Dashboard Design and Driving Data(fication)[1]

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In this chapter I consider how the re-design of vehicle dashboards has restructured car-related data processes. I do so by charting the emergence of two such processes enabled by the re-design of vehicle dashboards. Firstly, the transformation of "geodata" into "navigational data" with the integration of voice-activated navigation systems into vehicle dashboards. Here, this transformation is enabled through the implementation of new addressing and speech protocols that radically change the relationship between driver and vehicle, when performing navigational tasks. Secondly, the transformation of "vehicle data" into "driving data" in the convergence, and customization, of dashboard features and functionality. Here, this transformation is enabled through the spatial, aesthetic, and operational integration of typically separate aspects of the driving experience (instrument cluster, navigation, entertainment), re-presenting vehicle-related data in new, and novel, ways. In evaluating these concomitant "datafication" processes, I use Mejias and Couldry's (2019, 3; emphasis added) definition, in which datafication involves "the transformation of human life into data through processes of *quantification*, and the generation of different kinds of *value* from data."

Both transformations are enabled through strategic design decisions, persuading drivers to participate in novel practices they might otherwise not. Firstly, through the strategy of "representational transparency" (Agre 1995, 186), in which voice-activation is depicted as a seamless, unmediated interface (Bolter and Grusin 2000) between the normal, natural speech of a driver, and the vehicle itself. Secondly, through the strategy of control, in which the driver is persuaded to believe they have full(er) customizable power within, and critically *of*, the vehicle – an example of what Mattern (2015, n.p.) refers to as "dashboard drama," or an aesthetic allure in which the driver is "empowered" (Agre 1995, 175) through the customization of their vehicle, that also results in their driving experience being managed by the vehicle manufacturer.

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Here, I interrogate how such systems transform car-related data from one state (geodata, vehicle data) into another (navigational data, driving data). The systems discussed here are representative of broader efforts within the automobile industry to transform the vehicle itself into "mobile spatial media" (Alvarez León 2019a) or wholesale into a "platform," through which the use of data is integral (Wilken and Thomas 2019; Alvarez León 2019b).

Whilst the automobile industry is not alone in making use of data streams produced as by-products (Thatcher 2014; Pridmore and Mols 2020), there are nonetheless unique challenges to be found in this application, such as interpreting spoken destinations or disambiguating common street names. These provide the possibility of articulating distinct aspects of datafication (van Dijk 2014; Sadowski 2019) within vehicles, and beyond other spaces such as the home (Pridmore et al. 2019; Maalsen and Sadowski 2019). The effect is manifold: the cultivation of new kinds or streams of data (touchscreen interfaces augmented with voice-activation, mirrors replaced by recordable cameras), new examples of representing established kinds of data (vehicle speed, or fuel levels), and altered practices in relation to both (entering destinations, checking mirrors).

The aim of the chapter is thus threefold. Firstly, to map where and how datafication takes place within the car. Secondly, to establish the role of vehicle dashboards in enabling this datafication. Then thirdly, to identify the strategies that come to shape the nascent "datafied" driving experience.

In the next two sections I consider how geodata is (and is not) transformed into navigational data, and how vehicle data is transformed into driving data. In the former, I discuss how some kinds of geographical information escape datafication, whilst others are subject to a practice I call "re-datafication." In the latter, I discuss how vehicle data is "surfaced" as driving data, generating alternative kinds of value in the process (Mejias and Couldry 2019). In the subsequent section I explore how dashboard "convergence" (Jenkins 2006; Hind and Gekker 2019) enables these transformations. In the final two sections I discuss two cases: a voice-activated navigation system built on the What3words platform, and a "widescreen" dashboard in a range of Mercedes-Benz vehicles.

Navigational Data: "Turn-by-Turn"

Geodata is data with a geographical, locational, or spatial component (Lauriault 2017; Leszczynski 2017). Typical examples include coordinates, a house address, or a postal code. Geodata may be relatively precise (GPS location) or represent a general geographic area (a state, or municipality), with scholars attentive to the spatialities of data, more broadly (Crampton et al. 2013; Shelton 2017). Further, geodata can be used for various kinds of navigational tasks: to orientate oneself on a hike, to enable the delivery of consumer goods, or to arrange a meeting with friends. In this section I consider first how some kinds of geographical information are *not* transformed into data in the act of navigating a vehicle. Then, how geodata *stays* as geodata whilst being enrolled into navigational practice, before discussing how geodata *is* transformed into navigational data in the act of navigating a vehicle. In other words, how navigational data is "activated" through various associated practices, which to varying degrees satisfies a general definition of datafication, as offered by Mejias and Couldry (2019) involving both (a) quantification and (b) generation of different kinds of value.

Navigational data is dependent on geodata. Geodata might be *added* to other kinds of (geo)data such that its use, or operational, value is enhanced. Geodata might also be *replaced* by more useful geodata that usurps the original geodata's low utility. Both enable a navigational task to be completed. Thus, navigational data is always composed out of geodata but may be combined with other contextual data that aids the completion of the navigational task. If there is no navigational task to perform, the geodata remains as geodata.[2] Even then, geodata may be enrolled into navigation without being transformed into navigational data. In any case, navigational data does not exist *a priori* but is transformed into navigational data through the act of navigation. It is, therefore, "ontogenetic," emergent in the practice of navigating (Kitchin and Dodge 2007; Hind 2020).

Navigational data is *not* always activated in the driving of a car. Firstly, geographical information may be embedded within the wider environment, both inside and outside the car, that remains as geographical information but is still integral to navigational practice. This may include visible buildings or landmarks and temporary road signs that issue text-based instructions, but also trusty road atlases or "occasion maps" scribbled on rough pieces of paper (Singh et al. 2019; Thielmann 2019). Although there may well be a change in value as these phenomena are enrolled into specific navigational tasks, they are not turned into (geo)data in the process, and as such do not undergo datafication.

Secondly, geodata may become enrolled into navigational practices, but stubbornly remain as geodata. Typically, such geodata might be found in fixed road signs with place names and numerical distances, or in traffic lights, in which geographical information has already been extracted, coded, and displayed. Yet, whilst enrolled into navigational practices (think of how many times a motorway road sign has been interpreted by a passing driver), this geodata is not transformed into navigational data, as no further quantification has taken place, even though different kinds of value are arguably being generated through its enrolment in many spe-

2 Whilst it is beyond the scope of this chapter, it is also possible for geodata to be transformed into other kinds of data, besides navigational data.

cific, unique navigational tasks each day. Thus, it cannot be said that additional datafication happens in such a case.

Thirdly, geodata may be enrolled into navigational practices that transform it into navigational data. Ordinarily, this activation occurs through digital devices such as integrated sat-navs, standalone sat-navs, generic or single-purpose map apps (Brown and Laurier 2012; Chesher 2012; Hind and Gekker 2014; Hind 2019). With each, geodata undergoes a second round of datafication, as pre-existing datapoints (house numbers, postcodes etc.) are transformed into "turn-by-turn" datapoints in the act of navigating via a digital device, or what Singh et al. (2019, 287) refer to as a "turn-taking machine," thus generating immediate navigational value to the driver. Rather than datafication, per se, this "re-datafication" instead further transforms one kind of data into another. These transformations are necessarily performed in part (or whole) through specific technical relations between devices, apps, platforms, and infrastructures, that differ between the examples given above.[3]

This final category is of particular interest because of how it usurps these other modes. When geodata is transformed into navigational data it captures and codifies the navigational experience, "turn-by-turn." However, these other sources of navigational information are also rather stubborn: they stand in the way – sometimes quite literally – of datafication, limiting the extent to which users might require, or interact with, navigational devices. It is this contestation between reliable, appropriate, and accurate sources of navigational information that I will turn to in the first case study.

In summary, whilst in the first category (geographical information in navigation) value generation might occur, this is not through datafication. In the second category (geodata as geodata) datafication has already occurred, and value generation does take place, but not through the transformation of geodata into navigational data. In the final category (geodata into navigational data), "re-datafication" can be said to occur, through which both quantification and value generation take place in the act of navigation.

Driving Data: "Smarter Decisions"

Vehicle data is data that is generated by the car for the technical operation of the vehicle itself. Ordinarily, the transmission of vehicle data is enabled through a centralized communication system, referred to as a "vehicle bus." Various protocols

3 For instance, in how the capacities of map apps lend themselves to more seamless and continuous modes of datafication than integrated sat-navs.

have been developed over the years to standardize these communication procedures, ensuring components can safely and effectively speak to each other. "Electronic control units" (ECUs) that control a suite of functions within the car are dependent on vehicle data, as well as the vehicle bus that sends such data throughout the vehicle. Examples include the engine control unit (for controlling the engine), the transmission control unit (for controlling gear transmission), or the control unit for anti-lock braking systems. Luxury cars now have between 100 and 150 ECUs (Stoltzfus 2017; Winning 2019), despite attempts to consolidate them into multifunctional systems (Intel 2018).

As vehicle data facilitates machine-to-machine communication, it does not need to be seen by, or made interpretable for, the driver. However, much like geodata is transformed into navigational data, so vehicle data can be transformed into driving data, surfaced through representation in indicators, dials, lights or some other visual (or audio) form. Driving data is vehicle data that is activated in the process of driving a vehicle. Whilst vehicle data lies under the bonnet, (usually) quietly ensuring the vehicle is operating properly, driving data is presented to the driver to aid decision-making. Like navigational data, driving data is brought into being through the various stages or moments in the driving experience.

Vehicle data is surfaced as driving data in multiple ways. Firstly, data can be *proximally* surfaced. Whilst the manual use of external indicators and headlights (to express "thanks") (Brown and Laurier 2017) are examples of proximal communication, these do not typically require ECUs, and thus do not generate data at all. As visual signs, they are analogous to the geographical information category discussed previously. Whilst such instances may well generate value, as these phenomena are enrolled into specific driving actions, they are not turned into (driving) data in the process, and as such do not undergo datafication. However, the development of "adaptive" or "intelligent" sensor-activated headlights that dynamically adjust to different conditions (fog, night) or situations (an urban environment, a sharp corner) do require ECUs and as such undergo datafication. Here, driving data is not only made available for other road users to aid safety and ensure appropriate driving etiquette, but is also dynamically enrolled into driver decision-making.

Secondly, such data can be *internally* surfaced. Here, data is surfaced through instruments, dials, lights, and screens on a vehicle dashboard. Such data is principally surfaced for the driver, to ensure they can perform driving activities, such as deciding when to refuel or change gear. In the USA, 44 separate indicators are standardized by law (Federal Motor Vehicle Safety Standard 2020). In 2020, Honda recalled 608,000 vehicles in the USA (O'Kane 2020) after discovering faulty software that could "cause the instrument panel to not display critical information" (National Highway Traffic Safety Administration 2020, 1). As vehicle data has already undergone a process of datafication (quantification and value generation), the transformation into driving data can be considered as re-datafication, through which new safety-critical forms of value are generated.

Thirdly, data can be *remotely* surfaced. Here driving data is extracted for the use of remote parties such as car rental companies, haulage firms, or insurance providers (Meyers and van Hoyweghen 2020). "On-board diagnostics" (OBDs) are typically used to track vehicles, with simple devices plugged into OBDs – i.e. transforming vehicle data into driving data. For fleet operators, external surfacing enables "smarter decisions, powered by data" (US Fleet Tracking 2020, n.p.), through which vehicle assets can be managed. Increasingly, however, this type of extraction is being enabled to both obtain ever-more granular driving data, as well as to expand such efforts to everyday vehicle owners (Gekker and Hind 2019). In this case, vehicle data is transformed into driving data through a re-datafication process that yields greater opportunity for the aggregation, combination, and comparison (i.e. quantification) of, and between, such data. This results in a more intensive and persistent generation of value, mostly for the parties above, but also potentially for other drivers as insights gained from the re-datafication process inform the redesign of vehicle dashboards and associated technologies.

In summary, in the first category (proximal surfacing) datafication occurs under certain circumstances, with recurring, and familiar, forms of value generated between drivers in the process. In the second category (internal surfacing) datafication has also already occurred, with secondary re-datafication processes seeking to cultivate new forms of value, principally for drivers. In the final category (remote surfacing), re-datafication results in more aggressive forms of data use for third parties, through which a multitude of different forms of value might be generated. Some of these final forms of value may find their way back to the driver in the redesign of vehicle dashboards. The following section will thus consider the role of the dashboard in the datafication process.

Dashboard Convergence: From Spatial to Operational Integration

Originally a physical board to prevent material from "dashing up" onto the exposed driver (Mattern 2015), dashboards in contemporary vehicles display an array of phenomena from operation-critical processes (gear, engine temperature) to multimedia options (radio station, Bluetooth connectivity). In this, the dashboard has developed from a device made to prevent any physical hinderances to driving, to a multifunctional aid meant to enhance the driving experience.

In this section I contend that dashboard "convergence" facilitates datafication, in which the otherwise separate interfaces housed within a vehicle dashboard – typically the instrument cluster, navigational assistance, and multimedia – are becoming operationally dependent. In this, I go beyond Alvarez León's (2019a, 370) suggestion that cars have become “integrated media spaces,” arguing that it is through this convergence that the datafication of wholesale vehicle operations is occurring.

Dashboard convergence is not necessarily a new phenomenon, with innovation in vehicle dashboard design being a constant since the early 20th century. Yet, as Mattern (2015, n.p.) discusses, the “standard package” of a Ford Model T in 1908 “consisted solely of an ammeter, an instrument that measured electrical current.” Whilst early computers only made use of displays to check for “errors” rather than for “complex data output or input” (Thielmann 2018, 47), early motor vehicles had more immediate ways to inform users of a problem: “[w]ater gushing from the radiator, an indicator you hoped *not* to see, was your ‘engine temperature warning system’.” (Mattern 2015, n.p.; authors’ emphasis). Yet dashboards had already became symbolic representations of vehicle state, rather than strictly indexical representations, “progressively simplify[ing] the information relayed to the driver, as much of the hard intellectual and physical labour of driving was now done by the car itself.” (2015, n.p.).

Following Mattern, then, dashboard design from the 1950s onwards exhibits a kind of rationalizing design tendency, with fewer vehicle operations needing to be represented (either indexically or symbolically) to the driver. However, the dashboard has become an important space for innovation in recent years as new driving features and data flows are represented. Dashboard convergence is both a preparation for, and a logical effect of, the “platformization” of the car, made connectable, modular, and interface-able (Helmond 2015).

This convergence is two-fold. Firstly, there is a *spatial* convergence in which previously separate modules are placed within the same part of the vehicle dashboard. A typical example is the integration of navigational capabilities within a multimedia system embedded within the central console of a vehicle (Alvarez León 2019a). Here, an external navigational device (sat-nav, road atlas, occasion map etc.) is replaced with an in-built feature, selectable by the driver in the same way as they turn on the radio, or adjust the air conditioning. In this, multimedia and navigation functions exist on the same ontological plane – as “apps” – embedded within such a system, accessible via buttons or a touchscreen.

Secondly, there is *operational* convergence involving the integration of previously separate systems. In this form of convergence, different systems are “vertically” integrated, such that either one is dependent on the other. Arguably, this operational convergence is newer, a required step towards the platformization of the car, in which different systems are made interoperable, in a “plug-and-play” approach, similar to how web platforms offer access via APIs (Plantin et al. 2016). A novel example, to be discussed in the next section, is the integration of voice-activation systems with navigational capabilities. Here, a voice-activation system, a unique addressing system, as well as an infotainment system, work together, with commands issued through one (voice-activation), triggering a response in another (addressing), to be presented in another (infotainment).

These two types of convergence – spatial and operational – are integral to "re-datafication": the transformation of geodata and vehicle data into navigational data and driving data. This horizontal (spatial) and vertical (operational) integration enables the activation, surfacing and/or extraction of these data types, in ways that were either previously unimaginable, technically impossible, difficult to implement, or otherwise "siloed." Through re-datafication, navigational and driving data streams are made more valuable, both for the driver of the vehicle, and – just as critically – for the manufacturer. Through this "interoperability" (Wilmott 2016) previously separate systems (and their accompanying data types) are made to work with each other.

In the following two sections I analyze how the question of convergence has been addressed in relation to two innovative vehicle dashboard designs: firstly, a voice-activated navigation system based on the unique addressing platform What3words. This can be seen to have transformed geodata into new forms of navigational data. Secondly, a self-styled "widescreen cockpit" designed by Mercedes-Benz, which has arguably surfaced vehicle data as novel forms of driving data. The result of both is an emerging datafied driving experience. I contend that their comparative successes – as examples of dashboard convergence in which data is transformed within the vehicle – rest on two strategies: representational transparency, and customizable control.

Voice-Activated Navigation as Representational Transparency

What3words is a geocode system that divides the world into 3m^2 grids, identifiable by a unique three-word string. In doing so, it converts underlying geographic coordinates, enabling users to remember locations such as "thread.strollers.bumble" (somewhere in Germany). What3words claim it is superior to established postal systems, with the 3m^2 grids enabling users "to specify a precise entrance, unlike a street address which identifies an entire building" (Macgregor 2020a, n.p.), and that "unlike street addresses which are often duplicated," What3words locations are "all unique," available in "over 40 languages" (2020a, n.p.).

1: An illustration of how the What3word grid system works

Source: What3words

In 2018 Daimler integrated What3words into its new infotainment system, "Mercedes-Benz User Experience" (MBUX), aboard the new Mercedes-Benz A-Class (Daimler 2018a, n.p.). In doing so, they suggested they had "moved one big step closer to [their] goal of making the vehicle into a mobile assistant" such that "[i]nputting locations…makes life easier for our customers and ensures a special experience" (Daimler 2018a, n.p.). In this, What3words could be activated through a touchscreen interface, but also via voice control.

As a promotional video demonstrates (Mercedes-Benz 2018a),[4] the combination of What3words and LINGUATRONIC (MBUX's voice control system) (Daimler 2018b) is seen as integral to the navigational experience within the A-Class. Rather than the driver using clunky search boxes, unresponsive knobs and buttons, or external apps or sat-navs, the owner merely issues instructions to the vehicle, with What3words deemed "the simplest way to talk about location" (Mercedes-Benz 2018a, n.p.). In this, typical (local) addressing systems are rendered confusing and frustrating. As the manufacturer reminds us, street names are rarely unique (Mercedes-Benz 2018b, n.p.), street numbers are difficult to differentiate between, and some towns are entirely unpronounceable to unfamiliar users (What3words 2019, n.p.). In short, the integration of What3words into the A-Class is set up to provide an improved navigational experience.

4 The original video has since been removed, however the page is still accessible via an archive link. A similar example can be found here: https://what3words.tumblr.com/post/179683783794/all-you-need-to-know-about-mercedes-benz-gps-voice

Figure 2: The frustration of inputting addresses by touch

Source: What3words

However, rather than simplifying vehicle navigation, the convergence of a novel addressing system, voice control system, and navigational system yields significant “praxeological changes” (Thielmann 2018, 50) between driver and vehicle. This operational convergence demands drivers follow, very carefully, a set of new conversational protocols to activate the navigational experience. Rather than offering a “transparent” interface, in which the “illusion of representational transparency” (Agre 1995, 186) between the driver and vehicle is maintainable, What3words “remediates” (Bolter and Grusin 2000) this navigational experience, inserting a number of new rules drivers must follow in order to navigate.

As a promotional video shows, “Sophie” receives a message on her smartphone: “let”s meet at hello.page.brand for brunch” (Mercedes-Benz 2018a, n.p.). As she gets into the car, she utters the words “hey Mercedes,” before asking the vehicle to “take [her] to What3words hello.page.brand” (Mercedes-Benz 2018a, n.p.). Yet rather than instantly generating a route, Sophie is instead given three choices: her intended destination, but also “hello.page.brands” as well as “hello.page.barn” (Mercedes-Benz 2018a, n.p.). Whilst What3words is designed to remove ambiguity, only a plural form of one word distinguishes two results (brand to brands). Further, that despite their claim that “What3words addresses are spaced as far apart as possible to avoid confusion” (Macgregor 2020b, n.p.), all three options are within a 23-mile (37km) radius of Sophie’s current location. Likewise, upon changing plans, a second set of results yields three locations in barely a 30-mile (48km) radius. Again, the three-word addresses aren't readily distinguishable, with "lanes.larger.daring" returned alongside "lands.larger.daring" and "ages.larger.daring" (Mercedes-Benz 2018a, n.p.).

The activation of navigational data in the use of a voice-activated navigation system results in a peculiar, and novel, experience. Geodata in the form of a typical, localized address is rendered mute, to be replaced in search results with both a broader reference to a geographic area (Bayswater, Cranleigh or Send) and the What3words addresses using words "assigned by a mathematical algorithm" using "simpler and more commonly-used words in each language" placed "in the areas where the language is spoken" (Macgregor 2020b, n.p.). In other words: "hello.page.brand" rather than 59A Portobello Road, Notting Hill, London W11 3DB.

This erasure – of localized names and places, idiosyncratic, ambiguous or unpronounceable to outsiders – is common to (digital) capitalism (Rose-Redwood et al. 2019; Sotoudehnia 2018; Nicas 2018).[5] The automatic translation, by "mathematical algorithm," otherwise a "toponymic reconfiguration" (Rose-Redwood, Alderman, and Azaryahu 2010, 454), of established place names into arguably banal if not trivial three-word locations, is key to the reorganization of navigational practice within the vehicle. With this, the driver is expected to change their navigational habits on two counts: firstly, to shift from using touchscreens/knobs to voice control; then secondly, to shift from using postcodes and addresses to using randomized three-word strings.

Regarding the former, it alters how geodata is transformed into navigational data. Rather than street names, whole addresses, or postcodes being selected from within an addressing database[6] by the user via a touchscreen or dials, three-word strings are spoken and "matched" to the What3words database by LINGUATRONIC. Thus, entirely *new* kinds of vocal data are created – and captured – in every command issued, and every destination uttered. Geodata is literally called into being at the beginning of a navigational task, undergoing a transformation into navigational data as each desired destination or datapoint is enrolled by the "turn-taking machine."

Regarding the latter, it constitutes, what Agre (1995, 186) refers to as "semantic colonization," in which new semantic terms replace others. Not only is one kind of geodata (postcodes) bypassed, but another kind altogether (three-word strings) created, even acting parasitically on the other to "convert" postcodes into What3word locations. This re-datafication process generates an altogether more

5 Thanks to Aikaterini Mniestri for originally alerting me to this, and especially to the colonial practice of place renaming.

6 Such as the UK Royal Mail's Postcode Address File (PAF).

problematic form of value rendered not from local road names or through a standardized (and nationalized) postcode system, but from randomized three-word strings. Whilst it is a strategy that purports to offer representational transparency, it only succeeds in adding further layers, as new navigational "procedures" are designed (Thielmann 2019; Garfinkel 1996).

The Widescreen Cockpit as Customizable Control

The 2018 A-Class not only integrates both voice control and a unique address system into the navigational experience, but also showcases a new dashboard design referred to as a "widescreen cockpit" (Mercedes-Benz 2018c). In this new dashboard, previously separate screens for the instrument cluster and the infotainment system (MBUX) are combined into a single entity operated either via touch or voice. Whilst previously the instrument cluster housing might have been contained behind the steering wheel, it now extends towards the center of the dashboard. Likewise, whilst the infotainment system might have previously existed as either an embedded screen in the center console, or an additional screen attached to the top of the dash, now it stretches across to the driver. In 2021 Mercedes-Benz will launch the "Hyperscreen," a 56inch display stretching the full width of the interior (Hawkins 2021), enabling even deeper forms of customizable control.

In another promotional video, we see a British car enthusiast and YouTuber explain the features of the widescreen cockpit (Mercedes-Benz 2018c). As it begins, he guides viewers through the "three screen set-ups available" to the driver (Mercedes-Benz 2018c, n.p.): two 7-inch displays, one 7-inch display and one 10.25-inch display, and two 10.25-inch displays, meaning "drivers can now customize their display screens." (Mercedes-Benz 2018c, n.p.). In this, there is a double spatial convergence. Firstly, the integration of both instrument cluster and infotainment system into a single entity: the widescreen cockpit. But secondly, a variable spatial convergence (the "three screen set-up") in which the new systems embedded within the interface can be resized. Either users can select two smaller screens (less intrusive), enlarge the media screen (for scrolling through songs etc.), or choose the full, "widescreen" experience.

Figure 3: The new MBUX "Hyperscreen" with three visible screen areas – even wider than the widescreen cockpit

Source: Mercedes-Benz

Next, he describes how drivers can perform this customization: "For example, if you wanted to rearrange the order of these apps [on the infotainment system], you just press and hold on one of the apps, in this case the navigation app, slide it across to where you want it, and then tick confirm and it locks it nicely in place." (Mercedes-Benz 2018c, n.p.)

Here, the media display works akin to the homescreen of a mobile device, in which app icons are presented in a grid-like fashion, movable at the user's discretion. But as he continues, he also highlights the possibility of customizing the instrument cluster, opting for an "understated" style option (Mercedes-Benz 2018c, n.p.). In the 2021 version, the MBUX system will include a "zero layers" feature in which apps will appear "in a situational and contextual way" meaning drivers will not "have to scroll through submenus or [even] give voice commands" (Daimler 2021, n.p.).

Whilst the claim of a "zero layer" display is certainly another example of the strategy of representational transparency, I argue it represents another tendency in vehicle dashboard design. Whilst media functions within cars have been "appified" (Morris and Murray 2018) for a while, instrument clusters and driving-related features have remained off-limits. But as the above, and another later video suggest, "there are many ways to customize your digital dashboard" (Mercedes-Benz 2019, n.p.) that extend beyond media screens and the presentation of apps, and into the representation of vehicle states. That is, to how vehicle data is internally surfaced and transformed into driving data.

This, I argue, constitutes a novel application of Phil Agre's "empowerment and measurement regime" (Agre 1995, 176), in which drivers are "empowered" to customize their digital dashboards, "personalizing" their own driving experience. Yet through novel measurement techniques – datafication by another name – vehicle manufacturers can further "manage" the driving experience. In the 2021 update, this regime is made even clearer and increasingly proactive, as app presentation is "supported by artificial intelligence" through a "context-sensitive awareness [that] is constantly optimised by changes in the surroundings and user behaviour" (Daimler 2021, n.p.). Here, the "MBUX Hyperscreen continually gets to know the customer better and delivers a tailored, personalised infotainment and operating offering before the occupant even has to click or scroll anywhere" (2021, n.p.). What display to show when, and for what purpose, is therefore a kind of situated surfacing in which the MBUX system offers a greater level of customizable control without the need for direct user interaction.

Figure 4: The Hyperscreen visualizing new kinds of driving data (electric vehicle energy "boost" and "recuperation") using a novel "clasp"-style display

Source: Mercedes-Benz

With these technologies, spatial convergence (both fixed, and customizable) leads to an operational convergence, in which both the media display (with app content), and the driving display (with driving data) are presented on the same ontological plane. In this, both are made customizable, not only to the driver's interests, tastes, feelings and passions (Sheller 2004), but also to their driving situations (i.e. going on a family holiday, or driving home from work). Indeed, with the new version of the MBUX, the system will even learn to automatically recommend the vehicle's massage function in cold weather (Daimler 2021, n.p.). Although, as

Mattern (2015) explains, instrument clusters have always enabled additional functionality, for a price, this has typically only concerned *what* can be displayed, not necessarily *how* or indeed *when*. With MBUX we get all three: interchangeable displays that not only show current speed, but also electric motor "recuperation," refueling limits, or the distance to a desired destination; different styles or "skins" for the displays themselves, and context-specificity enabled by artificial intelligence according to who the driver is, and what they're likely to be doing.

Conclusion

Vehicle dashboards are being radically re-designed to represent data differently within the car. With this, vehicle manufacturers are moving beyond the representation of typical features such as fuel levels and speed, or simply the digitization of previously mechanical indicators such as fingers and dials. As vehicles are becoming platformized, new data streams are being generated, sometimes derived from entirely novel operational states. New techniques are being employed to represent this data, and new strategies to convince drivers of their utility.

In this chapter I have considered how the re-design of vehicle dashboards has restructured both navigation and driving through two datafication processes. Firstly, in the transformation of geodata into navigational data, and secondly, in the surfacing of vehicle data as driving data. The spatial and operational convergence of navigation, entertainment and driving features within the car has been a critical enabler of these processes. In order to convince drivers of the value of these design changes, two strategies have been deployed by manufacturers. Firstly, "representational transparency" (Agre 1995, 186) in which new vehicle interfaces are sold as fixes to existing systems deemed "annoying," confusing, or complicated to use. Secondly, "customizable control" in which drivers are afforded greater ability to "personalize" vehicle displays. These strategies, I have argued, are specifically enabled by "re-datafication," in which existing forms of data are transformed into others, actively shaping the experience of driving a car.

To evidence the transformation of geodata into navigational data, I discussed the integration of What3words – a unique addressing system – into a Mercedes-Benz navigation system. Constituting a rather complex operational convergence of multiple systems and functions, navigational capabilities are primarily enabled through voice-activation. Here, geodata is activated as a very particular kind of navigational data, posing both novel practical issues for the driver, as well as constituting a kind of "semantic colonization" (Agre 1995, 186) in which placenames (i.e. geodata) are rendered as randomized three-word strings for the purposes of navigation.

To elucidate the transformation of vehicle data into driving data, I turned to Mercedes-Benz's MBUX system. Here there is an obvious spatial convergence as driving, navigational, and entertainment features are fitted into a single "widescreen" dashboard, or "Hyperscreen." But the MBUX system also demonstrates another more subtle convergence, in which the different display screens of the vehicle dashboard can be customized, enabling driving data to reflect a driver's interests, tastes or personality. As an imminent new version of the MBUX system demonstrates, this customizable control is to be further enhanced through artificial intelligence, enabling a "situated surfacing" of context-relevant functions. These customizable forms, far from being additional elements or features, subtly yet substantially reconfigure the experience of driving. Indeed, rather than a curious side effect, they constitute intended design effects: techniques to transform the driver and their ways of driving.

Thus, this chapter has sought to add to the emerging work on data and platforms, considering how automobiles are being subjected to datafication processes. In the process of transforming both geodata and vehicle data into navigational data and driving data, respectively, new driving experiences are emerging. These, I argue, are worthy of ongoing investigation, as they generate unique effects that help to better understand how datafication is shaping the world-at-large.

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