs) to describe the semi-autonomous and “intelligent” technologies that are now broadly available to assist a vehicle’s operator (e.g., automatic braking and blind spot monitoring) (Transport Canada, 2017). As people age, they are more likely to experience changes in psychomotor, visual, and cognitive abilities that can endanger safe driving. However, AVTs have the potential to mitigate age and health-related changes that can affect driving performance (Eby & Molnar, 2012; Eby, Molnar, Zhang, St. Louis, Zanier, & Kostyniuk, 2015). Investigation of how AVTs improve safety-related outcomes and impact driving behaviour is burgeoning, often through the use of studies conducted in a tightly controlled laboratory environment (Fisher, Rizzo, Caird, & Lee, 2011) or under naturalistic conditions (Coxon, Chevalier, Lo, Ivers, Brown, & Keay, 2015). This research, while important, is unable to capture older drivers’ perspectives on how a “high-tech” car is transforming the lived experience of driving in experiential and embodied ways.

Inspired by phenomenology, communication studies, and automobility studies, this article examines the everyday experience of driving a high-tech car and the interrelationships between bodies, technology, and driving. The intent is not to assess whether advanced vehicle technologies can compensate for age-related changes and common driving mistakes. Rather, the principal aim is to understand, from the perspective of older drivers, how AVTs are changing bodies and relationships to driving. As such, the research is positioned to contribute to qualitative scholarship focused on the dynamic co-evolution of drivers with in-vehicle technology (Elaluf-Calderwood, 2009; Girardin & Blat, 2010). First-person accounts of everyday driving are drawn on to explore how the use of AVTs (re)configures driver-bodies, and how these changes dynamically influence drivers’ use of AVTs. The article begins by outlining the conceptual approach used in this research.

Conceptualizing driver-body hybrids in the high-tech car

Phenomenological understandings of the “driving body” can help conceptualize the lived experience of driving a high-tech car. A phenomenological perspective on driving begins with the fundamental proposition that the body is both a physiological and a phenomenal entity—with the latter grounded in culture and direct experience—and the precondition for perception and action (Macdonald, Hargreaves, & Miell, 2002). The work of Maurice Merleau-Ponty (1962) is used to highlight that perceptual engagement when driving occurs from the standpoint of bodily “being in the world” (Dant, 2004; Sheller, 2007). The viewpoint that a driver’s view or perception of the road exists in the mind as “an inner representation of an outer world” (Crossley, 1995, p. 46) is rejected in favour of the notion that perception is a relationship that is established over time between an object (the car, the surrounding environment) and the body of a perceiver (the driver). Hence, perception entails the “whole body to the world through which it moves” (Dant, 2004, p. 72) and includes senses, habits, and memories. The process of driving is an embodied and sensuous experience with habits acquired in relation to the materiality of an automobile in motion. For instance, drivers learn the “sense of how fast they are going and what speed the road conditions will
permit” by using “dials and controls,” as well as through the “sounds and vibrations” (Dant, 2004, p. 73) a car exhibits as it moves. Driving, therefore, comes to feel straightforward and familiar because the driver-body brings an embodied orientation and kinaesthetic awareness into each interaction with the automobile. With the car incorporated into the body, the body has the practical competence to act with the world on the road and use the necessary equipment—the car—and to do so irrespective of reflective thought (Crossley, 1995).

Driving becomes a routine habit that is entangled with “culturally bound procedures ... [that] are ‘proper’ in particular contexts” (Edensor, 2004, p. 112) through the body’s ability to incorporate external qualities into bodily know-how. However, as Tim Edensor (2004) reminds us, driving habits and skills, once learned, are not necessarily rigid; drivers respond to changing circumstances and “operate in an improvisatory fashion within a known motorscape” (p. 112). As such, changes that embed technology into the automobile can lead to a phenomenological disruption of the mind/body equilibrium. Here, drivers can become “aware” of a new environment and begin to reflect on driving practices previously performed without thought. In speaking of “cybercars,” Mimi Sheller (2004, 2007) argues that while new technologies become incorporated into, or inhabit, the driver-body, they also, simultaneously, can change bodies. The introduction of new driving technologies have the capacity to transform modalities of movement in terms of how driver-bodies respond to, and interact with, the world through the senses.

In light of vehicle technology advancements, this article explores the new relationships to driving that are emerging for driver/body-car-technology hybrids. Hence, this research raises the following questions: What approaches to driving exist in a high-tech car? What techniques do older drivers develop to “tame” or adjust to the technology in the automobile? The research shows that AVTs are reconfiguring older driver-bodies by altering the material practices, perceptual and sensory experiences, and modalities of control over driving in late modernity. It finds that AVTs demand new forms of embodiment and habit, which enhance and challenge driver-bodies, as well as prompt reformulated meaningful action with the automobile. The research illustrates that AVTs have brought about new capacities for driving while concurrently redefining values and norms with regards to “what constitutes safe driving” in ways that are both exciting and unsettling. Such changes require reflection on the part of drivers and more generally, new considerations in policy and practice. This point is returned to in the discussion.

**Method**

*Participants and recruitment*

Qualitative interviews were used to access participant’s changing experience and engagements with AVTs. We conducted in-depth interviews with 35 older drivers (20 men, 15 women) aged 60 to 85 years, and there were 32 unique vehicles in our sample. Three couples were included in the study, and in these cases, both participants drove the same vehicle. Recruitment efforts included community posters/flyers, notices in local e-newsletters of retiree associations (e.g., teachers and the use of a university research
database on seniors). Participants were deemed eligible to participate if they: 1) possessed a valid driver’s license, 2) drove at least one day a week, and 3) owned a vehicle that had at least two advanced vehicle features (e.g., back-up camera, lane departure warning). One participant did not personally own a vehicle that contained AVTs, but drove a high-tech car daily as part of his work. Although our recruitment efforts generated interest from drivers aged 70 plus, our eligibility requirements (i.e., a vehicle with at least two AVTs) often excluded many from participation. We thus broadened the eligibility criteria from 70 to 60 years of age. Table 1 provides further detail on the educational and socioeconomic status of the participants.6

Table 1: Sociodemographic characteristics of the study sample

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Number (35 total participants)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age range</td>
<td></td>
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<tr>
<td>60-69 years</td>
<td>16</td>
</tr>
<tr>
<td>70-79 years</td>
<td>15</td>
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<td>80+ years</td>
<td>4</td>
</tr>
<tr>
<td>Marital status</td>
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<tr>
<td>Married</td>
<td>26</td>
</tr>
<tr>
<td>Divorced</td>
<td>2</td>
</tr>
<tr>
<td>Widowed</td>
<td>3</td>
</tr>
<tr>
<td>Never married</td>
<td>2</td>
</tr>
<tr>
<td>Unreported</td>
<td>2</td>
</tr>
<tr>
<td>Household income</td>
<td></td>
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<tr>
<td>$20,000-$49,000</td>
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<tr>
<td>$50,000-$79,000</td>
<td>11</td>
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<tr>
<td>$80,000+</td>
<td>18</td>
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<tr>
<td>Unreported</td>
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<tr>
<td>Education level</td>
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<tr>
<td>University</td>
<td>12</td>
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<tr>
<td>Post graduate</td>
<td>11</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
</tr>
<tr>
<td>Unreported</td>
<td>2</td>
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</table>

Table 2: Types of advanced vehicle technology within participant vehicles

<table>
<thead>
<tr>
<th>Advanced Vehicle Technology</th>
<th>Number (32 total vehicles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptive cruise control</td>
<td>9</td>
</tr>
<tr>
<td>Automatic braking</td>
<td>5</td>
</tr>
<tr>
<td>Automatic crash notification</td>
<td>4</td>
</tr>
<tr>
<td>Automatic high beam dipping</td>
<td>9</td>
</tr>
<tr>
<td>Back up camera</td>
<td>31</td>
</tr>
<tr>
<td>Blind spot monitoring</td>
<td>16</td>
</tr>
<tr>
<td>Driver fatigue warning system</td>
<td>2</td>
</tr>
<tr>
<td>Forward collision warning</td>
<td>7</td>
</tr>
<tr>
<td>GPS/Navigation assistance</td>
<td>27</td>
</tr>
<tr>
<td>Hands-free parking</td>
<td>1</td>
</tr>
<tr>
<td>Lane departure warning</td>
<td>11</td>
</tr>
<tr>
<td>Lane keeping</td>
<td>1</td>
</tr>
<tr>
<td>Proximity sensors</td>
<td>19</td>
</tr>
<tr>
<td>Rain sensing windshield wipers</td>
<td>7</td>
</tr>
<tr>
<td>Rear cross traffic alert</td>
<td>5</td>
</tr>
<tr>
<td>Right-side mirror camera</td>
<td>5</td>
</tr>
<tr>
<td>Voice control</td>
<td>13</td>
</tr>
</tbody>
</table>

Note: 32 unique vehicles were included in our sample.
Table 2 details the advanced features of the participants’ vehicles. Our intent was to include drivers with a wide array of AVTs in our sample. The most common technologies across participants’ vehicles were the back-up camera, blind spot monitor, global positioning systems, lane-departure warning, proximity sensors, and voice control. Participants in our study drove different types of vehicles, but for clarity of expression, we will refer to their vehicles as a “car” unless it is important to distinguish the car as a sports utility vehicle or truck. Most participants (n = 31) had purchased their vehicle in the last five years and participants had different levels of experience driving with AVTs. Twelve participants were interviewed within six months of vehicle ownership, four participants were interviewed within 7–12 months, and 14 participants had owned their vehicle for one year or longer. Eight participants in our sample were first-time users of AVTs in personally owned vehicles, though most had previous experience using navigational technology. Each person received a $20 honorarium for participation. The McMaster University Research Ethics Board (ref #164) approved this study.

Data collection and analysis
Each participant took part in an in-depth interview lasting between one and two hours. Participants were interviewed at least once, with three of the drivers completing a second interview. At the time of recruitment, these three potential participants were identified as “new” vehicle owners and arrangements were made to conduct the first interview early into vehicle ownership. We saw this as an opportunity to capture reflection and awareness on how AVTs were changing their experiences of driving. For these participants, initial interviews were conducted within two weeks to three months of vehicle ownership, and follow-up interviews occurred approximately two to ten months later, depending on participant uptake and scheduling.

A member of the research team (JG or BVM) completed interviews using a semi-structured interview guide. Interviewers employed a descriptive line of questioning to elicit concrete examples of participant experience as it occurred in definite conditions. For instance, participants were asked to describe in detail how AVTs worked in their vehicle, and then illustrate, by way of example, how they use AVTs to drive. If necessary, they were prompted to consider how they use AVTs to complete common driving-related tasks, such as changing lanes, parking, and reversing. Follow-up questions explored how the physical and sensory affordances of the high-tech car informed or mediated driving performance and relationships between car-driver. These questions allowed participants to reflect on how the experience of driving a high-tech compared to a low-tech car. Participants were also asked to describe their feelings of driving with AVTs, using prompts of comfort/discomfort, satisfaction/dissatisfaction, and excitement/frustration. Each interview was digitally recorded and transcribed verbatim.

Two members of the research team (JG and BVM) independently coded the transcripts using NVivo 10. To begin, we thoroughly read the transcripts and assigned first-level or open codes to the data. Codes were generated inductively in response to research objectives, and deductively to reflect participants’ language, meaning, and experience (see Ravitch & Mittenfelner Carl, 2016). Next, team members reviewed the list of codes, the proposed schema, and discussed emerging themes that captured how AVTs changed relationships with driving and the affective dimensions of driving a
high-tech car. With these themes in mind, we then completed a second coding of the transcripts. Further sub-codes were identified to add depth and meaning to the emergent themes. The excerpts below exemplify prominent examples of participants' experiences driving a high-tech car. In all accounts, participants have been assigned pseudonyms to protect their identity.

Findings
Interview results demonstrate how AVTs transformed driving into an increasingly technologically mediated process, thereby changing relationships with driving and bodies. The following section discusses key interpretations of the most prominent themes: driving routines, sensations and sensuous dispositions, and modes of control. In each theme, we draw on participant insights to outline how older drivers described everyday driving, and how driving was shifting in relation to the high-tech car. We include verbatim quotations from participants in each theme.

Driving routines
Participant's responses highlighted how AVTs modify the routine and habitual driving-related tasks that people are required to do to ensure “safe driving.” These tasks include shoulder-checking, turning on a signal light, braking, checking mirrors, and looking for pedestrians. Throughout the interviews, participants described how AVTs revise or extend customary forms of safety checking. For example, Janessa details how a blind spot monitor has reshaped and reordered the way in which she performs a “head check” before changing lanes:

I will look, and then if I’m on the highway, and I want to pull out, to the left, into the next lane, using the monitor, using the mirror, and using a look, I sort of know where the cars are, and then I’ll rely on the blind spot monitor before I pull out … And actually once I’ve really checked the highway traffic, then I will rely … more on the blind spot monitor without having to do the head check all the time. (Janessa, age 78; blind spot monitor)

In a low-tech car, Janessa would check the mirror and “look” over her shoulder before moving across lanes. However, in a high-tech car, the blind spot monitor becomes part of this routine with Janessa using the monitor, mirror, and a “look,” but her monitor replaces the final “head check” that she performs before actually departing her lane. Notably, participants’ comments highlight how they experienced AVTs and developed new driving habits that came to replace the embodied gestures characteristic of driving. For instance, Randall describes how he prefers the quality of the information communicated on the “screen” of his high-tech car to looking over his shoulder. Other participants echo how AVTs are taking over former bodily modes of safety checking, such as “turning around” when reversing and “turning one’s head” when lane changing:

[If I’m driving] where there’s three lanes of highway, I tend to leave it on all the time so then it’s much easier to see if there’s something in the right-hand lane. I … don’t have to look over my shoulder. I can just look at the screen there and see whether there’s somebody, or whether somebody’s coming over from the other lane. (Randall, age 63; right-side camera)
So it’s very easy to park the car. Very easy, you know. You don’t have to turn around anymore. You don’t have to. (Jeffrey, age 65; backup camera)

If I was in super, super heavy traffic and going at a slow rate of speed I would probably literally turn my head. Other than that, if it’s light traffic, okay I’ve checked my mirror and probably almost rely totally on those turn signal things and looking, visually looking at the mirrors. Probably not the safest thing to say, but those things, they are very, very reliable. (Leonard, age 70; blind spot monitor)

Participants noted how cameras create new opportunities to gather information about driving in ways that are not possible in a low-tech car. For example, Janet (aged 73) spoke about how a right-side camera allows you to see pedestrians or cyclists more clearly before turning right: “You can see what is coming with a quick glance while you are still looking at the traffic.” Further, the technological capacities of “screens,” “sounds,” and “flashing lights” enabled drivers not only to appraise the driving environment more thoroughly but also inspired ingenious applications of the technology and idiosyncratic routines while driving. Consider the following depictions of how participants employed technology to facilitate lane changing, turning right, and driving on the highway. These applications range from turning on a camera to check for traffic before indicating a turn, watching for flashing lights on other people’s side view mirrors to help position oneself in a lane, and using a screen to monitor the proximity of vehicles approaching from behind:

[S]ometimes I’ll turn it on, to see what the status is before turning, my turning signal on, if I’m changing lanes. I will just turn it on and have a look. Because as soon as you turn on the turning signal, you’re giving a message to somebody behind you. And I’m just assessing the situation sometimes. (Hannah, age 69; right-side camera)

[Y]ou can also see it on other vehicles too. So that you know that, you’re coming up beside them and that little light comes on and now you’re in their blind spot. You’re in the, their danger spot, right? So why are you there? So if I don’t, if I’m not continuing to pass them, I’ll get out of it. And you’ll see the light go off, right. So you can use the other guy’s indicators [sic] as well. (Connor, age 72; blind spot monitor)

[Q]uite often I’ll be driving and I’ll say … you don’t have to come up and kiss me. So I’ll put my little camera … the backup camera on and it shows the vehicle behind me. And that gives me an idea of how far. Cause myself, I like lots of room to stop. … If they are sitting on my bumper long enough I’ll let them pass me [or] I’ll move over. (Wayne, age 73; backup camera)

**Sensations and sensuous dispositions**

Participants in our study emphasized how AVTs capture their attention in ways that align with the physical and sensory affordances of the driver-body, but in doing so, rearrange the sensations and sensuous dispositions of driving. Following from Mark Paterson (2009), we see sensations as “information routed via distributed nerves and
sense-system clusters” (p. 279). Such sensations are distinguishable from, but also related to, changing sensuous dispositions or the alteration of the sensorium over time through shifting “contexts and technologies” (Paterson, 2009, p. 279). For instance, participants’ descriptions suggest that new ways of sensing and interacting with the driving environment have arisen through the actions of AVTs. Specifically, AVTs demand driver-bodies make sense of “sounds” and two-dimensional images on “screens,” thereby re-routing information through “ears” and “eyes” and provoking new sensuous dispositions, embodied competencies, and preferences for driving. For example, Heidi explains how listening and looking are now entangled as a new driving habit, with technology reprioritizing the sensory skill of “listening” over that of only “looking.” The accounts of other participants support this interpretation through explanations that outline how the intrinsic bodily power of proprioception (e.g., looking over the shoulder) is no longer needed to ascertain where a vehicle is relative to space. For example, in the high-tech car, participants now use “lines,” “grids,” and sounds emitted by sensors to facilitate their movement. Driving in a high-tech car is therefore felt to be more effective, “easy,” and safe, compared to driving a low-tech car without a technologically enhanced driver-body:

[I]t beeps if there is somebody beside me. … I listen, I would say, I listen more for that … So I tend to listen for that, but I always look over my shoulder. (Heidi, age 60; blind spot monitor)

There's [sic] two blue lines that show you where the car is, and two yellow lines that show where the car is going. So if you're backing up, you get the blue lines inside the yellow lines. So you use the white lines on the grid, in the parking lot, and then you can adjust with the yellow lines to straighten it out or whatever. So it really is very easy to park the car. … You don't have to turn around anymore. … [I]t's got side sensors and front and rear sensors. So if there was some idiot standing beside the car, if you got too close to a car as you were swinging it back to park, then it would go off. And then you'd know you were too close. (Jeffrey, age 65; backup camera)

Participants’ descriptions of their experience suggest that driving with AVTs requires learning and bodily training. They described how they came to acquire the ability to interpret the visual, auditory, and spatial feedback that was communicated by the technology. For instance, participants discussed how they learned to discern the meaning of different tones, the speed of the sound cues, and the colours and “grid” lines on a backup camera’s screen. This learning involved interpreting new functions as well as configurations and meaning. In particular, they needed to understand what information conveyed on a two-dimensional screen meant relative to three-dimensional space:

[T]he lane departure is a beep, more of a squawk. And the um, the car approach is a, is a, much softer beep. … So they are, they are different, different tones. (Jacob, age 83; lane-departure warning)

[I]f somebody’s behind you in your blind spot, it’ll show up as a red triangle in your mirror. If I turned on my signal to turn, it would start beeping. And
that beep would get a whole bunch more severe if you actually turned the wheel and started going in. (Leonard, age 70; blind spot monitoring)

It's interesting the instructions don't tell you anything about those lines as to what they exactly mean. But the, I'm assuming the red line means that the vehicle is in front of the rear bumper. In other words, if you went over you would physically hit it. And then if it's behind the red, but it's in the orange, you're not going to hit it, but you're going to cut them off. You're going to get some sort of reaction [from the other driver]. (Randall, age 63; backup camera and proximity sensors)

Interestingly, participants' comments suggest that even without formal instruction they can make intuitive and unreflexive sense of the technology. This is possible in Western culture where “alarm” sounds and the colour “red” are frequently linked to the meaning of “danger” and used as warnings to stop. In this way, the driver-body draws upon practical experience, embodied knowledge of interpreting signs and signals, and culturally acquired, habit-based forms of conduct to use AVTs. However, technologically mediated forms of communication can create tensions and discomfort for drivers when the information AVTs communicate is out of sync with pre-existing embodied orientations, forms of logic and interpretation, and sensuous dispositions.

**Modes of control**

Participants’ descriptions illustrate that embedding technology into the automobile has shifted modes of control over their driving. Modalities or approaches to driving with AVTs vary according to whether a human (or driver-body) and/or technology takes the lead and has ultimate control or judgement over driving (Norman, 2007). In our study, participants’ accounts reveal insight into the shifting modes of control, as well as the preferences and negotiations that older driver-bodies make within the high-tech car. Participants described feeling as if AVTs were in control of simple driving tasks because technology demanded their use and attention, through signals that connected with driver’s “eyes” and “ears.” Yet, even though participants felt that driving was in some ways being taken over by technical instruction, they were often willing to relinquish control to technology and adhere to “digitally mediated” judgements. For example, one participant, Malcolm, illustrates the forceful quality of the “bright orange light” on a blind spot monitor during lane changes. Similarly, other accounts depict how global positioning systems (GPS) can defer human judgement to technology:

Malcolm (M): It would be reminding you because as you're looking like this [turns his head to one side], that catches your eye. .... [I]t is bright, and it doesn't matter if the mirror's dirty or anything. It's this bright orange light and it comes on.

JG (interviewer): You would notice it.

M: You wouldn't have any choice. You would, you would be using [it].
(Malcolm, age 70; blind spot monitor)

If I'm going to a place that I've never been before, um I will just put in the, the, um, address and then go there. (Lucia, age 69; GPS)
I could tell from the GPS there was an exit, so I started moving over based on the GPS, and sure enough it ... the lighting condition[s] [during a snow storm] got just to the point, I was actually on the exit but didn't realize [it]. But it's one point where I had faith in the GPS. It was telling me the right thing, and without it who knows? (Bob, age 67; GPS)

Participants’ comments outline concerns with regards to the control that technology had over their driving. Even though they were willing to let technology take the lead while driving and were comfortable doing so, they felt uncomfortable and unsettled with the control that technology had over their driving in some situations. In such cases, while participants perceived AVTs to be useful, they intentionally overrode technologically mediated forms of communication and judgement in order to use “low-tech,” bodily-based forms of perception and practice. In these instances, participants drew upon pre-existing habits because they perceived that driving was a task that required human effort and judgement. For instance, Evelyn states the following about the backup camera, “It’s lovely to have that camera, but it’s not an improvement on my judgement. It gives me an assist to make a judgement, but ultimately it’s still my judgement.” Thus, participants readily described certain driving situations that called exclusively for human—rather than technological—control over driving. This was especially the case given the perceptions outlined in the excerpts below that reliance on technology is unsafe in congested areas, screens are limited in their abilities, and that technology is redundant given the presence of “low-tech” embodied preferences and competencies that enabled participants to back up easily and comfortably without assistance:

[T]here’s a time when you can use that technology and time when you’ve gotta, you’ve gotta do the work. And as you get closer to [the big city] it’s time to shut all that stuff down, and do the driving yourself because, you just can’t, you can’t have it. You can’t depend on it. Things happen too quickly, and it’s too crazy out there. (Connor, age 72; adaptive cruise control)

[I]t wouldn’t show you if somebody was coming from a different direction. Like it just shows you what’s behind you, so I do use all the other, um, techniques that you would use backing up anyway, because it would be foolish just to use that to go out. (Mabel, age 61; backup camera)

I still prefer to see what I’m seeing, as opposed to being told through another individual thing that I’m looking at what I’m seeing. But then you know, forty years of driving as opposed to the last ten years. (Frank, age 67; backup camera)

Finally, participant accounts illustrated how driving with AVTs is a hybrid of human and technological modes of control where human and technological judgements work together. Participants expressed a readiness to distribute responsibility for driving-related tasks between human and technology. Consider the descriptions below that show how driving in a high-tech car is perceived to be a shared responsibility between the driver-body and technology. Joshua argues that driving with AVTs requires achieving a “balance” between human and machine, but he alludes to, as the
other participants also explain, a developed disposition toward driving that involved alternating between more embodied “low-tech” forms of driving, and a digitally mediated, “high-tech” mode of control:

I will refer to the light and you know as I’m clearing somebody, you know passing somebody and that, I’ll check the light before I pull in. And if the lights [sic] still on, I do an extra look. ... [T]here’s a balance. (Joshua, age 68; blind spot monitor)

And sometimes I’ll back into a parking spot and do it the way I was trained, and I don’t use the backup camera until I’m almost all the way back. And then it shows me very accurately where the back bumper is, so I can make sure that I’m not ... leaving the nose hanging out. (Jason, age 62; backup camera)

[If] I’m backing out onto the street, I would be tending to look over, backwards until I came to a stop. Now, once I get it to a certain point, I can see up the street and I can see that there’s nothing, or nobody there and so I’m relying on the camera more then. (Randall, age 63; backup camera)

Discussion

Shifting experiences, driver-bodies, and older drivers’ responses to the high-tech car

A high-tech automobile is an object in which drivers encounter sophisticated digital, computing, and informational systems in the form of advanced vehicle technologies. Our study revealed how AVTs are changing phenomenological relationships with the driver-body at practical, sensory, and habitual levels, and provoking new interrelationships between the body, technology, and the material world. Our research is conducted at a pivotal moment in the history of the automobile characterized by advancements in driver assist and collision avoidance technology. Over time, meditation on how AVTs are changing driving experiences will become more difficult as new routines fade, through processes of incorporation, into experiential/bodily background (Leder, 1990).9 We also approach understanding engagement with AVTs not from the dominant narrative of “bodies in decline” but from the standpoint of a group of drivers who are in a unique position to observe and respond to the changing nature of driving in the high-tech car. Older drivers have lengthy driving histories and rich embodied driving memories, having experienced firsthand many changes in the automobile in their lifetime.

Our participants’ descriptions suggest that driving has become a digitally mediated activity with ever-increasing information about the driving situation communicated by way of a third-party “actor.” These emerging technologies and forms of communication thereby require the generation of a driver-body that contains a new “habitus” and/or “common-sense” (Edensor, 2004, pp. 111–112) way of driving. Thus, the drivers in our study developed an embodied disposition toward driving where one “listens for” auditory feedback, “looks at” visual information, and “interprets” the meaning of cues and symbols. While research has begun to examine the effectiveness of external
stimuli on cognition and response times (Biondi, Strayer, Randalli, Gastaldi, & Mulatti, 2017), our research identifies older drivers’ responses to driving a vehicle that “warns” drivers in sensory ways and demands new habits. For our participants, the presence of technology engendered potent and diverse “visceral and other feelings associated with car-use” (Sheller, 2004, p. 223). In other words, in a high-tech car, older drivers felt more comfortable, confident, and safe, but also uncomfortable, apprehensive, and unsafe. Thus, future research needs to make sense of older people’s complex and varied affective reactions and responses to driving with technology. Janet Speak (2015) has begun to do this with young people’s use of navigational technologies. Much as Speak’s (2015) undergraduate students, who report changing emotions as control shifts between human and technology, we find that older drivers’ responses to driving a high-tech car are linked to whether “human” or “technology” is in direct control over the task of driving.

Counter to the stereotypical view that older adults are unwilling and unable to use technological devices (Mitzner, Boron, Fausset, Adams, Charness, Czaja, Dijkstra, Fisk, Rogers, & Sharit, 2010), the drivers in our sample did not ignore in-vehicle technology. Instead, they responded to the agencies of AVTs by revising “traditional” and embodied forms of safety checking. They also brought technology into their driving through altering their everyday practices and actions in the car. Using phenomenological insights, we began to witness that older bodies were able to achieve a technologically mediated motor understanding of the world, through the anchorage of the body, even though AVTs change how they encounter and interact with the world. Like the blind man who is no longer aware of his “stick,” as outlined by Merleau-Ponty, AVTs became “transplanted into them” (p. 143). As drivers became accustomed to AVTs, they “incorporate[d] them into the bulk” of their own body (p. 143) and developed new ways to act meaningfully and masterfully with a high-tech automobile. Elsewhere we examine, using N. Katherine Hayles’ (1999) notion of “incorporating practices,” how the drivers in our study “encoded into bodily memory” (p. 199) actions with AVTs so that driving with them becomes habitual (Gish, Grenier, & Vrkljan, in development).

Drivers in our study described AVTs as “interesting” and “exciting” because, given extensive driving histories in “low-tech” cars, they experienced the physical and technological affordances of a high-tech car to extend and enhance the capacities of the driver-body. Even though the body has the practical ability to drive, they expressed bodily awareness for how corporeal limits can constrain everyday driving, thereby understanding the driving-body to be a source for technology. Thus, a phenomenological perspective that attends to practical, corporeal, and sensuous levels of experience is helpful for understanding how AVTs generate relationships with the older driver-body that produce a somatic driving experience characterized as comfortable, pleasurable, easy, and “safe” (see also Gish, Grenier, Vrkljan, & Van Miltenburg, 2016). Unfortunately, without the inclusion of “younger” bodies with different driving histories and automobile experiences, it is difficult to conclude whether these perceptions of driver-body extension and enhancement in a high-tech car are specific to older bodies with embodied competencies linked to “low-tech” automobiles.
The new automobility of driving, regaining control, and implications for policy and practice

AVTs are “auto-mobile” (Thrift, 2004) developments that present new modalities for movement and redefine what it means to be human and in control of driving. Technological advancements in information and communication blur boundaries between the car and the driver, such that driving in late modernity has become a practice that “intertwines and mixes the human and the inhuman, the person and the thing, the material and the informational” (Sheller, 2007, p. 177). Thus, commentators argue that the naturalization of technology and the “active intermediaries” of software are producing a phenomenology of driving that makes it increasingly difficult to disentangle who, or rather, “what,” is doing the work of driving (Dant, 2004; Sheller, 2007; Thrift, 2004). For instance, as we move toward self-driving vehicles, how do we discern whether the driver or the car is at fault upon a crash? How should law enforcement officials and licensing authorities be expected to regulate human drivers who are using driving technology? While these questions have no easy answers, investigation into older drivers’ practices with semi-autonomous vehicles can suggest how they might perceive their role and responsibility in relation to technology given their specific embodied experiences and preferences.

To begin the discussion on how to regulate the use of AVTs to ensure “safe” driving, we draw on Mike Featherstone (2004) to point out that driving a high-tech car requires a “flexible driving habitus” (p. 9). Featherstone (2004) uses the term “flexible driving habitus” to illustrate how developments in automotive technology require drivers to switch between two “communicative modes” (p. 12) upon “the touch of a switch” (p. 9). Driver-car hybrids are able to interact with other driver-car hybrids and the surrounding environment via the body (i.e., low-tech), but also through technology (i.e., high-tech). However, the drivers in our study also described a third mode of driving; the entangling of a “low-tech” driving body with high-tech forms of control and assistance. Our participants were fascinated by the “intelligent” capacities of their cars and demonstrated a willingness to “delegate” (Latour, 1992, p. 157) control and judgement over driving to AVTs. For instance, they were agreeable to using a backup camera to negotiate more precisely their position in space and sensors to identify pedestrians. Yet, at the same time, they remained extremely keen to reflect on which modality of control was necessary for safe driving, expressing reluctance and uncertainty about whether it was judicious to delegate entirely tasks to technology to ensure safety. AVTs made our participants feel more comfortable and in control while driving, but this feeling was not a steady state. The presence of AVTs, through modifications to the driver-body, made some older drivers feel out of control and unsafe upon the detection of changes or shifts to “low-tech” embodied driving habits. Thus, as with other hybrid bodies (Oudshoorn, 2016), drivers engaged in specific material practices to help them regain control over unwanted agencies.

Our participants endeavoured to find creative ways to use and adapt AVTs into their driving. For example, even in the presence of technology, the drivers in our sample found themselves using their bodies in customary ways, or opting to turn off technology, such as adaptive cruise control, so that they could do the work of driving.
them selves. To feel comfortable driving, they developed an embodied preference to move between “low-tech” and “high-tech” forms of driving. This intentional shifting between communicative modes was an attempt to “tame” the technology to suit their needs and preferences (Pols & Willems, 2011). Ultimately, it was an act of resistance against AVTs taking over the more reflective and conscious components of driving (e.g., deciding how much distance to leave between one car and another when driving on the highway). Thus, for our drivers, a “flexible driving habitus” requires not only shifting between disparate modes of control over driving but having bodily knowledge about if, and when, control over driving should be delegated to technology (Latour, 1992), so that they can feel safe, less vulnerable, and comfortable behind-the-wheel. As such, in this study, we see evidence that older driver-bodies of high-tech cars carry over a history of sensuous and bodily experience accumulated in a low-tech car into high-tech driving situations, because the body remains “geared” to the world (Merleau-Ponty, 1962) in which habitual training was formed—a low-tech car. In terms of ongoing and future discussions regarding the regulation of semi-autonomous driving to ensure safety, we have learned that while older drivers enjoy technological assistance behind the wheel, they also have an embodied preference to be “in control of” the more reflective aspects of driving. They prefer to “take control back” of the vehicle in complex driving situations or particular contexts, such as high congestion. This finding suggests that some older drivers may be likely to accept and understand a governance structure that expects drivers to be personally accountable for driving-related errors that occur in a high-tech car, given their embodied preference “to be in control.”

**Directions for future research**

Unlike other research that has examined older person’s embodied relationships with the automobile (e.g., entry and exit into a vehicle) (Gish & Vrkljan, 2016), our participants did not struggle to describe or reflect on their embodied and sensuous experience with AVTs. The drivers in our study possessed an acute awareness of their actions and the situated quality of their skills, which could be due, in part, to the relatively short amount of time they had been driving their high-tech cars. AVTs were thought about in reflective terms because the world of the high-tech car had become “unready-to-hand” (Heidegger, 1962) and foregrounded in consciousness as an object of attention. Rapid technological innovation in the automobile requires drivers to reconfigure long-established routines. However, what remains unanswered is the examination of the “flexible driving habitus,” and how, over time, older drivers move between different communicative bodies and embodied modes of control. Research is needed to understand what happens to driving skills, the feel of the car, and perception of “safe” driving practice when AVTs become “ready-to-hand” and disappear from consciousness and attention. Furthermore, based on our findings, further research needs to be conducted with drivers of varying ages to explore cohort differences. Such research is required to more fully understand how affective reactions and responses to AVTs are grounded in bodies differentially constructed due to varied driving histories and experiences with technology. This is important in light of recent findings suggesting that there are cross-generational differences in the acceptance of and interest in advanced vehicle technology (Owens, Antin, Doerzaph, & Willis, 2015), and that young students feel
less in control when humans are in direct control of navigational technology (Speake, 2015). By comparison, in our study, some older drivers felt “more in control” when technology was not in direct control of their driving.

**Conclusion**

In summary, our research examines how AVTs are refashioning older people’s embodied relationships with driving, including driving routines, skills, sensuous dispositions, and modes of control that are considered integral to driving. Embedding AVTs into the vehicle can threaten the displacement of experiential knowledge, bodily gestures, and habits characteristic of driving, thereby generating disquieting corporeal experiences. Such sensations revolve around the sensation and observation that “humans” are less in control of driving. However, a high-tech car also “enables a range of humanly embodied actions” (Dant, 2004, p. 74), such that the car feels to older drivers to be more secure, safe, comfortable, and in control on the road. This study calls attention to the opportunities and challenges that entanglements with AVTs can present for aging drivers and raises ethical questions about who, or what, is in control of our driving, and what embodied relationship with the car is preferred for “safe” driving.

**Notes**

1. For instance, older drivers may have trouble turning their heads and checking for blind spots due to decreased flexibility, coordination, and muscle strength (Canadian Medical Association, 2012). Changes in visual ability can also make it difficult to see in low light conditions, judge gaps in traffic when merging, and change lanes or turn at intersections (Canadian Medical Association, 2012). Older drivers may also be more easily distracted, have slower reaction times, and experience trouble wayfinding (Bryden, Charlton, Oxley, & Lowndes, 2013; Marottoli & Drickamer, 1993).

2. For instance, research shows that: 1) lane departure warnings keep people from mistakenly leaving their lane, driving closer to the centre of the lane, and using turn signals (LeBlanc, Sayer, Winkler, Ervin, Bogard, Devonshire, Mefford, Hagan, Bareket, Goodsell, & Gordon, 2006); 2) forward collision warnings generate faster reactions to threats, better pedestrian detection, and longer headways (Adell, Várhegyi, & Fontana, 2011); 3) blind spot warnings increase driver awareness of adjacent traffic, help drivers react more quickly to a lateral threat, and prompt mirror checking before lane changing (Fitch, Bowman, & Llaneras, 2014; Kiefer & Hankey, 2008; Sayer, Buonarosa, Bao, Bogard, LeBlanc, Blakenspoor, Funkhouser, & Winkler, 2010); and backup cameras rouse drivers to look at a display when accompanied by an alert, as well as park closer to the curb, and back further into a parking space (Hurwitz, Pradhan, Fischer, Knodler, Muttart, Menon, & Meissner, 2010; Mazzae, Barickman, Baldwin, Scott, & Ranney, 2008; McLaughlin, Hankey, Green, & Kiefer, 2003).

3. See “Driving with Advanced Vehicle Technology: A Qualitative Investigation of Older Drivers’ Perceptions and Motivations for Use” (Gish, Grenier, Vrkljan, & Van Miltenburg, 2016) for an extended discussion about the relationship between the aging body and older drivers’ use of advanced vehicle technologies. It reports that age-related changes are not a primary reason for why older adults seek out AVTs. However, older drivers who own and regularly drive a high-tech car still perceive and experience AVTs to counteract age-related changes in their driving performance, based upon changes they felt occurring within the body.

4. The terms “hybrid” and “assemblage” are both used to describe new forms of action, identity, and social being that result from the collaboration of “human” and “machine” in the driving body. However, as Dant (2004) explains, the term cyborg, when used properly, is a misleading characterization of the driver-body. Donna Haraway developed the concept of the cyborg to refer to “the feedback systems incorporated into the body that can be used to replace or enhance human body parts” (Dant, 2004, p. 62), such that a radical and permanent transformation of what it means to be human occurs through
the blending of machine and biological body. For Dant, it is preferable to conceptualize the driver-body not as a cyborg but as an assemblage since the driver-car is a grouping “that comes apart when the driver leaves the vehicle and ... can be endlessly re-formed, or re-assembled given the availability of the component cars and drivers” (p. 62). We agree with Dant that there are significant conceptual differences between the terms hybrid and assemblage, but use the terms interchangeably. However, our analytic interest stays in line with Dant’s conceptualization of a driver-car assemblage. Our research aims to ascertain the capacities and forms of action that are made possible as a result of bringing together human and the non-human elements of digital communication technology into the driver-car assemblage.

5. Jeanette Pols and Dick Willems (2011) use the concept “tame” to refer to how users transform technology to fit their own routines and goals, so that the object can become meaningful in their lives.

6. Our sample contains a relatively privileged group with high-end automobiles. Eligibility requirements likely excluded members of the oldest-old, a cohort that is significantly more likely to be living in poverty and more likely to own “low-tech” vehicles that do not contain the latest safety innovations. Thus, it is important to note that new relationships to driving and enhanced safety outcomes are not being experienced equally by people from lower socioeconomic backgrounds.

7. For two participants, the length of ownership of their high-tech vehicle was unreported.

8. Two couples were interviewed separately, and the third couple was interviewed as a pair. It was our preference to interview partnered participants separately, but on one occasion we adapted to the participant’s preference.

9. Donald Norman (2007) argues further that at some point in the twenty-first century, driver-car hybrids will be extinct because with the development of autonomous technologies, cars will no longer need drivers.

10. Technology is naturalized when a “human-factors” approach is taken that considers anthropometric, biomechanical, and body kinematics in the creation of technology. Nigel Thrift (2004) provides an extended discussion of how a human-factors approach is affecting the driver-body assemblage.

References


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