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Enmeshed with the digital: satellite navigation and the phenomenology of drivers' spaces

Viktor Berger

Department of Sociology, Faculty of Humanities and Social Sciences, University of Pécs, Pécs, Hungary

ABSTRACT

This paper aims to develop a theoretical interpretation of how satellite navigation transforms drivers' experience of automotive spaces. The use of satellite navigation has, so far, been predominantly studied from a cognitivist perspective based on the computer model of cognition and the theory of spatial disengagement. Experimental studies have concluded that over-reliance on digital navigation tools diminishes spatial orientation and spatial memory. According to the dominant interpretation, satellite navigation causes disengagement from space. After addressing these approaches, the paper introduces an embodied perspective of satellite navigation. This is accomplished by applying the phenomenology of perception of Maurice Merleau-Ponty, whose notions, such as perception, body schema, motor habit, and virtual body, illuminate otherwise undertheorized dimensions of drivers' spaces. By using digital tools for wayfinding, drivers' body schema, virtual body, and perception of space are modified, thereby enabling an engagement with convoluted 'mesh spaces.' This new term is integral to the interpretation of drivers' spaces, as well as being distinct from that of 'hybrid space,' although both aim to conceptualize spaces, including physical objects and their visual representations. Conclusions will be drawn against the broader context of the mediatization of everyday life.

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Introduction

Digitized wayfinding and satellite navigation are popular topics in scholarly discussions (among others see: Aporta and Higgs 2005; Ben-Elia 2021; Dahmani and Bohbot 2020; Girardin and Blat 2010; Brown and Laurier 2012; Ishikawa 2019; 2016; Leshed et al. 2008; Speake 2015; G. E. Burnett and Lee 2005). The present paper aims to add a new layer to this debate by developing a theoretical interpretation of how satellite navigation transforms drivers' experience of automotive spaces.

As a starting point, it should be noted that today's mobilities are bound up with the mediatization of everyday life, understood as the process of media and infocommunications permeating all segments and levels of social life (Couldry and Hepp 2017; Hepp 2019; Füzér et al. 2023). Through computerization and connectivity, mediatization infiltrates previously unaffected

CONTACT Viktor Berger viktor.berger@pte.hu Department of Sociology, Faculty of Humanities and Social Sciences, University of Pécs, Pécs, Hungary

domains and practices (Hepp 2019, 6), including mobilities. Satellite-based navigation, as a form of mediatized mobility, transforms how people experience the mobile spaces of activities such as driving. Since the advent of the mobilities turn (Sheller and Urry 2006), automobility and driving have been important topics in social science (Sheller and Urry 2000). Thorough studies applying this framework have shown how drivers experience space (Pearce 2017) and what role, for example, sounds (Bull 2004) and emotions (Sheller 2004) play in this. While satellite navigation and its relation to driving have been studied through the prism of the new mobilities paradigm (Brown and Laurier 2012; Holton 2019; Laurier, Brown, and McGregor 2016; Leshed et al. 2008), no comprehensive theoretical account of digital navigation's impact on the perception of spaces has so far been offered. The present paper aims to rectify this.

It is the explicit purpose of the paper to introduce a new, embodied perspective into scholarly investigations of satellite navigation. Most research on digital navigation has employed extrinsic cognitive theoretical models removed from actors' experiences. While studies applying an extrinsic perspective have the advantage of answering specific questions seen as important by the researcher, intrinsic interpretations focus on actors' own experiences, which may not come to the fore in extrinsically oriented research. The paper's main premise is that any assessment of how drivers experience spaces while using digital navigation calls for an intrinsic embodied perspective.

Using satellite navigation (as well as driving itself) is a sensually rich and bodily engaging experience. To assess this experience, Maurice Merleau-Ponty's (2005) phenomenology of perception will be applied, because his theory and concepts are not only suited to interpreting bodily sensations and experiences (Merleau-Ponty 2005), but also the specific role played by technological artifacts (Verbeek 2001, 125).

However, in order to get a better understanding of the discourse to which the present paper aims to add a novel layer, it is necessary to reflect on how satellite navigation is predominantly conceptualized, researched, and interpreted in academia. Accordingly, the purpose of the first section is to summarize and critically address the theoretical implications and results of experimental research on satellite navigation usage. In parallel, it also reconstructs the theory of disengagement from physical space, which serves as the dominant interpretational tool for experimental studies in this field. It is argued that while this line of research can answer questions that are relevant in a cognitivist frame (mostly related to satellite navigation's effects on spatial memory and the formation of cognitive maps), it also has some limitations, including an (overall) disembodied view of actors and an inability to account fully for the bodily-spatial experience of drivers using satellite navigation. By applying Merleau-Ponty's embodied approach, the subsequent sections intend to enrich the existing research.

The second section is dedicated to a brief outline of Merleau-Ponty's phenomenology of perception, including his conceptualization of perception, and to a delineation of his relevant ideas. By drawing on these insights, section three analyzes the spatial experience of driving with satellite navigation. Merleau-Ponty's concepts will be applied in order to examine drivers' engagement with or 'gearing into' the enmeshed spaces of satellite navigation. Special attention will be given to how the use of digital navigation tools fosters new types of sensations. Section four addresses the question of how to conceptualize these driver spaces, and argues that the notion of 'hybrid' spaces does not properly interpret the spatial experiences of actors bodily engaged with digital media. Instead, the paper proposes the term 'mesh space' as an alternative. The final section summarizes the findings and draws conclusions against the background of the broader social context, namely the mediatization of everyday life.

Experimental studies of satellite navigation and the theory of spatial disengagement

Since its public spread, satellite navigation has attracted attention in academia, and has predominantly been approached through cognitivist experimental research. Studies have examined the effects of digital navigation on spatial cognitive skills, the ability to orient in space, wayfinding behavior, spatial learning, spatial memory, and the formation of users' cognitive maps (Münzer et al. 2006; Ben-Elia 2021; Ishikawa et al. 2008; Ishikawa 2016; Ruginski et al. 2019; G. E. Burnett and Lee 2005). The common theoretical background is cognitivism, according to which the brain allocates finite cognitive resources in order to function, for example to carry out cognitive operations, including spatial ones. This version of cognitivism is denoted here as 'mainline' or 'computational' cognitivism.

The principal premise of mainstream cognitivism is that '[t]hinking can best be understood in terms of representational structures in the mind and computational procedures that operate on those structures' (Thagard 2005, 10). Accordingly, it is believed that the mind, by applying syntactic rules, carries out operations on various symbols – and cognitive science aims to find the neural equivalents of these processes (Gallagher 2012, 320). With respect to spatiality, this means that the emphasis is on spatial *knowledge*: how it can be acquired through coding of environmental cues; how spatial representations of physical environments (cognitive maps of various kinds) are generated, stored, and updated; and how these mental representations can be transferred to new situations (Ben-Elia 2021, 2).

Beyond their common theoretical background, experimental studies share similar conceptualizations of spatial knowledge, have common elements in their research designs, and feature results pointing in similar directions. Results (extracted either from experiments with pedestrians or drivers, or from real-world situations or virtual environments) are generalized with respect to spatial knowledge acquisition and spatial memory. Experimental studies have concluded that using digital navigation tools leads to lower navigation performance, and impairs spatial memory, spatial orientation, and the capacity of orientation in physical surroundings. Experiments conducted in virtual laboratory environments have diagnosed adverse effects on navigation skills, spatial learning, and especially on the formation of survey-type (bird's eye view) mental maps (Parush, Ahuvia, and Erev 2007; Ruginski et al. 2019; G. E. Burnett and Lee 2005; Fenech, Drews, and Bakdash 2010); real-world driving experiments have come to the same conclusions (Dickmann 2012; Ben-Elia 2021). Regarding the long-term effects, Ishikawa (2019) stresses that the prolonged usage of satellite navigation leads to diminishing spatial learning abilities and poor navigational performance. Additionally, Dahmani and Bohbot (2020, 11) have found that negative consequences for spatial cognitive skills and spatial memory are dose-dependent, in that they are positively correlated with the frequency of use.

In accordance with their underlying cognitivist assumptions, experimental studies also highlight the same factors as reasons for the detrimental effects of satellite navigation. One often-cited reason is that digital navigation only requires users to follow instructions passively (Ben-Elia 2021, 8; G. E. Burnett and Lee 2005, 414–415; Ishikawa 2016, 125, 127–128; 2019, 207; Ishikawa and Takahashi 2014), preventing them from engaging in cognitive efforts and from actively exploring their surroundings (Ishikawa 2016, 128). In other words, there is supposedly a lack in encoding environmental cues and processing spatial information. Furthermore, another explanation is that glancing frequently at the screen and processing that information absorbs too many cognitive resources, making it impossible to attend fully to one's actual physical surroundings (Ishikawa 2016, 125, 127; Ishikawa and Takahashi 2014; Ben-Elia 2021, 8; G. E. Burnett and Lee 2005, 414–415; Ruginski et al. 2019, 18–19; Dahmani and Bohbot 2020, 12).

Experimental studies of satellite navigation are not only characterized by similar research questions, theories, and results, but also often hint at more general consequences. Spatial deskilling, they argue, impoverishes our perception of the material world, resulting in a more

superficial involvement in our physical surroundings, spatial disengagement, and the loss of our sense of place (Dahmani and Bohbot 2020, 12–13; Ishikawa 2019, 198; Göktürk and Pakkan 2013, 57, 60, 63; Clemenson et al. 2021, 2; Gardony et al. 2013, 339; Gramann, Hoepner, and Karrer-Gauss 2017, 2). The multitude of studies alluding to 'spatial disengagement' suggests that, beside the cognitivist reasoning, the notion of disengagement serves as the dominant theoretical interpretational means for experimental research on the effects of satellite navigation. This is remarkable, given that the first paper developing the theory of spatial disengagement did not focus on modern, urbanized societies, and rather than adhering to cognitivism, it built on philosophical approaches – Albert Borgmann (1984) and Tim Ingold (2002) in particular – quite far removed from the hard-science approach of subsequent research.

The theory of spatial disengagement was conceived by Claudio Aporta and Eric Higgs in their seminal paper on wayfinding behavior and GPS[1] use among the Inuit of Igloolik (Aporta and Higgs 2005). In their study, they contrast the wayfinding practices of present-day Inuit with their traditional ways. Their centuries-old methods of navigation included discerning wind directions, observing snow drifts and the few available landmarks, as well as learning multiple routes on seemingly homogenous surfaces. Wayfinding – and correspondingly, the relation to space – was a rich sensorial and deeply engaged experience, accompanied by a tightly-knit web of social interactions. As a result, the Inuit, prior to the adoption of digital navigation tools, had fine-tuned spatial skills (Aporta and Higgs 2005, 731–732). In contrast, the growing reliance on GPS navigation has, according to the authors, led to sensory and interactional deprivation, resulting in spatial deskilling (the loss of important navigational abilities) and a disengagement from spaces (Aporta and Higgs 2005, 744).

While the results of experimental cognitivist research have been validated multiple times, there is still room for thinking about the spatial experience of driving with satellite navigation, as these studies also have some limitations. Most prominently, experimental research is indebted to 'mainline' cognitivism or the computational-representational understanding of the mind (Thagard 2005, 10–12), according to which humans are 'symbol systems' driven by their 'computational system that constructs representations' (Newell 1994, 113). Consequently, spatial cognition and spatial experiences are, for the most part, conceptualized from a disembodied point of view.

This is not to say that references to embodiment are entirely missing from this discourse. The role of the body is considered at least in two respects. First, it is assumed that spatial cognition is anchored in the brain. More specifically, certain studies scrutinize the neural correlates of spatial knowledge and the effects of satellite navigation on the formation of spatial knowledge (Fajnerová et al. 2018; Dahmani and Bohbot 2020). Second, the role of the body is implicitly acknowledged when admitting that, in virtual environment experiments, only audiovisual cues are present for the participant, while in real-world settings, through the movements of the body, proprioceptive and vestibular cues are also provided, which are supposed to be relevant in spatial knowledge formation (Ruginski et al. 2019, 18; Ben-Elia 2021, 2).

However, these implications are not fully elaborated in experimental research, and by and large the computational-representational model of (spatial) thinking is not focused on the embodied experience of spatiality. This poses a problem, since a large part of human spatiality cannot be understood in terms of computational operations on symbols and representations. Human actors, as bodies, are woven into their surroundings, and elements of the environment are not merely information to be coded, processed, abstracted, retrieved, and updated, i.e. they are not just aspects of neutral spatial representations, but have a vital significance for the acting body. Furthermore, driving itself relies on bodily engagement with technology and spaces, and the experience of driving cannot only be explained by pointing to how the driver creates, uses, and updates spatial representations.

Aporta and Higgs, in contrast, apply a bodily perspective, but some of the characteristics of their theory make it difficult to exploit fully the inherent potential of the bodily engagement concept for interpreting the situation of driving with digital navigation. Initial responses have

highlighted that, contrary to the authors' view, deep engagement with modern technology is possible (Pfaffenberger 2005, 749), and that the dichotomy between engagement and disengagement is exaggerated because new technologies not only have deskilling effects but may engender new competences (Widlok 2005, 50).

This criticism seems all the more relevant in light of insightful qualitative studies carried out in modern, urbanized societies. These emphasize that users of digital navigation are active agents rather than passive executors of instructions (Brown and Laurier 2012, 1625–1628); that digital navigation not only has deskilling effects but also engenders the acquisition of novel competencies (Brown and Laurier 2012, 1629; Girardin and Blat 2010); and that satellite navigation tools foster sensemaking and the forming of new attachments to both known and unknown spaces and places (while not denying that using 'in-car GPS navigation' in some respects leads to spatial disengagement) (Leshed et al. 2008, 1679–1680).

In relation to drivers' experiences, the ('mainline' or computational-representational) cognitivist perspective of experimental research and the figure of spatial disengagement are rather extrinsic interpretive frameworks, and there is still uncharted territory in interpreting the spatial experience of satellite navigation, especially its embodied aspects. Actors in the normal flow of everyday life do not conceive spaces, but live them. This calls for an alternative theoretical interpretation that allows us to assess this embodied experience, which is where Merleau-Ponty's phenomenology of perception comes in.

Merleau-Ponty's phenomenology of perception

As mentioned above, human spatiality is not reducible to the manipulation of symbols and information by a neutral observer (a mind), as human actors are always already bodily engaged with their surroundings, and the experience of spatiality is (in large part) an embodied one. This – coupled with the fact that driving itself is also a bodily engaging activity – calls for a theoretical perspective capable of accounting for the embodied nature of spatiality. In contrast to the (mainly) disembodied view of mainstream cognitivism and the interpretation of spatial disengagement, Merleau-Ponty's *Phenomenology of Perception* (2005) provides an adequate theoretical scheme for assessing the embodied spatial experience of using digital navigation while driving.

Merleau-Ponty is one of the key thinkers in contemporary discussions of embodiment and the embodied mind (cf. Gallagher and Zahavi 2021). However, phenomenologists and scholars of Merleau-Ponty are divided whether his insights are applicable to the digital world, or if such a thing as digital embodiment even exists.

Several authors have argued that online and digital phenomena do not constitute real perceptions (O'Shiel 2022; cf. 2020); that online communications are not mutually bodily affective and do not generate a reciprocal resonance in the bodies of the persons involved (Fuchs 2014, 157, 167); and that 'virtuality' is a disembodied experience providing no actual bodily engagement, no real encounters with others (Fuchs 2014, 169; Dreyfus 2009), and no resistance and surprises, but only expected and preset programmed features (Fuchs 2014, 170).

Contrarily, several other scholars emphasize the realness of online perceptions (Ekdahl 2023); that the lived body is not necessarily equal with the physical body and can enter various online spaces (Osler 2021, 2020); that actors may sense presence in online spaces and take their interactions with online others as genuine and real (Lindemann and Schünemann 2020); that presence in online environments may in some cases generate a sense of place and embodied engagement with the online surroundings (Tjostheim and Waterworth 2022, chap. 3); that intercorporeality is possible in online spaces (Vidolov 2022; Ekdahl 2022; Ekdahl and Osler 2023); and that the surprises and resistances of the (online) world are not missing from programmed environments such as online video games, for example (Ekdahl 2022; Ekdahl and Osler 2023; Ekdahl and Ravn

2022). In light of these studies, it seems justified to apply Merleau-Ponty's thought to an interpretation of the embodied spatial experience of using satellite navigation while driving.

In order to apply the Merleau-Ponty's phenomenology of perception to the issue at hand, it is, first of all, necessary to outline briefly how he envisions perception. The following section will first evoke his understanding of perception as bodily and intersensorial in nature, before outlining the role of the body schema in perception and offering an account of habit and motricity in the continual process of inhabiting the world.

For Merleau-Ponty (2005, 53), perception is the 'living communication with the world that makes it present to us as the familiar place of our life.' This view of perception presupposes embodied beings who actively engage with the world through the projects they pursue. By virtue of their bodily intentionality, sensing and perception is always and already imbued with meaning on a preconceptual and preconscious level (serving as the basis for all conscious operations). Perception is understood as a 'living communication,' since both the objects of the world and the perceiver are active participants (Merleau-Ponty 2005, 222). A perceived thing, whether animate or inanimate, only acts as a 'vague solicitation' for the body, and perceivers must find an answer to this solicitation, an attitude through which they can get 'attuned' to that object or sensation, so that it is no longer merely a 'confused problem' but something determinate (Merleau-Ponty 2005, 222).

Perception, according to Merleau-Ponty, is by its very nature Gestalt-like, meaning our 'natural attitude' is holistically oriented. This holds for at least three aspects: our perception of objects; our perceptual fields; and the relation between various perceptual fields. Objects are perceived as wholes rather than the sum of their elements, and perceptual fields – such as the visual, the auditory, the haptic, or the olfactory field – are similarly experienced as wholes and not as an aggregation of discrete objects (Merleau-Ponty 2005, 62, 274–275, 293). Likewise, while perception is certainly tied to these fields, they are not separate entities constituting what we traditionally call the 'senses,' but rather modalities of perception. In the natural attitude, perception is intersensory: all the fields (or modalities) of perception constitute a Gestalt-like perception (Merleau-Ponty 2005, 242–244). Our body attunes us to the world; it orients us, enabling us to inhabit the world as the meaningful site of our lives, where the body 'is an object sensitive to all others, which resonates for all sounds, vibrates for all colors' (Merleau-Ponty 2005, 245).

Since Merleau-Ponty understands perception as a bodily phenomenon, he puts great emphasis on interpreting motricity, the spatiality of one's own body, and the body schema. According to him, our own body is not just another object – it is a lived body, and as such is experienced Gestalt-like as a whole: 'my entire body is not for me an assemblage of organs juxtaposed in space' (Merleau-Ponty 2005, 100). The body schema first of all refers to the preconscious knowledge of one's body as a whole, though it is more than just 'the global awareness of the existing parts of the body,' or 'the global awareness of my posture in the inter-sensory world' (Merleau-Ponty 2005, 102). The body schema is active, dynamic, oriented towards the body's tasks and thus open to modifications. Everyday agents actively engage with the world; they are absorbed in various projects, which, in turn, mold the (situational, rather than positional) spatiality of their bodies. Actors sense their bodies differently – their body schema *is* different when they engage in diverse activities, as this example from Merleau-Ponty shows:

> If I stand in front of my desk and lean on it with both hands, only my hands are accentuated and my whole body trails behind them like a comet's tail. I am not unaware of the location of my shoulders or my waist; rather, this awareness is enveloped in my awareness of my hands and my entire stance is read, so to speak, in how my hands lean upon the desk. (Merleau-Ponty 2005, 102)

Human agents are intentional beings, and their 'intentional arc' shapes their everyday experiences, thereby lending unity to their flow. It is this intentional arc that polarizes the body schema, as described in the quote above. Additionally, the intentional arc also reveals the objects of our world as relevant for us; or put differently, it also polarizes the perceptual fields,

resulting in accentuated perceptions: 'the normal person's projects polarize the world, causing a thousand signs to appear there, as if by magic, that guide action' (Merleau-Ponty 2005, 115). Consequently, the body schema is not a fixed, static sense of the body and its parts, but 'an open system of an infinity of equivalent positions in different orientations,' and this is the reason why 'motor tasks are instantly transposable,' and actors are able to carry out their projects in various settings (Merleau-Ponty 2005, 142). By being situated in the flow of everyday projects and tasks, the body inhabits space.

In order to carry out tasks on the basis of their body schema, actors need to acquire habits. For Merleau-Ponty, habits are formed through motor acquisition of (motor) signification, so that the body has to 'catch' or 'understand' movements on a preconscious level. Habitualization is the process of bodily understanding, whereby actors learn to use their bodies in certain situations in specific ways. Objects in the surroundings may also play a role in habitualization, as bodily engaged actors learn to utilize them, and get used to them, until they 'take up residence in them' (Merleau-Ponty 2005, 145).

The radical aspect of Merleau-Ponty's phenomenology of perception – missing from mainstream cognitivist approaches – is that, through habitualization, physical objects may be incorporated into the body schema. Therefore, the body schema of humans is not exclusively shaped by physiology, but also by habits and culture. Merleau-Ponty (2005, 144) two famous examples are the woman with a tall feather in her hat and the blind person's cane. Both utilize a physical object to alter their body schema. After a while, the lady with the feathered hat will incorporate the hat into her body schema and thus sense how to move about without damaging the feather. The relation of blind people to their cane is special, in that they not only extend the spatiality of their bodies by incorporating the cane into the body schema, but also employ it as an extension of their tactile sense (Merleau-Ponty 2005, 144). While the cane is being used, it vanishes as an object of perception, to be incorporated into the sensorial apparatus (cf. Glezos 2020, 200).

To sum up, the body schema is dynamic, malleable, and dependent on actors' intentional arcs in specific situations, while habit is 'the reworking and renewal of the body schema' (Merleau-Ponty 2005, 143). The possibility to modify the body schema through habitualization also applies to technological artifacts, and this is exactly why Merleau-Ponty's phenomenology of perception lends itself to the interpretation of the spatial experience of driving with satellite navigation.

The spatial experience of driving with satellite navigation

Based on Merleau-Ponty's notions outlined above, this section is dedicated to assessing the spatial experience of drivers using satellite navigation, and to proposing an interpretation distinct from that of cognitivist research and the theorem of spatial disengagement. To this end, two steps are necessary: first, to analyze (briefly) the relation between driver and car; and, second, to evaluate the role digital screens play in drivers' lived space.

As for the first step, the sensual intertwinement of drivers and their automobiles has been widely discussed in mobilities studies. This relation is often represented as a symbiosis of driver and car, the two being not separate, but one compound entity called, among others, the 'driver-car' (Randell 2017, 663–664). The relation of drivers to their automobiles has also been interpreted by Merleau-Ponty (2005, 144–145) himself. Just as in the case of the blind person's cane or the woman with the feathered hat, the car is incorporated into a driver's body schema through repeated bodily acts of habitualization.

As Dreyfus and Dreyfus have remarked, all skill acquisition begins at the 'novice' stage, where actors must consciously consider rules and facts, and perform calculations, whereas skilled 'experts' intuitively know what to do and how to do it, without any conscious effort or calculation: 'she or he knows how to perform the appropriate action without calculating and comparing alternatives' (Dreyfus and Dreyfus 1999, 110). By gradually learning how an automobile behaves

and becoming skillful at driving, drivers take up residence in the automobile, so that for them, it will cease to exist as an object and start to function as an extension of their body.

By habituating ourselves to a car, we are 'altering our existence through incorporating new instruments,' and the car then participates in the 'voluminosity of one's own body' (Merleau-Ponty 2005, 144, 145). This is why a person who possesses the habit of driving does not consciously compare the volume and size of their automobile to other objects when maneuvering (for example, while changing the lane) (Merleau-Ponty 2005, 144). This assessment of the driver-car relation is also in line with recent entanglement-theory accounts of autonomous driving, which precisely focus on how technologies and humans intermingle and stress that they 'should not be classified as existing independently of each other but as related' (Lindgren, Fors, and Pink 2022, 1609).[2]

The second step is to interpret what role navigation screens play in drivers' lived space. In order to accomplish that, it is necessary, first, to look at screens from a phenomenological point of view. The question to be answered, then, is why screens (whether of built-in navigation tools or of mounted devices such as smartphones and dedicated satellite navigation units) even contribute to the spatial experience, i.e. why they even play a role in drivers' perception of spatiality at all.

In their phenomenological study, Introna and Ilharco (2006) have pointed out that the defining aspect of the 'screenness' of screens – the screen itself as it displays content – is that they capture the attention of actors because the information they provide is regarded as relevant in specific situations. Without this fundamental presupposition, representations on screens would not matter for agents (Introna and Ilharco 2006, 62–63). But this presumption makes sense only in a lifeworld saturated with media and particular types of screens, each embedded in specific contexts of action. In these particular settings, screens of all sorts refer to a whole range of connections with specific motivations, activities, objects, and infrastructures (Introna and Ilharco 2006, 60).

Screens displaying turn-by-turn navigation are embedded in a web of relations linked to activities and aspirations of (motorized) mobilities, the physical infrastructure of driving, telecommunications, software development, and a whole lot more. Satellite navigation is thus one instance of what Simondon (2011, 58) calls 'techno-geographic' milieus in which various kinds of technologies create a previously unknown degree of interlocking with the material world (Stiegler 2011, 135–138). Drivers using satellite navigation take this interconnected world of mediatized navigation for granted, presupposing that the content displayed on their screens is immediately relevant to their task of wayfinding.

Screens displaying satellite navigation, however, have to be habituated, so that the actor can 'take up residence' in their spatiality. The process of habitualization, of getting accustomed to a navigation application, involves processes of (bodily) learning and understanding a variety of minute practices, such as: glancing at the screen; observing the movement of the navigation icon on the display and comparing it to that of the car; listening to and interpreting audio instructions; learning the optimal timing of when to execute the instructions or when to diverge from them; performing hand and leg gestures (steering, changing gears, and handling the pedals) to adjust the movements of the automobile to the route displayed on the screen; and so on.

While in the first stages of habitualization, drivers need to be more attentive to the software, skilled experts use it out of habit: without explicitly following rules, without calculations and conscious comparisons of alternatives (cf. Dreyfus and Dreyfus 1999). Such drivers are attuned to navigation screens, whose displayed contents are no longer 'vague solicitations' but meaningful. This acquisition of novel skills is confirmed by the results of qualitative research on satellite navigation (Brown and Laurier 2012; Leshed et al. 2008; Girardin and Blat 2010).

By relying on the assumption that the screen displays content relevant for wayfinding and the driver's intentional arc of getting from one place to another, experienced users who have habitualized the use of their navigation tool are sensing *with* the screen. They perceive the

content displayed without consciously thinking of it *as* spatiality, and incorporate these sensations into their space (exceptions include initial route selection, arriving at decision points where reflexivity is needed, and problem-solving). That this is indeed possible is already foreshadowed by Merleau-Ponty (1964, 164) in one of his later essays, *Eye and Mind*, with reference to paintings: 'I do not look at it as I do at a thing (…). It is more accurate to say that I see according to it, or with it, than that I *see it*.'

Driving with satellite navigation involves a modification of the perceptual field and the body schema. The spatial experience of human actors, according to Merleau-Ponty, is neither a construction of an abstract mind, nor the mere causal result of sensory input, but grounded in action and the possibilities of action, since the body is a locus of activity. This implies that actors' spatial experience – the 'spatial level,' as Merleau-Ponty puts it – arises not from any predetermined directions and axes of the physical body, but rather from the body as it is engaged (or is able to engage) with the world in specific situations of action.

In situations where there is no modification of the perceptual field or the body schema, actors' actual physical bodies coincide with their 'virtual' ones, the latter being the body demanded by the 'spectacle' at hand in order for an action to be performed (Merleau-Ponty 2005, 261). However, there are situations diverging from this simple case, where '[t]he virtual body displaces the real body, so much so that the subject no longer feels himself to be in the world he is actually in' (Merleau-Ponty 2005, 261). This is demonstrated by an experiment cited by Merleau-Ponty, in which a participant had to move about in a room with mirrors reflecting the room at a 45-degree angle from the vertical. After an interval of confusion, he learned how to inhabit this strange perceived space: 'rather than his genuine legs and arms, he feels the legs and arms required for walking and acting in the reflected room – he inhabits the spectacle' (Merleau-Ponty 2005, 261).

While driving with satellite navigation is not such a radical departure from the 'normal' situation, it is nonetheless also a case where the actual and the virtual body do not completely coincide. This is because, first, drivers have incorporated the automobile into their body schema, so that their virtual body is an extended one, incorporating the voluminosity of the vehicle. The second reason for the virtual and the actual body not being the same is that the elements displayed on the screen do not only represent the visible part of the physical world as seen from the driver's angle, but also elements and their configurations beyond the visible (or audible). The practical situation of driving with digital navigation transforms the body schema, which in this context refers to the virtual body needed to navigate the 'car-body' in a situation where the spatial level consists of physical objects and visual elements on the screen.

The transformation of the virtual body and the body schema while driving with digital navigation is tied to the 'living communication' between driver and screen, which alters the spatial experience by enabling new modalities of sensing. Before returning to the virtual body and the body schema, it is therefore necessary to investigate these new ways of sensing in detail.

That using turn-by-turn navigation may lead to new sensations is no surprise, since this is also the case with driving itself. An example is when the driver's extended body (with the automobile being incorporated into it), senses – by experiencing vibrations, shaking, and the movements of the steering wheel – the hardness and unevenness of the cobblestones underneath. Another instance of new sense modalities afforded by technology was the experimental 'tactile television' of the 1960s; transforming visual data recorded by cameras into tactile stimuli on the participants' backs resulted not simply in improved seeing or feeling but a new sensation (Real and Araujo 2019, 3; Glezos 2020, 195–196). And it is not only mechanical technology that gives rise to new sensations, since information and communications technology (ICT) is also capable of this, as highlighted by Glezos (2020, 231) with reference to mobile phone users' new sensations (e.g. sensing wall thickness by way of fluctuations in internet connection).

Users who have habitualized the use of satellite navigation tools do not incorporate them into their body schema as physical objects (as they do with the automobile); instead, the visual

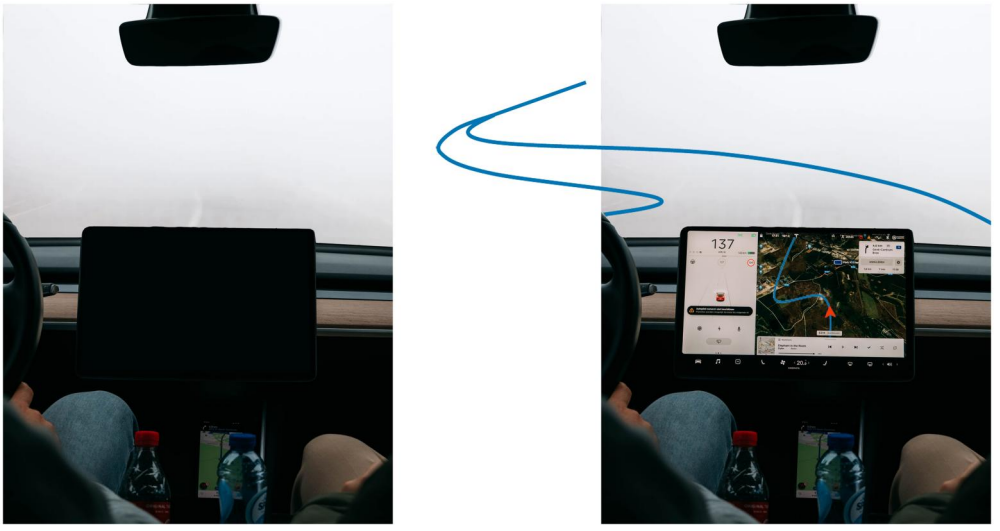

Figure 1. Driving in foggy weather without (left) and with (right) satellite navigation.
Source: Photograph by Brecht Denil at unsplash.com (license: free to use, edit, and distribute), modified by the author.

elements on the screen provide the basis for new sensations. Drivers may, for example, adjust their speed in a curve in accordance with the depiction of its continuation on the screen. The sensation is visual, but it refers to physical configurations not visible from the driver's locus (the screen may indicate that a sharp bend is coming, causing the driver to slow down) (Leshed et al. 2008, 1679). Similarly, zooming out while driving on a curvy road may serve the purpose of identifying straight sections of the road so as to overtake other vehicles safely. Moreover, satellite navigation devices and applications may indicate heavy, moderate, or light traffic, thus generating an anticipation of traffic conditions. Regular exposure to the precise instructions of satellite navigational aids ('turn right after 200 meters,' etc.) may stimulate the development of a quantified sense of distances in everyday life. Furthermore, it is also possible to sense road curvature while driving in the dark or in foggy weather.

The right and the left panels of Figure 1 compare the driver's 'spatial level' while driving in foggy weather with and without satellite navigation. The driver's own space when not using digital navigation consists solely of physical elements. If satellite navigation is turned on, the spatial experience is transformed, so that the driver's space includes the visual elements onscreen. The driver now senses objects and configurations beyond what is physically visible.

For a driver habituated to navigation software, this sensing of far-away elements in fog is an organic part of the Gestalt-like perception of space. It is not that the driver adds a further ('virtual') layer to the given perception of the material world – because there are no distinct layers in this situation, perception is a convoluted mesh combining all kinds of things. The driver immediately senses road curvature, even if it would not be visible without the software. Without consciously thinking about it, and through bodily movements acting on the steering wheel, pedals, and gear stick, s/he adjusts the position and speed of the automobile as would be expected in the respective situation. Sensing road curvature in the fog is not simply a linear extension of vision, but a new modality of sensing. This is because, while seeing refers to visually recognizing things within reach of the eyes, sensing road curvature is perceiving something that is 'not there' and incorporating this sensation into one's 'spatial level'; as a new modality of sensing, detecting road curvature is thus tied to a feeling of anticipation that is missing from 'regular' seeing.

In *Eye and Mind*, Merleau-Ponty (1964, 171) refers to sensing beyond the reaches of the eyes as 'voyance,' which 'renders present to us what is absent.' For him, though, 'voyance' is 'seeing farther,' 'showing us the invisible as "the outline and the depth of the visible"' (Carbone 2015, 3).

This would imply that the new sensations of satellite navigation are not novel sense modalities. However, the present paper makes the case that these are new modalities of sensing, since none of the new sensations mentioned above – sensing road curvature, detecting opportunities for taking over, anticipating traffic, acquiring a quantified sense of distances, sensing the road in fog or the dark – represent a linear extension of an already existing sense, but an enrichment of perception with new stimuli.

Just like driving the automobile itself, driving with digital navigation has to be learned in a bodily manner, and if accomplished, navigating with software becomes a habit. The intentional arc of driving (or, generally, wayfinding) is relatively simple: drivers (or mobile persons) intending to get from one place to another reach out, 'project' themselves to their destination, and in this sense are already there (cf. Merleau-Ponty 2005, 113). The intentional arc of aiming to get from one place to another – along with the automobile's incorporation into the body schema and the new, screen-induced modalities of sensing – polarizes and shapes the perception of space.

Just as in the case of 'walking in the city' – described by Michel de Certeau (1984, chap. VII) – drivers' spaces are mostly linear, in that they do not employ a bird's eye view, but rather a near-to-Earth, bodily perspective, with a dominant front side emphasizing successiveness (cf. 'space of action,' Ströker 1987, 48–81). If drivers' Gestalt of space is essentially a linear, successive route, even in situations without satellite navigation, this is amplified by the use of digital navigation, which reduces all spatial information to a route-like representation on the screen. Thus, the driver's overall spatial experience is not only shaped by how satellite navigation influences the engagement with physical spaces, but also by how physical elements are perceived, because the route-like representation of space is engineered precisely to match this experience.

The virtual body, then, is what is needed in this practical situation to be able to act (drive). The virtual body exists to achieve the goal of reaching a destination by moving through a polarized route-like space; it inhabits this mediatized space. Correspondingly, the body schema is transformed. For drivers, the body parts important for driving (hands, feet, head, and eyes) are accentuated, but the body schema also incorporates the car as the body's appendix. In addition, the extended body schema is oriented or adjusted to becoming a driver-car, and to perceiving with additional sense modalities that go beyond the visible and enable awareness of things beyond the reach of the eyes.

It is this extended body schema that defines the virtual body, that makes driving with satellite navigation, if no problems arise, a seamless experience, facilitating immediate bodily reactions (steering, changing gear, accelerating, slowing, etc.) to stimuli outside the reach of the 'normal' modalities of sensing (sensing without technical augmentation). To have a 'hold' on the digitized world, the mesh space of material and onscreen objects requires such a modified body schema or virtual body, which, in turn, is attuned to that space. In this interchange, both the world (physical and onscreen objects) and the driver are active: the driver has learned to incorporate the 'vague solicitations' on the screen into his/her 'spatial level,' according to the requirements of the screen and his/her own intentions. This mutual attunement of digital navigation and driver is evident, first, in the fact that the software reinforces the route-like shape of the driver's space, and second, in that the driver perceives elements on the screen as being part of her/his route-like space.[3]

Spatial experience, as Merleau-Ponty (2005, 242–244) emphasizes, is intersensory. In the case of using digital navigation while driving, this means that various stimuli specify or add affectivity to the spatial experience. Sounds (Bull 2004), moods and emotions (Sheller 2004), weather and light conditions (Pearce 2017), heavy or light traffic, road conditions, objects seen from the car, interactions with passengers, and the behavior of other vehicles all contribute to the singular holistic experience of driving with satellite navigation. The affectivity of mobilities may also be influenced by listening to and telling stories that redefine the bodies involved, as shown with reference to automation in the mining industry (Bissell 2021).

With respect to the debates on spatial disengagement, the following question arises: In this situation, to what extent is the driver's body 'geared into' the world, and to what extent does s/he have a 'hold on' it? For Merleau-Ponty, being geared into or having a hold on the world is equivalent to spatial engagement as presented by Aporta and Higgs (2005, 744). Merleau-Ponty describes the requirements of having a hold on the world, or being geared into it, as follows:

> My body is geared into the world when my perception provides me with the most varied and the most clearly articulated spectacle possible, and when my motor intentions, as they unfold, receive the responses they anticipate from the world. (Merleau-Ponty 2005, 261)

Merleau-Ponty thus points to three important aspects: a) having varied perceptions, b) having clearly articulated perceptions, and c) receiving responses from the world that match one's anticipations. Evaluating these aspects with respect to the situation of driving with satellite navigation reveals a mixed picture.

a) Motorized mobilities themselves are already accompanied by a loss of sensorial stimuli (Urry 2004, 30) in comparison with unmechanized mobility (walking, horse riding, riding a bicycle, etc.) – and the use of digital navigation further amplifies this tendency. If, additionally, the driver uses satellite navigation, the perception of the physical environment further diminishes, as experimental cognitivist research has shown. However, as pointed out above, using digital navigational tools not only leads to sensory deprivation, as they also engender new modalities of sensing. These new sensations afforded by media compensate for the sensory loss to a certain extent.

b) Digital navigation can help to articulate perceptions. A driver who – by way of repeated bodily acts – has habituated the use of the navigation application will incorporate the elements on the screen into her/his spatial experience. And because the visual representations of spatial elements on the screen are deliberately abstract, they tend to emphasize only those spatial aspects which are thought of as immediately important for navigation. For example, turn-by-turn navigation intentionally abstracts all properties of a roundabout considered to be irrelevant for reaching the destination (colors, materials, etc.), and emphasizes only those that are needed for wayfinding (size, shape, number of exits, exit to be taken). The aspects considered relevant are clearly articulated, while others remain vague or are excluded. Furthermore, as shown above, digital navigation may help to somewhat articulate objects and material configurations outside the reach of vision (and hearing). That some elements of the physical environment are excluded from this clear articulation is not necessarily a sign of spatial disengagement, since it happens by alignment to the driver's intentional arc of getting from one place to another.

c) If drivers apply navigation tools habitually, it is indeed possible that the responses their motor intentions get from the world match their anticipations. The space of experienced drivers/users is a crumpled mesh of digital and tangible objects; they instantly and preconsciously 'know' when to make certain bodily movements. By contrast, technical difficulties (e.g. poor internet connection) or inexperience as a driver or software user may lead to disturbances, anger, and frustration (cf. Speake 2015, 352).

All three dimensions illustrate that while driving with satellite navigation is, in some respects, accompanied by perceptual loss, it is nevertheless possible to be 'geared into' this situation and to have a relatively good 'hold' on the world. The diagnosis of spatial disengagement in the context of driving with satellite navigation is exaggerated, as it only stresses drivers' relations to their physical surroundings. On the contrary, using satellite navigation while driving may lead to *engagement with* the mesh space of physical and onscreen objects. In a similar vein, Leshed et al. (2008, 1680) intriguingly remarked that the results of their qualitative study 'illustrate [the] blurring of the virtual and physical spaces in which the individual is acting, engaged a little more with the technological environment and a little less with the material environment.' But how can we conceptualize the spaces with which drivers engage when using digital navigation? The next section explores this issue.

Hybrid spaces or mesh spaces?

The entanglement of actors with the digital world has captured the imagination of scholarly research, especially in new media studies. The conceptual interpretation of the spatial experience of using ICT is, however, a contested matter. Several theories and concepts have surfaced emphasizing the 'hybrid' nature of mediatized spaces. Galloway (2004, 390) uses the term 'mixed reality' to denote spaces where physical objects and elements of the 'virtual' world are combined, and observes the saturation of everyday life with hybrid environments. According to Benyon, in 'blended spaces,' objects from the physical world become linked to digital, informational elements, and in these 'new hybrid, blended spaces and environments (…) digital images commingle with real objects' (Benyon 2012, 220, 223).

Blended or hybrid spaces are conceived as being separate spheres held together only by anchors or touchpoints such as QR codes and satellite navigation. In blended spaces, physical and digital space 'correspond' with each other (Benyon 2012, 223). The present author (Berger 2020), with reference to online gaming worlds and video calls, also advocated the notion of hybrid spaces. Regarding the spatial experience of driving with satellite navigation, Leshed et al. (2008, 1680), as mentioned before, note the 'blurring' of two spaces, one being 'physical,' the other 'virtual.' Glezos (2020, 192, 239–241) refers to 'spaces sutured together,' where information technology stitches faraway places to each other, enabling actors – who thus perceive these spatial configurations as hybrid spaces – to act at a distance (for example, by means of a drone).

A common feature of the various conceptualizations of hybrid space is that they envision hybridity as a layered spatial experience: the virtual is supposedly layered over the physical space. The term hybrid space itself refers to a duality, to two initially separate and ontologically different spaces (a physical and a virtual one), which are being brought together, blended, mixed, or connected by ICT. This duality is more strongly present in the classic accounts of Benyon (2012) and Galloway (2004). Although duality is a characteristic of the present author's previous approach (Berger 2020), acknowledging the possibility of embodied presence in 'hybrid' spaces pointed, implicitly, beyond this dualism. Duality is less apparent in the study of Leshed et al. (2008), who not only speak of layering two distinct spheres of reality, but of a blurring, and also in Glezos (2020, 192, 239–241) interpretation of suturing together distant elements into one spatial experience. However, none of these approaches have been able to shed the dualism inherent in the concept of hybrid spaces fully.

This dualism of virtual and physical space is not reflected in actors' experiences of using ICT, including satellite navigation tools. They perceive spatiality not through connecting and merging two ontologically distinct spheres, but as a whole from the onset. This is in line with Merleau-Ponty's (2005) theory of perception, according to which perceiving space and spatiality is never an act of synthesis because there is nothing to be synthesized, as we already inhabit the world, and spaces are perceptual wholes for us. Furthermore, Merleau-Ponty's (1968) late work, *The Visible and Invisible*, reinforces the negation of the purported ontological difference between the virtual and the physical. By interpreting Merleau-Ponty's work, Glezos (2020, 200) stresses that 'the flesh of the body and the flesh of the world are always already intertwined.' In the context of the late works, 'the flesh of the world,' as pointed out by Carbone (2015, 4), not only denotes physical objects but all that is visible (including images), with no ontological difference between them.

It is not an easy task to find an alternative term for what is regularly labelled hybrid space without falling back into dualistic thinking. Following Tim Ingold, the present paper applies the term meshwork or mesh to these types of spaces. For Ingold (2011, xii, 64), a meshwork is 'a texture of interwoven threads' or 'an interweaving of lines'. In contrast to networks connecting separate and fixed entities, a mesh is a convoluted ensemble. The metaphor of the mesh also has the benefit of highlighting the philosophical connection to Merleau-Ponty (2005, 49, lxxiv), who considers movement, perceptual signification and external objects to be tightly inter*woven*, and

for whom 'the real is a tightly woven fabric'. In perception, onscreen and material objects are already seamlessly interwoven by the 'intentional threads' (cf. Merleau-Ponty 2005, 108) of bodily actors. The spatial experience of a driver using satellite navigation is, accordingly, not a 'hybrid' spatiality bringing together the physical and the virtual, but an already convoluted whole of physical and onscreen objects perceived holistically from the onset as a mesh space.

The mesh spaces of various media may differ significantly: they provide different information for different ends, demand varying kinds and amounts of skills, and are stable to a varying degree, with users likely being geared into them to different degrees. Mesh spaces are to be seen as what Merrill et al. (2020, 550), with reference to the atmospheres of public spaces, have called 'more or less digital' spaces, consisting of 'a changing mix of the digital and the non-digital, continually shifting in their gradation of digitality and non-digitality.' Merrill et al. (2020) manage to avoid the pitfalls of dualistic thinking, to which the present paper adds two novel insights.

First, mesh spaces may not only be more or less digital at the meso-level of public spaces involving many people, but also for individual actors bodily engaged with ICT. A prime example of this is how drivers constantly shift their attention from the road to the screen and back again, and how, because of this, their mesh space is gradually more or less digital at different times. An additional example is the fact that driving duration and familiarity with spaces may also influence the degree of digitality for the driver. Being exposed to onscreen objects during a long drive, or not being familiar with a specific space, may lead to a shift in the drivers' sense of broader spatial anchoring and spatial horizon, as they may perceive the physical environment within reach merely as a materialized island in the broader digital space represented onscreen. This leads to the mesh space being more digital in these cases than in instances the drive itself is of shorter duration, or where drivers are familiar with their physical surroundings, which they perceive as anchored in an overarching material space embellished additionally with new facets by onscreen objects.

Second, the gradational logic inherent in the more or less digital spaces of Merrill et al. (2020) should also be applied to the question of to what degree actors are geared into mesh spaces (to what extent they have a hold on them). The mesh space of driving with satellite navigation should – in the manner of Ingold (2002) – be considered as a scale ranging from being loosely to tightly knit. The mesh space of experienced drivers who have habitualized the use of satellite navigation is tightly woven together, and they have a tight hold on it. In contrast, for inexperienced drivers or drivers who have not (yet?) become accustomed to satellite navigation, the mesh is looser, replete with frictions and holes, and in this fraught experience, they constantly need to make a conscious effort to drive and/or to attend to the screen and the navigational instructions.

Of course, even for experienced drivers and users – who are normally deeply engaged with this mesh space – there are cases where the mesh becomes problematic, where they lose their hold on it. For example, the software may malfunction, there may be no signal, or the driver may have arrived at a decision point. In all these cases, the driver is to a lesser degree geared into the mesh space of satellite navigation and has to make conscious efforts to overcome the resulting difficulties, which can often lead to stress and frustration (Speake 2015, 352). Furthermore, media affordances (Nagy and Neff 2015) may also contribute to a tighter or a more loosely woven mesh space. As for satellite navigation, contemporary augmented-reality devices projecting digital images on the windshield make the mesh even more tight and pronounced than devices with screens. To sum up, by being enmeshed in these mesh spaces, drivers using satellite navigation create new ways of spatial engagement.

Conclusions

The aim of the present paper was to develop a theoretical interpretation of how satellite navigation transforms drivers' experience of automotive spaces by relying on Merleau-Ponty's phenomenology of perception. Cognitivist experimental research applying the computational-representational model of cognition has concluded that prolonged use of satellite navigation tools leads to a weakening of spatial memory and navigational abilities, especially by diminishing the capability to build mental representations of spaces. However, this line of research is, overall, characterized by a disembodied view of human spatiality. In contrast, spatiality is, above all, not a cognitive phenomenon but a bodily, lived experience. Furthermore, as has been shown, the interpretational concept of spatial disengagement frequently mentioned in experimental studies is not fully able to account for the experiences of satellite-navigated mobilities.

The proposed alternative interpretation is engagement with or being geared into convoluted mesh spaces (as distinct from hybrid spaces). The notion of engagement with mesh spaces admits that using satellite navigation on a regular basis may lead to a weakening of sensorial richness vis-à-vis the physical world and to a loss of certain wayfinding abilities. However, it stresses that using this technology is also accompanied by changes of perception and bodily presence. Driving, especially with satellite navigation, transforms the body schema, as the automobile is now incorporated into the voluminosity of the body, with the virtual body's sensorium extended by the act of sensing through the spatiality of the screen. Together, these phenomena make possible the acquisition and utilization of new skills and modalities of sensing.

The results of the present phenomenological investigation point in a similar direction as those of qualitative studies on satellite navigation that have stressed the emergence of new skills and novel forms of engagement. However, this paper gave greater prominence to the perceiving body and the bodily experiences of mesh spaces. If skilled users of satellite navigation modify their body schema and perceptual field, along with developing novel skills, it is reasonable to assume that technology not only causes a loss in their perceptual richness, but also leads to a shift in how the world is revealed to and unfolds for them – how they inhabit their world.

In late modernity, the various techno-geographic milieus form a 'global technological habitat' (Aporta 2013, 255–256) sheltering humanity. The 'media manifold,' understood as the complex of tightly interwoven and interconnected digital technologies and media (Hepp 2019; Couldry and Hepp 2017), is part of this global technological habitat and serves as the lifeworld's primary horizon of meaningful activities. Mesh spaces and their accompanying spatial experiences and sensations vary with technologies and media, and the convoluted space of digital navigation is only one case of many. Techno-geographic milieus, according to Stiegler (2011, 138), have a tendency to transform elements of the physical surroundings into functions of the respective technological systems.

Regarding navigation, this is the 'digitization of territory and inhabitable spaces,' whereby geo-information is said to give spatiality and territory a technical, navigational function (Stiegler 2011, 138). However, from the perspective of actors, the experience of driving with digital navigation is not merely a calculative or instrumental reduction of the physical world to the function of navigation – being geared into mesh spaces, being enmeshed with the digital, and having new(ly emerging) aspects of the world revealed to us means being absorbed in mediatized spaces, where absorption equals the absence of the calculative stance necessary for treating one's surroundings as nothing more than a standing reserve.

As for actors' strategies in everyday life, the results of experimental research on digital navigation should be taken into consideration, as should qualitative studies which suggest that by using satellite navigation moderately and in conjunction with other wayfinding methods, its detrimental effects can be alleviated. As the paper has shown, driving assisted by satellite navigation is not simply a novel and helpful way of navigating, given that it is accompanied by an engagement with mesh spaces. Being geared into the mesh spaces of digital navigation is also

tied to new risks: if the technological habitat faces difficulties, if the ties to the broader mesh of technological infrastructure providing the possibility of mesh spaces are cut, drivers with limited navigational abilities will face serious difficulties in navigating complex spatial arrangements, while often having to arrive at precise times at specific places.

Certainly, in modern, urbanized societies, it would be anachronistic to demand wayfinding skills comparable to those of hunter peoples, but navigational skills of some sort are needed in every society. Living in a mediatized global technological habitat, actors must make a choice of how deeply they want to engage with the mesh spaces of satellite navigation, how much they are going to trust the technological infrastructure, and how much of their 'offline' navigation skills they are willing to sacrifice.

Notes

1. As the Global Positioning System is merely one of several global satellite navigation systems, the paper uses this term only in the context of the article by Aporta and Higgs, who refer explicitly to 'GPS.'
2. In the case of (semi-)autonomous vehicles, however, embodied knowledge of driving not only refers to drivers assimilating the car into their body schema (as in the case of 'regular' driving), but also to interactions with the automobile which are 'instinctively' felt without conscious efforts (Lindgren, Fors, and Pink 2022, 1613–1614).
3. A more orthodox, 'anti-virtuality' scholar of Merleau-Ponty might argue that positional space alone is what satellite navigation provides. Contrarily, the present paper claims that elements of a screen displaying satellite navigation may elicit immediate bodily reactions and bodily engagement from drivers, rendering their digital and material mesh space situational.

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ORCID

Viktor Berger http://orcid.org/0000-0002-1263-6722

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