[1] “And while jabbing your finger at a car’s flat-screen seems like a modern pastime, the first car to use one arrived more than 30 years ago. Justifiably denounced for its small size and lackluster styling, the 1986 Buick Riviera pioneered the concept of the infotainment system, a development that evolved from car radios.” (Hagerty “Infotainment systems? That’s so 1986”)

[2] “There, mounted dead center, like a window on the future, is the magical, touch-sensistive CRT screen,, a.k.a. Graphic Control Center…” (Curbsideclassic.com, “Vintage Car And Driver Review: 1986 Buick Riviera T-Type – What Is This Car Supposed To Be?”)

[3] “Buick says the touchscreen replaces over 80 physical controls.” (TopSpeed.com, “The First Car With A Touchscreen Display Is Older Than You Think”)

[4] MotorWeek | Retro Review: 1986 Buick Century T-Type & Riviera CRT Note: until the next footnote, all links that follow are also from this source.

[5] Buick Graphic Control Center In-Depth Look|Buick Electronic Control Center|CRT|Touchscre…

[6] https://youtu.be/EbWp1Y8qREU?si=d4h7RsLV-czm7C4j&t=16

[7] “Because not all of the electronic brain’s information can be displayed at once, such a normally simple act as adjusting the sound system’s bass level can require as many as three touches in three different places on the screen—or even more, if your aim is slightly off and you accidentally summon the climate-control display instead. Similarly, if you’re watching the trip monitor and you wish to adjust the radio volume, two well-aimed fingertip touches are required. Meanwhile, please try to keep an eye on the road. Suffice it to say that computers are intended to make life simpler and more efficient, but the Riviera's setup does nothing that a conventional array of knobs, buttons, and analog instruments could not do in a fraction of the time one spends diddling with this microciruited mess.” (Curbsideclassic.com, “Vintage Car And Driver Review: 1986 Buick Riviera T-Type – What Is This Car Supposed To Be?”)

[8] 1985: 65,305; 1986: 22,138 (Riviera Owner’s Association, “Riviera Production Numbers”)

[9] “The ECC was in the Riviera from 1986-1989, when it was mercifully retired, and suddenly sales rebounded somewhat.” (TopSpeed.com, “The First Car With A Touchscreen Display Is Older Than You Think”)

[10] https://youtu.be/8Aa83ruXspU?si=FstEn--EWIlb3UwD&t=59

[11] https://www.youtube.com/watch?v=gAHcMQVmBPU

[12] 1.”Driving is one of the most cerebrally challenging things humans manage regularly—yet in recent years manufacturers seem almost addicted to switch-free, touchscreen-laden cockpits that, while pleasing to those keen on minimalistic design, are devoid of physical feedback and thus demand visual interaction, sometimes at the precise moment when eyes should be fixed on the road.” (Wired, “Rejoice! Carmakers Are Embracing Physical Buttons Again”)
2. “Suddenly it was decreed acceptable to have a TV-sized touchscreen in the car that displayed every bit of essential driving information and controlled every in-car function, including the whoopee

cushion. Rivals took notice. [...] But what appealed most was the saving in cost versus developing, testing, homologating and manufacturing traditional switchgear. And now? Touchscreens are everywhere. Research suggests 97 per cent of new cars released after 2023 had a touchscreen on the central dash area." (Hagerty, "Touchscreens in Cars are Still a Stupid Idea – But Help is on the Way")

[13] 1. "Additionally, over-the-air updates almost require in-car computer screens. A car's infotainment system, the operation of ambient lighting, and other design factors are an increasingly important part of car design, and they need a screen for manufacturers to incrementally improve software-defined vehicles after rolling off production lines." (Wired, "Rejoice! Carmakers Are Embracing Physical Buttons Again")
2. "Market researchers, interior designers, software engineers, user experience designers and bean counters were told to put their heads together and examine the pros and cons of touchscreens, and for the manufacturers, there was a lot going for it – on-trend, easy to integrate, seemingly limitless functions, over-the-air updates. (Hagerty, "Touchscreens in Cars are Still a Stupid Idea – But Help is on the Way")

[14] See ch. 3, "Worse than being drunk?', for specific safety claims and citations.

[15] 1."The first car radio was introduced in 1930 by Galvin Manufacturing Corporation (later known as Motorola)." (Sound Electronics, "The History Of Car Audio Systems")
2."In 1930, early car radios were first introduced by two entrepreneurial brothers, Paul and Joseph Galvin." (Industry Today, "Road Tunes: How Car Audio Systems Have Evolved")

[16] 1."This early radio, known as the Motorola 5T71, was an AM radio that was expensive, costing around $130, which was nearly a quarter of the price of a new car at the time."(Sound Electronics, "The History Of Car Audio Systems")
2. "The Galvin car radio cost $130, equivalent to roughly $1,500 nowadays. The system used vacuum tubes powered by a single battery and depending on your location; you could listen to the hits of the day on a hissy AM radio." (Industry Today, "Road Tunes: How Car Audio Systems Have Evolved")

[17]
1."By the 1950s, car radios had become more common and affordable. This decade saw the introduction of FM radio in cars, which offered better sound quality and less static compared to AM." (Sound Electronics, "The History Of Car Audio Systems")
2. "In 1952, a German company, Blaupunkt, released the first ever FM radio that was also car-ready." (Industry Today, "Road Tunes: How Car Audio Systems Have Evolved")

[18] 1."The first in-car cassette players were introduced in the early 1970s and quickly became the dominant format for in-car entertainment. Cassette tapes were smaller, more portable, and allowed users to create their own mixtapes, making them a favorite among music enthusiasts."
2."Slowly but surely, the smaller cassette tapes quality improved, eventually replacing the larger 8-trackWith the advent of the Walkman, developed by Sony in 1979, Cassette tapes became the standard, as an individually-created playlist could be made for the first time." (Industry Today, "Road Tunes: How Car Audio Systems Have Evolved")

[19] "The 1980s saw another major shift in car audio with the introduction of the compact disc (CD)." (Sound Electronics, "The History Of Car Audio Systems")
2. "By the early 80s, just as everyone got comfortable with their audio set-ups, Philips and Sony began developing the prototype for the 90s-ubiquitous compact disc or CD, marketed commercially for home use starting in 1982." (Industry Today, "Road Tunes: How Car Audio Systems Have Evolved")

[20] 1. "In 1956, Chrysler introduced the first (and only) in-car phonograph, named the Highway Hi-Fi. The phonograph was equipped with a miniature turntable mounted on the bottom dash on the passenger's side,

directly connected to the car's electronic system." (Industry Today, "Road Tunes: How Car Audio Systems Have Evolved")

[21] "And that stayed with us really up until probably the 2000s and where we are now, where we started a new millennium and we're getting towards a glass cockpit where the cockpit is no longer analog. It's going to a digital experience and a combination of digital analog sort of thing started to come in. And again, that kind of reflected really what was happening in other technologies. So at the same time as that, we were getting a lot more kind of micro cameras and video players and all those sorts of things come to market with a lot of technology embedded in them. So people came to expect a lot of technology and lot of features, you know, so companies started to overload drivers with a lot more information and features and things they never thought they needed, you know. So it started off with simple navigation and simple trip computers, but then it became much more involved in terms of everything else you might expect. Digital, digital." (Interview with Prof. Dale Harrow, 4.9.2025. Interview transcript here.)

[22] 1."When the Tesla Model S hit the market in 2012 it instantly became an automotive benchmark, and did much to create the Cult of Elon. [...]The Model S launched Tesla into the luxury sedan market and quickly became the car of choice for wealthy Hollywood types. And it brought electric motoring into the spotlight for many auto enthusiasts." (Car & Driver, "Tested: 2012 Tesla Model S Takes Electric Cars to a Higher Level")

[23] https://www.youtube.com/watch?v=SLio4A13Ric Footage

[24] "Our measured range was 211 miles—not quite the EPA-predicted 265, but impressive, given our 75-to-80-mph highway speeds." (Car & Driver, "Tested: 2012 Tesla Model S Takes Electric Cars to a Higher Level")

[25] "But "gets by" understates the Model S's performance. We measured a zero-to-60-mph time of 4.6 seconds, a quarter-mile pass of 13.3 seconds at 104 mph, and a governed top speed of 134 mph. That's similar to the performance of the V-8 German sedans." (Car & Driver, "Tested: 2012 Tesla Model S Takes Electric Cars to a Higher Level")

[26] "Another unusual aspect of the Model S is an enormous capacitive touch screen that almost completely replaces the knobs and buttons on the dash. It measures 17.0 inches diagonally, is mounted vertically, and presents the area of four to six typical screens." (Car & Driver, "Tested: 2012 Tesla Model S Takes Electric Cars to a Higher Level")

[27] 1."Nevertheless, the arrival of the Tesla Model S added a big electrified push to a horrible car design trend: that of ditching the switchgear and bunging every possible control into a touchscreen menu. Soon, every manufacturer would be jumping on this brand-new bandwagon, leading to a generation of cars that delegate the simplest functions into glitchy, fiddly, distracting touchscreens." (WVS, "The touchscreen-for-everything fad is disappearing – good riddance!")
2."Similarly, you can see the industry influence of Tesla's choice to design its vehicles with minimalist interiors. "The industry has picked up on it because—guess what? It saves them money," Niedermeyer says." (Consumer Reports, "How the Tesla Model S Changed the World")

[28] 1."As technology continued to advance, car audio systems began to integrate more digital features. Bluetooth connectivity, introduced in the mid-2000s, allowed drivers to stream music wirelessly from their smartphones or MP3 players, as well as make hands-free phone calls." (Sound Electronics, "The History Of Car Audio Systems")
2."Using USBs, Bluetooth or an aux cord, the way we would select what to listen to would never be the same. Add to this Satellite radio and streaming services like Spotify and Pandora, companies offered increasingly varied

methods of getting the music we want when we wanted it." (Industry Today, "Road Tunes: How Car Audio Systems Have Evolved")

[29] 1. https://www.youtube.com/watch?v=2goaglM2Wiw 2:22: "It actually costs a lot of money to engineer all of these buttons and switches and to have the wiring, because you've got to have wires that run to all of these different physical controls, doing the validation of all this, making sure that it's going to be durable over the life of a car. Doing all of that in software is a lot cheaper." —Sam Abuelsamid, Principal Research Analyst, Guidehouse Insights
2. "Crucially, touchscreens are ubiquitous partly because of cost—it's cheaper to write lines of computer code than to add wires behind buttons on a physical dash. And there are further economies of scale for multi-brand car companies such as Volkswagen Group, which can put the same hardware and software in a Skoda as they do a Seat, changing just the logo pop-ups.
Additionally, over-the-air updates almost require in-car computer screens. A car's infotainment system, the operation of ambient lighting, and other design factors are an increasingly important part of car design, and they need a screen for manufacturers to incrementally improve software-defined vehicles after rolling off production lines. Adding functionality isn't nearly as simple when everything is buttons." (Wired, "Rejoice! Carmakers Are Embracing Physical Buttons Again")
3. "Inspiration for the screen-heavy interiors in modern cars comes from smartphones and tablets. Designers want a "clean" interior with minimal switchgear, and the financial department wants to lower the cost. Instead of developing, manufacturing and keeping physical buttons in stock for years to come, car manufacturers are keen on integrating more functions into a digital screen which can be updated over time." (Vi Bilägare, "Physical Buttons Outperform Touchscreens In New Cars, Test Finds")
4. "MCGEHEE: So we're pushing 30 years in the market with touch screens. Over time, we've migrated to that kind of interface because it's cheaper to put in a touch screen than it is to put hard buttons that are more reliable." (NPR, quoting Dan McGehee of the University of Iowa, "Touch Screens Are Distracting Drivers. What Are Carmakers Doing To Help?")

[30] 1."All newly manufactured vehicles to be sold in the U.S. are required as of Tuesday to have backup cameras equipped as a standard feature." (ABC News, "All new cars in US now required to have backup cameras")
2.CarScoops, "Backup Cameras Now Mandatory On All New U.S.-Spec Vehicles"

[31] 1."Congress passed the Cameron Gulbransen Kids Transportation Safety Act in 2008. The bill, signed into law by then-President George W. Bush, ordered NHTSA to issue by 2011 a standard for improving drivers' ability to detect pedestrians behind their vehicles. NHTSA's proposed standard was stalled for several years in the White House's Office of Information and Regulatory Affairs, according to a Reuters. It wasn't until March 2014, when a coalition of advocacy groups filed a lawsuit against the U.S. Department of Transportation (of which NHTSA is a part), that a rule was issued, with a May 1, 2018, deadline for full implementation." (ABC News, "All new cars in US now required to have backup cameras")
2."S. 694, as amended, would direct the Secretary of Transportation (Secretary) to issue regulations applicable to passenger cars and light trucks that will reduce the incidence of injury and death. The Secretary would be granted rulemaking authority to consider requiring that power windows and panels automatically reverse direction when they detect an obstruction, to issue a performance standard to provide drivers with a means of detecting the presence of a person or object behind the vehicle, and to require that automatic transmissions manufactured on and after September 1, 2010, include a service brake system in which the service brake must be depressed before the driver can shift the transmission out of a ``park'' position. [...] S. 694 requires the Secretary to initiate a rulemaking within 12 months of enactment to expand the required field of view to enable a driver to better avoid accidental backover incidents." (Congress.gov, "S. Rept. 110-275 - CAMERON GULBRANSEN KIDS TRANSPORTATION SAFETY ACT OF 2007")

[32] See quote from David Strayer in text. CNBC, "How Safe Are Touchscreens in Cars Like Tesla?"
"As recently as 10 years ago, touch screens in cars were tiny — if they were there at all. Most were grudgingly added by automakers in anticipation of a U.S. mandate on backup cameras, or an early response to Elon Musk, who dropped a 17-inch monitor into a Tesla in 2012." (Automotive News, "Are Touch Screens Getting Out of Control?")

[33] https://www.youtube.com/watch?v=2goaglM2Wiw 2:22: "It actually costs a lot of money to engineer all of these buttons and switches and to have the wiring, because you've got to have wires that run to all of these different physical controls, doing the validation of all this, making sure that it's going to be durable over the life of a car. Doing all of that in software is a lot cheaper." —Sam Abuelsamid, Principal Research Analyst, Guidehouse Insights
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[34] https://www.youtube.com/watch?v=2goaglM2Wiw 1:14" Touchscreens, we think, really are an outgrowth of the requirements to put in backup cameras, probably about ten years ago in the vehicle. So you had to have a screen on the

display so someone could see what the camera was picking up." —David Strayer, Professor, Cognition and Neural Science, The University of Utah

[35] https://cleantechnica.com/2019/01/06/teslas-software-first-approach-foreshadows-the-future-of-cars/ In Steinberg's view, Tesla's most important innovations stem from the fact that it's the first company to approach cars the Silicon Valley way: as a software problem.

[36]
https://evannex.com/blogs/news/tesla-s-software-first-approach-foreshadows-the-future-of-cars?utm_source=chatgpt.com
Tesla's software-first approach foreshadows the future of cars
2."Notably, Tesla's design strategy used technological innovations such as autonomous driving functionality, pioneered over-the-air software updates and provided a fully electric experience." (R&D Today, "How Tesla made sustainable innovation desirable")

[37] Tesla event / Apple event

[38] https://evannex.com/blogs/news/tesla-s-software-first-approach-foreshadows-the-future-of-cars Tesla's software-first approach foreshadows the future of cars
2."The (Tesla) Model S changed the way the world thought about electric cars – "they were no longer the vegetables you should eat but the dessert that you desired," said Jake Fisher, Senior Director of Consumer Reports' Auto Test Centre in 2022. Its strategy made sustainable innovation desirable." (R&D Today, "How Tesla made sustainable innovation desirable")
3. "Tesla seemed to come out of nowhere. I mean, I, I'm old enough to remember when, a designer, I practiced as a designer, the project for taking the Lotus Elise and turn it into a Tesla was, was knocking around lots of design studios and people trying it and test. at that time, Tesla was just a small company that no one really understood, you know, and for it to have grown to become what it is. It's quite amazing, I think. And it came out of the blue and I think it. It kind of created a car in a different way and the thinking was very different." (Interview with Prof. Dale Harrow, 4.9.2025. Interview transcript here.)

[39] "Tesla wouldn't happen in the UK or possibly even Europe because I don't think the companies and the scale of the is big enough to kind of support the innovation. But I think in America, you can still do that with the market. [...] The difficult thing has been is to break away from the big three and you can see in the big three, they're all struggling to innovate fast enough. I read something recently that one of the CEOs has had a was driving a Chinese car that had been imported and he thought it was a concept car and it was just their daily, it was just a new electric car, know, and it was so advanced from what they were doing internally. And I suppose you get that, you get silos of kind of silos of activity. And I think what's interesting with Tesla and with the Chinese is they're approaching it from a slightly different way." (Interview with Prof. Dale Harrow, 4.9.2025. Interview transcript here.)

[40] https://www.caranddriver.com/features/a44040564/modern-car-door-designs-amalyzed/

[41] Ford website

[42] Tesla website

[43] 1."In a Mercedes Benz GLC, the shifter is a mono-stable electronic shifter. What that means is that no matter what position you're in, it always returns to the center, makes it hard to see what gear you're in. And putting it into park is actually a small button at the end, which is completely blocked by the steering wheel." (Consumer Reports, "Consumer Reports: Gear Shift Designs Could Be Dangerous for Drivers")
2."The shifter is a monostable electronic shifter. What that means is that no matter what position its in, it always returns to the center. Makes it hard to see what gear you're in." (Consumer Reports, "How to Stay Safe If You Have a Confusing Shifter," at 0:26)

[44] Motor1.com, “The GMC Terrain's shifter is Worst In Show at Detroit [UPDATED]”

[45] 1. Introduction of this shifter: ““We did a rethink of the interior,” explained Volkswagen of America’s vice president of e-mobility, Matthew Renna. “Our design colleagues threw away everything we knew about interiors.” Throwing away everything is an invitation to throw out the metaphorical baby with the bathwater, and I believe VW has done exactly that in some aspects of its re-thought driver HMI. But the ID.4’s EV equivalent of a shifter could be the best example of alternative design, as it preserves the useability of traditional combustion cars’ transmission shifters without occupying a lot of space.” (Design News, “How Volkswagen Developed the ID.4 EV’s Drive Mode Selector”)
2. Images of the shifters in the 2021, 2022, 2023, and 2024 models show that by 2024, the triangular shifter had been removed. (Car & Driver, “Volkswagen ID.4”),

[46] “And then after that, we had a kind of plateau really where things were fairly stable until the eighties and nineties, where there was a period really of trying to make cars work.” (Quinn Duffy interview, 0:43)

[47] ““The beautifully crafted Crystal Sphere embodies Genesis’ approach to design, luxury and ergonomics, representing a striking interior focal point for GV60 and an emotional connection between the driver and the vehicle.” (Genesis website)

[48] Genesis Europe, “How to use the Crystal Sphere | Genesis GV60 | United Kingdom | Genesis Europe”

[49] Car & Driver, “Why Are So Many New Cars' Gear Selectors So Stupid?”

[50] ““Ninety-seven percent of new cars released after 2023 contain at least one screen, reckons S&P Global Mobility.” (Wired (2025), “Rejoice! Carmakers Are Embracing Physical Buttons Again”)

[51] https://www.youtube.com/shorts/PboEeLghTIA

[52] 1. “BMW has sparked debate after offering an online subscription to turn on heated front seats in its cars in the UK for £15 per month.A monthly heated steering wheel subscription costs £10.” (BBC, “BMW introduces new heated seat subscription in UK”)
2.”That includes the roughly $18 monthly fee — or $180 annually — to activate heated seats, which come pre-installed in these cars. BMW cars typically cost anywhere between the low $30,000s to the high $70,000s in the US. Back in 2020, the company said they could start charging subscriptions for features already in the car. Seat warming charges appear to have been rolled out in 2022.” (Business Insider, “Good news, BMW owners: You won't have to pay $18 to heat your seats after all”)
2.“The Germans had to get used to the idea that user acceptance of the heated seats subscription program got very low user acceptance. The reason BMW chose to stop the program is that customers complained of paying double for the feature, even though it was not exactly true.” (Auto Evolution, “BMW Drops Controversial Heated Seats Subscription, No Extra Money for Onboard Features”)

[53] 1.“"We thought that we would provide an extra service to the customer by offering the chance to activate that later, but the user acceptance isn't that high," Nota told Autocar during the IAA Mobility conference in Munich."People feel that they paid double – which was

actually not true, but perception is reality, I always say. So that was the reason we stopped that."" (Business Insider, "Good news, BMW owners: You won't have to pay $18 to heat your seats after all")
2.Forbest, "BMW Drops Controversial Heated Seats Subscription, To Refocus On Software Services"

[54]""The vehicle of the future will be like a smartphone on wheels," Professor Dia said." (The Driven, "It's All in the Software")

[55] https://www.rca.ac.uk/more/staff/professor-dale-harrow/

[56] Interview with Prof. Dale Harrow, 4.9.2025. Interview transcript here.

[57] "But between 2019 and 2022, groups of Tesla employees privately shared via an internal messaging system sometimes highly invasive videos and images recorded by customers' car cameras, according to interviews by Reuters with nine former employees. Some of the recordings caught Tesla customers in embarrassing situations. One ex-employee described a video of a man approaching a vehicle completely naked." (Reuters, "Tesla workers shared sensitive images recorded by customer cars")
"At one point, Teslas on autopilot were having difficulty backing out of garages and would get confused when encountering shadows or objects such as garden hoses. So some data labelers were asked to identify objects in videos recorded inside garages. The problem eventually was solved. In interviews, two former employees said in their normal work duties they were sometimes asked to view images of customers in and around their homes, including inside garages. "I sometimes wondered if these people know that we're seeing that," said one. "I saw some scandalous stuff sometimes, you know, like I did see scenes of intimacy but not nudity," said another. "And there was just definitely a lot of stuff that like, I wouldn't want anybody to see about my life." As an example, this person recalled seeing "embarrassing objects", such as "certain pieces of laundry, certain sexual wellness items and just private scenes of life that we really were privy to because the car was charging"." (The Guardian, "Tesla workers shared 'intimate' car camera images, ex-employees allege: 'Massive invasion of privacy'"

[58] "Personal information we collect when the BMW Services are activated. When the BMW Services are activated, we may collect and retain an electronic or other record of the following information –which is personal information when associated with you: [...] Sensor information (radar, ultrasonic devices, gestures, voice, etc.)..." (BMW Canada, "Connected Drive Privacy Policy")

[59] "Kia and Hyundai, which have the same parent company, collect voice recognition data from inside their cars and sell this to the artificial intelligence (AI) software training company Credence, the Choice investigation found." (ABC News, "These car brands are collecting and sharing your data with third parties")
2. "A spokesperson for Hyundai told Guardian Australia its Bluelink app collects data in two ways: through in-vehicle activation that collects information on automatic collision notification and voice recognition but no other personal information, and the full enrolment through the Bluelink app which connects an email address and mobile number to create an account.
Customers can deactivate in-vehicle and no more data is saved from that point, and if the Bluelink account is deleted all data is deleted. The company said voice recognition data is collected on "an aggregate and non-identifying basis" to share with Cerence, a third-party provider of automotive voice and AI products." (CBC, "Is your car spying on you? Here's how vehicles gather your data")

[60] 1.Tesla's policy indicates that facial expressions may not be shared, but they are definitely monitored and *can* be shared: "This active safety feature utilizes cabin camera to monitor driver attentiveness. Cabin camera does not perform facial recognition or any other method of identity verification. By default, images and video from the camera do not leave the vehicle itself and are not transmitted to anyone, including Tesla, unless you enable data sharing. To adjust your data sharing preferences touch Controls > Software > Data Sharing > Allow Cabin Camera Analytics. You can change your data sharing settings at any time." (Tesla, "Driver Drowsiness Warning")
This feature can be turned off, but re-starts itself: "According to Tesla's policy, driver's faces are monitored by a feature that is difficult to disable: "You can disable or enable Driver Drowsiness Warning alerts by touching

Controls > Safety > Driver Drowsiness Warning for the current drive cycle (every time the vehicle is in Park and you walk away). Driver Drowsiness Warning automatically re-enables at the start of every drive cycle." (Tesla, "Driver Drowsiness Warning")
2. WTHR, "Cars collect massive amounts of driving and personal data I 13 Investigates"

[61] "Privacy should be a right for everyone, everywhere. Join our global movement for privacy rights." (Mozilla Foundation, "Privacy for All")

[62] 1. "Mozilla Foundation is a non-profit building a better technology future — powered by people, open by design, fueled by imagination. We deliver people-first alternatives to today's extractive systems. We build side by side with developers, innovators and advocates, united in the belief that a better technology future is not only possible — it's ours to create." (Mozilla Foundation, "This Is Who We Are")
2."A study of 25 car brands found they all failed consumer privacy tests carried out by internet-focused non-profit Mozilla Foundation." (The Guardian, "From sex life to politics: car driver data grab presents 'privacy nightmare', says study")

[63] "We reviewed 25 car brands in our research and we handed out 25 "dings" for how those companies collect and use data and personal information." (Mozilla Foundation, "It's Official: Cars Are the Worst Product Category We Have Ever Reviewed for Privacy")

[64] "All the car brands we reviewed, ranked from bad to worst for your privacy [info in image under heading]" (Mozilla Foundation, "It's Official: Cars Are the Worst Product Category We Have Ever Reviewed for Privacy")

[65] "That's right: every car brand we looked at collects more personal data than necessary and uses that information for a reason other than to operate your vehicle and manage their relationship with you." (Mozilla Foundation, "It's Official: Cars Are the Worst Product Category We Have Ever Reviewed for Privacy")

[66] "But then, most (84%) of the car brands we researched say they can share your personal data -- with service providers, data brokers, and other businesses we know little or nothing about. (Mozilla Foundation, "It's Official: Cars Are the Worst Product Category We Have Ever Reviewed for Privacy")

[67] "Worse, nineteen (76%) say they can sell your personal data." (Mozilla Foundation, "It's Official: Cars Are the Worst Product Category We Have Ever Reviewed for Privacy")

[68] (Mozilla Foundation, "It's Official: Cars Are the Worst Product Category We Have Ever Reviewed for Privacy")

[69] Chart: "Data your car-maker can collect…" (Mozilla Foundation, "What Data Does My Car Collect About Me and Where Does It Go?")

[70] ""Nissan earned its second-to-last spot for collecting some of the creepiest categories of data we have ever seen. It's worth reading the review in full, but you should know it includes your "sexual activity." Not to be out done, Kia also mentions they can collect information about your "sex life" in their privacy policy." (Mozilla Foundation, "It's Official: Cars Are the Worst Product Category We Have Ever Reviewed for Privacy")

[71] "Experts say car owners in sensitive industries or in political and government positions should exercise discretion. "If you are an engineer who is working on a sixth-generation fighter jet and you have a work phone that you are connecting to your personal vehicle, you need to be aware that by connecting these devices you could be allowing access to data on your mobile," says Joseph Jarnecki, a research fellow at the Royal United Services Institute thinktank." (The Guardian, "'Source of data': are electric cars vulnerable to cyber spies and hackers?")

[72]1. "The smartphone apps collecting driver data might not be obvious at first glance. One, Life360, is popular with parents who want to keep track of their families. MyRadar offers weather forecasts. GasBuddy can help you

find cheap fuel on a road trip. But all of these apps also have opt-in driving analysis features that offer insights into things like safety and fuel usage. Those insights are provided by Arity, a data broker founded by Allstate. Arity uses the data to create driving scores for tens of millions of people, and then markets the scores to auto insurance companies. “No one who realizes what they’re doing would consent,” said Kathleen Lomax, a New Jersey mother who recently canceled her subscription to Life360 when she found out this was happening. Arity says that insurers ultimately need consent to link a person’s driving data to their auto insurance rate. But in some cases, the request for smartphone data may appear as boilerplate contract language — “third party data and reports” — that online shoppers regularly click past without reading.” (NYT, “Your Driving, Tracked’)

2. “When a mobile device has been used after being connected to a vehicle’s IVI system, several types of data are also stored in the IVI system [17], [18]. Kang et al. [17] identified various artifacts left on Android-based IVI systems which had been connected to the smartphones of a vehicle’s driver. The artifacts include mobile devices’ name, call history, connection times, list of the connected devices, MAC addresses of the connected mobile devices, engine start time, driving routes, recent destinations, Global Position System (GPS) tracklogs, etc.” (Science Direct, “Forensic investigation of vehicle-related data in Android phones connected to In-Vehicle Infotainment systems”)

[73] “This seemingly innocuous act can expose a trove of sensitive information — like contact lists, voice and text messages, passwords, garage codes, GPS data, and medical and financial information.” (CNBC, “Connecting your phone to rental car infotainment system? There is a big, hidden privacy risk”)

[74] “Among the trove of data points were unique identifiers for my and Doug’s phones, and a detailed log of phone calls from the previous week. There was a long list of contacts, right down to people’s address, emails and even photos.” (Washington Post, “What does your car know about you? We hacked a Chevy to find out.”

[75] “Most Tesla vehicles come equipped with nine internal and external cameras. Information from your Tesla, delivered via location trackers, sensors and more, can paint an intricate picture of your life and movement.” (The Guardian, “Opt out: how to protect your data and privacy if you own a Tesla”)

[76] “Sensor Fusion – Tesla doesn’t just rely on the cameras. It also uses radar and ultrasonic sensors (like the ones used in parking sensors) to get a fuller picture of the environment. This combination of cameras and other sensors gives Tesla cars "sensor fusion," meaning the car’s computer can make better decisions based on multiple inputs.” (Yeslak, “Tesla Camera guide: Where they are, how they work and what they do”)

[77] All camera locations shown here: It’s Electric, “Where Are the Cameras Located on a Tesla (Quick Step-By-Step Guide) - 2024”

[78] WTHR, “Cars collect massive amounts of driving and personal data I 13 Investigates”

2. “All current Teslamodels have an interior camera mounted above the rear-view mirror. This camera monitors the driver's attention, especially when the autopilot is activated. You can display the interior camera on the screen by going to Controls > Service > Interior camera. It is also available via the Tesla app when Sentry Mode is activated and Sentry Mode Live Access is available in your region.” (Shop4Tesla, “Tesla Camera Guide”)

[79] “Tesla vehicles are equipped with a camera suite designed from the ground up to protect your privacy while providing advanced features such as Autopilot, Actually Smart Summon, and Autopark.” (Tesla privacy policy)

[80] “But between 2019 and 2022, groups of Tesla employees privately shared via an internal messaging system sometimes highly invasive videos and images recorded by customers’ car cameras, according to interviews by Reuters with nine former employees.” (Reuters, “Tesla workers shared sensitive images recorded by customer cars”)

[81] “Other images were more mundane, such as pictures of dogs and funny road signs that employees made into memes by embellishing them with amusing captions or commentary, before posting them in private group chats.” (Reuters, “Tesla workers shared sensitive images recorded by customer cars”)

[82] “Also shared: crashes and road-rage incidents. One crash video in 2021 showed a Tesla driving at high speed in a residential area hitting a child riding a bike, according to another ex-employee. The child flew in one direction, the bike in another. The video spread around a Tesla office in San Mateo, California, via private one-on-one chats, “like wildfire,” the ex-employee said.” (Reuters, “Tesla workers shared sensitive images recorded by customer cars”)

[83] “Some of the recordings caught Tesla customers in embarrassing situations. One ex-employee described a video of a man approaching a vehicle completely naked.” (Reuters, “Tesla workers shared sensitive images recorded by customer cars”)

[84] “One ex-employee also said that some recordings appeared to have been made when cars were parked and turned off. Several years ago, Tesla would receive video recordings from its vehicles even when they were off, if owners gave consent. It has since stopped doing so.
“We could see inside people's garages and their private properties,” said another former employee. “Let's say that a Tesla customer had something in their garage that was distinctive, you know, people would post those kinds of things.”” (Reuters, “Tesla workers shared sensitive images recorded by customer cars”)

[85] “About three years ago, some employees stumbled upon and shared a video of a unique submersible vehicle parked inside a garage, according to two people who viewed it. Nicknamed “Wet Nellie,” the white Lotus Esprit sub had been featured in the 1977 James Bond film, “The Spy Who Loved Me.” The vehicle’s owner: Tesla Chief Executive Elon Musk, who had bought it for about $968,000 at an auction in 2013. It is not clear whether Musk was aware of the video or that it had been shared.” (Reuters, “Tesla workers shared sensitive images recorded by customer cars”)

[86] “One ex-employee also said that some recordings appeared to have been made when cars were parked and turned off. Several years ago, Tesla would receive video recordings from its vehicles even when they were off, if owners gave consent. It has since stopped doing so.“We could see inside people's garages and their private properties,” said another former employee. “Let's say that a Tesla customer had something in their garage that was distinctive, you know, people would post those kinds of things.”” (Reuters, “Tesla workers shared sensitive images recorded by customer cars”)

[87] Tesla, “Customer Privacy Notice”

[88] 1.“Other Users/Occupants of your Vehicle. You promise to educate and inform all users and occupants of your Vehicle about the Services and System features and limitations, the terms of the Agreement, including terms concerning data collection and use and privacy, and the Nissan Privacy Policy. Neither we nor any Service Provider has any obligation to inquire about the authority of anyone using your Vehicle. it’s *your* responsibility to inform any passengers about the company’s data collection.” (Nissan USA, “NissanConnect® Services Powered by SiriusXM® Subscriber Terms and Conditions”)
2. This doesn’t appear to be US-specific, or at least US-exclusive. The same language is in the EU policy.

[89] “When it comes to disclosing who your car shares and sells your data to, vague language strikes again! The privacy policies we read usually only listed the categories of businesses they share with, like “service providers.” When they did name companies, the privacy policies often used more qualifying language like “such as,” “etc.” “and others,” “or similar” to make it clear that they’re only sharing a sample. Other times, the privacy policies only said that data would be shared or sold without saying to who.” (Mozilla Foundation, “What Data Does My Car Collect About Me and Where Does It Go?”)

[90] 1. “The companies on the receiving end of your data, our investigation has found, include car insurers and lenders that are partners in “telematics data exchanges,” which compile driving data on millions of drivers, thousands of data brokers that create personalized risk scores, companies selling infotainment and WiFi hotspot

products, and even local and state government agencies working on planning, traffic, and safety initiatives." (Consumer Reports, "Your Car May Be Spying On You. Here's How to Get It to Stop.")
2."Amico said that if your car uses Android Auto, for example: "Guess what? Google collects data from you as well." Google does not have an Android Auto-specific privacy policy or data disclosure, Amico said. The data can also potentially be sold by Google for targeted advertising. Google did not respond to a request for comment." (The Record, "Your car is probably harvesting your data. Here's how you can wipe it")

[91] 1. "Modern cars are internet-enabled, allowing access to services like navigation, roadside assistance and car apps that drivers can connect to their vehicles to locate them or unlock them remotely. In recent years, automakers, including G.M., Honda, Kia and Hyundai, have started offering optional features in their connected-car apps that rate people's driving. Some drivers may not realize that, if they turn on these features, the car companies then give information about how they drive to data brokers like LexisNexis. [...] Numerous people on the forums complained about spiking premiums as a result. A Cadillac driver in Palm Beach County, Fla., who asked not to be named because he is considering a lawsuit against G.M., said he was denied auto insurance by seven companies in December. When he asked an agent why, she advised him to pull his LexisNexis report. He discovered six months of his driving activity, including many instances of hard braking and hard accelerating, as well as some speeding. [...] According to the report, the trip details had been provided by General Motors — the manufacturer of the Chevy Bolt. LexisNexis analyzed that driving data to create a risk score "for insurers to use as one factor of many to create more personalized insurance coverage," according to a LexisNexis spokesman, Dean Carney. Eight insurance companies had requested information about Mr. Dahl from LexisNexis over the previous month." (NYT, "Automakers Are Sharing Consumers' Driving Behavior With Insurance Companies")
2. "Don Butler, Ford's executive director of connected vehicle and services, agrees. "We only share mileage information with an insurance company partner at this point, not driver behaviour," he says. "We'd tread very carefully in this area."" (BBC, "Is your connected car spying on you?")

[92] "Legal compliance and lawful requests: We may disclose your information in accordance with applicable law to comply with applicable legal or regulatory obligations, including as part of a judicial proceeding, in response to a subpoena, warrant, court order, or other legal process, or to cooperate with investigations or lawful requests, whether formal or informal, from law enforcement or government entities." (Hyundai, "Privacy Policy")

[93] "At the federal level, there is no comprehensive "GDPR" equivalent that gives consumers sweeping data rights. Rather, there are a handful of laws that are more limited in scope or apply to a specific sector. [...] In fact, the only reason we even know about how Nissan shares and sells personal data (thanks again, Nissan, for your utmost transparency) is because stronger state privacy laws like the California's Consumer Privacy Act made it the law for companies to tell us how they are using our data in their privacy policies. Despite this progress, a majority of people are left without laws in their own states, many existing state privacy laws are weak, and the patchwork of conflicting rules makes compliance harder." (Mozilla Foundation, ""Is This Even Legal?" Our Top Cars-And-Privacy Question, Answered.")

[94] "Art. 6 GDPR: Lawfulness of processing. 1. (Processing shall be lawful only if and to the extent that at least one of the following applies…" GDPR.EU, "General Data Protection Regulation")

[95]"Already facing significant headwinds, VW has now been hit by a data protection nightmare. Location data from 800,000 electric vehicles and contact info from owners was accessible unprotected on the internet. And the company didn't even know about it. [...] The incident goes far beyond just Cariad and VW. Many modern cars contain a three-figure number of sensors and they collect a massive amount of data. Usually, only the carmakers themselves know precisely what information is collected and how much. A random sampling taken by the ADAC, Germany's roadside assistance association for car-owners, involving four models from BMW, Renault and Mercedes found that the Mercedes B-Class vehicles, to take one example, communicates its current location back to Mercedes every two minutes. Additional information reported includes the odometer reading, fuel level, tire pressure and number of seatbelts being used, all of it information that can be used to draw conclusions about driving style. The BMW i3 analyzed in the study transfers a number of datapoints each time it is turned off, including detailed information regarding the battery in addition to the locations of the previous 16 charging stations used." (Spiegel International, "Massive Data Breach at VW Raises Questions about Vehicle Privacy")
"Automakers are slowly losing their grip on the data. In May, a regional court in Cologne ruled that it was no longer permissible to prevent independent car repair shops from accessing data necessary to make repairs.

Unaffiliated mechanics had complained that some producers required them to purchase expensive licenses to access vehicle data and fault memory." (Spiegel International, "Massive Data Breach at VW Raises Questions about Vehicle Privacy")

[96] "All 25 car brands we researched earned our *Privacy Not Included warning label -- making cars the official worst category of products for privacy that we have ever reviewed." (Mozilla Foundation, "It's Official: Cars Are the Worst Product Category We Have Ever Reviewed for Privacy")

[97] Conclusion drawn from quote that follows.

[98] The online privacy policies of both Tesla and Nissan, for example, both contain some of the most egregious language mentioned in the Mozilla article—Tesla's opt-out option will still brick your car, and Nissan USA still makes you promise to inform your friends about the contents of the policy.

[99] https://www.google.com/maps/place/Coquihalla+Pass/@49.6000254,-121.0706425,4237m/data=!3m2!1e3!4b1!4m6!3m5!1s0x5483c3311048cfe3:0xdb9074a267787826!8m2!3d49.6!4d-121.05!16s%2Fm%2F026cz7w?entry=ttu&g_ep=EgoyMDI1MDkxNy4wIKXMDSoASAFQAw%3D%3D

[100] "There's plenty of evidence of non-standard controls causing confusion. Some involve near misses: Kelly Funkhouser, associate director of vehicle technology at Consumer Reports's Auto Test Center, narrowly avoided an accident while testing a Rivian R1S: ""Traffic was slowing to a crawl, and someone cut in front of me. I wanted to make sure the ACC [adaptive cruise control] was off, so I pushed upward on the shifter stalk with my finger, which is how you deactivate cruise," Funkhouser says. "Instead of a quick flick, I held it up for a couple of seconds, which is when the SUV started backing up. The vehicles behind me were speeding up as I started to go backward, so it certainly caused a moment of panic." (Consumer Reports, "How to Safely Use Unconventional Car Shifters")

[101] imdb.com/de/name/nm0947338/?reasonForLanguagePrompt=browser_header_mismatch

[102] "In April 2016, the company had recalled 1.1 million vehicles across the world because of concerns that they could roll away after drivers exit." (BBC, "Anton Yelchin: Star Trek actor's parents settle legal case with car firm")

[103] " Although the Monostable gearshift has the familiar appearance of a conventional console mechanical gearshift assembly, it has an unfamiliar movement that does not provide the tactile or visual feedback that drivers are accustomed to receiving from conventional shifters. Consequently, the driver must take additional time to verify that the desired gear position was achieved by checking the PRNDL display on the shift knob or the Electronic Vehicle Information Center (EVIC) display." (US Department of Transportation, "ODI Resume")

[104] The Verge, "Why Chrysler's Recalled Gear Shift Is So Bad")
"Here's how FCA addressed the problem to dealers:"The vehicles ... deliver warning chimes and alert messages if their driver-side doors are opened while their engines are still running and "PARK" is not engaged. However, investigation suggested these measures may be insufficient to deter some drivers from exiting their vehicles without selecting "PARK," so FCA US will enhance the warnings and transmission-shift strategy on these vehicles." (NPR, "Vehicle Blamed For 'Star Trek' Actor's Death Was Subject Of Recall")
"To give you an example, here's how FCA described the shifter problem. "The vehicles affected by this recall are equipped with electronic shift levers that return to the same position after each manipulation. Gear-selection is conveyed to the driver by multiple sets of indicator lights, not gear-selector position, and unless due care is taken, drivers may draw erroneous conclusions about the status of their vehicles."
(NPR, "Vehicle Blamed For 'Star Trek' Actor's Death Was Subject Of Recall")
"According to FCA's DIR [Defect Information Report], "The existing strategies built into these vehicles to deter drivers from exiting the vehicle after failing to put the transmission into PARK have not stopped some from doing so. Drivers erroneously concluding that their vehicle's transmission is in the PARK position may be struck by the

vehicle and injured if they attempt to get out of the vehicle while the engine is running and the parking brake is not engaged." (US Department of Transportation, "ODI Resume")

[105] "The vehicles affected by this recall are equipped with electronic shift levers that return to the same position after each manipulation. Gear-selection is conveyed to the driver by multiple sets of indicator lights, not gear-selector position, and unless due care is taken, drivers may draw erroneous conclusions about the status of their vehicles. The vehicles also deliver warning chimes and alert messages if their driver-side doors are opened while their engines are still running and "PARK" is not engaged. However, investigation suggested these measures may be insufficient to deter some drivers from exiting their vehicles without selecting "PARK," so FCA US will enhance the warnings and transmission-shift strategy on these vehicles." (Stellantis, "Statement: Shift Strategy")

[106] "In June 2016, Yelchin parked his 2015 Jeep Grand Cherokee on the steep hill that led down to his Studio City home in Los Angeles, and then walked down the slope toward his house. But Yelchin's car was not in park." (All That's Interesting, "Inside The Sudden Death Of Anton Yelchin, The Star Trek Actor Killed By A Faulty Car")

[107] "Anton Yelchin, who was best known for playing Chekov in the new Star Trek films, has been killed by his own car at his home in Los Angeles, police say. It struck him after rolling backwards down the steep drive at his Studio City home, pinning him against a brick postbox pillar and a security fence." (BBC, "Anton Yelchin, Star Trek's Chekov, killed by his own car")

[108] 1."The parents of Star Trek actor Anton Yelchin have settled their legal case against the makers of his car, which rolled downhill and killed him in 2016. [...] His parents filed a wrongful death case against Fiat

[109] "Failure Report Summary [table]" (US Department of Transportation, "ODI Resume")
All investigation documents here.

[110] "Deaths and MV Rates, 1913–2023 [chart]," (NSC, "Car Crash Deaths and Rates")

[111] "Everett, Massachusetts (50,318)" (United States Census Bureau, "Population Rebounds for Many Cities in Northeast and Midwest")

[112] "Many of the infotainment features in most 2017 vehicles are so distracting they should not be enabled while a vehicle is in motion, according to a new study by University of Utah researchers. The study, led by University of Utah Psychology Professor David L. Strayer, found In-Vehicle Information Systems take drivers' attention off the road for too long to be safe." (University of Utah, "Caution ahead: The growing challenge for drivers' attention")

[113] David Strayer, professor of cognitive and neural science, University of Utah: "We've actually seen fatalities going up, and that's fatalities adjusted for per million miles driven. So something's going on that's actually making our roads less safe. And it corresponds with kind of the increased prevalence of cell phones and touchscreens and all electronics in the vehicle." (CNBC, 6:19, "How Safe Are Touchscreens In Cars Like Tesla")

[114] "Two repeated-measures experiments were conducted to measure driver performance when using either Android Auto or Apple CarPlay while driving. Participant's reaction time, eye gaze behaviour and vehicle control measures were analysed for evidence of the effect of using these in-vehicle infotainment systems on driver performance." (IAM RoadSmart, "Interacting with Android Auto and Apple CarPlay when driving: The effect on driver performance")

[115] "Forty-six participants were recruited using an opportunistic sampling approach; there were six cases of simulator sickness (5 females and 1 male). For the 20 participants who completed the Android Auto trial, the average age was 45 years (range 20 to 77; sd=18); 15 were male and 5 were female. The 20 participants who completed Apple CarPlay trial had a mean age of 37 years (range 20

to 57; sd=9); 13 were male and 7 were female." (IAM RoadSmart, "Interacting with Android Auto and Apple CarPlay when driving: The effect on driver performance")

[116] "- Controlling the vehicle's position in the lane and keeping a consistent speed and headway to the vehicle in front suffered significantly when interacting with either Android Auto or Apple CarPlay, particularly when using touch control" (IAM RoadSmart, "Hey Siri! Are the latest vehicle infotainment systems reducing road safety more than cannabis or alcohol?")

[117] "- Participants failed to react as often to a stimulus on the road ahead when engaging with either Android Auto or Apple CarPlay – with reaction times being more than 50 per cent slower." (IAM RoadSmart, "Hey Siri! Are the latest vehicle infotainment systems reducing road safety more than cannabis or alcohol?")

[118] "- Reaction time to a stimulus on the road ahead was slower when selecting music through Spotify while using Android Auto and Apple CarPlay (via touch control rather than voice control), compared to texting while driving (based on previous studies)"" (IAM RoadSmart, "Hey Siri! Are the latest vehicle infotainment systems reducing road safety more than cannabis or alcohol?")

[119] "For both touch and voice control with both systems, reaction times were greater than established benchmarks of the effect of alcohol consumption (at the legal limit) and cannabis use on reaction time when driving." (TRL, "Interacting with Android Auto and Apple CarPlay when driving: The effect on driver performance")

[120] "Vi Bilägare gathered eleven modern cars from different manufacturers at an airfield och measured the time needed for a driver to perform different simple tasks, such as changing the radio station or adjusting the climate control. At the same time, the car was driven at 110 km/h (68 mph). We also invited an "old-school" car without a touchscreen, a 17-year-old Volvo V70, for comparison." (Vi Bilägare, "Physical Buttons Outperform Touchscreens In New Cars, Test Finds")

[121] "Vi Bilägare gathered eleven modern cars from different manufacturers at an airfield och measured the time needed for a driver to perform different simple tasks, such as changing the radio station or adjusting the climate control." (Vi Bilägare, "Physical Buttons Outperform Touchscreens In New Cars, Test Finds")

[122] "The easiest car to understand and operate, by a large margin, is the 2005 Volvo V70. The four tasks is handled within ten seconds flat, during which the car is driven 306 meters at 110 km/h." (Vi Bilägare, "Physical Buttons Outperform Touchscreens In New Cars, Test Finds")

[123] "At the other end of the scale, Chinese electric car MG Marvel R performs far worse. The driver needs 44.6 seconds before all the tasks are completed, during which the car has travelled 1,372 meters – more than four times the distance compared to the old Volvo." (Vi Bilägare, "Physical Buttons Outperform Touchscreens In New Cars, Test Finds")

[124] 1. "The car came to rest more than 70 metres away, on the opposite side of the road, leaving a trail of wreckage. According to witnesses, the Model S burst into flames while still airborne. Several passersby tried to open the doors and rescue the driver, but they couldn't unlock the car. When they heard explosions and saw flames through the windows, they retreated. Even the firefighters, who arrived 20 minutes later, could do nothing but watch the Tesla burn." (The Guardian, "'The vehicle suddenly accelerated with our baby in it': the terrifying truth about why Tesla's cars keep crashing")
2. "*Auch komplizierte Türgriffe des Tesla Thema im Prozess - die Opfer verbrannten im Auto"* (rbb24, ""Unser Verlust wird ein Leben lang bleiben")

[125] "Under the new rating scheme, which is due to come into force from January 2026, manufacturers won't be able to achieve the highest safety ratings if they don't provide proper, physical switches for certain functions including indicators, hazard lights, sounding the horn, operating windscreen wipers and activating the eCall SOS

function." (European Transport Safety Council, "Cars will need buttons not just touchscreens to get a 5-star Euro NCAP safety rating")

[126] "The European New Car Assessment Program (NCAP), which Avery represents, is a nonprofit not formally affiliated with a government or automaker. However, the independent research body is backed by several European Union governments, and Tesla, Volvo, VW, and BMW advertise their high NCAP scores." (Hagerty, "Buttons Are Best, Says European Safety Org, Years After Everyone Knew It")

[127] 1. Survey was published in this press release.
2. "Yet research last year by Britain's What Car? magazine found that the vast majority of motorists prefer dials and switches to touchscreens. A survey of 1,428 drivers found that 89 percent preferred physical buttons." (Wired, "Rejoice! Carmakers Are Embracing Physical Buttons Again")
3 . "In a survey of 1,428 drivers, it found that 89 per cent prefer having physical buttons, knobs and dials in their cars over touchscreen systems that can be fidgety, time-consuming and sometimes infuriating to operate - especially when on the move and trying to concentrate on the road ahead." (This is Money, "Car makers with most distracting touchscreens revealed as drivers and safety bodies say they want more buttons in vehicles")

[128] "The study by What Car?, the consumer review magazine, also found that 60 per cent of prospective buyers would be put off buying a car that prioritised touchscreen controls over physical switches." (The Sunday Times, "Drivers prefer buttons to 'distracting' touchscreens, study finds")

[129] "The Maverick is one example of a contradiction that's become common in the auto industry: Cheap new vehicles, the type of entry-level car favored by young buyers and many in the middle class, have become vanishingly rare, allowing automakers to hike prices on the scarce number that remain." (The Hustle, "Why the $25,000 car is going extinct")

[130] "Automakers are currently prioritizing luxury vehicles over entry-level sedans and crossover SUVs to get the most return for their investment on limited chips." (The Zebra, "Gen Z are the most likely to pay for their car in cash")

[131] "In February 2025, the share of overall new auto sales under $25k was 4.8%, according to the automotive pricing source Edmunds, down from 23% during the same month in 2019." " (The Hustle, "Why the $25,000 car is going extinct")

[132] "The Maverick is one example of a contradiction that's become common in the auto industry: Cheap new vehicles, the type of entry-level car favored by young buyers and many in the middle class, have become vanishingly rare, allowing automakers to hike prices on the scarce number that remain." (The Hustle, "Why the $25,000 car is going extinct")

[133] "With fewer budget-friendly vehicles on the market, automakers that still offer them have taken advantage of the low supply by raising prices — as evidenced by the above-average price increases across the vehicle lineups of Hyundai, Kia, and Toyota." (The Hustle, "Why the $25,000 car is going extinct")

[134] "Back in the early 20th century, affordable cars were key to the widespread adoption of the automobile. But in modern times they've been a drag for automakers for a simple reason: nice, expensive vehicles carry higher profit margins." (The Hustle, "Why the $25,000 car is going extinct")

[135] "Given this preference, dealers can stock up on expensive models while keeping a low supply of cheaper models, as with the Maverick. They can also prioritize selling cars with higher trim levels — more elaborate features — that cost thousands more than a base trim and carry higher margins." (The Hustle, "Why the $25,000 car is going extinct")

[136] “Half of Americans purchased their most recent car through financing: Across all respondents, 1 out of 2 purchased their most recent vehicle through an auto loan. Auto loans are the third largest consumer credit market in the United States, and Americans currently have a total of $1.4 trillion in outstanding auto debt. This is double the amount of loan debt 10 years ago, and it’s only expected to increase in the future along with rising auto prices.“ (The Zebra, “Gen Z are the most likely to pay for their car in cash”)

[137] 1. “Dominating the center stack is an available seven-inch touchscreen Display Audio system with — get this — a physical volume knob, which replaces an infuriating touch slider. For even more convenience, this arrangement also supports Apple CarPlay and Android Auto.” (AutoGuide, “All-New 2017 Honda CR-V Debuts With Optional Turbo Engine, Standard Volume Knob”)
2. Reddit thread, “Everyone complained about the lack of a volume knob (which doesn't bother me), but I hate that there's no Play/Pause button on the steering wheel!”

[138] “Back in 2015 BMW unveiled a function called gesture control for the then-new 7 Series. You could spin your finger to adjust the volume, flick left or right to change a song, and other features best served by a button. The Bavarian automaker has apparently realized this, as it's just announced at CES it's killing gesture control.” (Motor1.com, “BMW Is Killing Off That Weird Feature You Never Used: Gesture control wasn't very popular, as it turns out.”)

[139] “All future Volkswagen models will feature physical controls for the most important functions, design chief Andreas Mindt has said.” (Autocar, “Volkswagen reintroducing physical controls for vital functions”)

[140] (Autocar, “Volkswagen reintroducing physical controls for vital functions”)