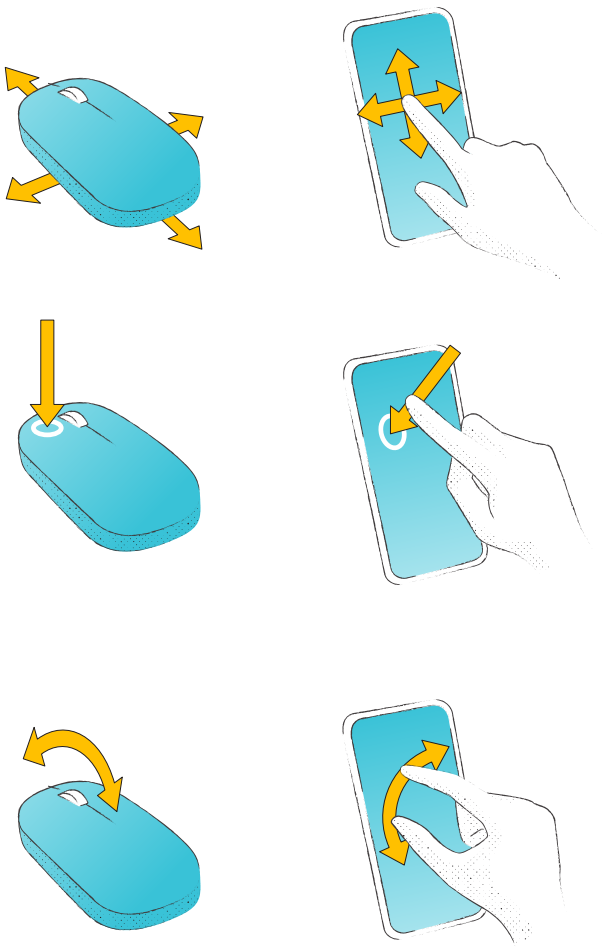
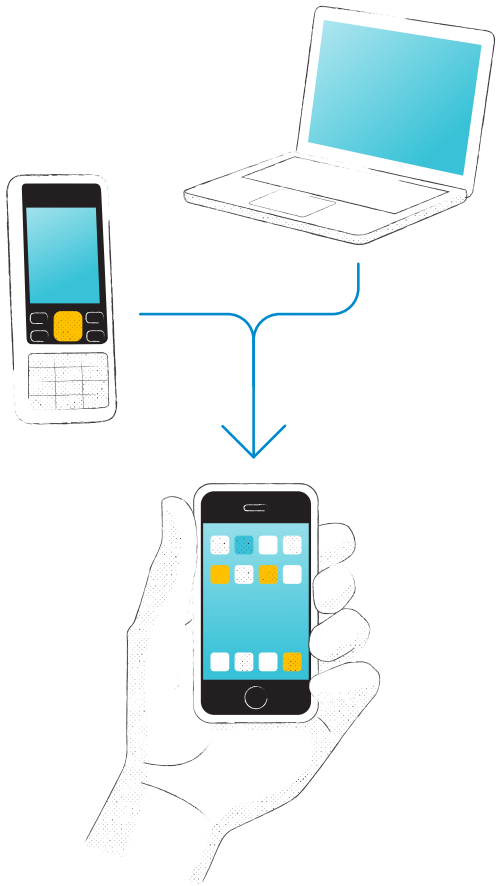
EPAM CONTINUUM

Evolving the UX Paradigm: How Automakers Can Outsmart the Smartphone

Smartphones have changed user expectations of technology, making the automotive six-year manufacturing cycle feel glacial. Car companies need to change.

Cars are getting lapped by smartphones. Automotive companies should *own* the digital driving experience, but have been too slow to take control of this highly contested space. Going forward, the car's value proposition must expand beyond transportation. The car needs to evolve into a conduit for services. This evolution starts with the user experience– a new paradigm that makes the coordination between the driver, the car, the cloud, and other smart devices effortless. It's not too late for car companies to catch up, but in order to do so they need to: (a) develop a new mindset, one oriented toward creating better digital experiences; and (b) start developing the connected cars that intelligently interface with their user's preferred digital ecosystem.





A UX paradigm shift occurs when we re-think the best way for users to interact with digital technology. We're there now, in the digital cockpit.

The smartphone, with its connectivity, versatility, and accessibility, has established well-understood interaction patterns and mental models for users. By comparison, the car is a far more challenging UX environment. Driving requires a significant cognitive load, making many of the interactive norms of other devices inappropriate or distracting. With the introduction of Level 3 autonomy ("hands off, eyes on," in which the vehicle handles driving tasks when it can but requires a human driver to take over when needed), drivers will start monitoring, rather than piloting, the car, opening up more cognitive bandwidth. Given that the average car is owned for roughly seven years, the UX paradigm needs built-in flexibility as new features are introduced with over-the-air updates.

The Hierarchy of Driver Needs

1. THE HIERARCHY OF DRIVER NEEDS

Understanding how to create a new user experience in the car requires understanding driver needs. A hierarchy of needs prioritizes how new features and the automobile need to feel to the driver, starting from the most basic requirements (safety and reliability or ease and convenience). Note: By only addressing the needs at the bottom of the pyramid, cars fail to meet their potential—and those that don't meet the foundational needs lose their core value.

3. INTEGRATION

As technology becomes omnipresent and blurs the lines between experiences, cars that differentiate are the ones that understand the user's ecosystem and best integrate within it.

2. ENJOYMENT

As car ownership became a lifestyle for consumers, vehicles that delivered on ease, convenience, comfort, and fun elevated driving from a task to an *experience*. Many car manufacturers define their branding around these needs.

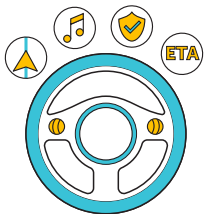
1. UBIQUITY

As cars became more popular, the broad introduction of autos that could safely and reliably transport people separated the manufacturers who succeeded from those who failed. Even today, manufacturers that fail to deliver on safety and reliability suffer.

The Essential UX Principles

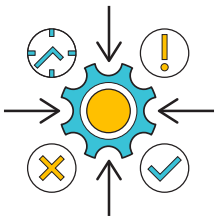
2.THE ESSENTIAL UX PRINCIPLES

These UX principles describe and direct the core values and qualities of a digital and connected driving experience. They ensure a better, more consistent experience for drivers. They must be understood before redesigning can commence.



1. OPTIMIZE

The car should improve driver performance (navigation, situational awareness) and provide a margin of safety.

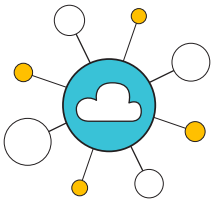


2. CONTEXTUALIZE

The car should surface relevant information and tools to interact with, only when it matters. In some cases, it will provide a recommended course of action.

3. PERSONALIZE

The car should know, anticipate, and learn the driver's habits, preferences, and routines (commute, weekend trip, errands).



4. HARMONIZE

The car should be an extension of the driver's ecosystem that seamlessly works with the other technologies in their life.

5. SELF-ANALYZE

The car should keep track of its status and, when needed, inform the driver of preferred intervention (maintenance, fuel level).

The Ways Cars Communicate to Drivers

3. THE WAYS CARS COMMUNICATE TO THE DRIVER

Cars communicate information to the driver in a variety of ways. Some are visual, while others are tactile or auditory. The increase in features and the breadth of information available in new cars means that a driver can easily become overwhelmed with beeps and flashing information, unable to decipher what they mean or how critical they are. Currently, the information that cars display follows old analog paradigms. Most information is persistent and always displayed to the driver. This visual and auditory clutter creates a cognitive burden. Different forms of communication should be broken out to reduce the cognitive load of drivers.

For example, current dashboards display a persistent and glanceable digital readout that estimates the miles until empty in addition to fuel level. The future version should provide a glanceable readout that emerges only when refueling/charging is needed soon as well as directions to the nearest/preferred station.

DIFFERENT INFORMATION TYPOLOGIES

Information that Always Matters

The act of driving requires drivers to know where they are on the road, what's around them, and how to navigate to their destination. This isn't necessarily information provided by the car, but a reminder that drivers need to see as much as they can without obstruction.

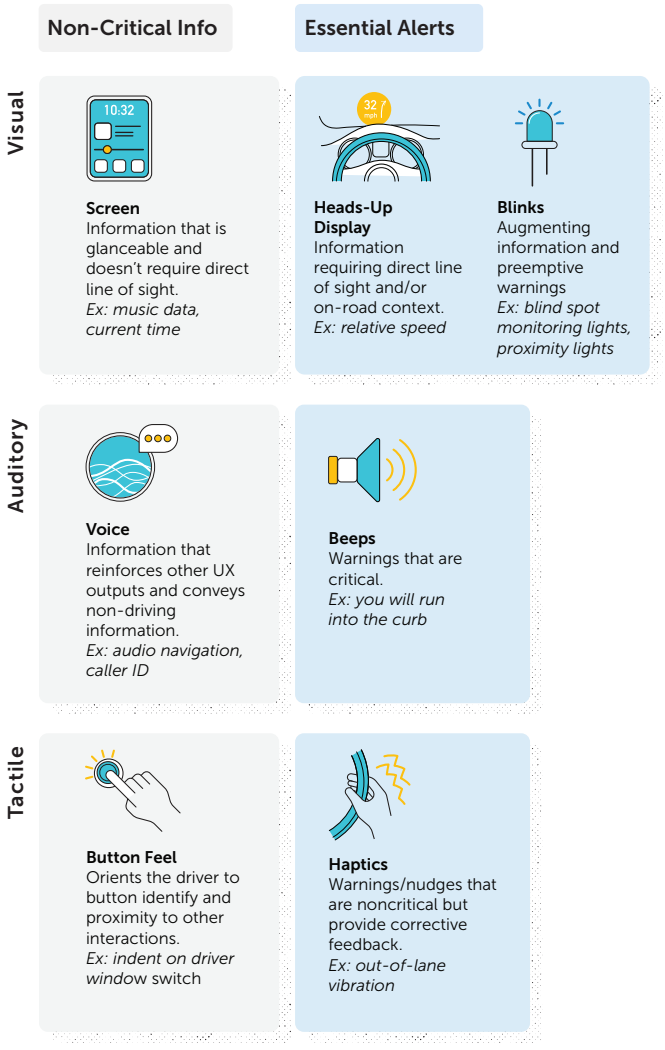
Information that Never Matters

Some information displayed to drivers is a holdover from analog systems or are proxies for problems and other information. For example, the tachometer takes up valuable visual real estate but is rarely utilized when driving modern cars.

Information that Matters When Relevant

The majority of information displayed to drivers is unnecessarily persistent. Traditionally displayed information needs to be contextualized. Drivers, for instance, don't need to know their speed; they need to know if they're *speeding* or not.

TYPES OF INFORMATION OUTPUTS



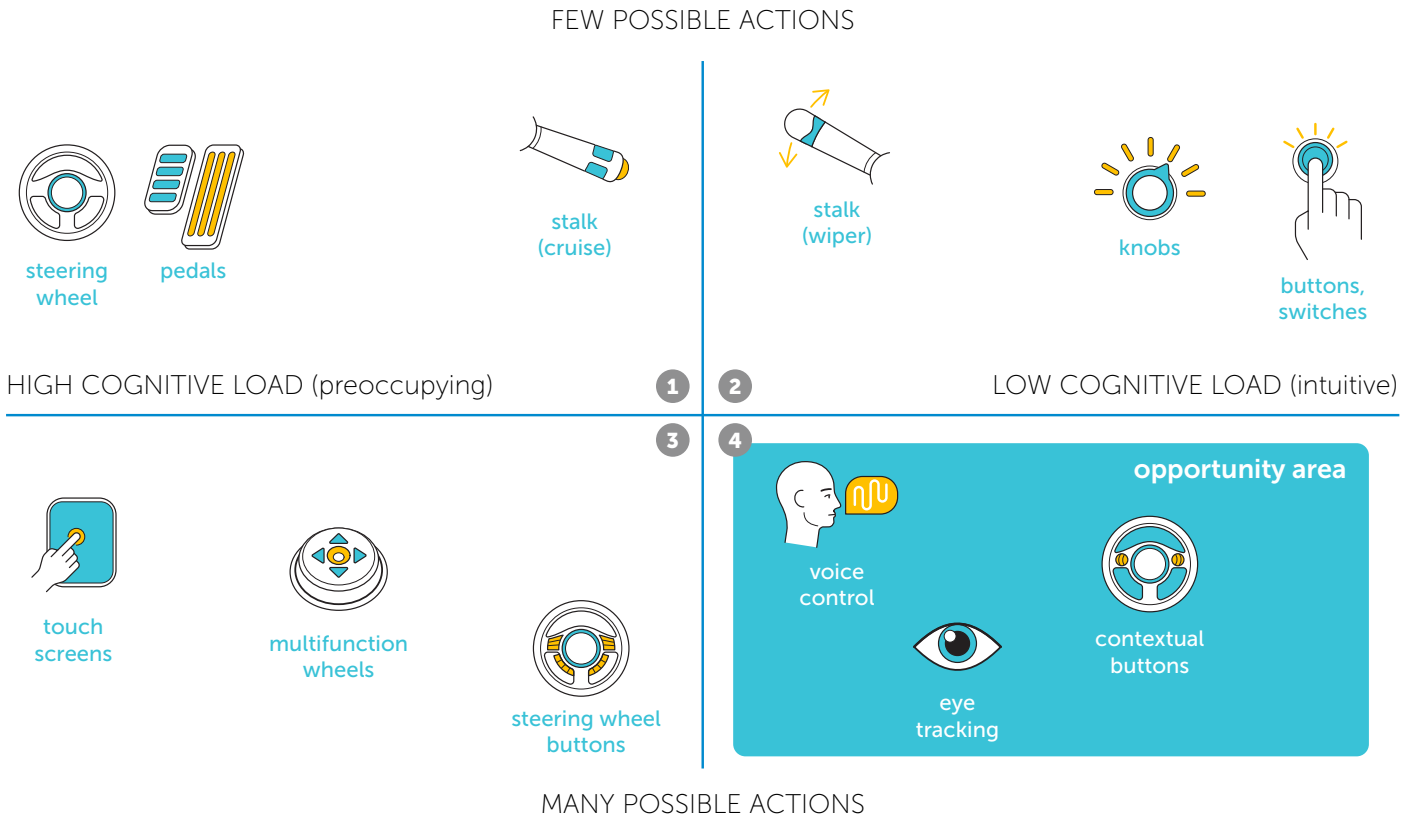
The Ways Drivers Can Communicate with Cars

4. THE WAYS DRIVERS CAN COMMUNICATE WITH CARS

Typically, when a new automobile feature is created, an attendant physical button is positioned somewhere within arm's reach. The precise location roughly depends on a combination of its importance to driving and frequency of use. The last few decades have brought digitization into the mix, creating new challenges and opportunities in how drivers communicate with the car.

1. Vehicle Controls
The basics of driving are interactions that require a high cognitive load but simple motions to execute within the car. For example, steering is a cognitively demanding task, but the wheel itself has only two actions possible (clockwise and counterclockwise).

2. Analog
These interactions require a low cognitive load and involve simple interaction points, such as switches, knobs, rockers, and buttons. Features with a set range, such as windshield wipers or music volume, utilize more action-dense touchpoints such as knobs and stalks. For a time, these interfaces and their consistency were necessary. It was essential that a driver could operate them intuitively from muscle memory.



3. Digital
With the advent of digital, cars began to employ joysticks and multifunction wheels as well as touchscreens. While these interaction points allow for the introduction of virtual menus and more granular control, engaging with them requires a high cognitive load. Poorly implemented touchscreen controls have resulted in a backlash because no one wants to take their eyes off the road to hunt through menus to adjust the temperature.

4.The Future Is Smart
Many car interactions are merely digitized versions of what was previously analog. By embracing software, voice controls, and remappable inputs—inputs that change function depending on the context—carmakers can design interactions that reduce dashboard clutter, decrease cognitive load, and allow for a wide range of actions. Reducing dashboard clutter is a challenge, but possible through the use of interoperable software running beneath the surface. Smart inputs will make using connected services viable in a driving environment.

The Ways to Deploy Emerging Technologies with Purpose

1. Spatial Audio and Subvocal Recognition
Spatial audio creates distinct audio zones within the car. Subvocal recognition would allow drivers and passengers to interact with the car without shouting. These technologies also permit the driver and passengers to experience different forms of content simultaneously. Combined with active noise cancellation, the cockpit can recognize and filter the outside environment to create a calm interior. Similarly, subvocal recognition would permit drivers and passengers to interact with their respective AI assistants without the awkwardness of multiple people talking in the car.

2. Heads-Up Displays (HUDs)
HUDs are not new—they're common in many modern cars—but by expanding them to occupy more of the windshield, they could enable ambient display of information: Extremely simplified proxies for useful contextual information. For example, a yellow glow gradating to orange along the bottom edge, might gently indicate how far above the speed limit a driver is without requiring them to look away from the road. To augment navigation, a soft green on the left or right edge of the windshield would increase in intensity, then pulse as a driver approaches a turn. Augmented reality windshields could overlay virtual objects and markers in the roadway. When pulling into a parking lot, a large virtual arrow might appear above the nearest empty spot, reserving the spot and reducing search time.

3. Remappable Inputs and Finger Force Detection
Remappable inputs can help declutter a car's interior. In a similar vein, finger force detection measures the fingers' exerted forces in single-axis direction, and in a dual-axis direction by the thumb. Both will clean up car dashboards by providing fewer inputs that are capable of doing more. Additionally, by changing function to the relevant context, it reduces the cognitive load for drivers and the need to "find" the right input in a crowded cockpit.

4. Eye Tracking and Biometric Monitoring
Eye tracking could reveal glanceable information when the driver is "looking for it" and, alternatively, hide it to reinforce when the driver needs to pay closer attention to the road. Biometric monitoring—tracking the unconscious changes of human traits and body parameters—can also help drivers be safe. For example, heartrate monitoring, combined with galvanic skin response tailored to the driver, could show a proxy for stress level.

These data points could consist of combined sensor data about the present driving environment to infer if interventions are needed. By further working with the user's digital ecosystem, the car might access sleep tracking data from the driver's wearable, enabling the car to recommend a more conservative driving style if, say, the driver only slept four hours the previous night.

The Way Ahead

How do we move beyond the idea that transportation is simply a means from A to B?

The driving system of the future will create an experience that ventures beyond mere transportation, as software and connected services create new value for drivers. Smartphones have already subsumed in-car services, such as music, communication, and navigation. Taking those back and capturing the potential of connected car services requires auto manufacturers to take the lead when partnering with software providers. Using a phone while driving is a poor, even dangerous, UX. A compelling UX paradigm designed for driving, paired with robust connected services, can turn the car into a powerful, valuable new platform.

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