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In-car HMI UX Evaluations

#635

In-Car HMI UX Evaluation & Benchmarking

Peugeot 408 GT

In this edition, the UX team is testing the Peugeot 408 GT.

The Peugeot 408 returns a strong score for user experience, finishing middle of the pack compared to 2022 and 2023 vehicles, but achieves a disappointing score of C+ for functionality finishing equal to the lowest ranked vehicle for functionality in 2022 and lowest overall in 2023.

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COVERAGE



GLOBAL



NA



CHINA



EUROPE

FREQUENCY



ANNUALLY



QUARTERLY



6 CARS PER YEAR

PUBLICATION FORMAT



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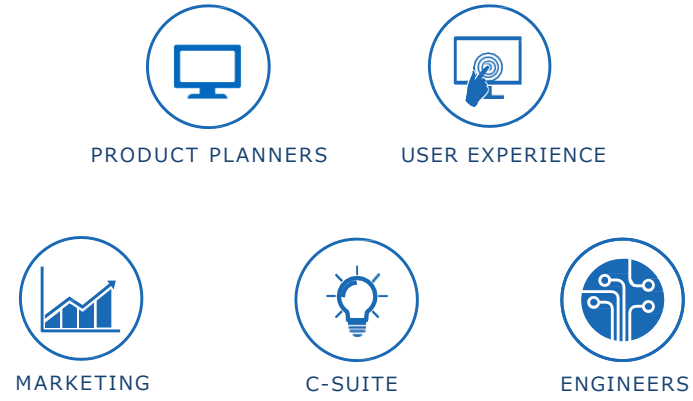
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Scoring

- > **Features and functionality:** evaluating whether the solutions provide features that customers expect, need and solve problems (or provide a wow factor).
- > **Reliability/stability:** evaluating the repeated usability and whether the users can have a similar (positive) experience each time.
- > **Usability:** evaluating whether the features available are easy to learn and use. This considers areas such as ergonomics, legibility, usability characteristics and how the system implements the various features.
- > **Perceived quality:** evaluating the potential perception in quality of the HMI components and how this contributes to the overall customer experience.

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Introduction

Aim of this report

Welcome to the 2023 HMI benchmarking report series. This report has been created to provide a fair, unbiased and objective view of the latest in-vehicle HMI solutions in the US, European, and Japanese markets. Evaluations are carried out by SBD usability experts with a deep understanding of CASE domains such as the Connected Car and ADAS and autonomy domains.

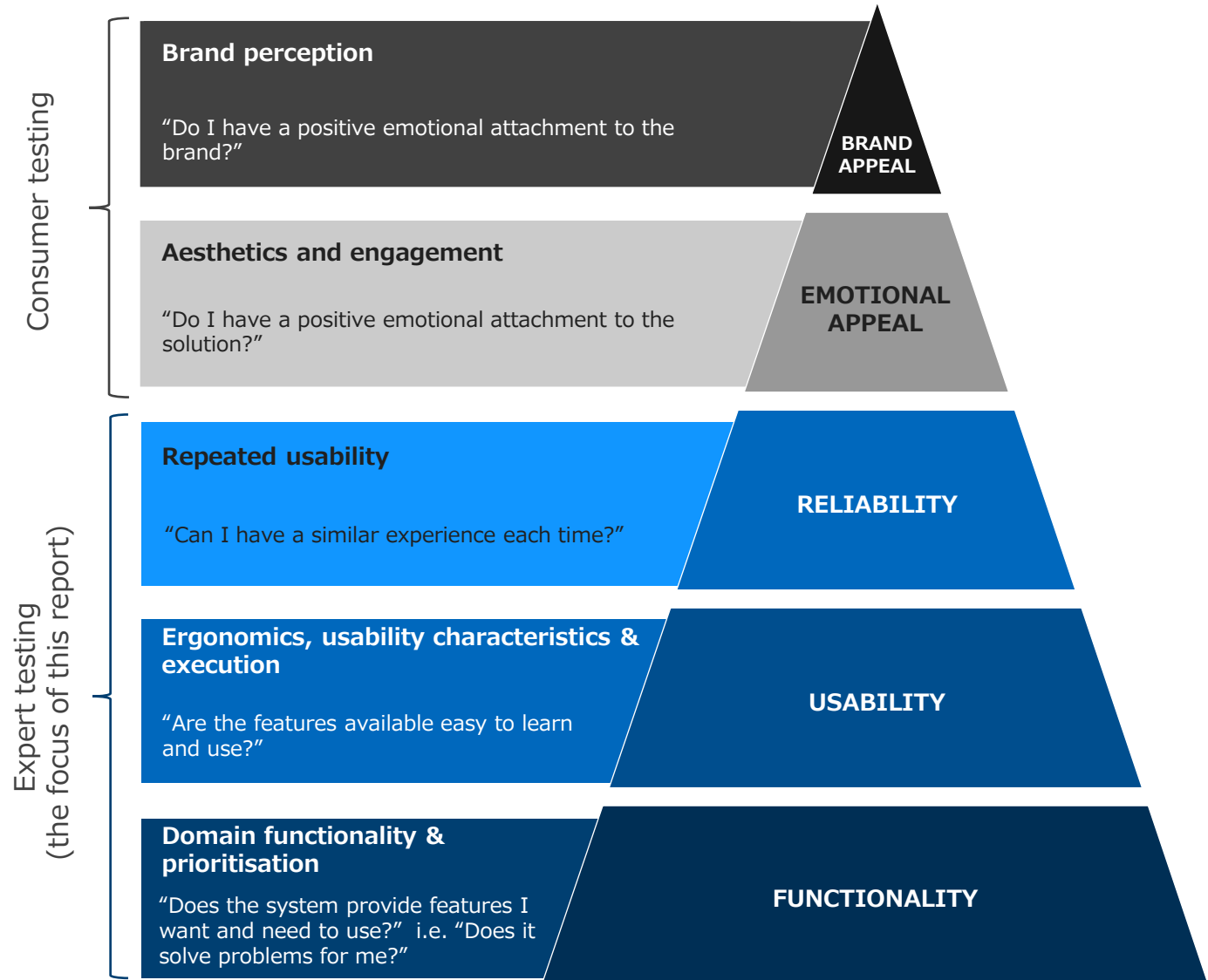
One of the core goals of these studies is to provide a true indication of what the final customer experience of each solution could be. To do this, evaluations are focused on providing scoring and analysis in the following areas:

- **Features and functionality:** evaluating whether the solutions provide features that customers expect and need, and solve problems (or provide a wow factor)
- **Usability:** evaluating whether the features available are easy to learn and use. This considers areas such as ergonomics, legibility, usability characteristics and how the system implements the various features
- **Reliability/stability:** evaluating the repeated usability and whether the users can have a similar (positive) experience each time
- **Perceived quality:** evaluating the potential perception in quality of the HMI components and how this contributes to the overall customer experience

SBD supports clients throughout the development of new HMI and products from a relatively simple companion app to a more complex multi-domain infotainment solution. The methodologies used in these reports consider many years of experience with consumer testing and custom client projects to provide a fair and, as much as possible, objective methodology.

All viewpoints and analysis within the report are aimed at defining areas of concern through a data driven approach. This report aims to benchmark and score solutions whilst also being able to provide actionable recommendations to design and development teams.

Please note that due to the ever-evolving automotive technology market, SBD updates its methodology each year, but does not update scores from the previous years. Therefore, please assume a slight drop in scores for both user experience (UX) and functionality from the previous year.



SBD's view on the hierarchy of needs for CX benchmarking



Scope of report: focus on in-car HMI evaluations

The scope of evaluations in this report are constrained to the in-car HMI experience, in both static and dynamic conditions. One notable element is driver distraction which SBD covers at only a high level in this study as carrying out a full driver distraction evaluation requires biometrics test equipment to ensure the collected data is unbiased and objective.



A full evaluation of the end-to-end customer experience is not within scope of this report, but it is something which SBD has many years experience in from both a consumer and expert perspective. Other areas such as the companion app, online portal and in-home smart devices are not in scope as they are defined as “out of car” experiences.

Within the vehicle, any HMI element that the user interacts with is evaluated including steering wheel controls, touch screen displays, voice control, HUDs and digital keys. The features and services on offer have been grouped into the following domains (or test areas):







- ADAS domain
- Infotainment domain
- Navigation domain
- Voice recognition domain
- Connected services domain
- Convenience domain





2023 vehicle list

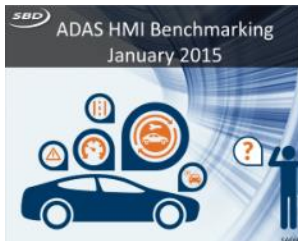
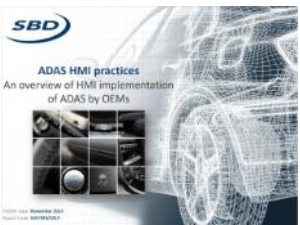
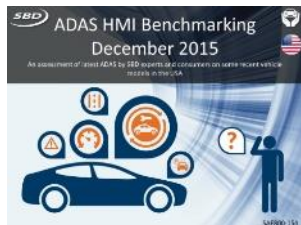
SBD has chosen six cars to evaluate in 2023, based on two selection categories. New/interesting UX focuses on systems with to never-seen-before features or functionality, or the implementation of a solution that has previously been a challenge or pain-point for end-users. New mass-market UX includes vehicles in segments that are sold in high numbers and are entering a new generation of UI for that vehicle. While we make best efforts to adhere to the chosen cars and schedule, the last two years have seen release dates slipping significantly, so it may be necessary to make substitutions.

Cars tested				Planned cars for 2023	
					
Jeep Grand Wagoneer	Nissan Ariya	BYD Seal	Peugeot 408	Fisker Ocean	Ford F-150 Lightning
<ul style="list-style-type: none"> ▪ Passenger display ▪ Amazon Fire TV ▪ Active Drive Assist ▪ US market test 	<ul style="list-style-type: none"> ▪ ProPilot Assist ▪ Unique HMI and interior ▪ EV SUV ▪ German Market Test 	<ul style="list-style-type: none"> ▪ Unique Home Screen HMI ▪ EV ▪ Chinese market test 	<ul style="list-style-type: none"> ▪ Drive Assist 2.0 ▪ 3D instrument cluster ▪ German market test 	<ul style="list-style-type: none"> ▪ EV SUV ▪ Sustainable materials ▪ Large central display ▪ German market test 	<ul style="list-style-type: none"> ▪ Android-based OS ▪ EV Truck ▪ US market test



SBD experience through years of testing in-car solutions

Over the last ten years, SBD has evaluated over 100 solutions from a Connected Car or ADAS perspective for our public report series (many more for private client evaluations). This current report series is an evolution of both test methodologies to provide a holistic view of in-car HMI. Furthermore, custom evaluations methodologies used across the globe for SBD clients have been included where applicable to enhance the overall approach.



One page methodology overview

One of SBD's core goals is for this report series to be objective, fair and transparent. To achieve this, various methodologies are used throughout the testing to evaluate different areas of the solution in a range of conditions.

These methodologies are a mix of different types of tests:

- **Objective tests:** where the value provided is not influenced by a tester's viewpoint e.g. response time
- **Subjective tests:** the test score is based on the expert testers' viewpoints e.g. task ease of use
- **Task-based:** evaluations carried out based on a predefined task list e.g. navigate to a pizza restaurant near location X
- **Freeform:** random free testing by the tester with no clear pre-defined task list. This allows the testers flexibility to dig deeper into various parts of a solution when needed
- **Scoring range:** ranges and definitions of how to score a test element e.g. poor depth and accuracy score = the results provided are not in line with what is reasonably expected by the user
- **Static:** tests are carried out when the vehicle is not moving
- **Dynamic:** tests are carried out when the vehicle is moving in various road conditions and locations e.g. motorways/highways, cities, villages, country roads etc.
- **Misuse/failures:** carried out to evaluate the stability of the solution in unusual conditions e.g. repeatedly pressing the voice command button

This report does not provide a detailed description of the methodology and this page serves to provide an overview of the approach.

For a detailed discussion and presentation of SBD's methodology please [contact us](#).

Test area	Type of tests							
	Objective	Subjective	Task based	Freeform	Scoring range	Static	Dynamic	Misuse/failures
First impressions		✓		✓		✓	✓	
Static tasks	✓	✓	✓		✓	✓		
Dynamic tasks	✓	✓	✓		✓		✓	
Random free	✓	✓		✓		✓	✓	✓
Navigation specific tests	✓	✓	✓		✓		✓	✓
Voice recognition	✓	✓	✓	✓	✓	✓	✓	✓
Performance & response	✓		✓			✓	✓	✓
System Usability Scale (SUS)		✓			✓			
Final SBD UX score	✓	✓			✓			
ADAS	✓	✓	✓		✓	✓	✓	✓
UX heuristics	✓		✓			✓	✓	
Execution		✓			✓			
Ergonomics	✓	✓	✓			✓	✓	
Legibility & readability	✓		✓			✓	✓	
Perceived Quality (PQ)	✓	✓	✓	✓	✓	✓	✓	



Example slides from the report

This is an example slide from the report, enclosed in a white border. The top half of the slide features a photograph of a car's interior, showing the steering wheel, dashboard, and center console. Below the image is a dark blue banner containing the SBD logo on the left and the text 'August 2023 In-Car HMI UX Evaluation & Benchmarking Peugeot 408 GT' on the right. At the bottom of the slide is a prominent blue button with the text 'Request price' and a white right-pointing chevron symbol.



Lacking some permanent controls, seamless integrations in navigation

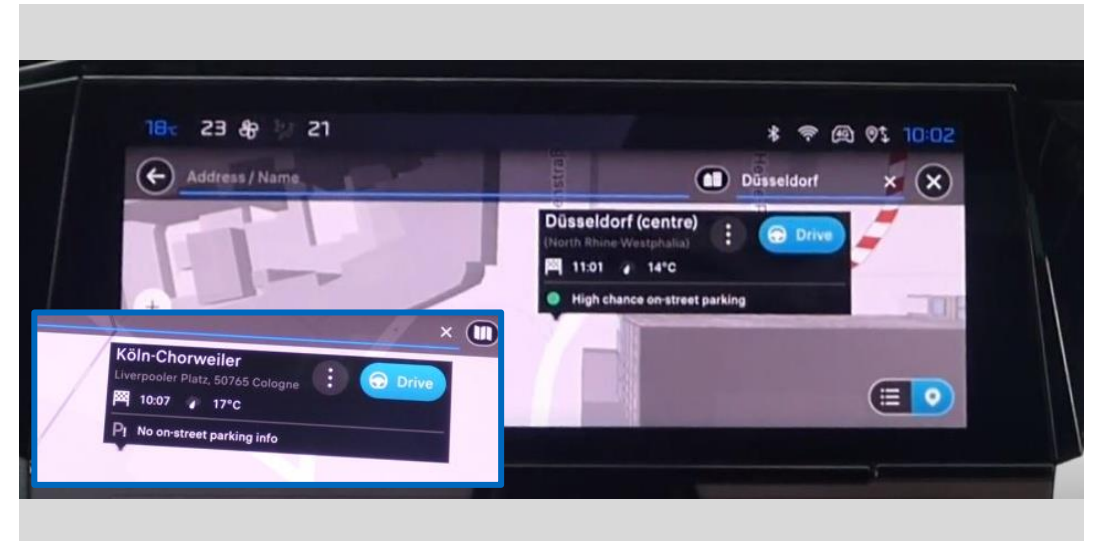
- Steering wheel button functionality is limited to only basic radio station selection and phone control.
- No cluster menu is offered, forcing users to always operate the central display while driving.
- No hard buttons are present for adjusting fan speed or temperature control. As a result, users must always navigate to the HVAC screen in the central display in order to adjust these settings.



Poor HVAC settings adjustment implementation

If the HVAC display is not currently being shown in the central display, the user has no way of adjusting the fan speed or temperature of the cabin. No hard button exists for controlling these settings. This means that users must always navigate back to the HVAC screen in order to adjust settings resulting in extra steps, increased task completion time and ultimately an increased risk of driver distraction.

- Live fuel prices are shown on the map. When searching for fuel stations, they are pre-filtered by fuel type specific for this vehicle. Fuel prices are not always accurate.
- Estimation of on-street parking is integrated into the route guidance start confirmation box.
- Well integrated live traffic data is shown by color-coded lines on roadways. Traffic information is largely accurate.



On-street parking estimation

When planning a route and selecting a destination, the route guidance confirmation box will also show an estimation of on-street parking availability at the destination. This is shown via a color-coded tell-tale (red, amber, green). The information is neatly integrated and shown to the user without them having to make any extra steps.



SAE L2 integrated well, severe lack of support from LKA

SBD tested five ADAS on the 2023 Peugeot 408. These were Rear Cross Traffic Alert (RCTA), Lane Keeping Assist (LKA), Blind Spot Monitoring (BSM), Adaptive Cruise Control (ACC) and Piloted Driving (PD).

Overall, most SAE L1 & 2 ADAS are well implemented with all these systems always providing important status information, regardless of the display chosen. However, SAE L0 LKA lacks sufficient status information, lane tracking status or appropriate level of warning. Audio prioritization is inconsistent across ADAS. The most negative aspect of the ADAS suite is the absence of SAPA (Semi-Automatic Parking Assist) or FAPA (Fully Automatic Parking Assist). This is a feature that most users are likely to expect in this type of vehicle.

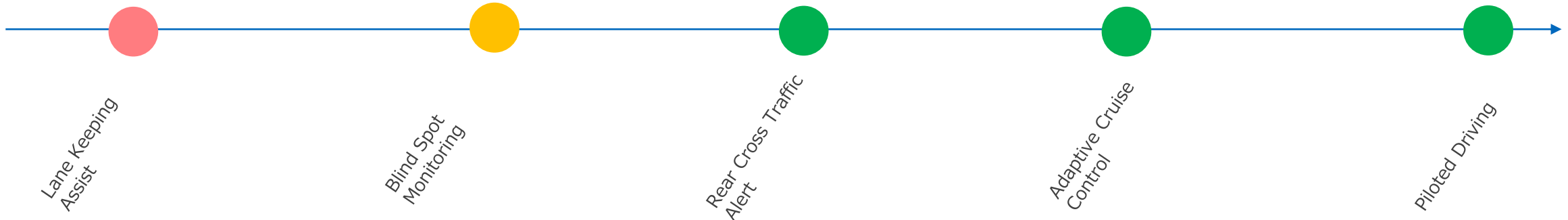
Lane Keep Assist struggles to provide the expected level of status information and support via the cluster. Lane departure events are only communicated via a flashing orange icon, the same icon and color used to show the system is OFF.

Blind spot monitoring has no obvious way to turn the system ON or OFF. Status communication is poor, especially in reflecting when the vehicle is below the activation speed. However, the visual warning in the side mirror is acceptable and detection is consistent. Using the BSM ISO icon would be an improvement.

Rear cross traffic alert is automatically activated when reverse gear is selected. Directional visual warning is given, and warning audio is prioritized over other infotainment volume. Utilizing BSM warnings in the mirror would add another layer of visual warning.

Adaptive cruise control can be activated and adjusted via controls on the steering wheel. Feedback in the cluster is very good and is always shown. Icons for ACC could be clearer and feedback during stop & go traffic should be made more supportive.

Piloted driving is engaged by pressing the same button as ACC which could be confusing for some users. However, the level of feedback in the cluster, lane tracking status and overall visual/audio warning during a hands-off event is very strong. The naming of this system could be made less ambiguous.



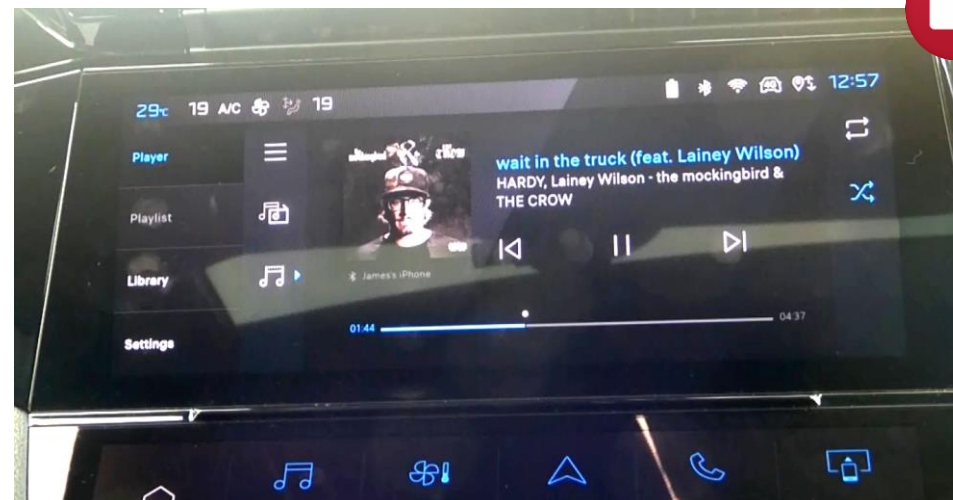


Stuck skip track function

1. Infotainment

When streaming from Spotify via Bluetooth, the user can press and hold the skip track button to skip through the currently playing track. However, when letting go of the button, the system continues to skip through multiple tracks in an endless cycle. Even when performing an ignition cycle, the system continued to skip through multiple tracks. Only turning Spotify off on the mobile device solved this issue.

Frequency	Low	Medium	High
Severity	Minor	Major	Critical

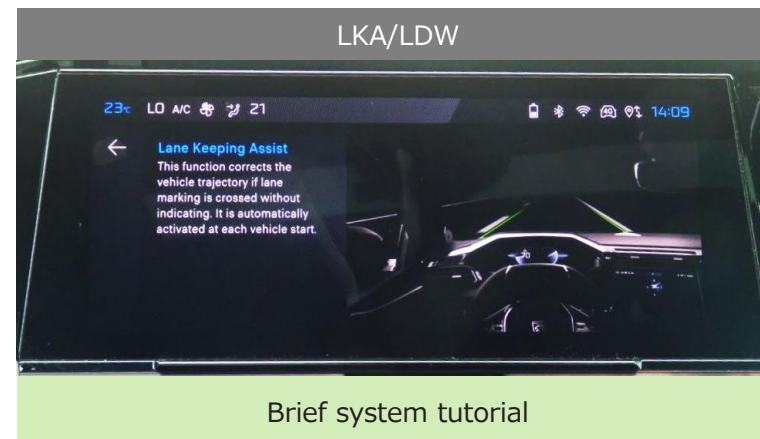
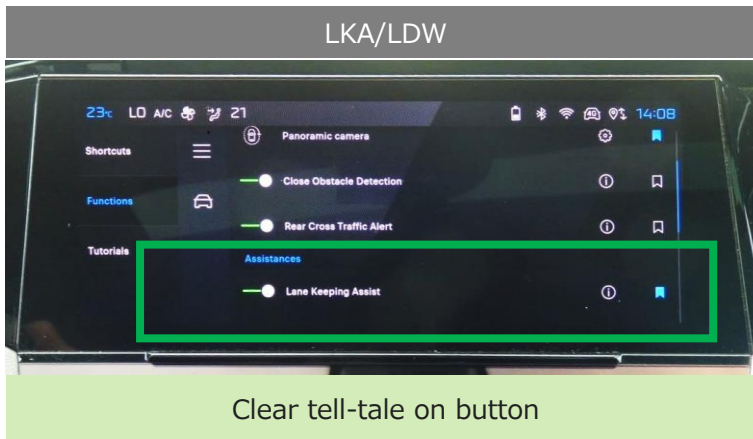
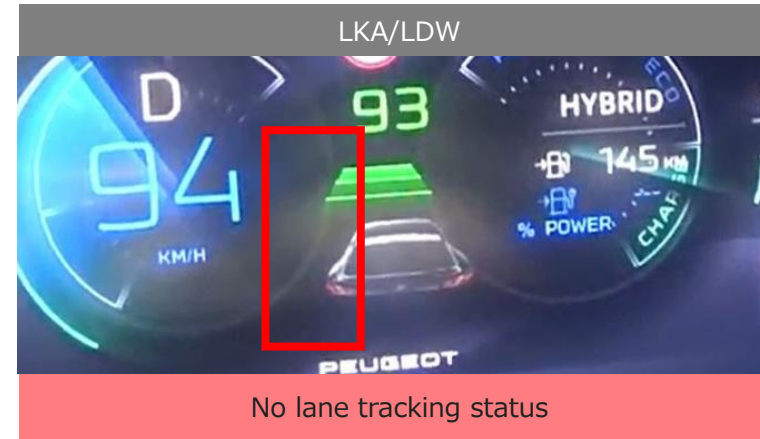


Perceived Quality: Tactile

Level 1	Tactile				
SBD viewpoint	<p>Stiffness & looseness: All panels and buttons are solid and secure with no noticeable looseness, contributing to a good sense of quality.</p> <p>Force feedback: No haptic feedback is used on any of the controls. However, the natural feedback across most controls and buttons gives a sense of solidity, giving an impression of quality. Some of the lesser used buttons such as the trunk release feel slightly less solid.</p> <p>Material quality: The tactile nature of the steering wheel and surrounding controls provide a sense of quality. The overall quality of materials throughout the cabin give the impression of a vehicle in a much higher quality segment.</p> <p>Material harmony: Most of the interior is harmonious in its material choice. The door panels appear somewhat busy with several different materials used across multiple panels.</p> <p>Geometric & Positioning: Most switches and controls throughout the vehicle convey a sense of quality and modern design. The gear selector has a chunky design but is in keeping with the minimalist feel throughout the cabin.</p>				
	Level 2 scoring				
	Stiffness & looseness	Force feedback	Material quality	Material harmony	Geometric & positioning
	Fair	Fair	Fair	Fair	Fair



SAE Level 0 ADAS: LKA/LDW



Customizable and dynamic shortcuts bar

SBD
viewpoint

The shortcuts bar along the bottom of the central display has a high degree of customization.

- Each button in the shortcuts bar can be assigned a custom function depending on the user's preference. The buttons can also be arranged to bring frequently used functions closer to the driver's side of the display.
- Buttons can be interchanged and swapped by pressing and holding the desired button. A selection of possible options will appear in the central display.
- When a mobile device is connected and Apple CarPlay or Android Auto is connected, the screen mirroring button will automatically change to an Apple CarPlay or Android Auto icon button.

The dynamic shortcut bar allows another aspect of the system to be customizable to the user's preferences and better meet their needs. The shortcut bar helps to enable a flatter menu structure overall.



Ability to swap out shortcut bar buttons



3D building graphics

SBD
viewpoint

A 3D view options shows buildings in rendered blocks and some in more detail.

- 3D building models are used to help represent the surrounding environment on the map in the central display. The models accurately show what the driver can see out of the window, enhancing situational awareness.
- The 3D graphics add a pleasing visual aesthetic to the map with good levels of detail. POIs such as sports stadiums are shown with team and sponsorship logos as part of the model.
- 3D graphics add to the map without obscuring important information such as roadways or route guidance information.

Overall, 3D buildings add both a visual enhancement to the map and help the driver relate what they can see on the map to what they can see out of the vehicle in the surrounding environment.

UX impact

Major negative

Minor negative

Minor positive


Major positive



3D buildings build situational awareness



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