![SBD]

2023
In-Car HMI UX Evaluation & Benchmarking
End of Year Summary

635-23(23g)

About SBD Automotive

Management & technology consultants to the automotive industry for over 20 years

Our expertise:

Connected

Autonomous

Shared Mobility

EV

Cybersecurity

Anti-theft

Our role:

As our industry faces...

We provide our clients with...

Uncertainty ▶ **Data** ▶ **Insight** ▶ **Advice**
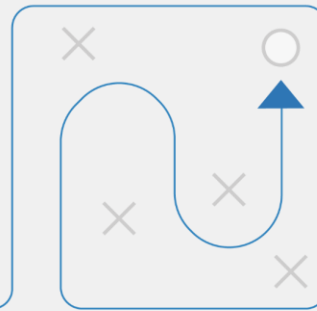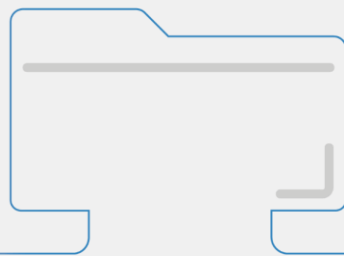
Seeing Beyond Data
Turning data into actionable advice

Click to find out more

Research Portfolio

Consulting Services

Contact Us

📖 Contents

635 - In-Car HMI UX Evaluation & Benchmarking – End of Year Summary

Customer Feedback
Provide your feedback to SBD regarding this report

Total number of pages - 42

Introduction to this report

Contents
Page

About SBD

Contact Us

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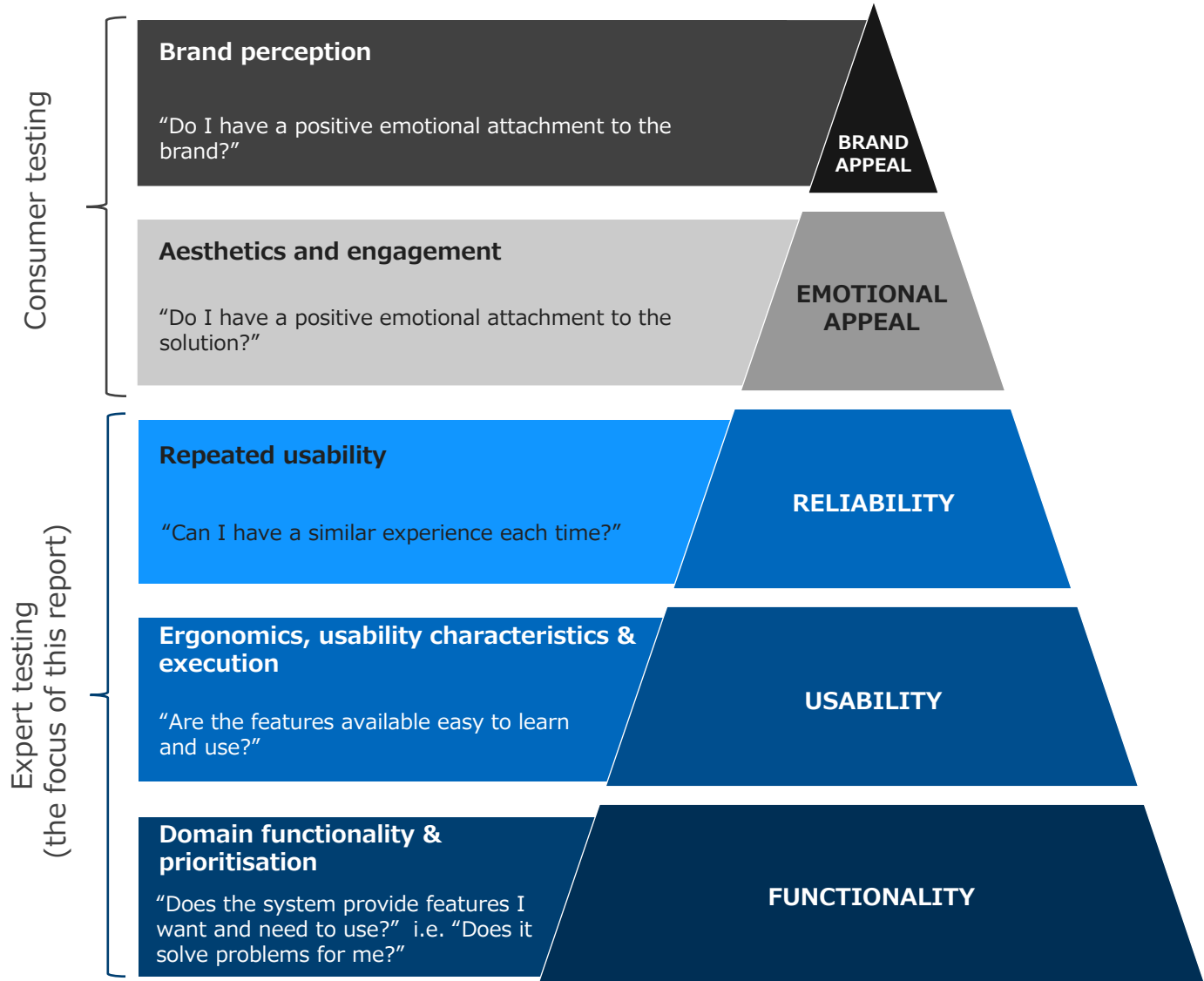
One of the core goals of these studies is to provide a true indication of what the final customer experience of each solution could be. To do this evaluations are focused on providing scoring and analysis in the following areas:

- **Features and functionality:** evaluating whether the solutions provide features that customers expect & 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 take into account 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 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 it's 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.

Consumer testing

Brand perception

"Do I have a positive emotional attachment to the brand?"

BRAND APPEAL

Aesthetics and engagement

"Do I have a positive emotional attachment to the solution?"

EMOTIONAL APPEAL

Expert testing (the focus of this report)

Repeated usability

"Can I have a similar experience each time?"

RELIABILITY

Ergonomics, usability characteristics & execution

"Are the features available easy to learn and use?"

USABILITY

Domain functionality & prioritisation

"Does the system provide features I want and need to use?" i.e. "Does it solve problems for me?"

FUNCTIONALITY

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

Scope of reports: 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.

Pre-purchase — Purchase — Activation — In-car HMI — Driver distraction — IoT

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 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 broadly 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 Automotive chose 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. The test month of each car has been added to this report to make it easier to identify at what point in the year it was tested.

Cars tested in 2023 report series

Jeep Grand Wagoneer	Nissan Ariya	BYD Seal	Peugeot 408	Fisker Ocean	MG4
▪ Tested in January	▪ Tested in March	▪ Tested in May	▪ Tested in July	▪ Tested in August	▪ Tested in October
▪ Passenger display	▪ ProPilot Assist	▪ Unique Home Screen HMI	▪ Drive Assist 2.0	▪ EV SUV	▪ Chinese-owned brand sold in EU market
▪ Amazon Fire TV	▪ Unique HMI and interior	▪ EV	▪ 3D instrument cluster	▪ Sustainable materials	▪ MG Pilot ADAS
▪ Active Drive Assist	▪ EV SUV	▪ Chinese market test	▪ German market test	▪ Large central display	▪ Live services
▪ US market test	▪ German Market Test			▪ German market test	▪ EU market test

Executive summary

Summary: Chinese OEMs raising the bar, others rushing to keep up

The chart to the right shows the six cars evaluated throughout 2023 for the 635 HMI UX evaluation and benchmarking reports.

In terms of overall functionality, the cars are relatively tightly grouped, spanning only four of the possible nine scores, A-, B+, B- and C+. This reflects the fact that although some functionality is notably absent from some of the cars, the baseline is still high for most vehicles, whether it's a high segment or low segment car.

The feature components with the biggest impact on overall functionality score this year are performance features, navigation features and music, with Jeep and Nissan scoring high for performance features, Jeep scoring high for navigation features and BYD scoring high for music. Some vehicles such as the Grand Wagoneer and BYD Seal excelled in providing a large number of delight features including passenger displays and rotating center displays.

The UX scores are still mostly clustered together but with one outlier ranging from 55 up to 67. The Fisker Ocean scores lowest due to poor system performance and critical stability issues leading to features becoming unusable and full system failures in the software version tested requiring a full system reset.
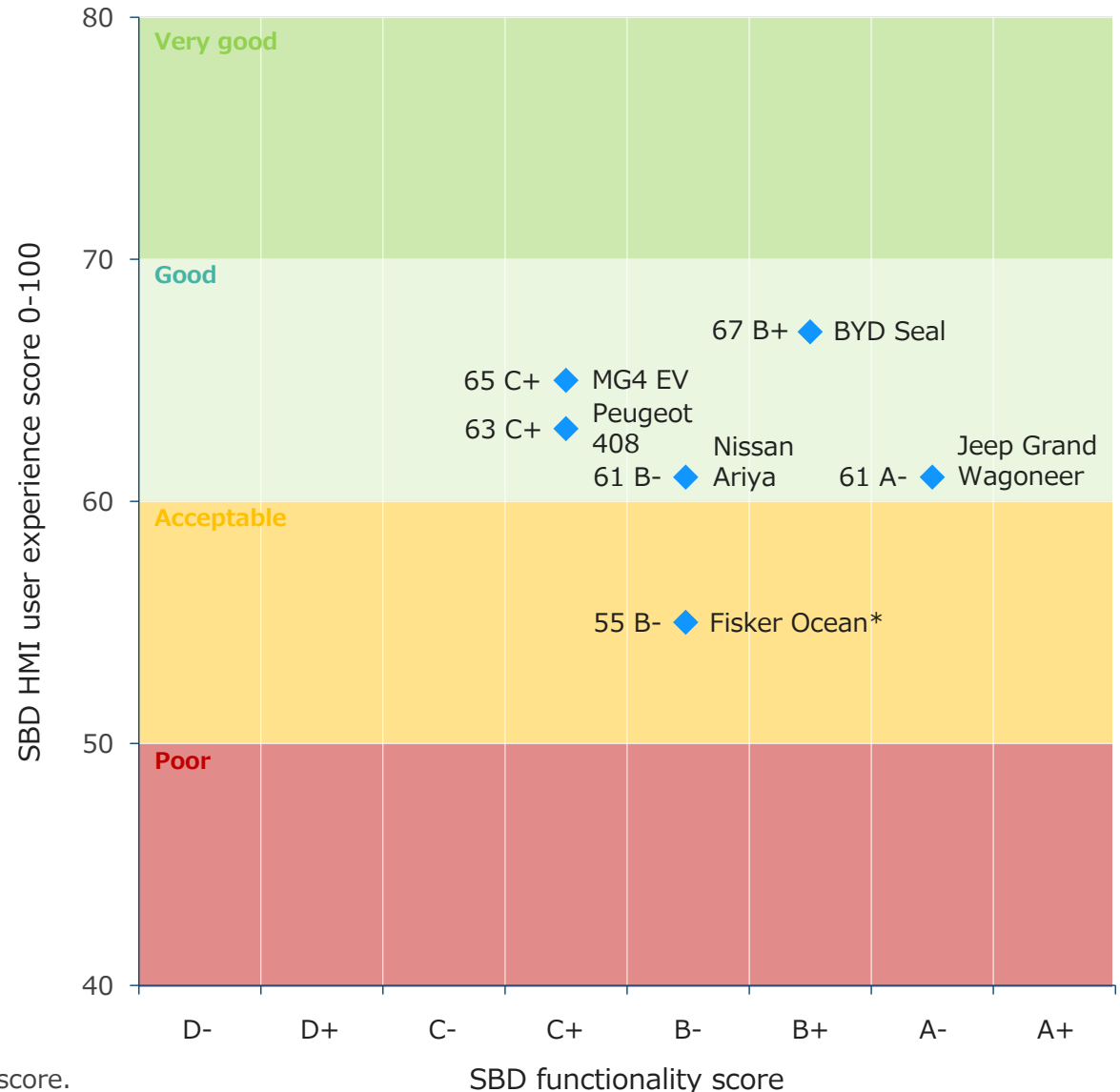
Despite achieving a strong functionality score, the Jeep Grand Wagoneer did not score a similarly strong UX score. This is mainly due to its highly unstable system and poor voice recognition. By introducing improvements to these areas, the UX score could rise from 61 to 73.

The Fisker Ocean is a good example of how OEMs should not rush vehicles to market with missing features and software that is clearly not yet ready for market. Frequent system crashes and bugs throughout multiple aspects of the system result in a frustrating user experience.

The MG4 EV is the only vehicle tested this year from a Chinese manufacturer, destined for the European market. While the system achieves a respectable UX score, this is mainly due to high levels of system stability. Other areas of the system provide opportunity for improvement in terms of feature offering and implementation.

The BYD Seal is the highest scoring system of 2023. The BYD manages to impress in terms of voice recognition capability and extensive app offerings. The rotating central display is likely to impress and delight many customers and prove to be a lasting talking point. However, the system is prevented from scoring higher by missing functionality and poor integration of some features.

*Score based on feature set at the time of testing. Future feature updates expected to improve score.

SBD HMI user experience score 0-100

- Very good
- Good
- Acceptable
- Poor

67 B+ ◆ BYD Seal
65 C+ ◆ MG4 EV
63 C+ ◆ Peugeot 408
61 B- ◆ Nissan Ariya
61 A- ◆ Jeep Grand Wagoneer
55 B- ◆ Fisker Ocean*

SBD functionality score

D- | D+ | C- | C+ | B- | B+ | A- | A+

Perception of quality

This section introduces analysis on factors related to perceived quality for HMI which may influence an end-user's overall experience of using that system.

Throughout the report series, vehicles have been rated relative to the type of vehicle (segment) that they are, and a verdict given on whether they are likely or unlikely to meet end-user expectation.

In this summary report, the verdict on each vehicle has been given in a simplified form to show only if the perceived quality across the individual attributes is likely or unlikely to meet expectation rather than also showing the absolute values.

This provides a single set of results to compare, and as a result should be easier to understand where each vehicle is performing well (to user expectation) or leaves room for improvement (under user expectation).

The rating system only applies to HMI in the vehicle and does not apply to the greater general trim, upholstery and bodywork of the vehicle (for example, paint finish or panel gap and flush).

Main points from 2023 vehicles:

- Relative to its segment, the BYD Seal meets quality expectation most successfully, with only three attributes being below expectation.

- Vehicles tested throughout the year sit in a variety of segments meaning they must live up to a range of varying expectations in terms of quality. For vehicles in higher segments, it can be easier to fall short of expectation. In this case, there were a number of concerns picked up for the Jeep Grand Wagoneer and Fisker Ocean.

- The Peugeot 408 is placed in a lower segment to some other vehicles tested this year, but outperformed expectations in many areas. Material quality is likely to exceed many user expectations and harmony and alignment is also a strong component. Some areas do fall short, with interior lighting only being very basic.

- The most considerable shortcoming compared to segment expectation was the MG4 EV. Overall, too many areas contributed to a cheap and budget appearance as well as missing basic feature expectations. Materials used in areas that users will see and touch often fell below visual and tactile quality expectation.

HMI perceived quality consideration	BYD Seal	MG4 EV	Peugeot 408	Grand Wagoneer	Nissan Ariya	Fisker Ocean
Total score /17	**14**	**7**	**13**	**9**	**10**	**9**
Harmony/alignment	✓	✗	✓	✗	✓	✓
Geometric	✓	✓	✓	✓	✓	✓
Spatial harmony	✓	✓	✓	✓	✓	✓
Branding	✓	✓	✓	✓	✗	✓
Output HMI	✗	✓	✓	✓	✗	✗
Interior lighting	✓	✗	✗	✓	✗	✓
Stiffness & looseness	✓	✗	✓	✓	✓	✗
Force feedback	✗	✗	✓	✗	✓	✗
Material quality	✓	✗	✓	✗	✓	✗
Material harmony	✓	✗	✓	✗	✗	✗
Geometric & positioning	✓	✓	✓	✓	✓	✗
Squeak & rattle (passive)	✓	✓	✓	✓	✓	✓
Solidity (after touch)	✓	✗	✓	✗	✓	✓
Active sound	✓	✓	✗	✗	✓	✓
Delight features	✓	✗	✓	✓	✗	✓
Performance features	✓	✗	✗	✗	✗	✗
Basic/Hygiene features	✗	✗	✗	✗	✗	✗

System execution

System execution focuses more on how all of the HMI components perform individually, aiming to highlight any particular component strengths or weaknesses in how they are implemented and to what extent they might have an impact on the overall user experience of that vehicle/system.

This can show the difference between the hardware and software execution of the vehicle, as it seems in recent years that software instabilities and other reliability concerns have become more common, whereas hardware is generally not updated throughout the vehicle's life and tends to be representative of a competitive offering at the time of release. This is of course not always what is experienced, and exceptions to this generalization are sometimes found.

Below are some trends which have been observed across the 2023 series:

- The BYD Seal achieved the best rating in system execution. System strengths include minimal cockpit clutter, clear map layout, good command response and a high level of system stability.

- Instrument cluster was a mixed experience across the tested vehicles. Some vehicles impressed with high level of functionality and customization possible. The Peugeot 408 featured an innovative 3D cluster effect. However, The BYD Seal and Fisker Ocean struggled to achieve similar praise with limited and underwhelming implementations.

- All vehicles for 2023 were considered 'Good' for cockpit clutter. This may be a result of more OEMs choosing to migrate physical buttons and switches to digital displays. However, caution must be exercised in not sacrificing usability over form.

- Few solutions demonstrated good examples of stability/reliability, with only two systems being rated 'Good', the two Chinese OEMs. Some stand-out examples of the types of issues include entire feature unavailability, unresponsive buttons and complete system crashes requiring a full reset. Such severe errors have a damaging effect on the user experience and the user's impression of that brand/system.

- Start up speed presented significant issues for many vehicles tested in 2023 with over half rating as 'Poor'. Slow start-up speeds give poor impressions of the systems overall performance and capability as well as being a source of frustration.

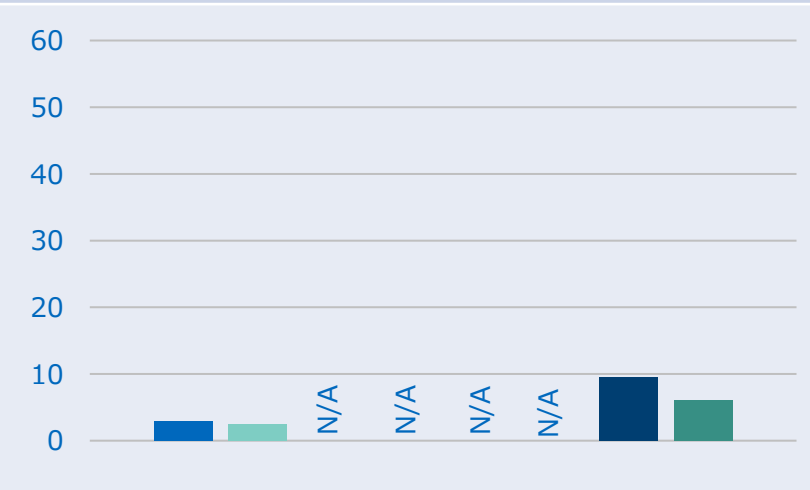| UX heuristic	BYD Seal	MG4 EV	Peugeot 408	Grand Wagoneer	Nissan Ariya	Fisker Ocean
Total score /13	**8**	**6**	**5**	**7**	**4**	**6**
Cockpit clutter	Good	Good	Good	Good	Good	Good
GUI clutter	OK	OK	OK	Good	Good	Good
Display quality/size	OK	Good	Good	Good	OK	Very Good
Map aesthetics	Good	Good	Good	Good	Good	Good
Map layout	Good	OK	OK	OK	OK	Good
Navigation routing	Good	OK	OK	Good	OK	OK
Instrument cluster	Poor	OK	OK	Good	Good	Poor
General system HMI	Good	OK	Good	Good	OK	Good
Start up speed	Poor	OK	Poor	Poor	Poor	OK
Command response	Good	OK	OK	Poor	Poor	OK
Connectivity speed	Good	Very Good	Good	OK	OK	OK
System performance	OK	Good	OK	OK	Poor	Poor
Stability/reliability	Good	Good	OK	Poor	OK	Poor

System performance
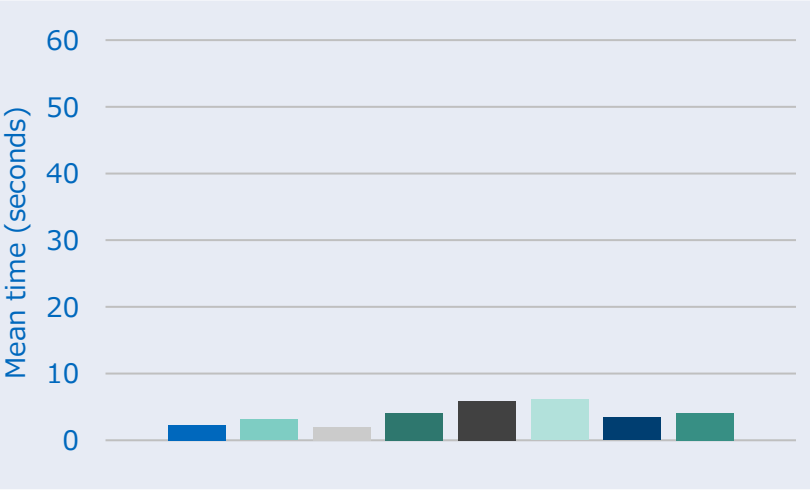

Long route calculation (~300miles/500 km)
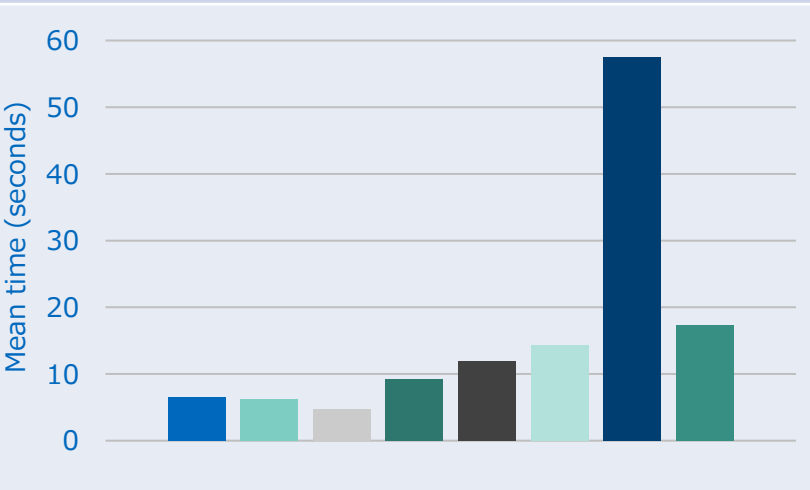
Short route calculation (~5 miles/10km)
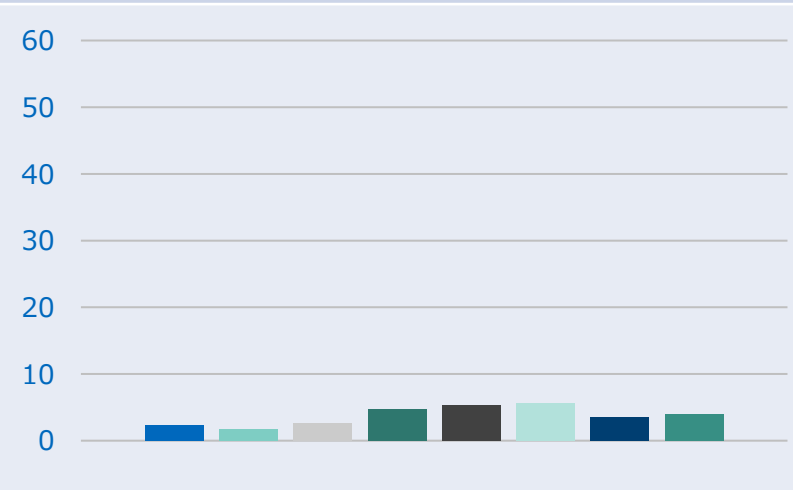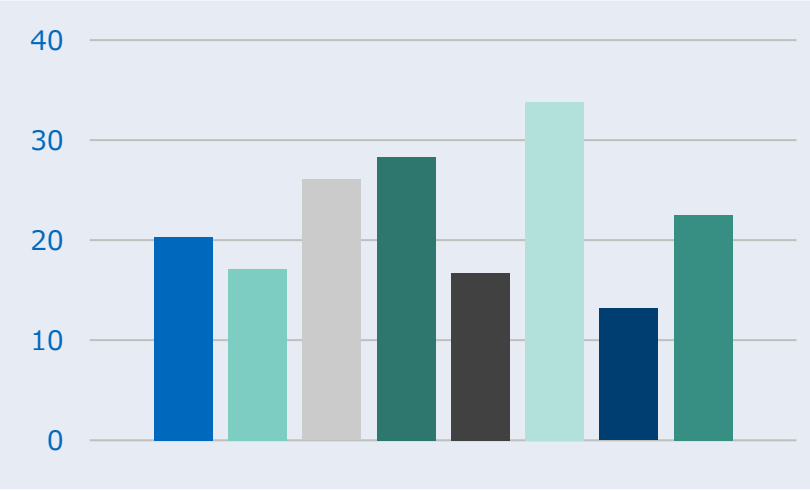
Tune to any music streaming station (central display)

Show fuel/charging POIs

System warm boot

System cold boot

Legend: ■ 2022 Average   ■ BYD Seal   ■ MG4 EV   ■ Peugeot 408   ■ Grand Wagoneer   ■ Nissan Ariya   ■ Fisker Ocean   ■ 2023 Average
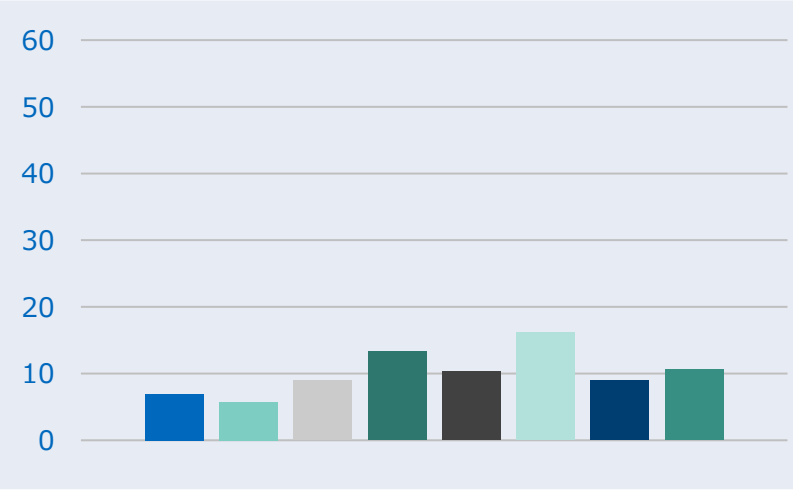
UX laws (1/2)

Acceptable	Concerns	Unacceptable

Law name	Law definition	What to check	BYD Seal	MG4 EV	Peugeot 408	Grand Wagoneer	Nissan Ariya	Fisker Ocean
Fitt's law	The time to acquire a target is a function of the distance to and size of the target	Are there any small buttons which hinder their usability?	Acceptable	Concerns	Acceptable	Acceptable	Concerns	Acceptable
Hick's law	The time it takes to make a decision increases with the number and complexity of choices	Are there any instances where the HMI in the vehicle offers too much choice, and makes it difficult to make a decision?	Acceptable	Acceptable	Acceptable	Acceptable	Concerns	Acceptable
Jakob's law	Users will transfer expectations they have built around one familiar product to another that appears similar	Are there any instances where the HMI in the vehicle uses an operating principle that is unlike similar products available today? If so, does this lack of familiarity make the HMI difficult to use?	Acceptable	Concerns	Acceptable	Acceptable	Acceptable	Acceptable
Miller's law	The average person can only keep 7 (plus or minus 2) items in their working memory	Throughout user journeys, are users required to remember a large number of things to complete that journey? An easy example of this is in menu architectures which are deep and require the user to memorize the location of a particular setting or feature.	Acceptable	Concerns	Acceptable	Acceptable	Acceptable	Acceptable
Occam's Razor	Complexity: The path along the user journey should be simplified to the point where no additional choices or steps in that journey can be removed	Has the complexity of a user journey had all unnecessary steps removed? Or are there a number of unnecessary inputs required before the task is complete?	Acceptable	Concerns	Concerns	Acceptable	Concerns	Acceptable
Pareto principle	For many events, roughly 80% of the effects come from 20% of the causes. Are the most commonly used user journeys prioritized and within easy access? e.g., on the home screen or supported with shortcuts from any screen	For the most common, everyday use cases: Can these be accessed from the visible area of the system home screen or found on a button that is within the main HMI zones such as center console or steering wheel? If a frequently used feature is below the fold on the system's main menu, it is an example of bad optimization.	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Tesler's law	All processes have a core of complexity that cannot be designed away and therefore must be assumed by either the system or the user. Has the system been over-simplified to the point of harm to usability?	For any given user journey: Has the process been over-simplified to the extent that it leaves not enough choice, and the user must forego what they need?	Concerns	Concerns	Acceptable	Acceptable	Acceptable	Concerns
Von Restorff Effect	When multiple similar objects are present, the one that differs from the rest is most likely to be remembered. Is important information visually distinctive from other parts of the interface?	Notifications, warnings, irreversible changes, any other important details. Is there anything which blends into its surrounding information too well and isn't visually, cognitively distinctive enough?	Concerns	Acceptable	Acceptable	Acceptable	Acceptable	Concerns

UX laws (2/2)

SBD

Acceptable	Concerns	Unacceptable

Law name	Law definition	What to check	BYD Seal	MG4 EV	Peugeot 408	Grand Wagoneer	Nissan Ariya	Fisker Ocean
Zeigarnik Effect	People remember uncompleted or interrupted tasks better than completed tasks. Provide a clear indication of progress in order to motivate users to complete tasks.	During any given journey that requires multiple inputs from the user: Is there an indicator of progress that would help the user determine how much is left to complete when they are part-way through?	Concerns	Concerns	Acceptable	Acceptable	Concerns	Acceptable
Doherty Threshold	Productivity soars when a computer and its users interact at a pace (<400ms) that ensures that neither has to wait on the other. Provide system feedback within 400 ms in order to keep users' attention and increase productivity. Less than 200ms is a good target and should be easily achievable for onboard content. Use perceived performance to improve response time and reduce the perception of waiting. Animation is one way to visually engage people while loading or processing is happening in the background.	Does the system seem responsive in use? Does it permit a good level of brevity, where as the user becomes more competent and speeds up, the system has capable enough underlying hardware to keep pace with the user? In the instances of loading connected content, loading times with clear indicators (or even better, masked by animations) are permitted and fully acceptable/expected, provided it does not take longer than 15 seconds to load the content.	Concerns	Acceptable	Concerns	Acceptable	Unacceptable	Acceptable
Serial position effect	Placing the least important items in the middle of lists can be helpful because these items tend to be stored less frequently in long-term and working memory. Positioning key actions on the far left and right within elements such as navigation can increase memorization.	In the instance of any kind of listed content, is it displayed appropriately so that important content is found visually and an understanding of how it is ordered can be immediately understood? This also applies to how content is ordered and placing more important content to the left side of the display can allow users who follow the "F-pattern" to find what they need at a glance.	Acceptable	Acceptable	Concerns	Acceptable	Acceptable	Acceptable
Aesthetic-Usability Effect	Users often perceive aesthetically pleasing design as design that's more usable. An aesthetically pleasing design creates a positive response in people's brains and leads them to believe the design actually works better. Visually pleasing design can mask usability problems and prevent issues from being discovered during usability testing.	Is the HMI visually pleasing?	Acceptable	Concerns	Acceptable	Acceptable	Concerns	Concerns
Law of Proximity	Objects that are near, or proximate to each other, tend to be grouped together, or perceived as grouped together.	Are there any instances where HMI is grouped in an unintuitive way? Or where grouping controls would be the more intuitive solution?	Acceptable	Concerns	Concerns	Acceptable	Acceptable	Acceptable

UX laws summary

Vehicle tested	Acceptable	Concerns	Unacceptable
BYD Seal	9	4	0
MG4 EV	5	8	0
Peugeot 408 GT	8	5	0
Jeep Grand Wagoneer	12	1	0
Nissan Ariya	7	5	1
Fisker Ocean	9	4	0

Pareto Principle	Tesler's Law	Doherty Threshold
Acceptable	**Concerns**	**Unacceptable**

In the **Jeep Grand Wagoneer**, the home screen contains customizable widgets that can be configured based on the users needs. HVAC is always accessible no matter which display has been chosen, even if the bottom screen is hidden due to a row of permanent hard buttons.

In the **Fisker Ocean**, all the main functions can be performed effectively. However, the cluster is so simple in its functionality and flexibility that the user cannot perform that many tasks using cluster menus and features. This forces the user to use the central display meaning more risk of driver distraction.

In the **Nissan Ariya**, inputs in quick succession are often not recognized and there is a lag between inputs and content appearing on screen. Some POIs can also take a long time to load.

Voice recognition

SBD's 635 UX report brings a deeper, more detailed look into voice recognition interfaces with multiple aspects evaluated using various methodologies.

Focus remains on attributes such as command structure and localization, but methodology also includes an A to E scoring system with set firm expectations for how these scores can be achieved.

The six test components with individual scores are combined to give voice recognition an overall score for each vehicle tested.

Key points for the 2023 vehicle series:

- The top performer of the group is the BYD Seal, which displayed a good performance across most attributes, only falling short in Command structure and Level of integration. Only content integration is supported by the system. Response time is a key strength with a median time of 1.86 seconds, positively impacting the Performance score.

- Achieving a similar score to the BYD is the Peugeot 408. This system falls below recognition expectations with only a 39% overall positive recognition score. Similar to the BYD, integration is limited to only weather-based use cases. However, response times are considered acceptable with an average median time of 2.66 seconds.

- Both the Nissan Ariya and Jeep Grand Wagoneer have a native and Amazon Alexa offering, although the Nissan achieves a better implementation. When using Alexa vs the native system on both vehicles, functionality is improved. However, in the Jeep, Alexa struggles to perform side by side with the native system, while in the Nissan the native system can be completely replaced by Alexa.

- The MG4 EV struggles in several areas including Performance, Command structure and Level of integration. However, the speech-to-text integration is an effective way of providing feedback for the user. Performance is one of the main factors driving down the overall score with a median response time of 6.37 seconds. No integration use cases are possible.

- The Fisker Ocean could not be assessed on voice recognition as this feature had not been enabled at the time of testing but is due to receive Amazon Alexa integration.

- Command structure was an issue for most systems in this year's line-up, with most defaulting to the lowest rating in this category due to a lack of abilities like conversation linking and contextual understanding. Some systems also lacked barge-in.

| Voice test component	BYD Seal	MG4 EV	Peugeot 408	Grand Wagoneer	Nissan Ariya	Fisker Ocean
Total score	**C+**	**D+**	**C-**	**D-**	**D+**	**N/A**
Functionality	B	C	B	C	C	N/A
Performance	B	E	D	E	D	N/A
UI	B	C	B	C	C	N/A
Command structure	E	D	E	D	E	N/A
Localization	B	C	B	C	B	N/A
Level of integration	D	E	D	E	D	N/A

Infotainment

A solution which has a leading feature set may not guarantee the best user experience, and that leading set could impact usability negatively by introducing too much complexity. Usability and feature offering positioning on this slide gives a comparative view of how each of the 2023 solutions perform relative to one another, to understand if any of the solutions have managed to achieve an acceptable balance between usability and feature offering for this domain.

The Grand Wagoneer has a highly customizable interface and Amazon Alexa for download. However, inconsistencies throughout and lack of embedded music streaming hold the system back. Both the Ariya and MG4 are lacking any major delight features and have dated appearances to their UI. Both systems have flat menu structures but the Ariya benefits from customizable home screen widgets, built-in Alexa and integrated Google search. The MG4 has built-in Amazon Music.

The Peugeot attempts to impress with a 3D cluster and modern interface. While the cluster is not executed well, the highly customizable layout and intuitive shortcuts make for a pleasing system to use. Both the BYD and Fisker have rotating central displays. However, apps in the Fisker are integrated better with the rotation than in the BYD. Both systems offer a rich selection of apps and entertainment, but the BYD has a more customizable layout. The Fisker struggles with a very basic and limited cluster. All of the vehicles have very limited or no IoT integration.

2023 Infotainment SUS Scores

*Placed based on expected future feature additions

17
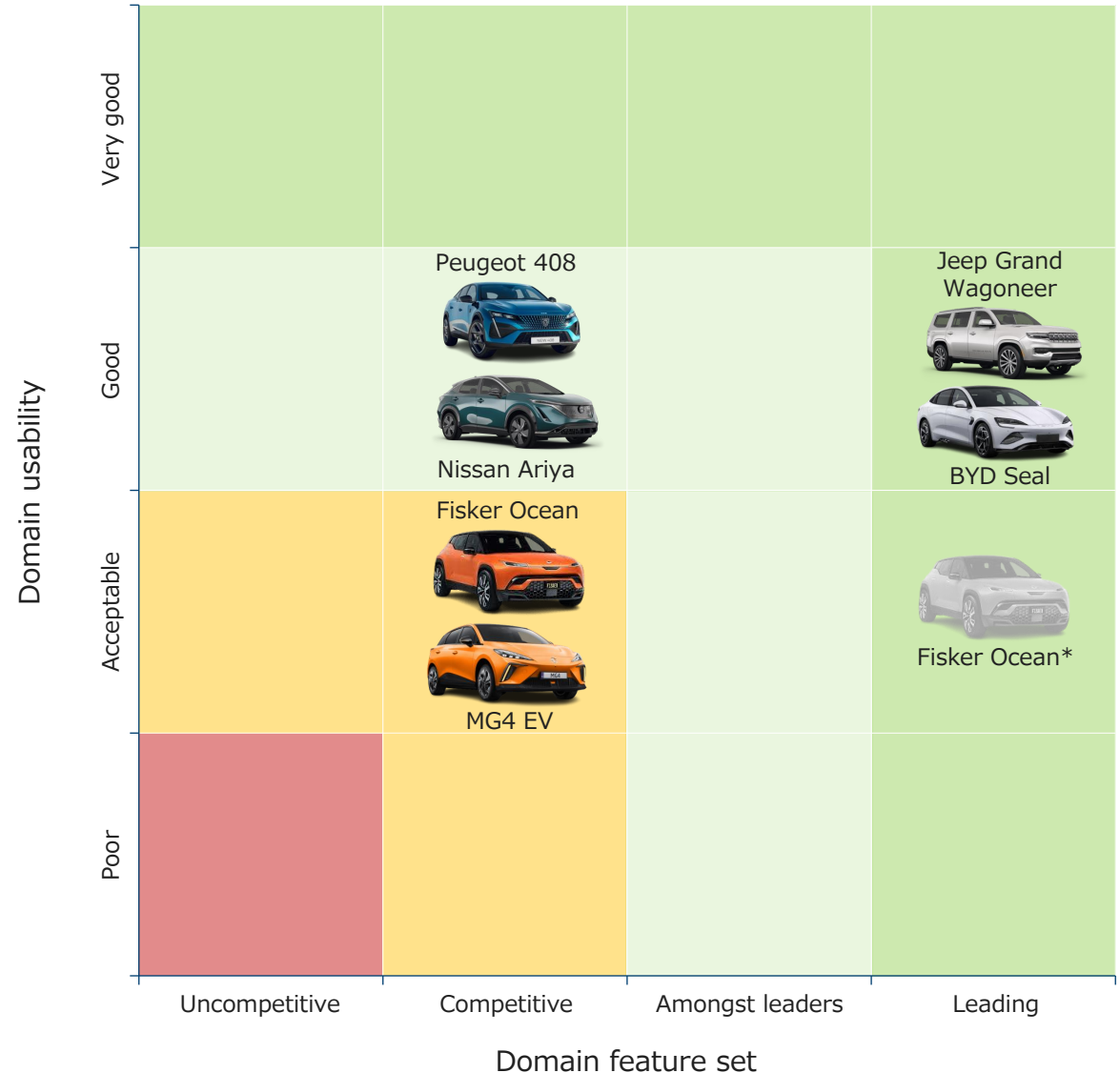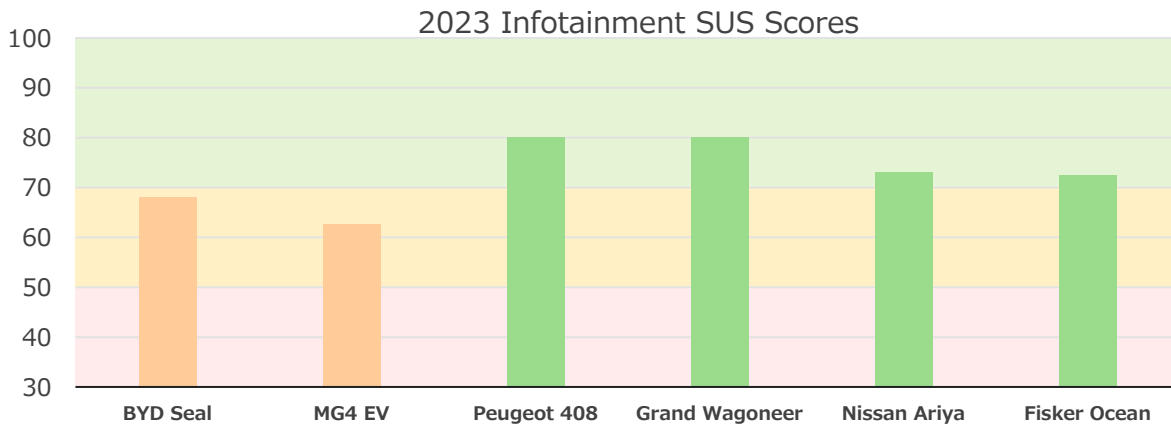
Navigation

This slide provides a similar comparison to the previous Infotainment slide, this time considering the performance of the vehicles within the Navigation domain. Usability and feature offering positioning on this slide gives a comparative view of how each of the 2023 solutions perform relative to one another, to understand if any of the solutions have managed to achieve an acceptable balance between usability and feature offering for Navigation.

The navigation system in the Grand Wagoneer and Peugeot 408 offer a host of well-integrated features. 3D building models bring a high level of map detail while home screen widgets ensure all critical information is available at the top level. The front passenger display in the Jeep can be used to view the map and send route guidance to the central display. Both systems suffer from poor POI list integration.

The Ariya provides well-timed commands and good visuals in the HUD. The system falls short in poor traffic data integration on the map and a lack of automatic zoom. The BYD Seal prioritizes information well with a floating navigation window and prioritized verbal commands. However, poor integration of POIs and filtering options for EV charging stations let the system down. The Fisker has several pleasing features such as automatic charge point routing when state-of-charge is insufficient to reach the final destination. The MG4 EV delivers well integrated waypoints and POIs, but inconsistent route guidance accuracy and traffic data disappoint.

2023 Navigation SUS Scores
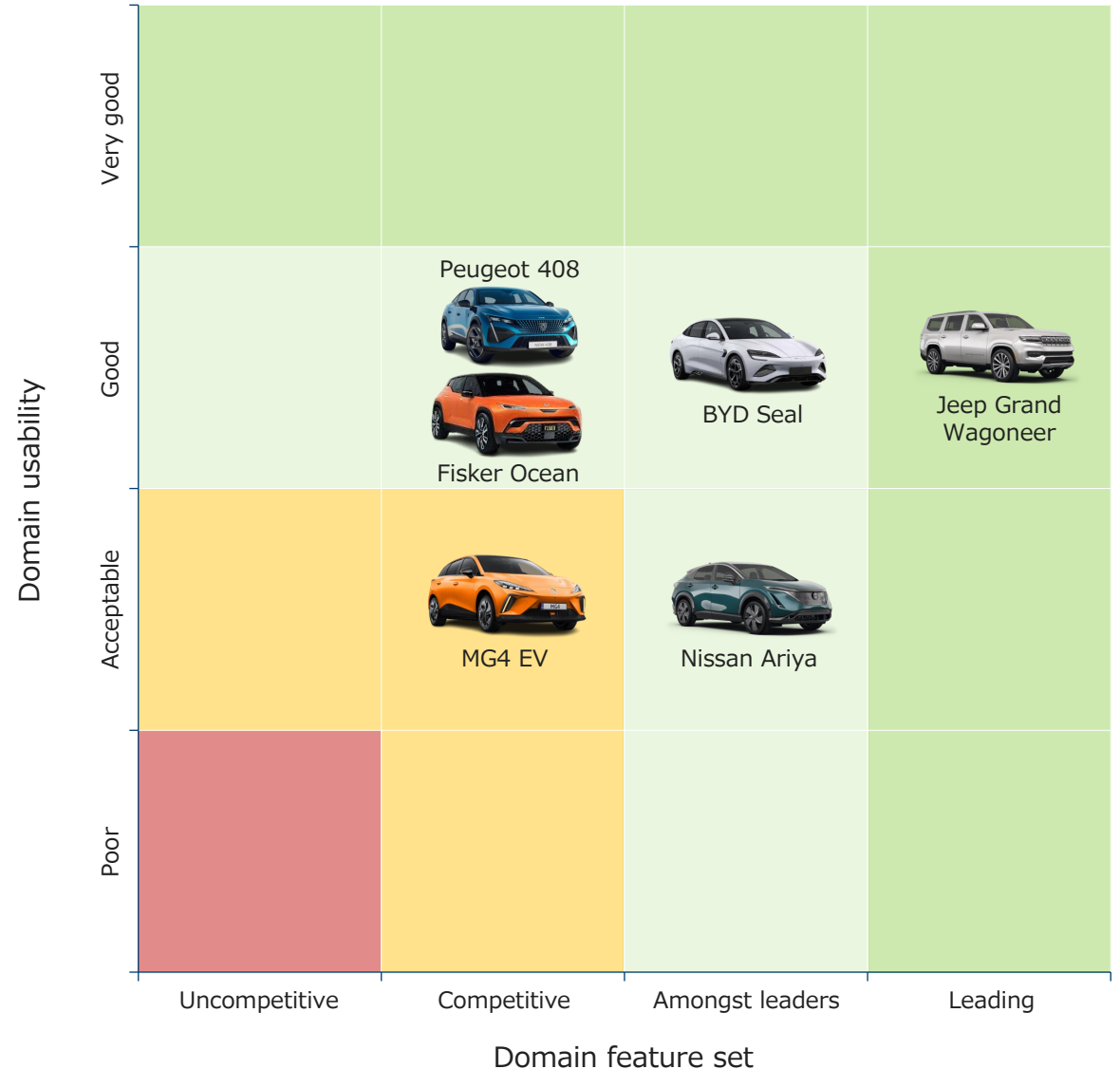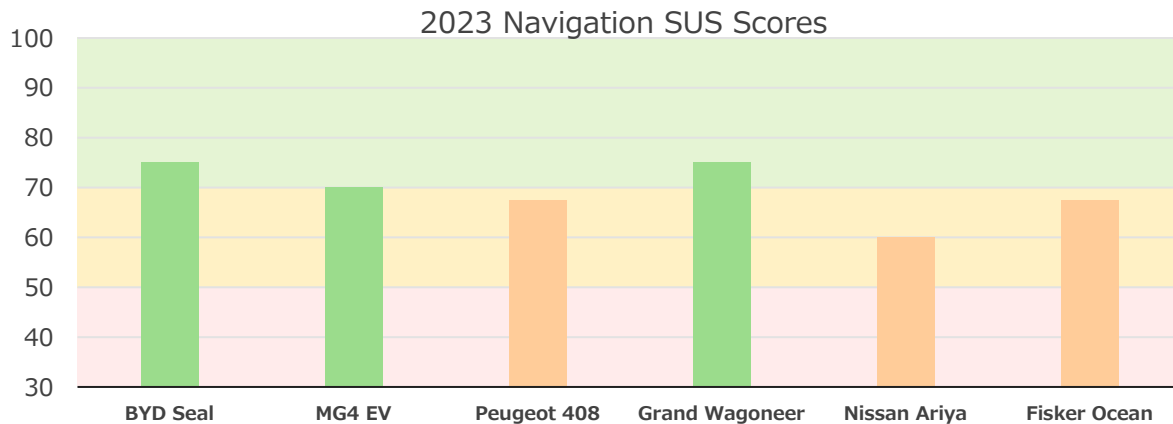
ADAS

This section summarizes the usability and feature offering of ADAS features across the 2023 series showing if there have been any success stories or trade-offs between features and user experience. The section considers the activation, deactivation and in-use feedback of assistance systems, and is not a feature performance rating.

Both in the Jeep Grand Wagoneer and BYD Seal most systems provide good visual feedback in the cluster and excellent audio prioritization. However, in the Jeep, some systems are let down by basic visual warnings while others lack the required level of user support. In the Nissan Ariya the level of visual feedback and system status for some systems is dependent on having the ProPilot display chosen in the cluster. The ProPilot icon could cause confusion for some users initially. Most systems are turned ON and adjusted via the cluster while the HUD provides a good reflection of ADAS information.

In the Peugeot 408 most SAE L1 & 2 ADAS are well implemented with all these systems always providing important status information. However, LKA lacks sufficient status information, lane tracking status or appropriate level of warning. In the Fisker Ocean and MG4 EV, LKA/LDW uses confusing color logic to show the system is OFF vs warning during an event. System status and differentiation for LKA/LDW is also lacking. The Fisker has three separate BSM warnings in three separate locations across the HMI has the potential to cause confusion. The MG4 EV lacks sufficient labeling on ADAS controls on the steering wheel. The BYD Seal, Peugeot 408 and MG4 EV are all missing Semi/Fully Automatic Parking. The Fisker Ocean was also missing this feature at the time of testing but is due to receive it in a future update.

2023 ADAS SUS Scores
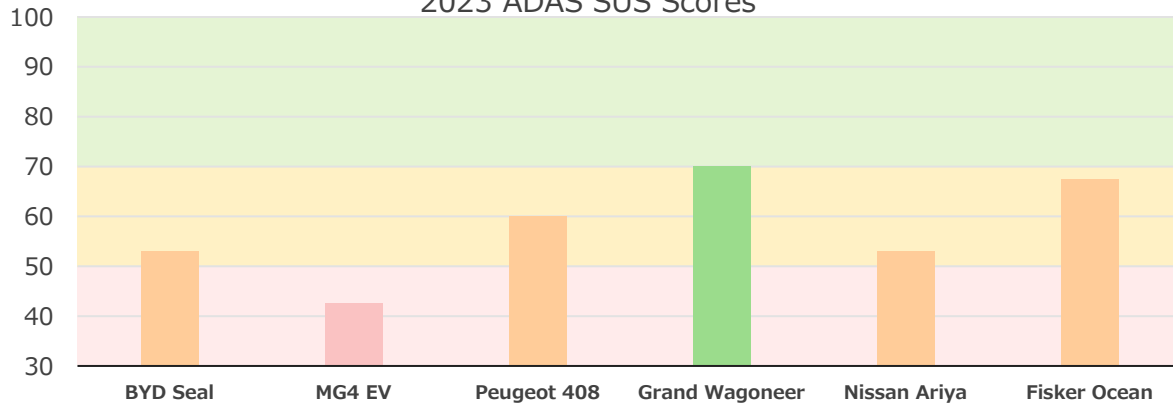
*Placed based on expected future feature additions.
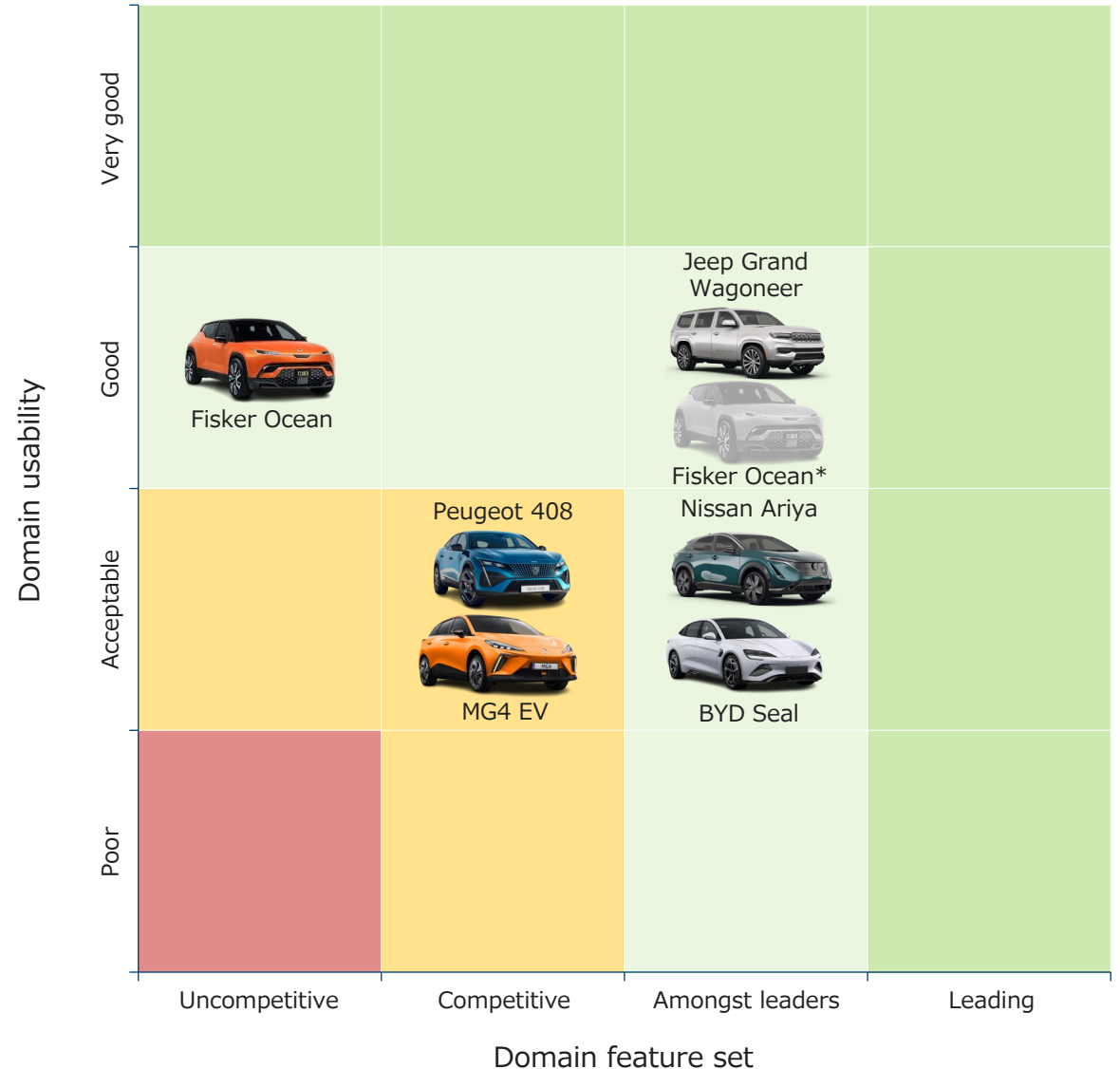
Convenience

Usability and feature offering positioning on this slide gives a comparative view of the convenience feature domain and how each of the 2023 solutions perform relative to one another, to understand if any of the solutions have managed to achieve an acceptable balance between usability and feature offering. Convenience features include HVAC, convenience access features, innovative user identification processes and any stand-out features of the companion app.

The Jeep Grand Wagoneer offers a dedicated HVAC screen permanently displaying controls and offer numerous convenience delight features. The Nissan Ariya HVAC can be operated via the central display or a row of 'shy-tech' buttons underneath the central display. In the BYD Seal, the main HVAC menu in the central display provides access to all major HVAC functions. This is made up of multiple sub menus which can be confusing to navigate. The Fisker Ocean provides access to most HVAC controls in the central display with an additional row of hard buttons underneath and rear LCD control panel for rear seat passengers. The Fisker also provides the delight feature 'California Mode' that lowers all windows and opens the glass roof at the touch of a button.

The Peugeot 408 and MG4 EV lack permanent access to HVAC controls, and they suffer from clutter in the main HVAC menu. The HUD in the Grand Wagoneer and Ariya is clear and well presented while the BYD provides pseudo-AR for navigation. In the MG4 EV and Fisker Ocean, only one user profile can be loaded at a time, severely limiting user flexibility. Setting up a profile in the MG4 is a cumbersome process, while the Peugeot user app is very limited.

2023 Convenience SUS Scores

Domain usability / Domain feature set
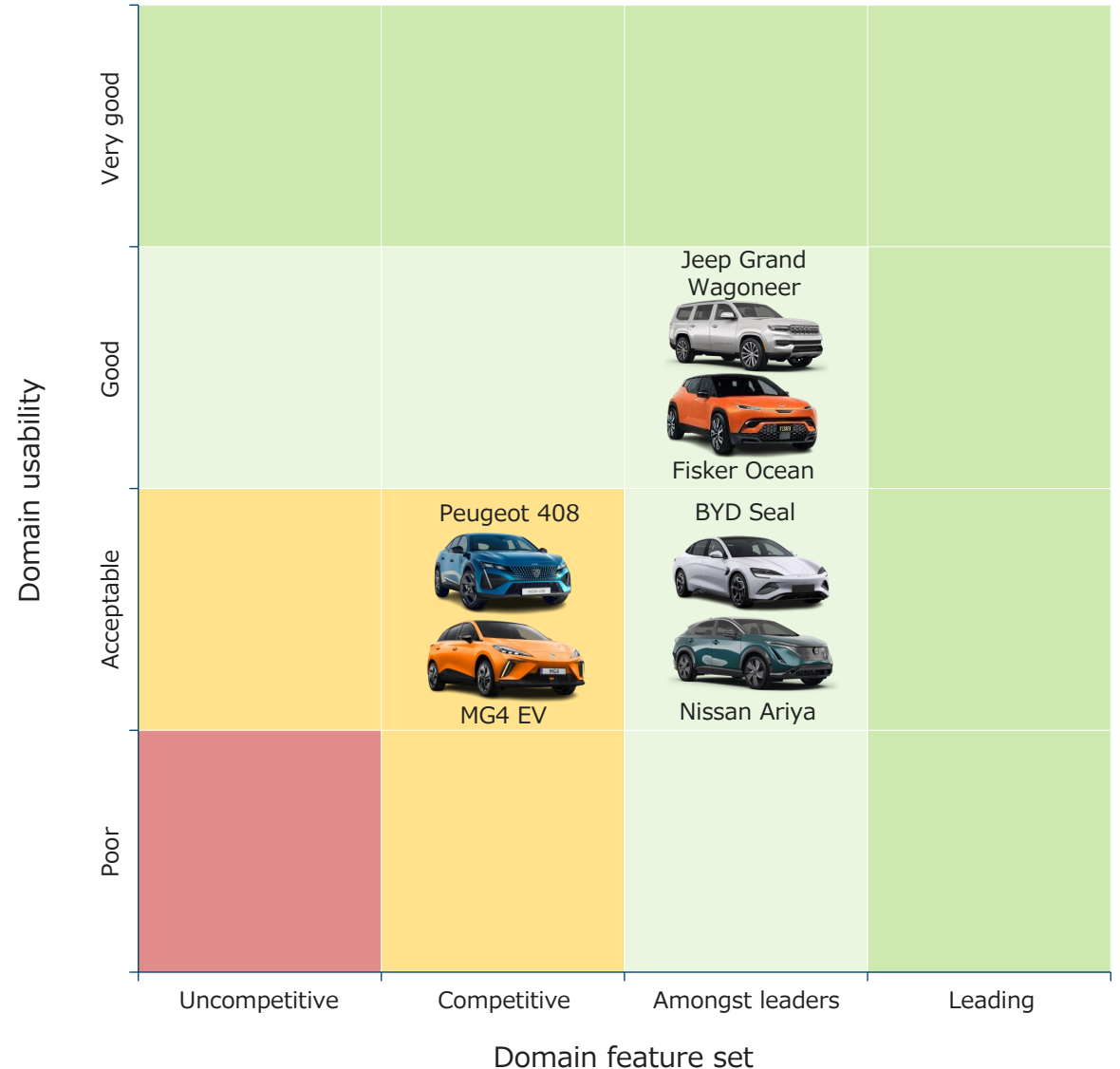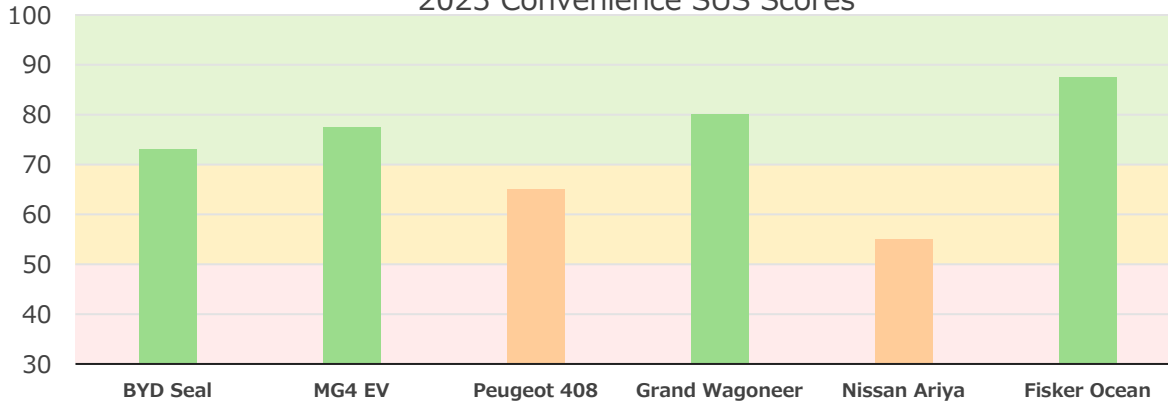
Unique feature commonalities

Throughout the six vehicles tested in the 635 2023 report series, certain feature trends and commonalities have become apparent. Below is an overview and description of some of the most notable trends seen on the test vehicles this year.
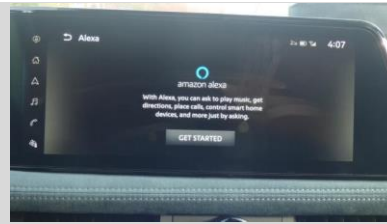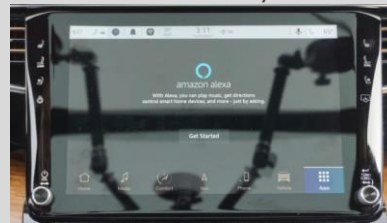

BYD Seal

Peugeot 408

Air quality features

Nissan Ariya

Jeep Grand Wagoneer

Third party voice assistant integration

BYD Seal

Fisker Ocean

Rotating central displays

- The BYD Seal and MG4 EV both had the 'air purifying modes' that can be accessed via the HVAC system.
- In the air purifier menu of the BYD, users can select PM2.5 detection, quick air purification and negative ion air purification.
- The Peugeot 408 GT has a cabin air quality monitoring system that can be viewed via the HVAC menu.

- The Jeep Grand Wagoneer and Nissan Ariya both offered an Amazon Alexa option for voice recognition.
- The Fisker Ocean is due to receive Amazon Alexa integration but was not available at the time of testing.
- Both examples in the Jeep and Nissan had varying level of implementation success with the Jeep's native system competing alongside Alexa and the Nissan providing the option to completely switch the native system off and only use Alexa.

- The Fisker Ocean and BYD Seal both integrated rotating central displays.
- In the Fisker Ocean, this feature is called 'Hollywood Mode' and can be used to watch a variety of media streaming services while the vehicle is stationary.
- The BYD Seal has a similar integration but can also be used to play games and other apps the user downloads onto the system.

Conclusion: Exciting feature sets with mixed implementation success

It is clear that entertainment eco-systems are becoming a key consideration in OEM UX design and decision. Both the Jeep Grand Wagoneer and Fisker Ocean offer comprehensive entertainment offerings with the BYD Seal offering an app store to allow users to expand this selection further. With Amazon, Android and others taking a more dominant role in in-car entertainment offerings, an important strategy for OEMs is to lay firm foundations of vehicle software which could enable an easy ecosystem switch so they are not locked into a single tech giant's domain.

This trend isn't isolated to only entertainment ecosystems. An increasing number of tech giant voice solutions are being integrated into vehicle voice recognition systems with varying levels of success. Both the Jeep and Nissan offer a native VR system and Amazon Alexa. In both cases the native system is likely to see limited use due to its lack of ability while Alexa is presented as a secondary interface and often interferes with the native system. Investing in one effective implementation would reduce complexity and result in a simpler, more unified and more effective experience.

The continued pressure of trying to release 'game changing' features or simply keep up with the rapid rate of innovation from competition pushes OEMs to make some sacrifices such as having to release a vehicle slightly too soon. The Fisker Ocean is a key example of a vehicle that holds immense promise but is let down by not being ready for market and plagued by numerous software issues. The Jeep also experienced feature blackouts after an OTA but has since been resolved. While OTA's can address some of these issues, it presents the question of how many issues are customers willing to put up with in the earlier phase of ownership.

A trend noticed in several vehicles tested this year is the lack of Semi/Fully Automatic Parking Assist. In past years this has been a common staple of ADAS suites throughout various segments. It is not entirely clear whether this is a result of cost saving from OEMs or direct response to waning customer demand and willingness to pay for such features.

Overall, the main challenges highlighted in this year's selection of test vehicles seems to be striking the balance of offering an immensely feature rich system while still delivering a system that is fully functional 'out of the box'. OEMs should exercise caution in not overlooking the basic fundamentals of good implementation and usability in the pursuit of delighting their customers with innovative features.

The BYD Seal tops the 2023 635 ratings table. Its impressive range of entertainment features and apps along with numerous delight features is likely to wow and satisfy many customers. However, the question remains whether it can make a similar impact in the European vehicle market.

BYD Seal achieves highest rating in 2023
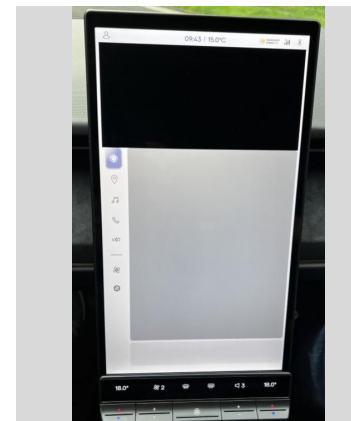
Fisker Ocean system crash

Rear seat entertainment in Jeep Grand Wagoneer

Car-by-car summary

A strong overall score, but held back by missing functionality

The BYD Seal achieves a 'Good' score for user experience, finishing at the upper end of the pack compared to 2023 vehicles. Functionality returns an acceptable score, finishing mid-pack.

While the Seal offers several minor delight features, the dominant delight feature is the rotatable central display. Most apps and displays adjust accordingly to the different screen layout but some struggle to adapt. The HMI is highly customizable via downloadable themes in the BYD app store. The navigation system has multiple connected integrations and convenience features. Visual information prioritization is very good with a floating navigation window to ensure route guidance information is always presented. Negative aspects of the system include poor integration of POI search and display while filtering options for EV charging stations are very limited. The system is missing some hygiene features such as no option in the native radio app to save favorite stations and no shortcut to change audio source without manually navigating to the desired app. The voice recognition system impresses with a high recognition rate and quick response times overall. Most ADAS are well integrated while some lack sufficient levels of warning, including RCTA.

The system manages to impress in terms of voice recognition and extensive app offerings but is prevented from scoring higher by missing functionality and poor integration of some features.
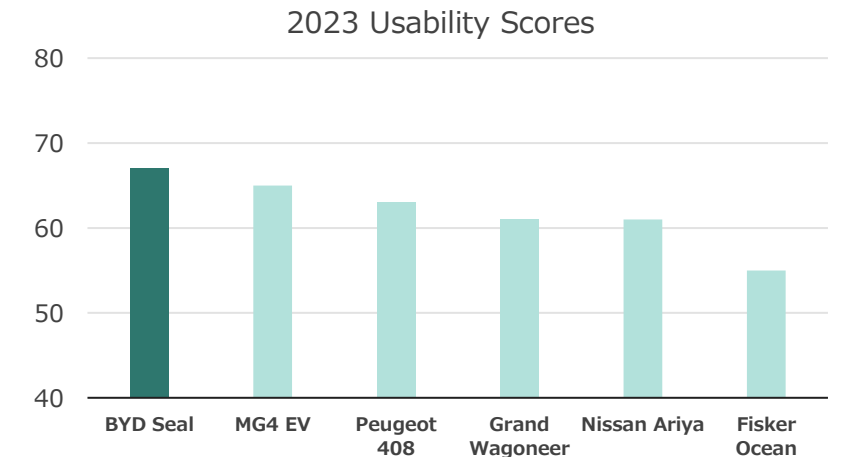
What the system **does** well	What the system **doesn't** do well
▪ Audio warnings and navigation commands are all prioritized over infotainment volume making sure that critical information is always heard.	▪ POI information is poorly integrated, and filtering of charge point POIs is very limited.
▪ A rich selection of apps form multiple app stores are offered giving the user a wide range of options.	▪ Visual warning for RCTA is limited to only side mirror icons, while BSM does not provide an audio warning.
▪ The rotating central display provides a wow-factor and optimizes the display for some apps.	▪ Some basic hygiene features are missing from the system including the ability to add favourites from the native radio app in the central display.
▪ Implementation of various navigation features such as detailed junction views and floating navigation window to ensure important guidance information is always shown.	▪ IoT integration is very limited and could benefit from more capabilities.
	▪ Fully Automatic Parking is not included on this vehicle which is likely to be a disappointment for most users.

SUS Score by Domain		
Navigation	Infotainment	Communication
75	68	83
Voice recognition	HVAC	ADAS
68	73	53

2023 Usability Scores

BYD Seal · MG4 EV · Peugeot 408 · Grand Wagoneer · Nissan Ariya · Fisker Ocean

Many delight features in infotainment domain

Rich selection of apps

The infotainment system offers a rich selection of apps including music, KTV, video, social media and game which users are likely to find satisfying. Apps can be downloaded from the BYD app store or other sources such as the Anzhi App store. A wide selection of apps greatly increases available options for entertainment and information sources.

Rotating central display

The 15.6-inch central display can be rotated from landscape mode to portrait mode by pressing a button. This is unique and creates a delight feature than many users are likely to find impressive and create a lasting talking point. Most apps can be viewed in different layouts depending on the screen rotation.
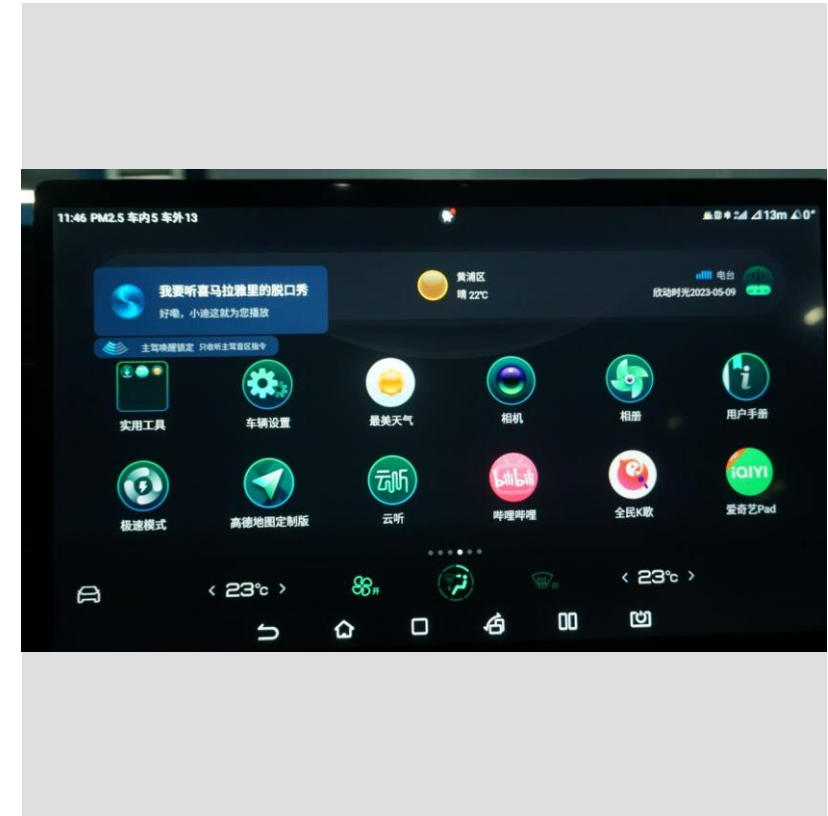
Good performance of voice recognition

The voice recognition system impresses in multiple ways including its high recognition rate and quick response times to user input and commands with a median average of 1.86 seconds. The system supports 66% of the core feature set while also being flexible and inclusive in offering multiple voice packages with different dialects.

Some features not up to market expectation

Frame of horizontal display rotation

App display uses only this space
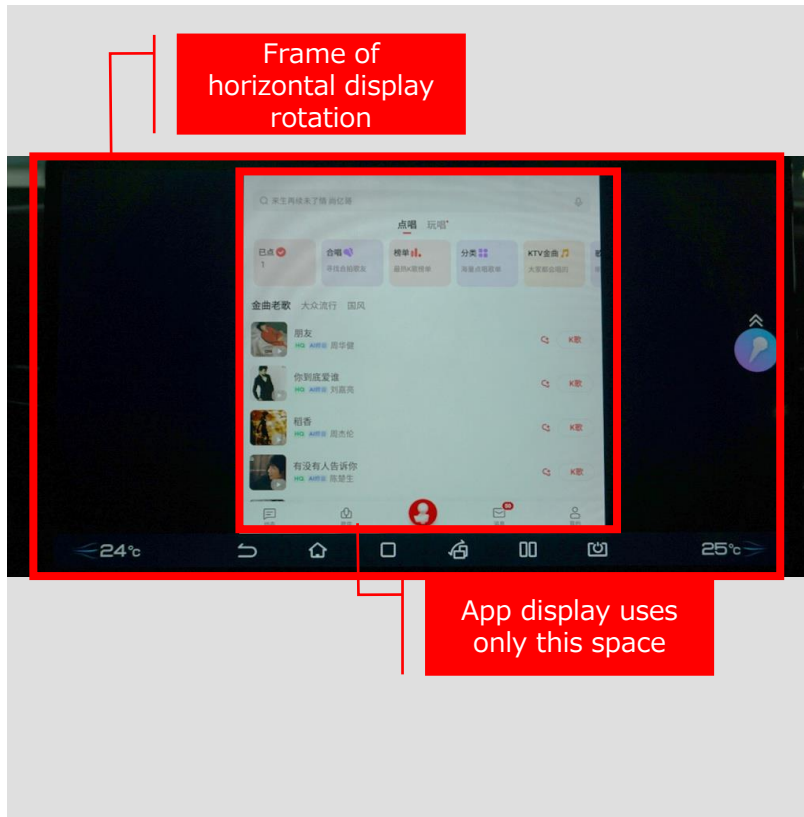
Unfinished app optimizations

The wide range of apps available in the BYD Seal makes for a competitive offering in the market with access to multiple app stores. However, some apps lack suitable implementations in relation to screen rotation and create an unfinished appearance.
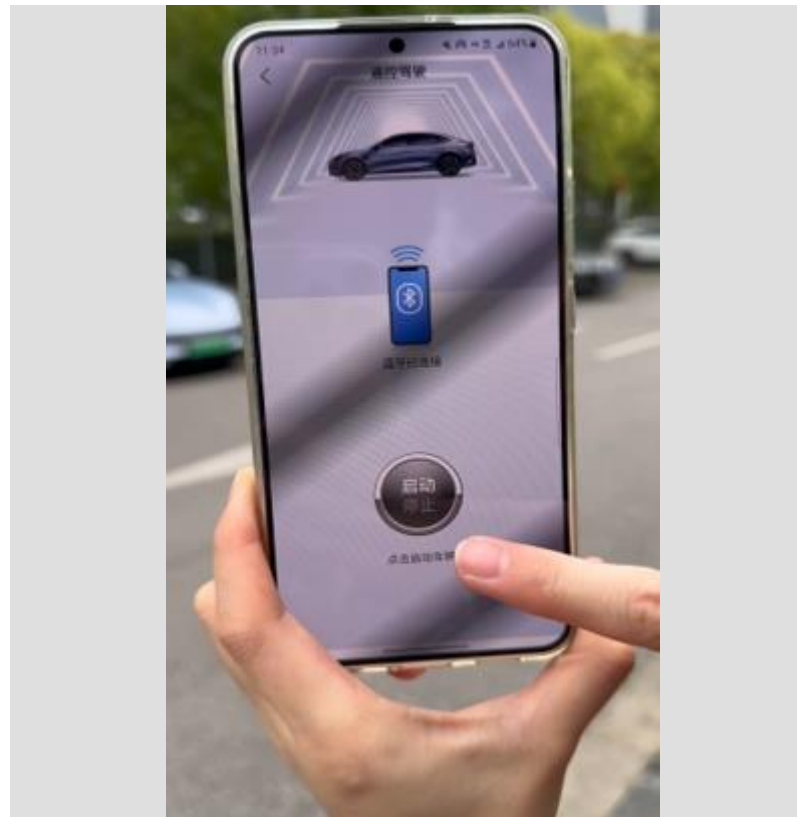
FAPA not offered

The vehicle is missing Fully Automatic Park Assist as part of the ADAS suite. This is likely to be disappointing as it is a feature that most users would expect to find in this segment and price point. The car does have a remote-control feature operated via an app, but only to enter and exit spaces in a straight line and does not carry out any parking procedures.
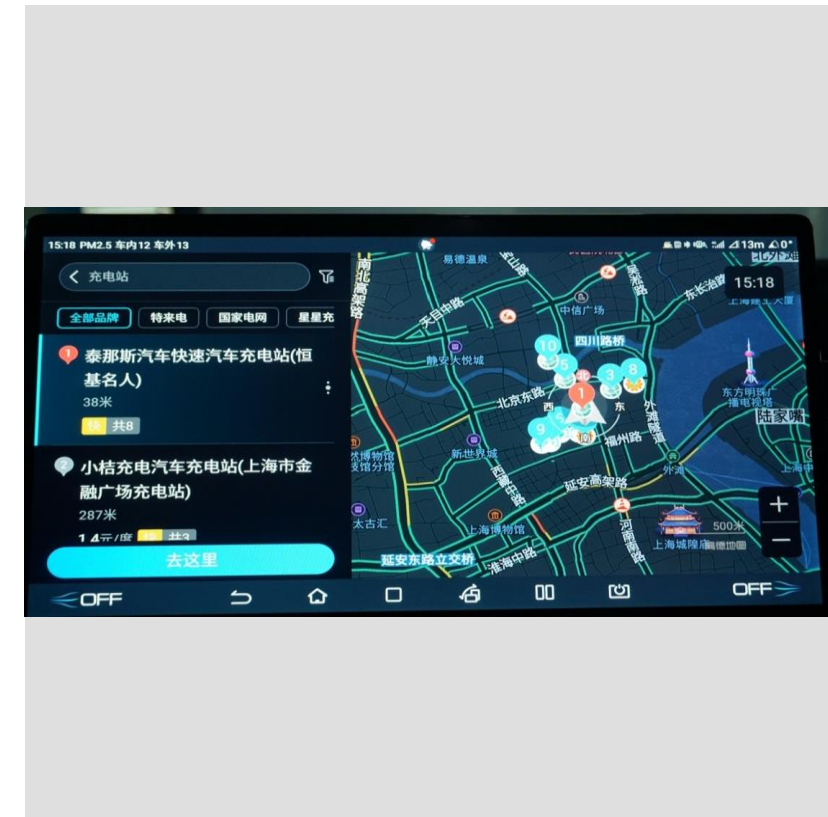
Poor POI integration

POI integration is considered poor in the way list are shown and filter options available. Only two POI options per page are shown in the central display forcing the user to scroll multiple times. Only very limited information regarding each POI is shown at the top level creating an extra step for the user to select each POI for any extra information. Filtering of EV charging POIs is limited to only brand and AC or DC charge.

A solid system, but may struggle to maintain user satisfaction

The MG4 EV returns a good user experience score compared to the vehicles previously tested in 2023. However, the functionality score is held back from being any higher due to a lack of delight features implemented in the vehicle and only a basic offering of information and entertainment features. While parts of the system feel dated, other elements are likely to impress such as built-in Amazon Music. The navigation system has multiple standout features that enhance the user experience, but inaccurate route guidance at times is a fundamental flaw. The system is very stable and reliable with only three bugs identified during testing. This is reflected in the strong user experience score.

ADAS benefits from a detailed multi-lane display in the cluster showing surrounding vehicles. Piloted Driving provides an acceptable level of warning when no hands are detected on the steering wheel. However, controls for ACC and PD are unlabelled and confusing for the driver. Color logic used for LDW/LKA is inconsistent with other systems and creates further uncertainty. No Semi or Fully Automatic Parking is offered.

Overall, the MG4 provides a solid and reliable system that meets user expectation for the most part. While the MG4 is a solid attempt from a Chinese developed system deploying in the European market, it suffers from numerous shortcomings in each domain, leaving opportunities for improvement.

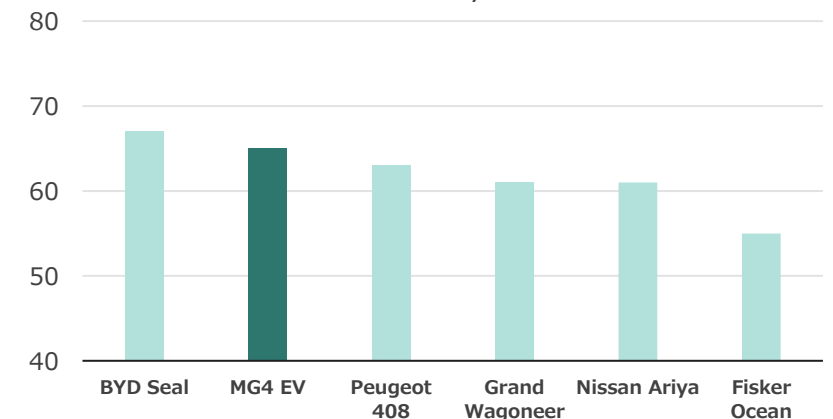| What the system **does** well	What the system **doesn't** do well
▪ Innovative and convenient navigation features such as work/home pop-up guidance suggestions. ▪ Programmable shortcut buttons on the steering wheel to being frequently used features closer to the user. ▪ Well implemented home screen widgets that show detailed information without having to leave the home screen. ▪ Built-in Amazon Music provides an additional listening option with on-demand music. ▪ POI listings and filter are well implemented to ensure popular POI categories are within minimal steps.	▪ Navigation route guidance can be inaccurate at times and ignore significant road features such as mini roundabouts and small junctions. ▪ Poor status communication, color logic and button labelling for various ADAS. Differentiation between LDW and LKA is too subtle. ▪ No permanent access to HVAC controls such as temperature fan speed. ▪ Illogical radio/media implementation with related features split across separate menus. ▪ Dated overall appearance to HMI and lack of customizability.

SUS Score by Domain

Navigation	Infotainment	Communication
70	62.5	75
Voice recognition	**HVAC**	**ADAS**
57.5	77.5	42.5

2023 Usability Scores

|	BYD Seal	MG4 EV	Peugeot 408	Grand Wagoneer	Nissan Ariya	Fisker Ocean
Score	67	65	63	61	61	55

# Detailed ADAS display, impressive home screen widgets

Programmable shortcuts

Two programmable shortcut buttons labelled with a star icon can be customized to access a variety of different features. On the right-hand side of the steering wheel the button can be configured to be a shortcut for either A/C or a search button. On the opposite side it can be configured for vehicle control, 360 camera, energy recovery or drive modes. These let the user configure this part of the system to meet their own needs.
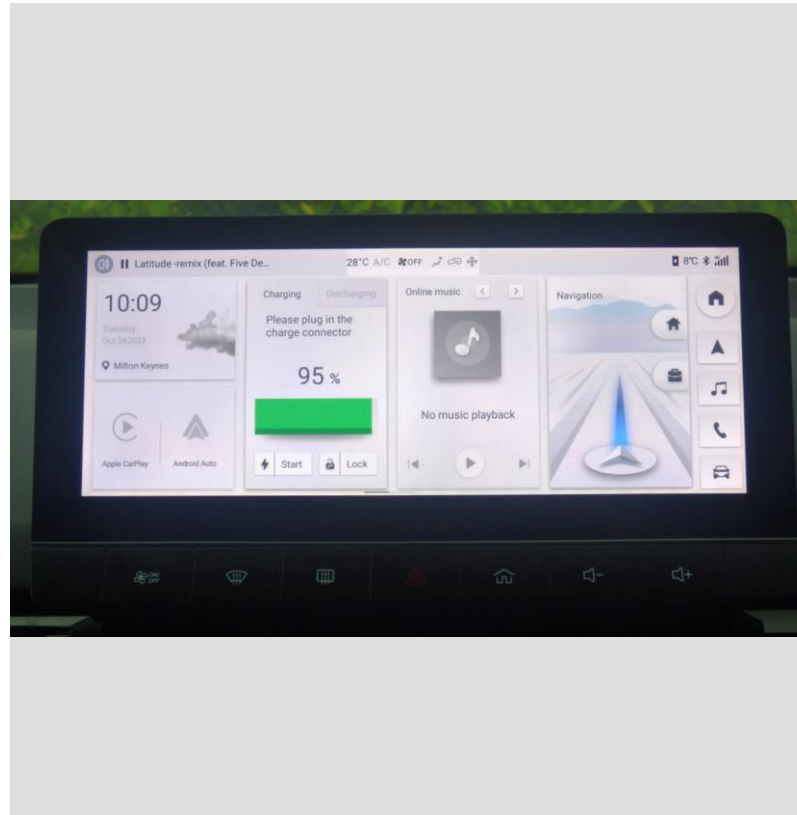
Widgets with high functionality

The home screen contains a number of widgets relating to various systems. These widgets allow the user to interact with multiple system quickly without having open up a dedicated menu. For example, the navigation widget provides quick access to home or work route guidance, the media widget allows the user to toggle between various sources and the weather widget provides a forecast for the current location.
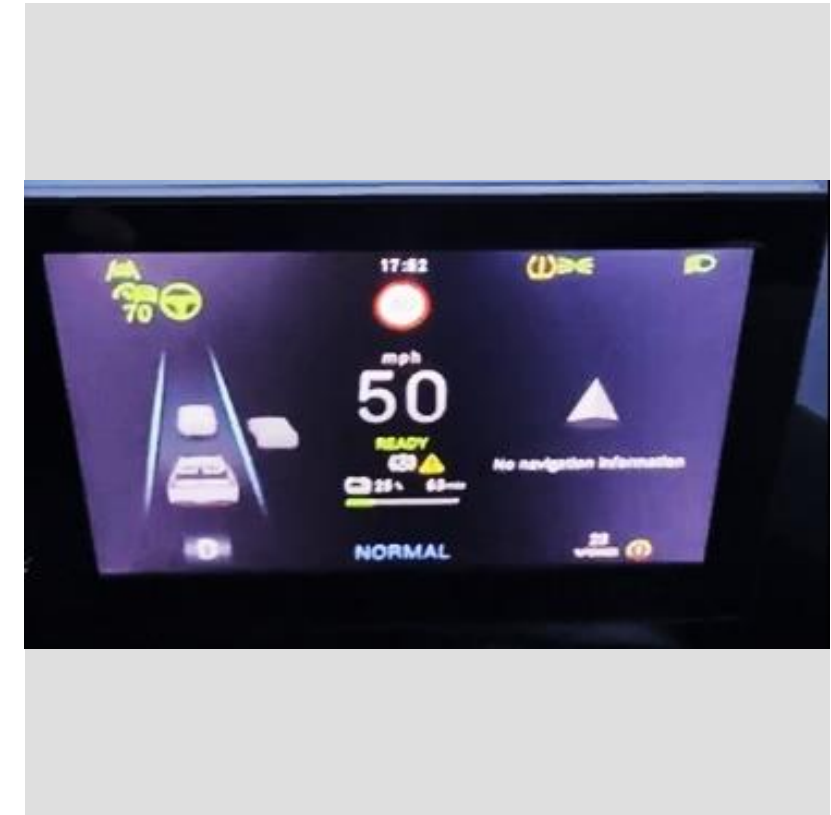
ADAS environment display

The permanently displayed ADAS display means that information relating to the systems are always present in the cluster not matter what other displays or configuration have been chosen. When ACC or PD is active the ADAS display shows a multi lane live depiction of the surrounding environment. This is similar to other more premium vehicles and is likely to increase levels of user confidence.

Poor navigation routing, lack of labelling creates confusion

Route and map guidance inaccuracies

On multiple occasions the navigation system failed to recognize and display upcoming mini roundabouts and incorrectly classified minor junction as bends in the road. Not only does the present a safety issue, but also affects levels of user confidence in the system. Additionally, route guidance was also found to be inaccurate at times with guidance being given on a closed road, forcing the tester to turn around.
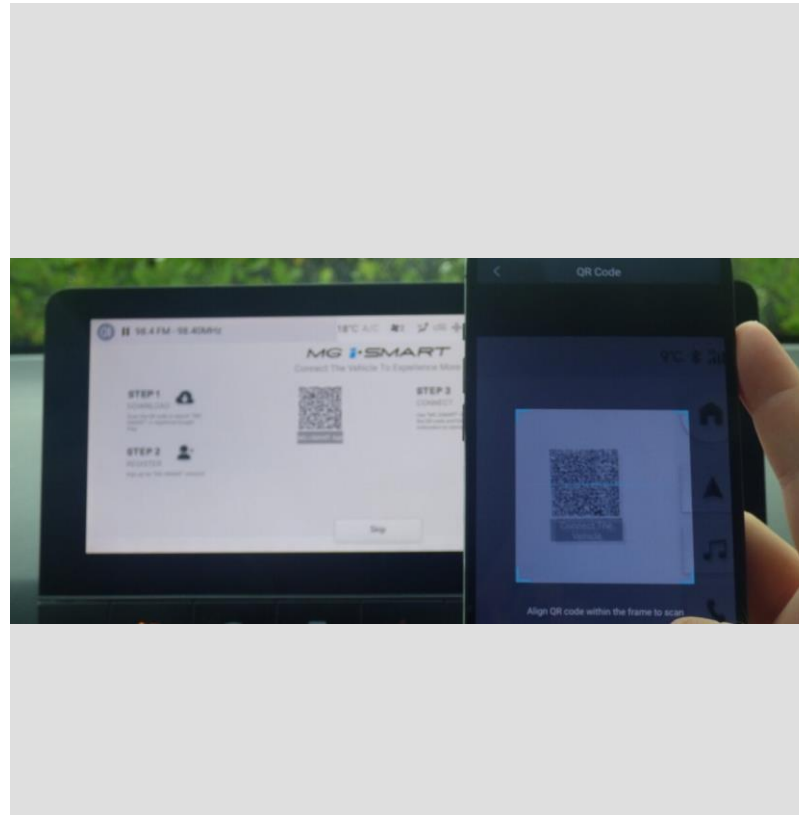
Cumbersome profile setup process

The process of signing up for an MG account and first linking it to the vehicle and then separately binding it to the vehicle is a long and complicated process that many users are likely to find frustrating. While the process may be more achievable for tech savvy users, some user will struggle with the complex switching between app and central display to successfully bind the device to the vehicle. A clearer step by step process should be given.

Lack of sufficient labelling of controls

The large steering wheel controls on either side of the wheel have no labelling to indicate their function. The left-hand side controls relate to ADAS, however this is not made clear and results in a trial-and-error process in discovering their function. Similarly, the controls on the opposite side of the wheel control media and cluster suffer from a similar issue.

Strong implementations, disappointing feature set affects score

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

The system suffers from a lack of features, especially concerning entertainment and media streaming options with only basic offerings for each. The navigation system provides a selection of well integrated features that make for an intuitive experience overall. However, some elements fall short of expectation with inconsistent search logic, excessively long POI lists and occasional inaccurate final destinations being some to note. The voice recognition system is quick to provide responses, but these are not always successful or correct.

The ADAS suite is lacking semi/fully automatic parking assistant, a system now expected by most users. ACC and PD both provide a good level of visual feedback in the cluster to show system status and during a warning scenario. However, LKA suffers from poor status communication and poor warning HMI.

Overall, the system provides a largely intuitive and easy to learn experience for most users, but the lack of features and functionality is likely to result in a loss of satisfaction over time.
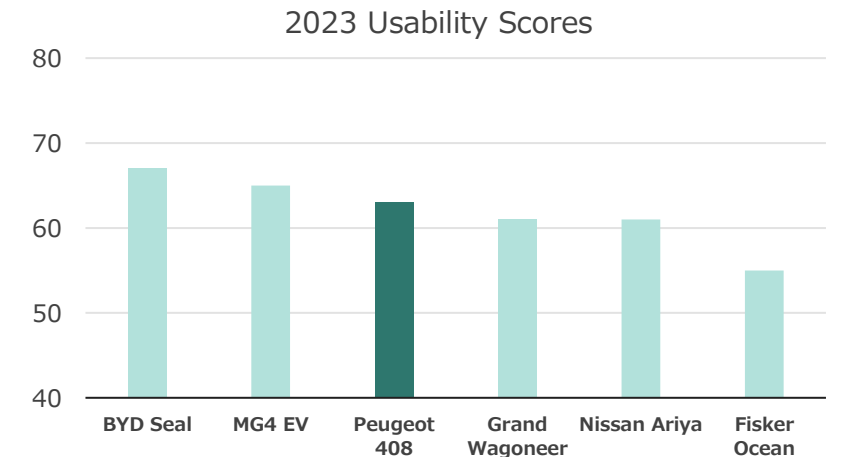
What the system **does** well	What the system **doesn't** do well
▪ Integration of on-street parking and weather estimation at the destination removes a step from the user journey and provides helpful information. ▪ The 3D cluster, while not adding any functionality, does provide a novel delight feature. ▪ Traffic data is always found to be accurate when tested against ground truth. The implementation of traffic is effective and provides users with critical journey information in the journey progress bar.	▪ An inconsistent back/return logic results in users sometimes becoming trapped in certain menus. ▪ No app store or media streaming options make for an underwhelming feature set that is likely to disappoint most users. ▪ No permanent control for fan speed or temperature adjustment forces users to navigate to the climate menu every time an adjustment is required. ▪ The accuracy of the final destination is sometimes lacking accuracy and context by not navigating to the associated carpark or incorrect parts of the parking area (coach park).

SUS Score by Domain

Navigation	Infotainment	Communication
67.5	80	75
Voice recognition	**HVAC**	**ADAS**
77.5	65	60

2023 Usability Scores

Bar chart showing usability scores: BYD Seal ~67, MG4 EV ~65, Peugeot 408 ~63, Grand Wagoneer ~61, Nissan Ariya ~61, Fisker Ocean ~55.

Customizable elements and seamless implementations


Good graphical feedback for SAE L2

Graphics used to support SAE L2 ADAS are of a high quality and communicate system status and warnings clearly to the driver. Piloted Driving provides a comprehensive level of warning, both graphical and audible to show that driver intervention is needed and how to correct the situation. System status for both ACC and PD is communicated clearly using green color coding and icons.
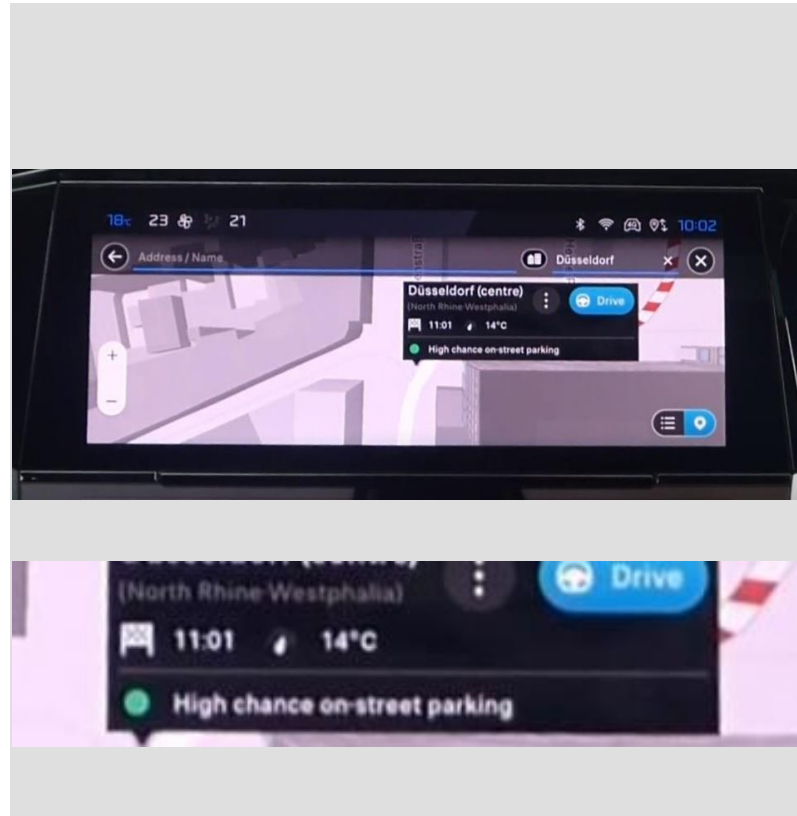
Seamless navigation implementations

The navigation system offers several intuitive integrations that provide seamless delivery of information such as on-street parking estimation at the destination and current weather at the destination. Both elements are shown in the journey confirmation pop-up. On-street parking estimation is communicated via color coded tell-tales, while weather conditions are represented with a clear icon.
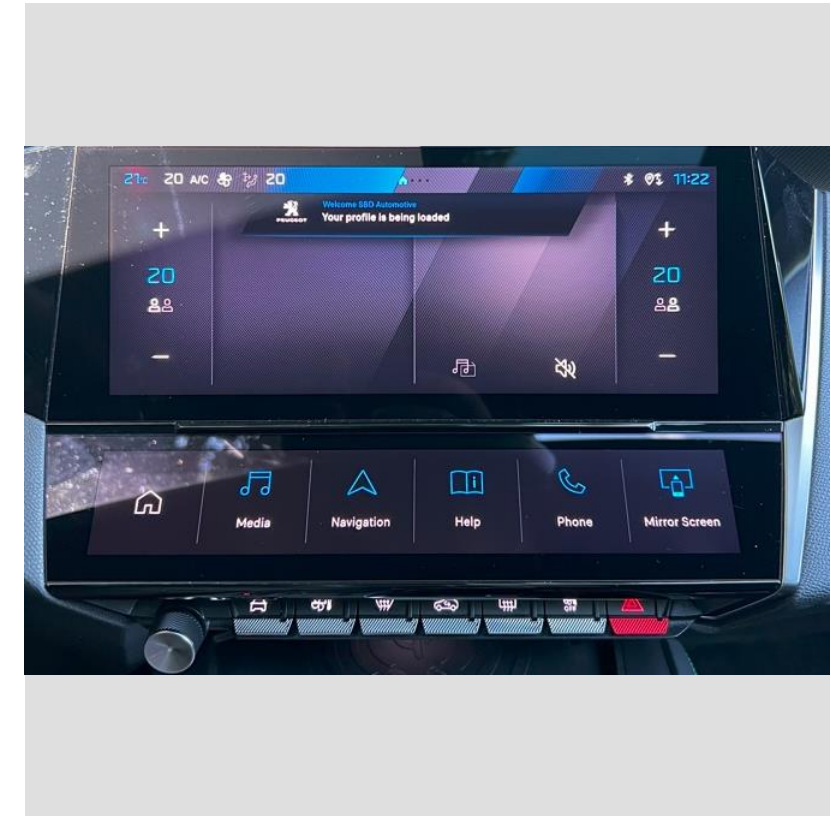
Customizable shortcut bar

A separate screen below the main central display shows several permanently displayed shortcut buttons that the user can customize in order to suit their needs. By pressing and holding one of the shortcut buttons, the user can drag and swap out for other shortcuts shown in the central display. This implementation allows for a flatter menu structure overall.

Distracting 3D cluster and underwhelming feature set

3D cluster presents distraction issues

While the 3D cluster offers a novel delight feature that many users are likely to find exciting, the display also presents some visibility issues depending on how it is viewed. If viewed off center, the 3D effect can blur information and graphics making them difficult to read.
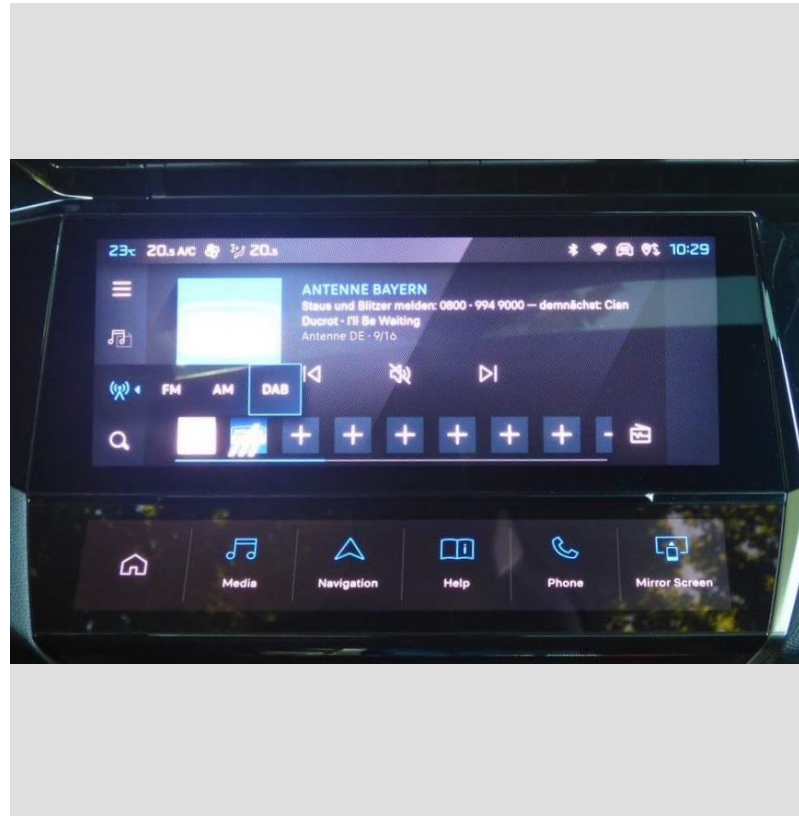
Lack of entertainment features

The system falls short of expectations in offering very little entertainment features and no option of music streaming or listening options. Additionally, no app store exists for users to download content to the vehicle. This considerably limits the ability to add to the basic FM/AM/DAB music options provided as standard. As a result, this lack of features may force users to use external sources such as Apple CarPlay and Android Auto.

Missing permanent HVAC controls

No permanent controls to adjust fan speed or temperature control exist. The user is forced to always navigate to the climate menu via the central display or shortcut button in order to adjust these settings. Not only is this inconvenient but it also increases the risk of driver distraction.

Impressive feature set, but still room for improvement

The Jeep Grand Wagoneer returns a strong score for functionality achieving the highest score in 2023 and a Good score for user experience, finishing middle of the pack compared to 2023 vehicles.

The system offers a high number of major and minor delight features including Amazon Fire TV and a 10.2-inch passenger display. The navigation system offers a host of well-integrated features including the front passenger display that can be used to view the map and send route guidance to the central display. One of the key negative aspects of the system is the native voice recognition system and its relatively limited functionality. Its struggle with inferred meaning and its lack of IoT integration makes for an underwhelming overall system.

The ADAS displays in both the cluster and HUD provide a good level of status and feedback. However, some systems lack the required level of user support such as ACC stop & go scenarios.

Overall, the system stands out with its comprehensive feature offering. However, the user experience score is affected by a high number of critical or major bugs.
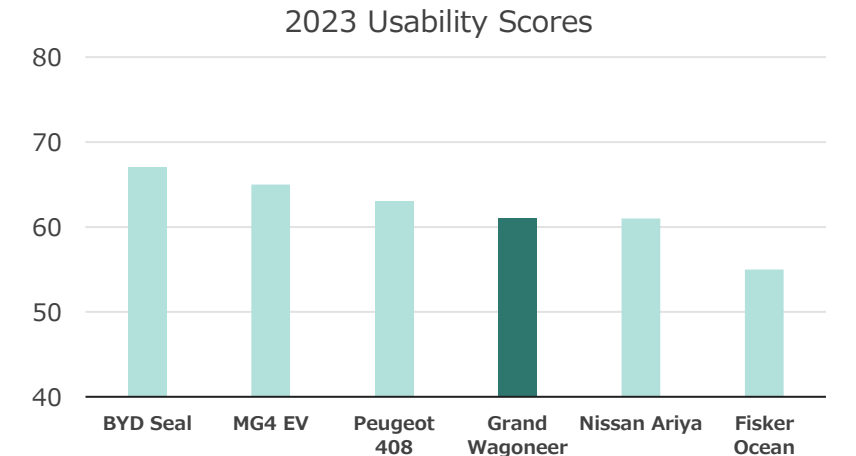

What the system **does** well	What the system **doesn't** do well
▪ The ADAS display screen in the cluster gives very good status feedback and visual warning while a repeater icon always shows current system status regardless of display chosen.	▪ Inconsistent audio prioritization for multiple systems.
▪ The system is feature and functionality-rich, offering connected navigation features and comprehensive entertainment and information features.	▪ Poor search logic and search integration for navigation producing unexpected results.
▪ The navigation system benefits from quick re-routing speeds and a pleasing and contemporary map aesthetic.	▪ Poor integration of traffic information in the map view.
▪ HMI is highly customizable allowing user to tailor their own experience.	▪ ACC gives little to no support during stop&go traffic scenarios leaving the driver potentially unaware of developing situations and system status.
	▪ Voice recognition fails all integration use tasks and struggles with some simple navigation tasks.

SUS Score by Domain

Navigation	Infotainment	Communication
75	80	70
Voice recognition	**HVAC**	**ADAS**
65	80	70

2023 Usability Scores

|	BYD Seal	MG4 EV	Peugeot 408	Grand Wagoneer	Nissan Ariya	Fisker Ocean
Score	67	65	63	61	61	55

# Numerous delight features with a highly customizable HMI
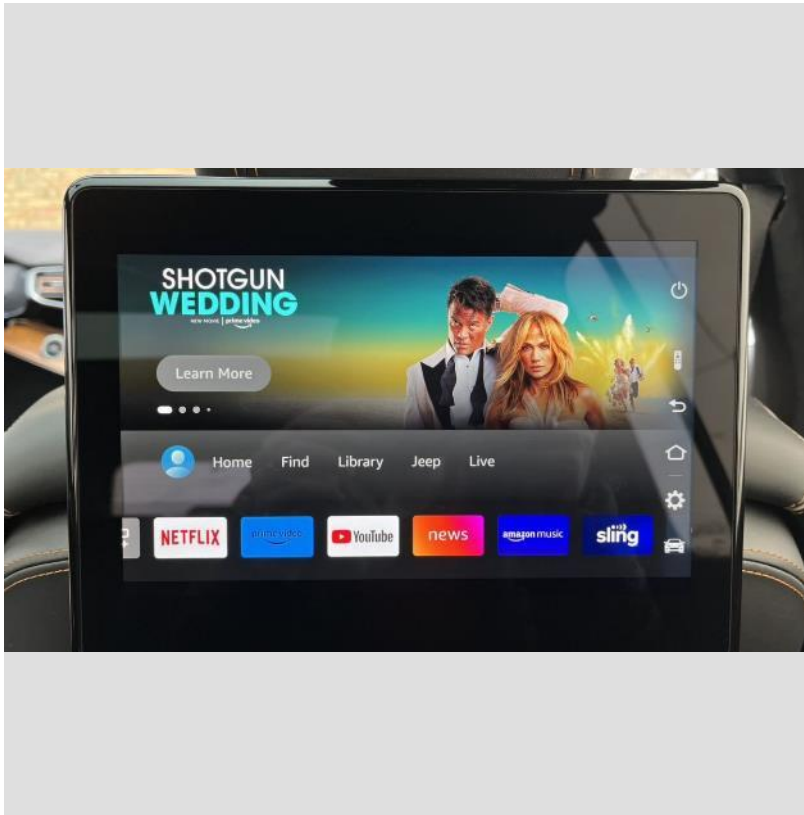
Numerous delight features

Several impressive delight features are offered including a passenger display which can be used to send navigation destinations to the central display, Amazon Fire TV and a retractable lower central display.
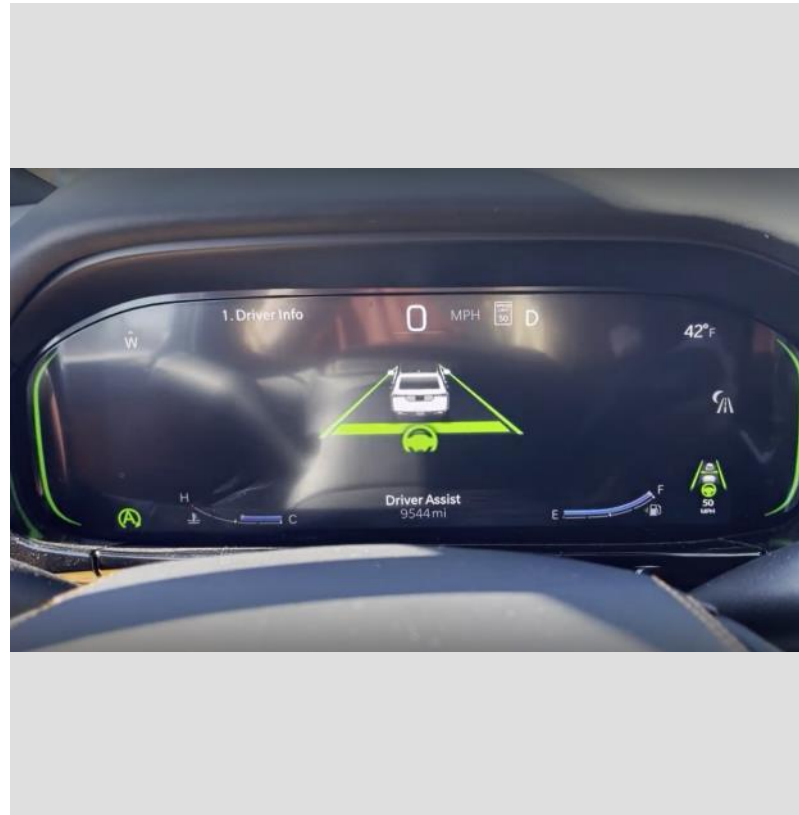
Informative ADAS HMI

ADAS information is shown across the cluster and the HUD with a good level of consistency. A detailed repeater icon ensures that ADAS status is shown at all times no matter which display has been chosen in the cluster. The large ADAS display option in the cluster gives a clear depiction of lane tracking status, headway, PD status and vehicles ahead. With the ADAS display chosen, all other information is kept to a minimum to avoid clutter.
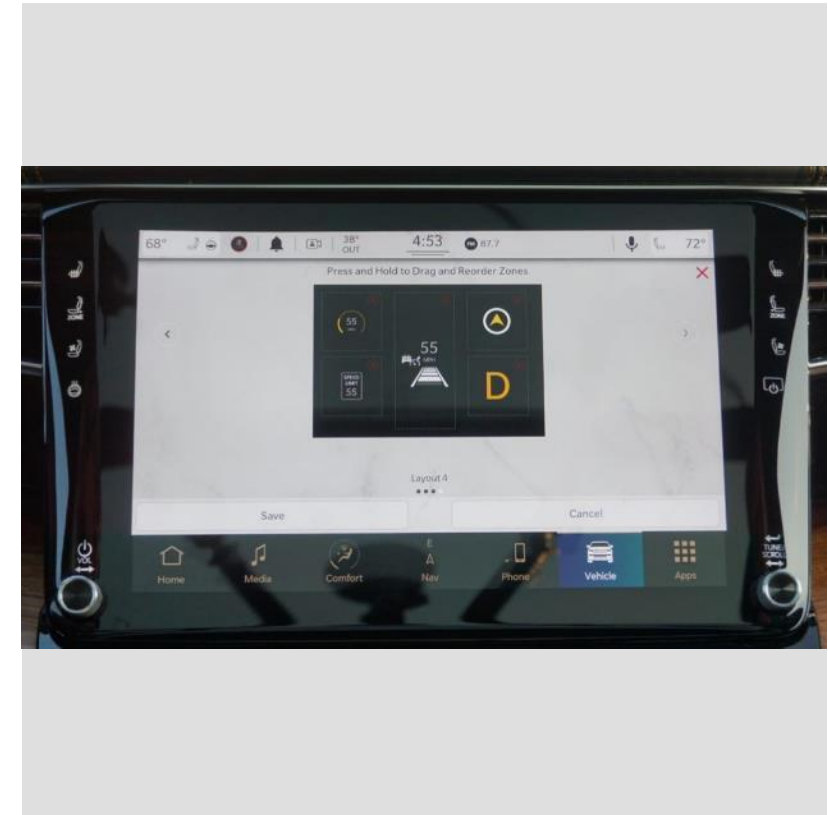
Highly customizable HMI

The level of customization for button and widget layout lets the user personalize their experience. Home screen widgets can be re-ordered and sized according to user preference. Buttons in the shortcuts bar along the bottom portion of the screen can be re-ordered to bring frequently used features closer to the driver's side of the screen. Multiple cluster layout options are available, while the HUD can be configured via a dedicated menu in the central display.

# Inconsistency throughout the system, lackluster voice recognition
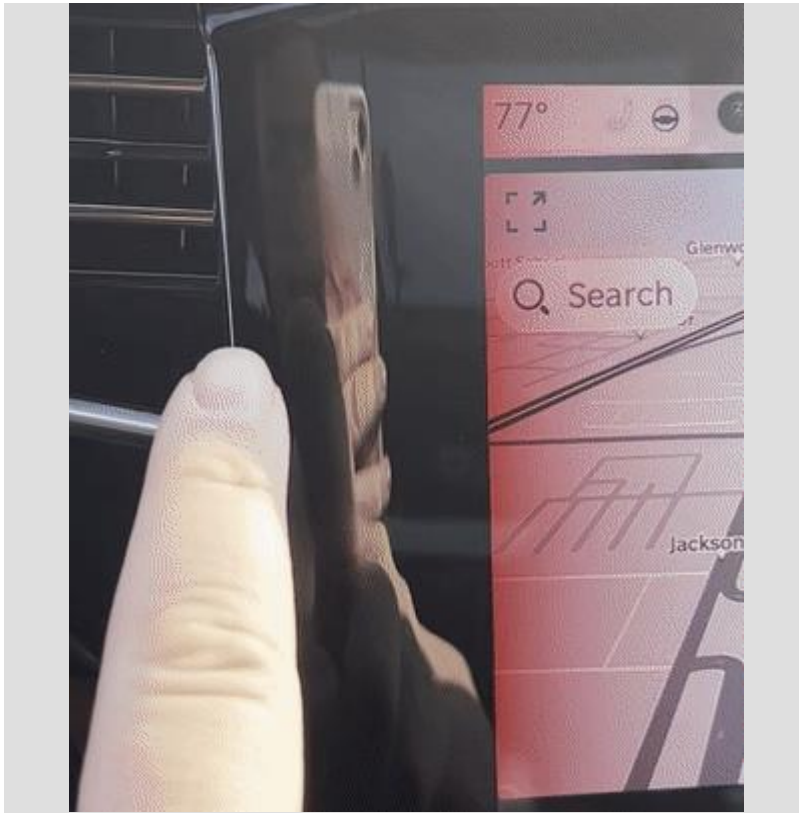
High number of bugs

A high number of bugs were experienced in the vehicle throughout testing. Many were ranked as critical or major in severity and had an impact on the overall user experience score. Some impacted the responsiveness of the overall system while others caused erratic behavior of the HVAC system.

Inconsistencies throughout HMI

In some cases the back button appears as an arrow and others as a cross. The number of steps back the button takes also varies. Visual inconsistencies between cluster and central display exist regarding color theme. The cluster is always shown in a dark theme while pale and light colors are used for the central display. Audio prioritization is present for some systems and not others while audio feedback for voice recognition is sometimes present and sometimes not.
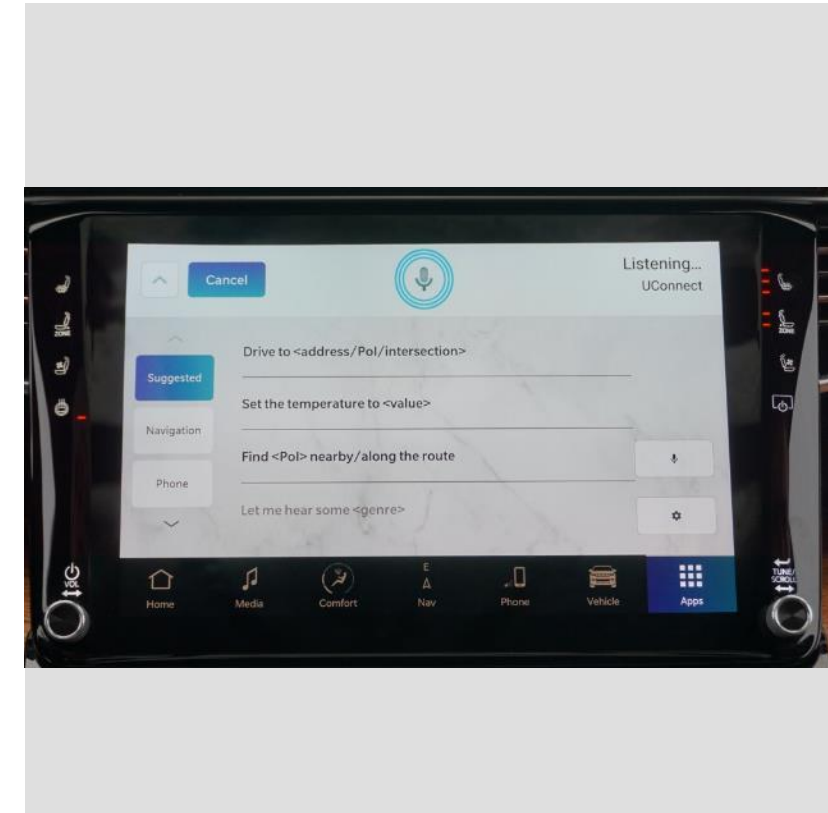
Voice recognition lacks ability

The voice recognition system struggles to impress with only a 39% overall positive recognition score. Categories such as phone and navigation have a reasonable recognition rate, however several simple hygiene commands within navigation and HVAC are not possible. No integration use cases are possible. Only after Amazon Alexa is connected can a wider range of tasks be completed successfully.

Pleasing system overall, feature set struggles to impress

The Nissan Ariya achieves a Good score for user experience, finishing middle of the pack compared to 2023 vehicles but achieves an average score for functionality.

The Ariya only offers a minimal selection of features with media streaming options limited to only basic offerings. Google search integration and Amazon Alexa complete the integration offerings. Perceived quality is of a high standard with materials in the cabin providing a sense of luxury that is likely to be unexpected by most users.

The navigation system provides a reasonable level of support whilst route guidance is active with well-timed command delivery and good visuals in the HUD. However, the system falls short in some areas such as poor traffic data integration on the map. The native voice recognition system struggles to impress. Amazon Alexa is offered as an alternative to the native voice recognition system and brings added functionality and greater levels of task completion success. Two main displays in the cluster present ADAS information. Each display provides varying levels of visual support for different systems.

Overall, many features are delivered to an acceptable standard, but an underwhelming feature set and struggling voice recognition system stand in the way of a higher overall score.
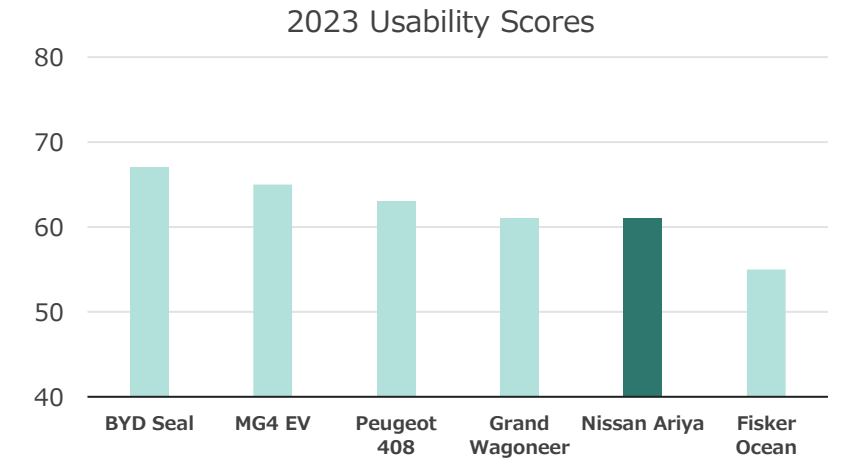
What the system **does** well	What the system **doesn't** do well
▪ Piloted driving warnings during a hands-off event are visual, audible and convey an increasing sense of urgency.	▪ Issues with map layout and functionality resulting in a difficult and cumbersome system to use.
▪ A permanent shortcut bar on the left-hand side of the central display allows for quick access to the main apps.	▪ Response and recognition issues across the system, especially concerning HVAC touch bar.
▪ In-depth head-up display (HUD) that offers support to the driver, including navigation and ADAS information.	▪ Significant visual inconsistencies between ProPilot and the rest of the ADAS.
▪ Google search integration brings added layers of information and detail to search results.	▪ Initial use of some ADAS systems were unintuitive and difficult to learn, like the fully-automatic parking assist (FAPA).
	▪ Voice recognition lacks flexibility and ability to successfully complete many tasks.

SUS Score by Domain		
Navigation	**Infotainment**	**Communication**
60	73	58
Voice recognition	**HVAC**	**ADAS**
60	55	53

2023 Usability Scores

	BYD Seal	MG4 EV	Peugeot 408	Grand Wagoneer	Nissan Ariya	Fisker Ocean
Score	67	65	63	61	61	55

Elevated cabin quality, good graphical support in cluster and HUD


Impressive cabin appearance

Cabin materials give the interior an impression of luxury. The use of Alcantara dashboard trim, a wood-effect center console with laser-etched buttons and ambient lit grille trim around the lower portion of the cabin help to elevate the interior beyond the perceived brand image.

HUD rich in detail

A good range of information and detail is shown in the HUD. ADAS information is accurately reflected with high levels of consistency compared to the cluster. When route guidance is active, junction views, current command, distance countdown, roundabout view with exit number and lane guidance are also shown.
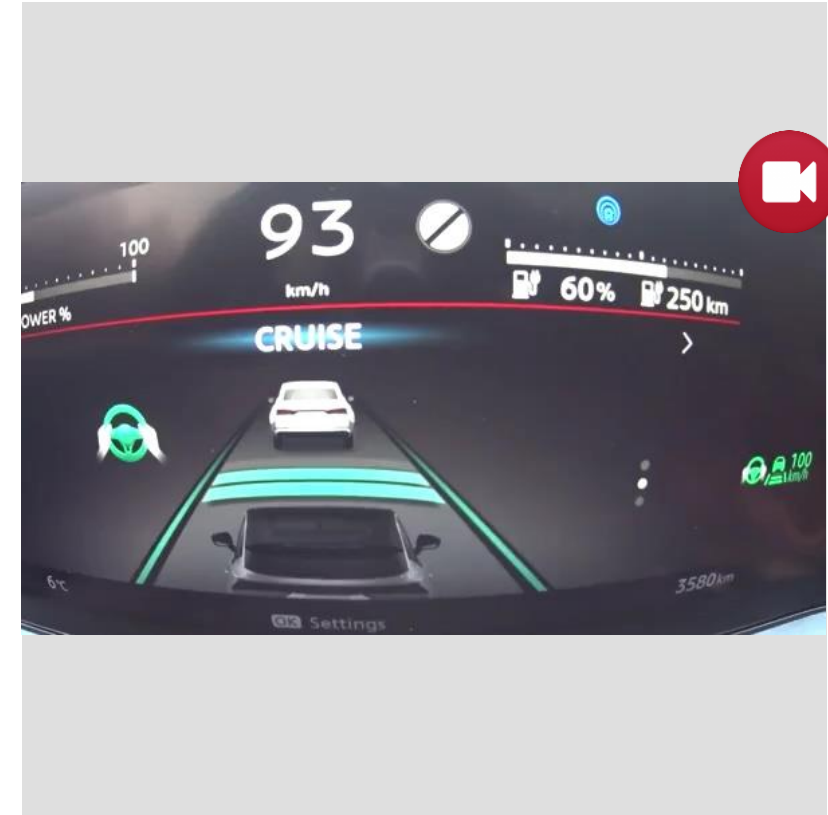
Extensive Piloted Driving warnings

The warnings given in the instrument cluster, HUD and audibly are clear and supportive when the driver's hands are no longer detected on the steering wheel during Piloted Driving operation. The visual warnings show how to correct the situation while the audible warnings increase in severity if a warning is ignored. Brake pulsing is initiated as a last resort.

System suffers from poor response, ADAS support is inconsistent
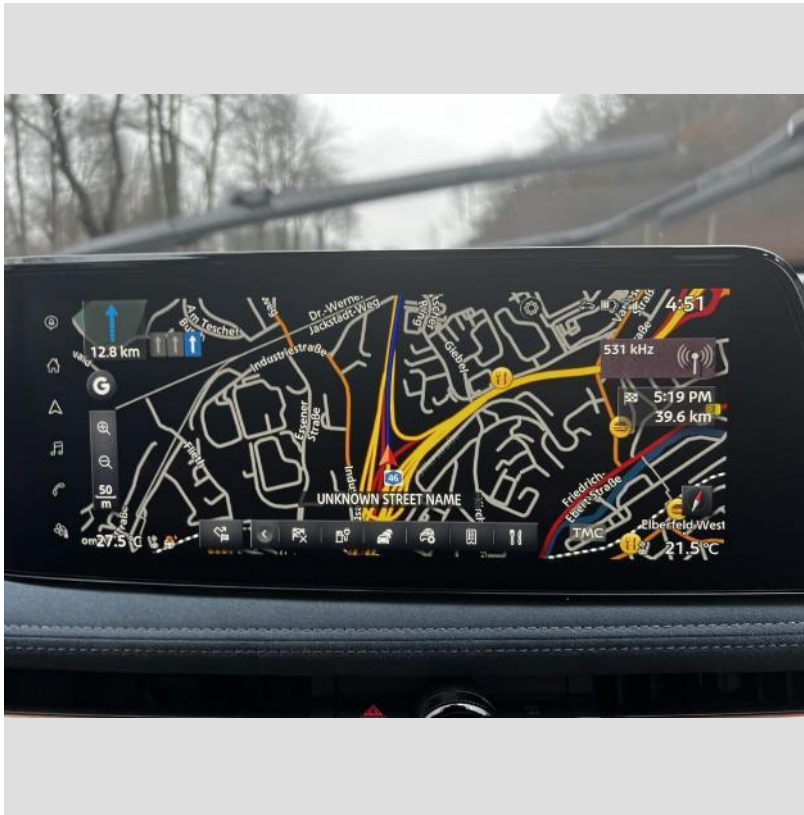

Map elements problematic

The map view in the central display has multiple issues preventing it from being as intuitive as it could be. A lack of automatic zoom makes intricate road layouts difficult to view. Harsh road coloring on the map makes for an unpleasant viewing experience at nighttime. Traffic jam indication is poorly integrated resulting in the current route guidance line being completely obscured.

ADAS and ProPilot inconsistencies

The ADAS display provides a good level of visual feedback for systems such ACC and PD, showing the car ahead and headway. However, the ADAS display does not show lane tracking status or any BSM warning beyond a small icon. The ProPilot display shrinks the detailed ACC and PD information to repeater icons, while providing more detailed status for LKA, LDW and BSM. Both displays provide good information for certain systems, but neither display provides suitable feedback for all systems.
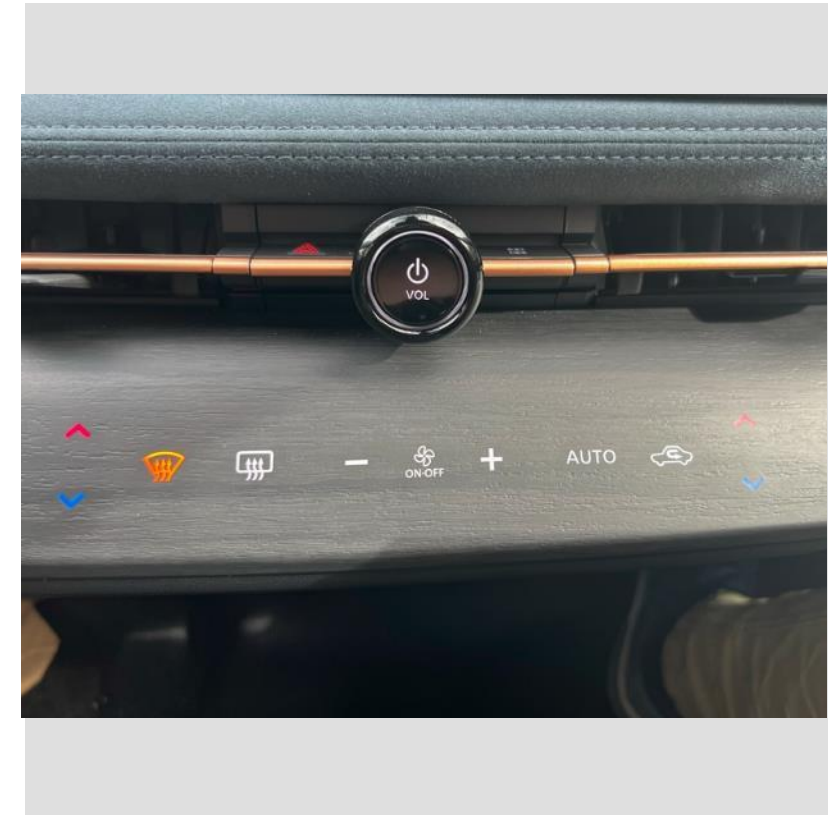
Response and recognition issues

The system struggles to keep up with user input, especially quick successive inputs and there is a noticeable lag when transitioning between menus. HVAC hard buttons below the central display suffer from poor response to user input and misoperation is a common occurrence often requiring multiple presses.

Solid first impressions, shortcomings and bugs disappoint

The Fisker Ocean returns a disappointing user experience score, finishing lowest among all vehicles tested in 2023. The functionality score is held back considerably due to missing features. This is a result of testing an early to market vehicle with these missing features expected in future updates.

The system does impress in other areas with a good selection of entertainment apps and music listening options. Many delight features are implemented including 'California Mode' and 'Hollywood Mode'. Core functionality of the navigation system is good with destination input largely intuitive and simple. However, the system lacks an element of flexibility with only very limited POI filtering options, especially for charge point locations. Most elements of the interior give a good impression of quality, but this is not consistent across the entire cabin.

'Fi-Pilot' was not available on this vehicle with only LKA/LDW and BSM present.

On the surface, the Fisker is an impressive and forward-looking entrant into the EV SUV segment. However, missing features that are likely to not go unnoticed by users and a very high level of instability create an impression of a vehicle that has been released too early with the expectation that users will dismiss its shortcomings until an OTA is released.

What the system **does** well	What the system **doesn't** do well
▪ Many delight features that result in lasting talking points such as 'Hollywood Mode', 'California Mode' and 'Boost Mode'. ▪ Good selection of entertainment apps such as Prime video, YouTube, Hulu, Apple TV etc. ▪ A permanent ADAS display in the top portion of the central display gives constant information relating to ADAS. ▪ The shallow and flat menu structure allows for easy navigation of the system and quick learnability. Task completion times are also quicker as a result.	▪ Very unstable system with many bugs and glitches. ▪ Lack of overall customization and personalization throughout the system. ▪ Legibility issues both in the cluster and central display, particularly with text size. ▪ Cluster lacks functionality and only presents very limited navigation information. ▪ Inconsistent loading times throughout the system and especially when calculating longer navigation routes is likely to cause frustration among users over time.

| SUS Score by Domain		
Navigation	Infotainment	Communication
67.5	72.5	N/A
Voice recognition	HVAC	ADAS
N/A	87.5	67.5

2023 Usability Scores
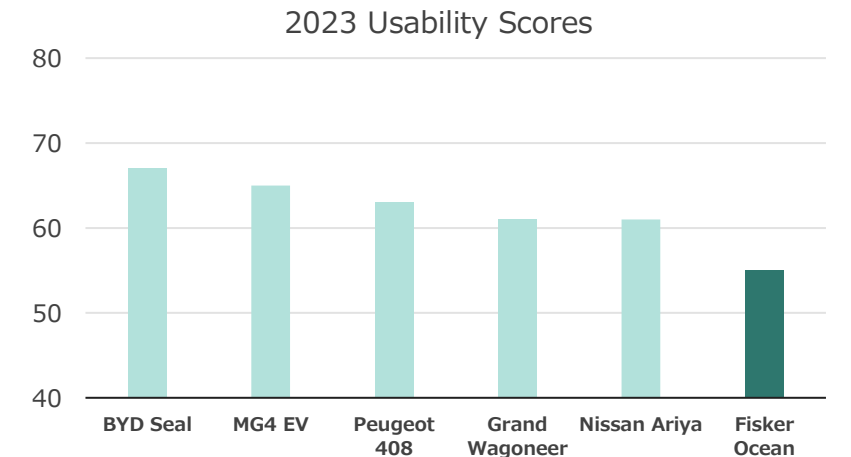
Entertainment features impress, convenient ADAS display


Many delight features

The rotating central display known as 'Hollywood Mode' is one of many delight features that are likely to impress users and create a lasting talking point. 'California Mode', which drops all of the windows including the rear screen and sunroof, is also likely to drive high levels of satisfaction and provide a wow-factor for many users. The high number of major and minor delight features in this vehicle help to create a unique identity for the vehicle among many other similar vehicles in this segment.
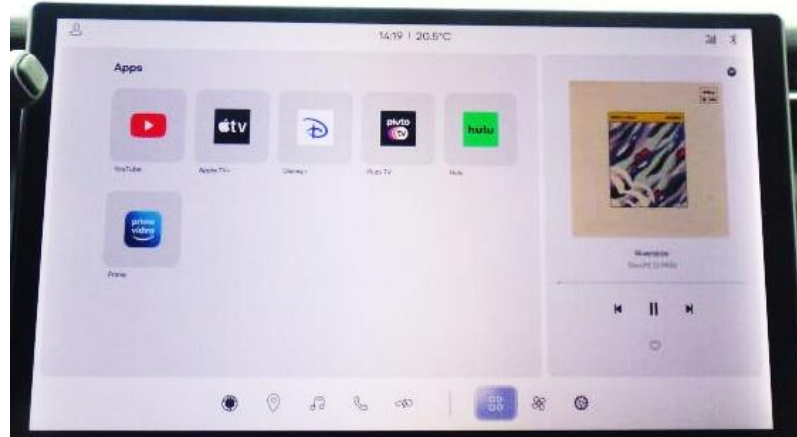
Entertainment offering

The system offers a good range of entertainment apps from leading services as default that are likely to satisfy users. These apps can be accessed when the central display is in 'Hollywood Mode' and make full use of the large wide screen central display.
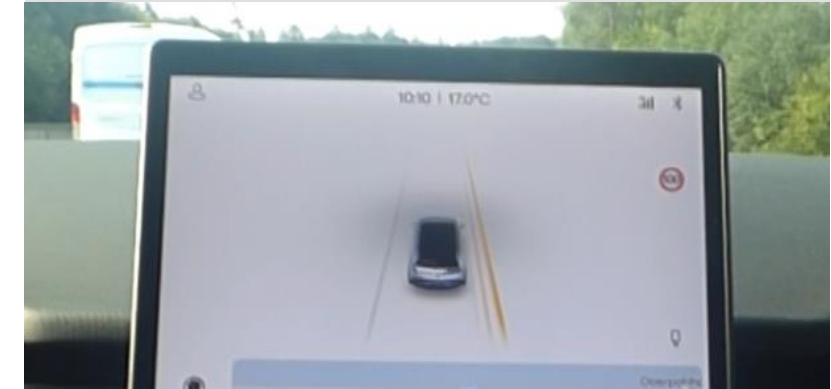
Permanent ADAS display

A permanent display of ADAS related information and warnings is shown in the top portion of the central display. This is never removed are changed in anyway regardless of what other settings or features are being displayed in the rest of the central display. This helps to provide the user with constant status of ADAS where possible.

Many bugs across the system, missing features disappoint


Legibility issues throughout

Text size is a major concern across both the central display and the cluster. The large size of the central display means that text below ideal height requirements is exaggerated and appears lost within the display. This can cause issues in locating the required text or labels, especially while driving. Navigation information in the cluster is also too small and difficult to fully read when driving. This is especially true for navigation icons such as destination arrival.
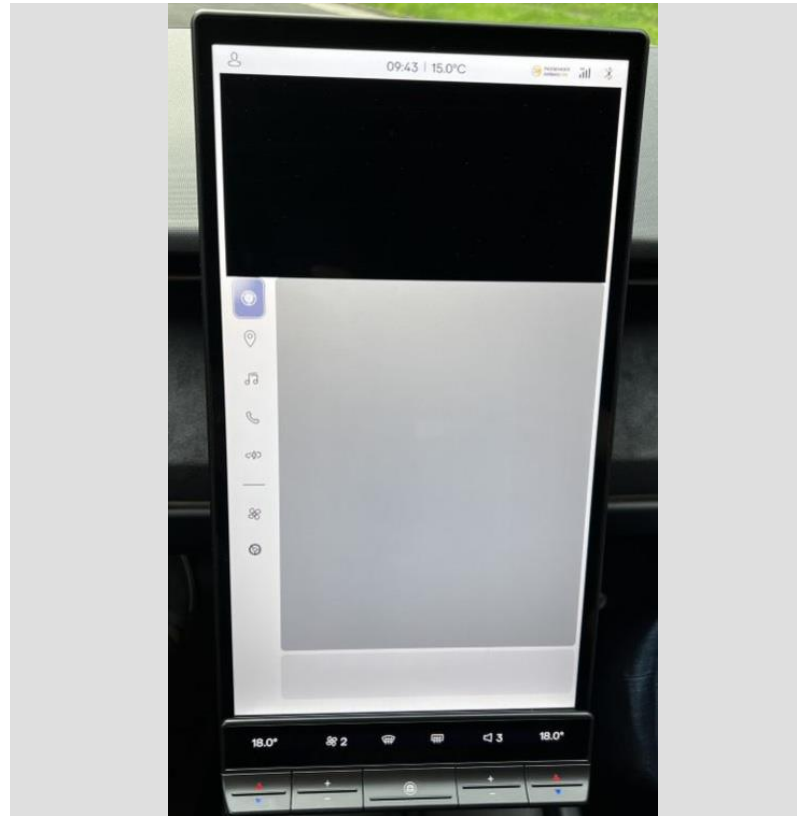
Highly unstable system

A total of 17 bugs were highlighted during the five days of testing. Many of these bugs are classified as critical or major in severity. On multiple occasions a soft software reset is required to rectify the issue. Most of these bugs concern the infotainment and navigation domains; however, bugs of varying severity exist throughout the system. This is likely to have a negative impact overall on levels of user satisfaction.
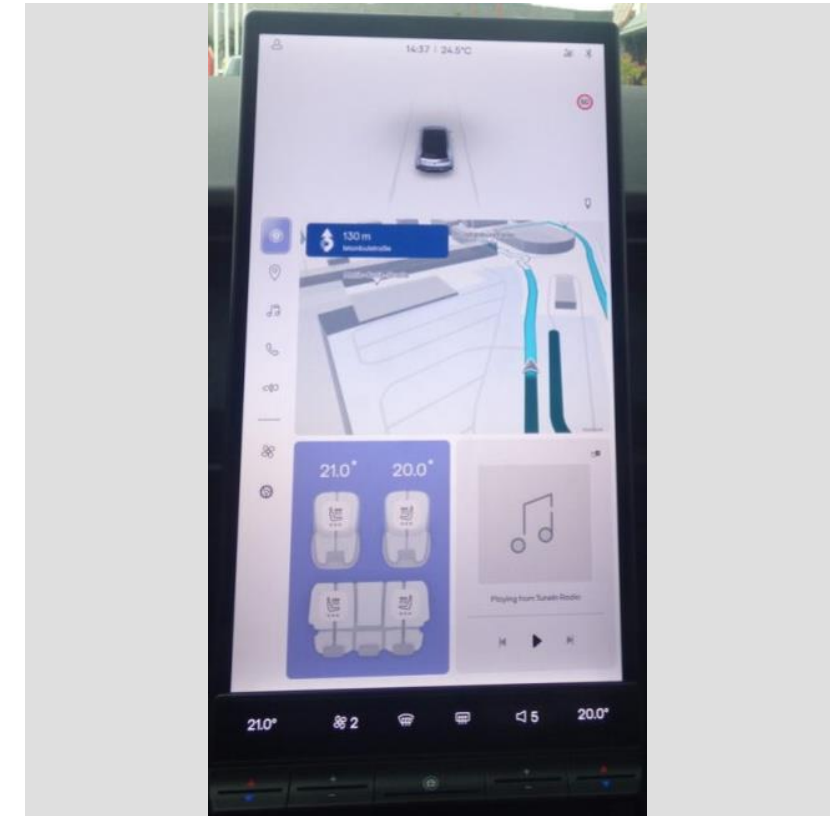
Lack of customization/personalization

Overall, the system lacks the expected level of customization and personalization for users to tailor the system to their needs and preferences. For example, none of the menu layouts, widgets or shortcut bar can be adjusted or changed. Only one user profile can be linked to the vehicle at any one time, resulting in an overall lack of flexibility.

Contact SBD Automotive

Do you have any questions?

If you have any questions or feedback about this research report or SBD Automotive's consulting services, you can email us at info@sbdautomotive.com or discuss with your local account manager below.

✉ info@sbdautomotive.com

Book a meeting

| USA | UK | Germany | India | China | Japan |

Garren Carr
North America
garrencarr@sbdautomotive.com
+1 734 619 7969

Luigi Bisbiglia
UK, South & West Europe
luigibisbiglia@sbdautomotive.com
+44 1908 305102

SBD China Sales Team
China
salesChina@sbdautomotive.com
+86 18516653761

Andrea Sroczynski
Germany, North & East Europe
andreasroczynski@sbdautomotive.com
+49 211 9753153-1

SBD Japan Sales Team
Japan, South Korea & Australia
postbox@sbdautomotive.com
+81 52 253 6201