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In-car HMI UX Evaluations

#635

# In-Car HMI UX Evaluation & Benchmarking

## MG4 EV

In this edition of the In-Car HMI UX Evaluation and Benchmarking series, the UX team is testing the MG4 EV.

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.

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### 619 – UX Benchmarking Series

A precursor to the new **In-Car HMI UX Evaluation & Benchmarking Series**, SBD Automotive's UX Team evaluates the infotainment user experience of over 40 vehicles.

### 806 – ADAS HMI Evaluations

A precursor to the new **In-Car HMI UX Evaluation & Benchmarking Series**, SBD Automotive's Autonomous Car Team evaluates the ADAS performance and usability of over 20 vehicles.

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# Scoring

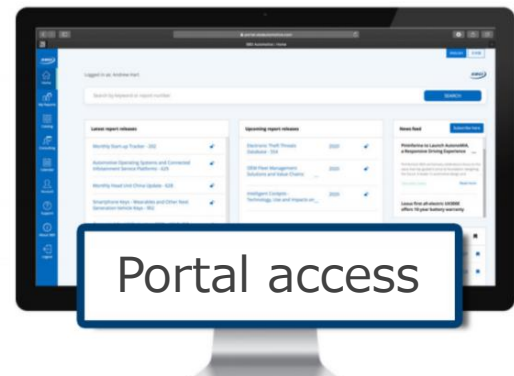
- > **Features and functionality:** evaluating whether the solutions provide features that customers expect, need and solve problems (or provide a wow factor).
- > **Reliability/stability:** evaluating the repeated usability and whether the users can have a similar (positive) experience each time.
- > **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

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# 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.

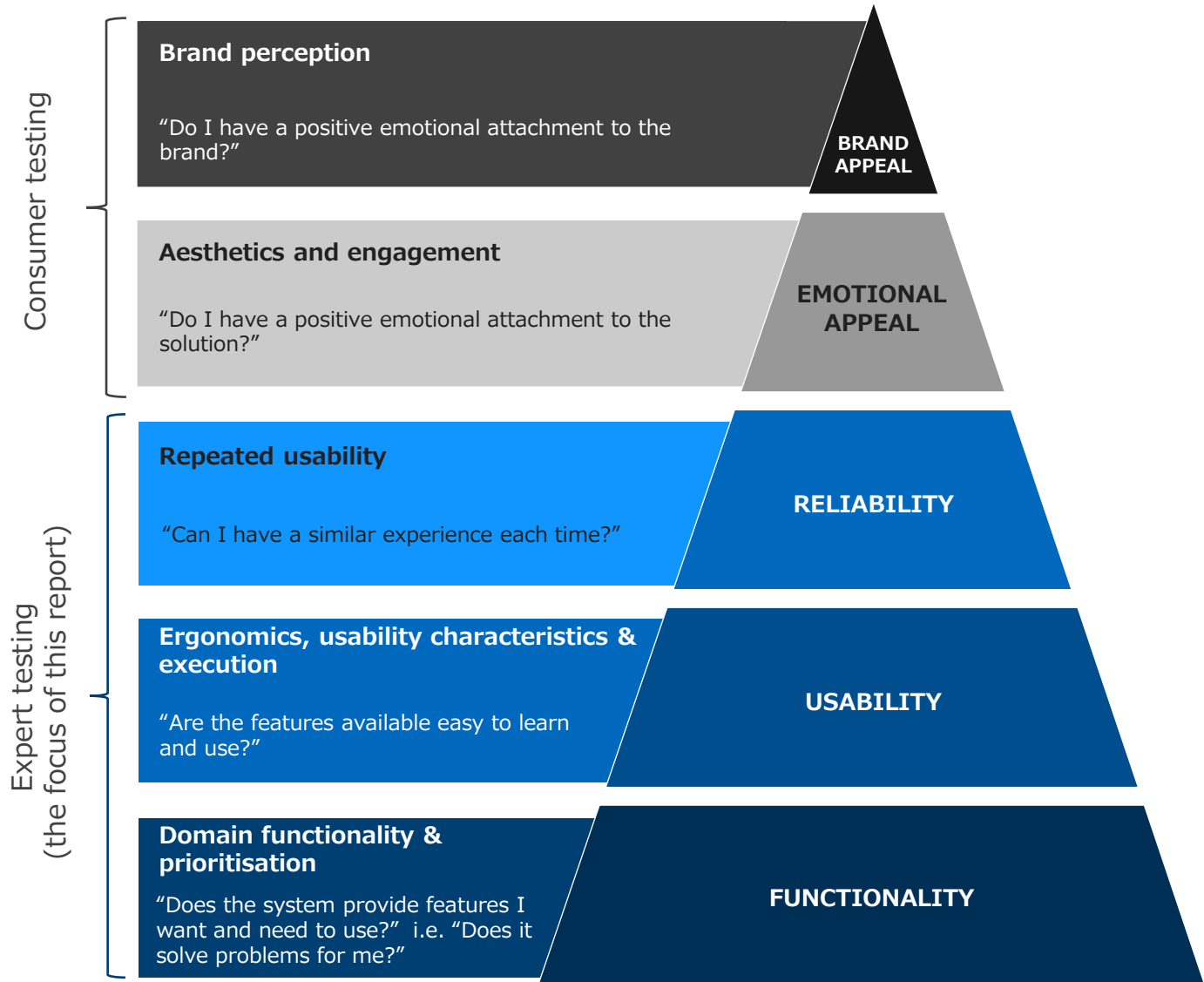
One of the core goals of these studies is to provide a true indication of what the final customer experience of each solution could be. To do this evaluations are focused on providing scoring and analysis in the following areas:

- **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.



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 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

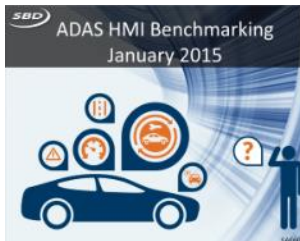
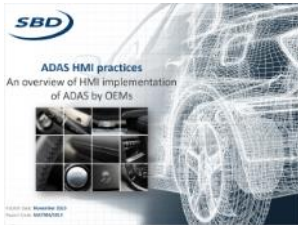
SBD has chosen six cars to evaluate in 2023, based on two selection categories. New/interesting UX focuses on systems with to never-seen-before features or functionality, or the implementation of a solution that has previously been a challenge or pain-point for end-users. New mass-market UX includes 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
					
<b>Jeep Grand Wagoneer</b>	<b>Nissan Ariya</b>	<b>BYD Seal</b>	<b>Peugeot 408</b>	<b>Fisker Ocean</b>	<b>MG4</b>
<ul style="list-style-type: none"> <li>▪ Passenger display</li> <li>▪ Amazon Fire TV</li> <li>▪ Active Drive Assist</li> <li>▪ US market test</li> </ul>	<ul style="list-style-type: none"> <li>▪ ProPilot Assist</li> <li>▪ Unique HMI and interior</li> <li>▪ EV SUV</li> <li>▪ German Market Test</li> </ul>	<ul style="list-style-type: none"> <li>▪ Unique Home Screen HMI</li> <li>▪ EV</li> <li>▪ Chinese market test</li> </ul>	<ul style="list-style-type: none"> <li>▪ Drive Assist 2.0</li> <li>▪ 3D instrument cluster</li> <li>▪ German market test</li> </ul>	<ul style="list-style-type: none"> <li>▪ EV SUV</li> <li>▪ Sustainable materials</li> <li>▪ Large central display</li> <li>▪ German market test</li> </ul>	<ul style="list-style-type: none"> <li>▪ Chinese-owned brand sold in EU market</li> <li>▪ MG Pilot ADAS</li> <li>▪ Live services</li> <li>▪ EU market test</li> </ul>



# 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 to overall approach.





# One page methodology overview

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

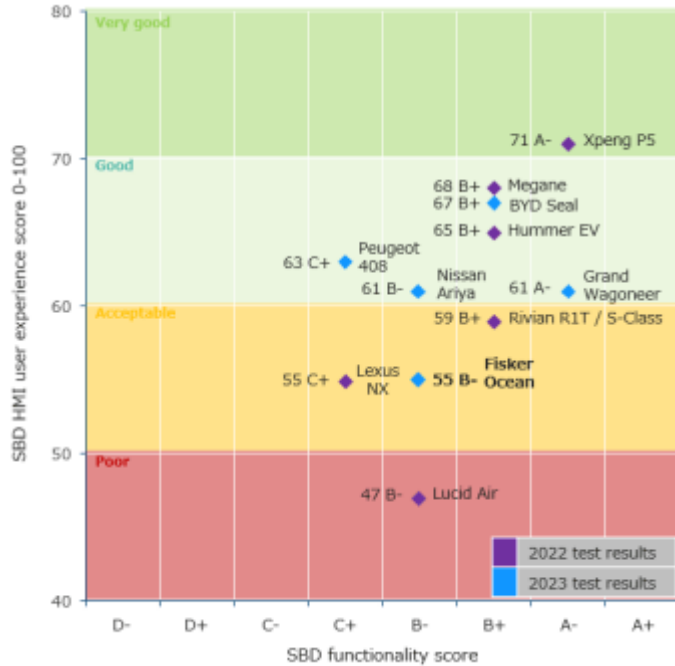
This document does not provide a detailed description of the methodology and this page serves to provide an overview of the approach.

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)	✓	✓	✓	✓	✓	✓	✓	

# Report structure and how to interpret certain data sets

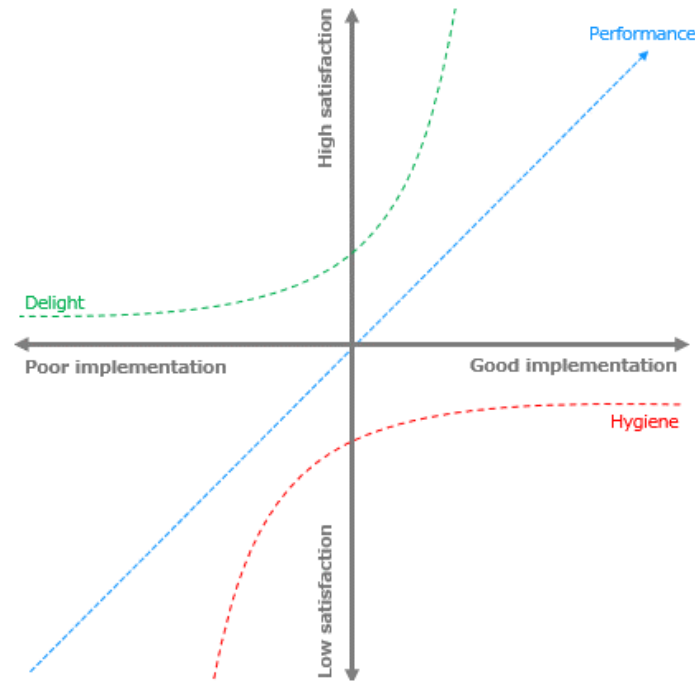
Throughout the testing and evaluation process SBD uses multiple methodologies to align to the situation and test area. Outputs from these evaluations can be broadly grouped into the following three types of report outputs - SBD's goal with these options is to ensure understanding of the results are as clear and fair as possible.



## UX & functionality score

Final usability scored based on a 100-point scale with solutions scoring less than 40 defined as “not fit for purpose” with major user complaints expected and score above 80 defined as “exceptional”.

Functionality score based on eight core feature set areas: delight features, performance features, hygiene features, navigation feature, ADAS, IoT integration, music, entertainment and info features.



## Modified Kano feature analysis

Features plotted against three lines based on their implementation and satisfaction levels:

- **Delight** features: “wow” features likely to provide high satisfaction even with poor implementation
- **Performance** features: as the level of implementation increases so does the customer satisfaction
- **Hygiene** features: poor implementation provides low satisfaction, but good implementation may not provide positive satisfaction as it can be considered as expected functionality

UX heuristic	Score
Cockpit clutter	Good
GUI clutter	OK
Display quality/size	Good
Map aesthetics	Very good
Map layout	OK
Navigation routing	OK
Instrument cluster	Good
General system HMI	OK



## Subjective & objective scores

Scoring across multiple areas through subjective scoring with pre-defined ranges, definitions, and comparison to past results.

Objective scoring generally based on a pass/fail criteria or time-based considerations. SBD attempts to minimize subjectivity as much as possible with results aimed at being fair and reasonable with a minimal level of bias.



# Example slides from the report

This is an example slide from the report, enclosed in a white border. The top portion of the slide features a photograph of a car's interior, showing the dashboard, a central infotainment screen, and the steering wheel with the MG logo. Below the photograph, there is a dark blue banner containing the SBD logo on the left, and the text 'October 2023' and 'In-Car HMI UX Evaluation &amp; Benchmarking MG4 EV' on the right. At the bottom of the slide, there is a prominent blue button with the text 'Request price' and a white right-pointing chevron symbol (&gt;).





# Few delight features and poor communication of support levels

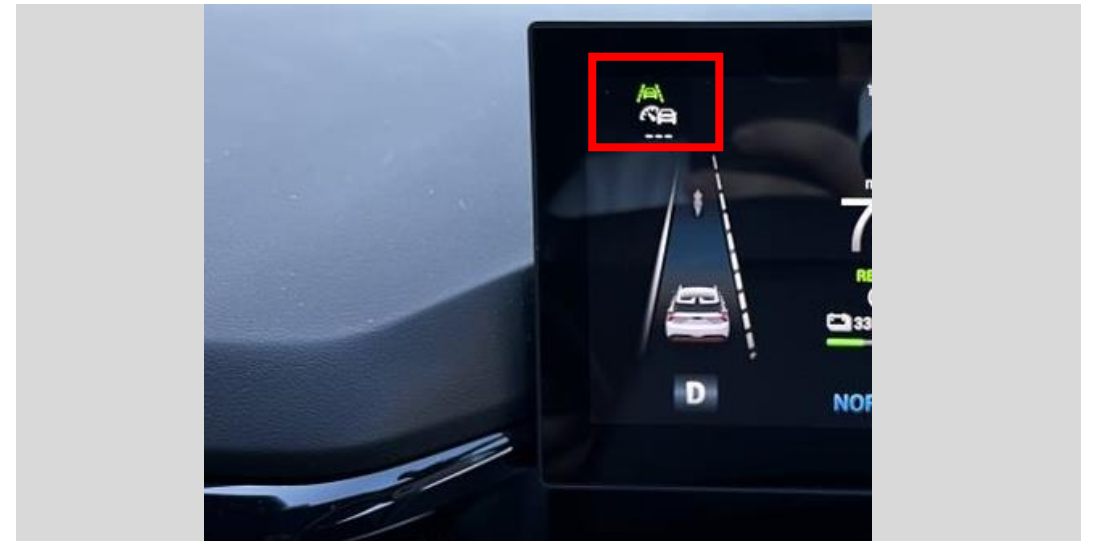
- Only one minor delight feature has been identified during testing.
- A pair of configurable star icon buttons on the steering wheel allow users to create shortcuts for a select number of features.
- The lack of notable delight features results in a lack luster system with no memorable elements.



**Configurable buttons on steering wheel**

A pair of configurable buttons on the steering wheel with star icons can be setup as shortcuts for some of the user's most frequently used features. Not only is this a convenient implementation, but it also adds an element of delight in being able to customize and personalize part of the system to the user's needs. The number of features it can be linked to are listed in the settings menu.

- The filtering of charge points is limited and restrictive with only a few options available.
- POI list integration is good with a mostly flat structure and effective filtering options.
- Lack of ability to reconfigure home screen widgets and layout.
- Some ADAS lacks user support and differentiation between carrying levels of support.



**Various LDW and LKA support options are not communicated clearly**

As part of the ADAS, various support levels for LDW and LKA are offered. However, the visual representation of each level of support in the cluster is very similar with only very subtle differences. This potentially leads to confusion over what level of support the driver is really being given. Different colors of icon is not sufficient to communicate such a big difference in support.

# Navigation map froze but audio guidance continued

## 1. Navigation

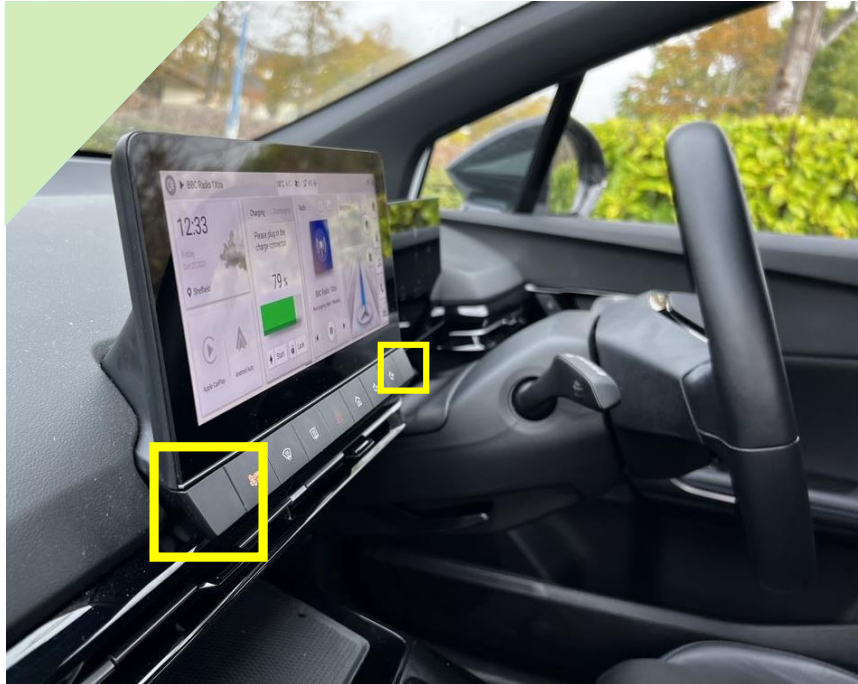
On one occasion, the map guidance in the central display froze completely. Other functions of the central display still worked, but the map view was inoperable. Audio guidance continued to guide the driver to the destination. A restart of the vehicle was required to remedy the issue.

Frequency	Low	Medium	High
Severity	Minor	Major	Critical





# Key highlight



Blanking plates provide support

## Support for center console buttons

### Blanking plates at either end of button bar provide support

Blanking plates at either end of the center console button bar provide an element of support for a hand or thumb so that the hard buttons can be operated confidently and comfortably. While this is not a perfect or even intentional method of support, it is suitable for short moments of steadying a user's hand.

While these blanking plates provide good support for the hard buttons, they are not sufficient support to operate the central display.



# Perceived Quality: Tactile

Level 1	<b>Tactile</b>
SBD viewpoint	<p><b>Stiffness &amp; looseness:</b> Some wobble and unwanted movement is experienced with the hard buttons below the central display. Other unwanted movement comes from the glove box area. Otherwise, steering wheel buttons and other areas that receive regular touch from the user give a good impression of solidity.</p> <p><b>Force feedback:</b> A soft and well damped mechanical feedback is felt from the steering wheel buttons. This provides a sense of quality. The hard buttons below the central display however are clicky and hard.</p> <p><b>Material quality:</b> Materials around the steering wheel meet the expected level of quality and in some cases go beyond. However, materials used on the door cards, top of the dashboard and on the hard buttons below the central display give a tactile and visual impression of sub-standard build quality.</p> <p><b>Material harmony:</b> Material harmony is not consistent across the cabin. Materials used around the steering wheel and gear selector area are solid and give a sense of good quality. However, around the cup holders and especially tops of the door cards, the material is not of the same quality and appears budget like.</p> <p><b>Geometric &amp; Positioning:</b> Switch shape such as those buttons below the central display are simple yet functional. Toggle buttons on the steering wheel have more aesthetic appeal and are finished in silver with a textured pattern on the face. These toggle buttons add some visual interest and a modern look.</p>

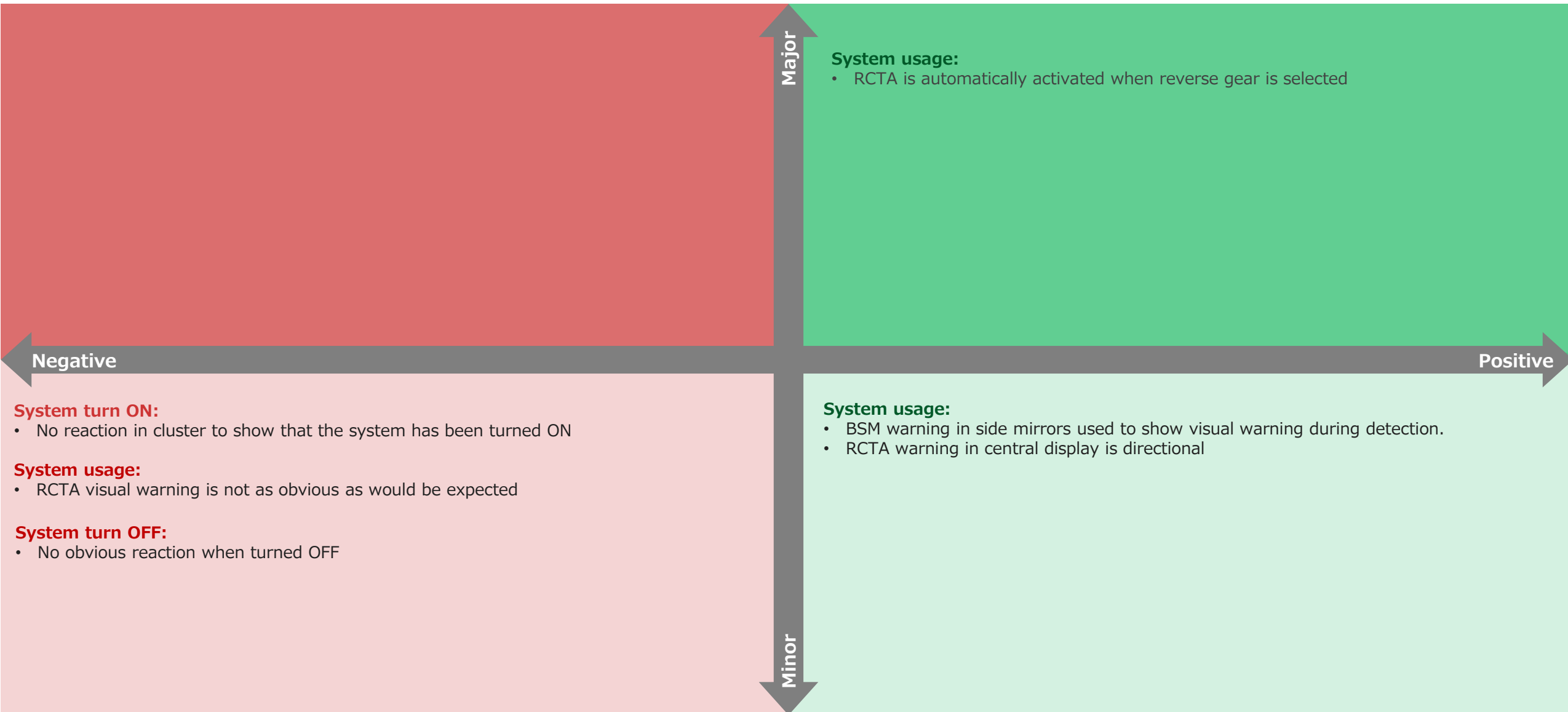


Level 2 scoring				
Stiffness & looseness	Force feedback	Material quality	Material harmony	Geometric & positioning
Poor	Poor	Poor	Poor	Fair





# Key positive and negative points - RCTA





# Clear layout and shallow menu structure

SBD  
viewpoint

The system is generally easy to navigate due to a shallow menu structure and simple layout.

- All commonly used features and functions are accessible within one or two steps for users and not hidden deep within the menu structure. This means that potential driver distraction levels are reduced and potential for frustration from the user is minimized.
- A permanent shortcuts bar and clear tile layout on the home screen provides easy access. The layout is very intuitive, and all icons are understandable and can be related to corresponding features.

A shallow menu structure allows for a more intuitive system and user experience. Overall task completion time can be reduced, and users are less likely to become lost within multiple sub menus. A shallow structure also allows for processes and tasks to be memorized easier.



Permanent shortcut bar provides quick access



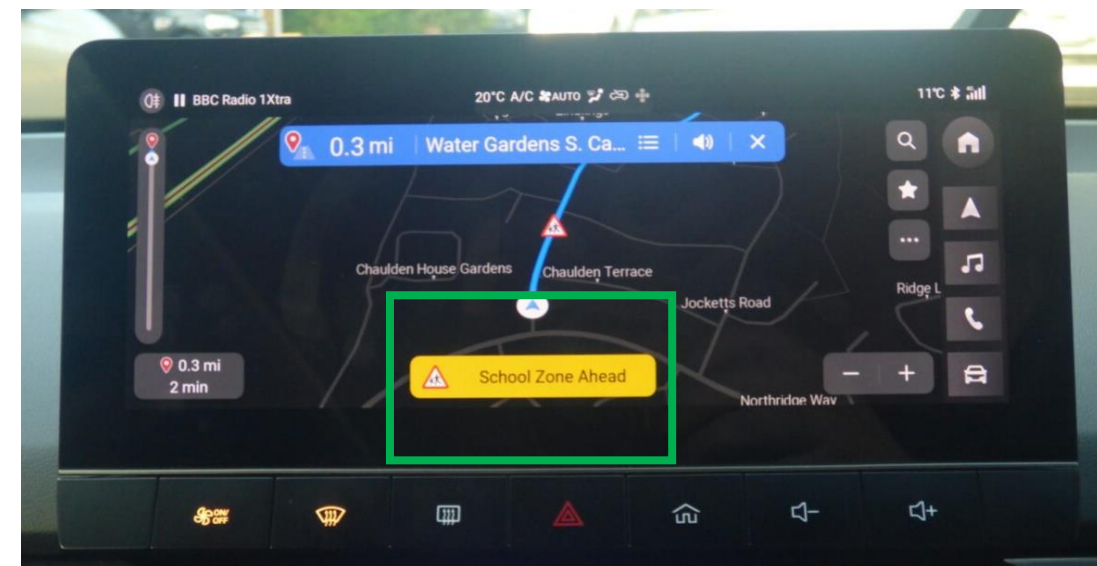
# Supportive speed camera and school zone alerts

SBD  
viewpoint

A visual and audible alert is given when entering school zones or approaching speed cameras.

- When approaching either a school zone or speed camera, a yellow pop-up box appears at the bottom of the central display with either a school or speed camera icon and the text 'School Zone Ahead' or 'Speed Camera Ahead'. An icon is also shown on the map to signify the exact location of the alert.
- As well as a visual warning, an audible warning is also given. This is brief but distinct from all other audible warnings issued.
- The warnings are noticeable and grab the driver's attention without obscuring or blocking other information on screen such as route guidance or directions.

Alerts for upcoming potential hazards and speed cameras are convenient and allow the driver to plan ahead accordingly. Providing these locations and alerts are kept up to date regularly, they can act as a considerable safety enhancement.



On-screen school zone warning

UX impact

Major negative

Minor negative

Minor positive

Major positive



# No IoT integration

SBD  
viewpoint

No IoT integration is offered as part of the system.

- IoT integration is not present as part of the feature offering in this system. No supplier of IoT such as Google or Amazon has been integrated into the system.
- The lack of IoT means the user is unable to interact with any smart home devices or automated smart systems outside of the vehicle.

While IoT integration in vehicles is still in relevant infancy, it is becoming ever more popular and common. OEMs should consider this in order to not get left behind in terms of in-cabin feature offerings.

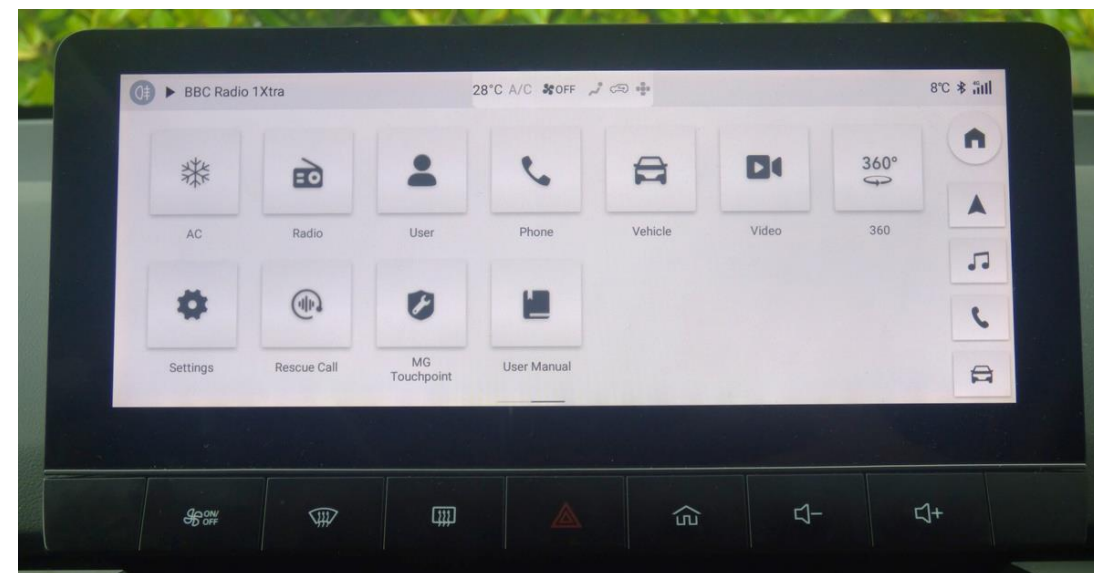
UX impact

Major negative

Minor negative

Minor positive

Major positive



No IoT offering



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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](mailto:info@sbdautomotive.com) or discuss with your local account manager below.



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