SBD

#635

UX
EVALUATION

In-car HMI UX
Evaluations

In-Car HMI UX Evaluation & Benchmarking

End of Year Summary

The 2021 HMI UX Benchmarking Report Summary has been created to provide a fair, unbiased and objective view of the latest in-vehicle HMI solutions in the European, US and Japanese markets. Evaluations are carried out by SBD usability experts with a deep understanding of CASE domains, specifically the Connected Car and ADAS & autonomy domains.

The following vehicles were evaluated as part of the 2021 Series – Mercedes-Benz S-Class, CUPRA Formentor, Tesla Model S, Hyundai IONIQ 5, Lexus LS, Cadillac Escalade, BMW iX and Nio ES8.

TABLE OF CONTENTS

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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.

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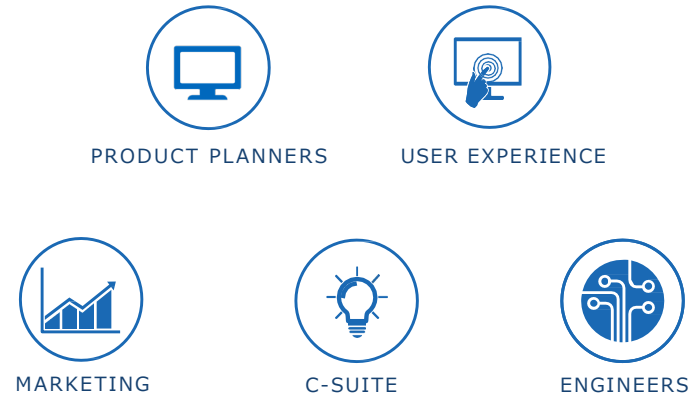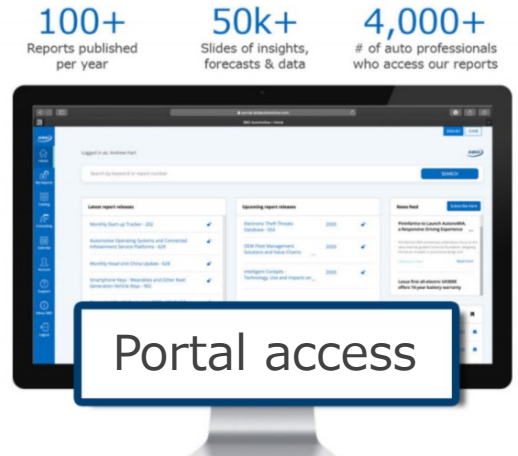| COVERAGE				FREQUENCY			PUBLICATION FORMAT				PAGES
GLOBAL	NA	CHINA	EUROPE	ANNUALLY	QUARTERLY	8 CARS PER YEAR	PDF	POWERPOINT	EXCEL	ONLINE	45

Report Preview >

Scoring

> **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.

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End of Year Summary

📖 Table of Contents

Report Preview ›

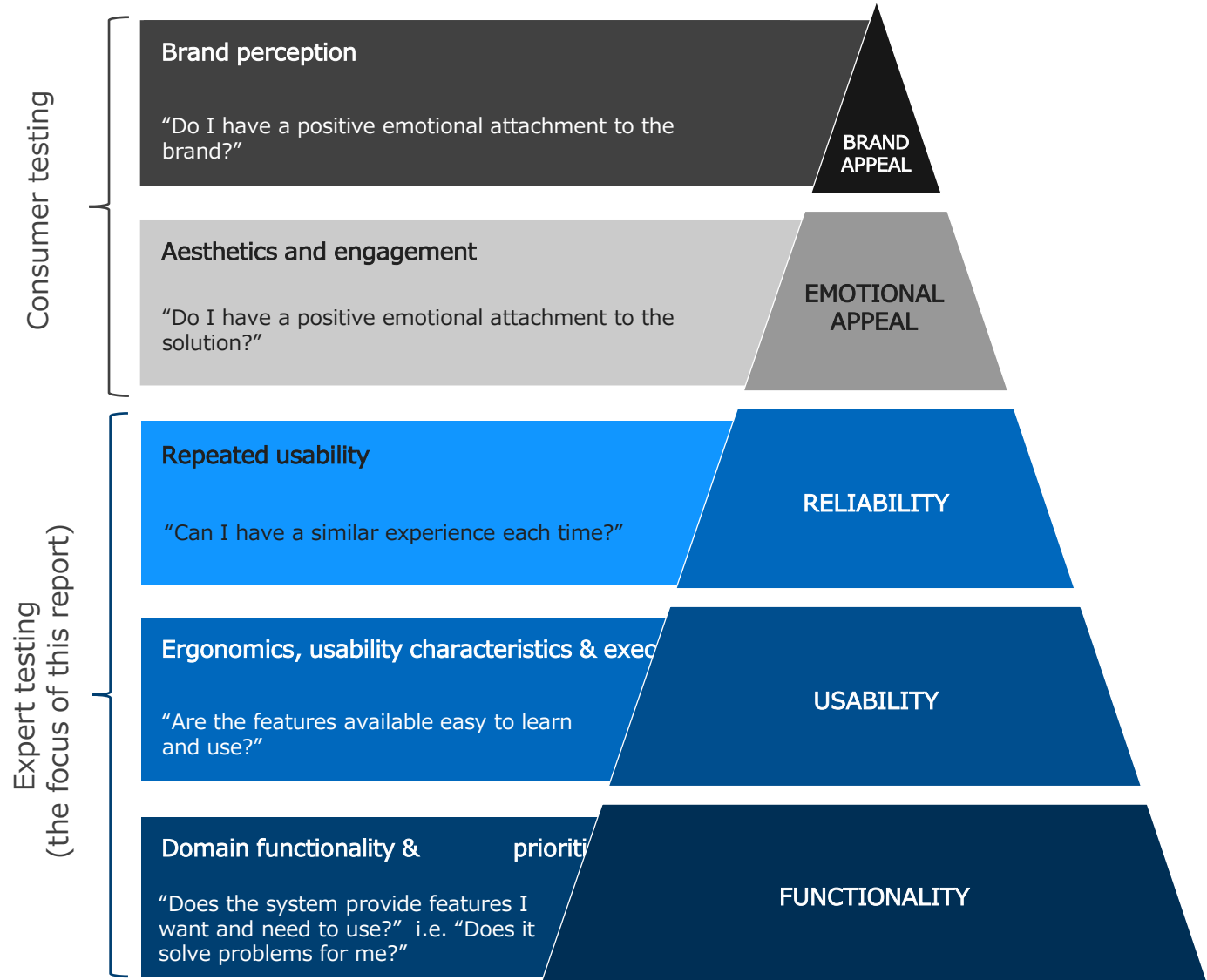Introduction

Aim of this report

Welcome to the 2021 HMI benchmarking report summary. This report series has been created to provide a fair, unbiased and objective view of the latest in-vehicle HMI solutions in the European, US and Japanese markets. Evaluations are carried out by SBD usability experts with a deep understanding of CASE domains, specifically 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 reports are aimed defining areas of concern through a data driven approach. These reports aim to benchmark and score solutions whilst also being able to provide actionable recommendations to design and development teams.

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 & exec

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

USABILITY

Domain functionality & prioriti

"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 series 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 these reports, but it is something which SBD has may 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

Vehicle list

SBD chose eight cars to evaluate in 2021, based on two selection categories. New/interesting UX focused on systems with 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 included vehicles in segments that are sold in high numbers and are entering a new generation of UI for that vehicle.

Cars tested in 2021 report series

Mercedes-Benz S-Class

Report Preview >

CUPRA Formentor

Report Preview >

Tesla Model S

Report Preview >

Hyundai IONIQ 5

Report Preview >

Lexus LS

Report Preview >

Cadillac Escalade

Report Preview >

BMW iX

Report Preview >

NIO ES8

Report Preview >

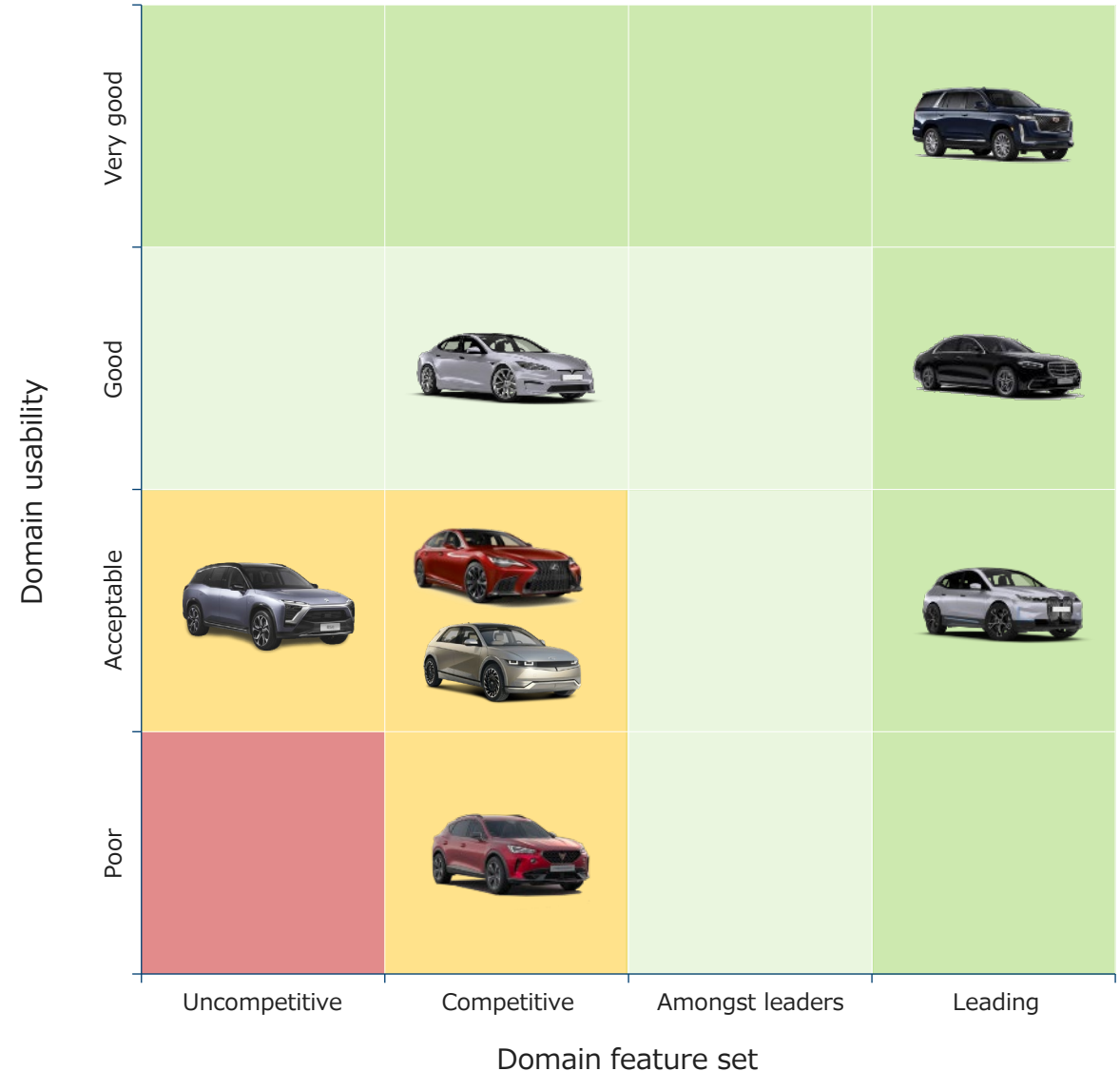# Example slides from the full report

Report Preview

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 offers a comparative view of how each of the 2021 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 Mercedes Benz S-Class was one of three solutions tested this year which offered Augmented Reality navigation. Several concerns were found when following this guidance as at times it could be considered confusing when compared to the instruction given and the outside environment. Otherwise, the navigation system generally performed well.

▪ The BMW iX also featured Augmented Reality navigation and in this implementation, guidance more closely matched the outside world – an important usability heuristic. There were times where the solution performed below expectation, such as out-of-date information for traffic data and overly repetitive spoken guidance.

▪ Tesla's navigation solution remains a streamlined solution, missing out on some of the special features of other vehicles in this series. The destination input process remains the most direct and accessible method available, however some new additions to the destination input process like "Hungry" and "Lucky" are yet to prove their worth.

▪ The CUPRA navigation system offered generally acceptable quality of guidance, but was severely let down by an unstable system. At one time, the current vehicle position was not correctly reported which caused the system to be unable to give accurate and useful guidance.

▪ Like some of the other solutions using HERE maps, it was quickly identified that the IONIQ 5 displayed some similar map data oddities which had a negative impact on the user experience. In one instance however, the IONIQ 5 solution stood apart and made a more significant mistake in the city of Cambridge, by instructing the driver to travel through a bus gate.

Domain usability (y-axis): Very good, Good, Acceptable, Poor

Domain feature set (x-axis): Uncompetitive, Competitive, Amongst leaders, Leading

Wow features with overall good implementations

AR navigation well implemented

As a minority of systems on the market offer augmented reality navigation, this offers wow factor for the Escalade and is an attractive feature. It also demonstrates a good level of implementation for one of the earlier versions of this technology. The next step for Cadillac would be to move this feature from the instrument cluster to the head-up display.

Destination arrival

On arrival at a destination, a detailed "Arrived" screen is displayed on the central display, which includes an accurate image of the destination along with the POI name and address. Additionally, further options are shown, for example, "Map with Parking" to show the nearest parking to the destination, "Save" to add the destination to favourites and "Report an Issue."

Welcome sequence

The Escalade features an animated welcome sequence spanning all three displays. It highlights the expansive screen area available, is impressively animated and consistent with the brand. It is expected to provide an element of wow.

11

Simplified interface creates some significant complexities

The revised Model S presents several high-importance changes to both the Tesla strategy and the automotive infotainment landscape continuing Tesla's strategy of simplification and decluttering.

Notable changes are the removal of stalk controls and the adaptation of the steering wheel into a yoke. Both have a notable effect on intuitiveness of operation and may present too great a challenge for some new owners.

SAE L2 systems such as Autosteer and Summon have been implemented well, providing more clarity on system functionality and status, however, LDW and ACC systems lack such clear levels of implementation.

Navigation features the familiar Google Maps data integration but remains entirely connected, which can present issues with content failing to show. Some core features remain missing, such as adding of stopovers to the route.

Overall, the system has evolved to be more complex than previous Tesla solutions. While it retains some of the reasons that previously made it an HMI leader, it may now have tipped the balance for what can be effectively achieved in a simplified and decluttered solution. It remains a great example in places of what should be done for in-car HMI, and a valuable lesson of what not to do when it comes to reinventing the wheel.
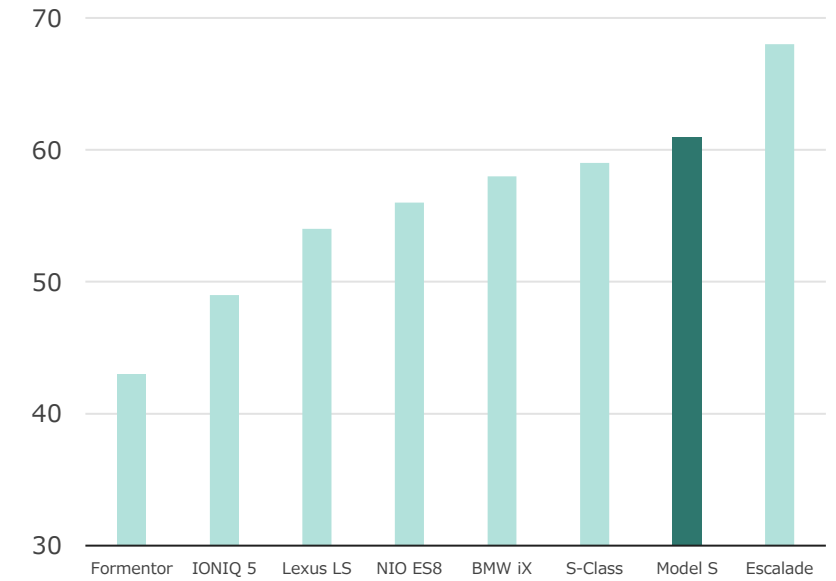

2021 Usability Scores

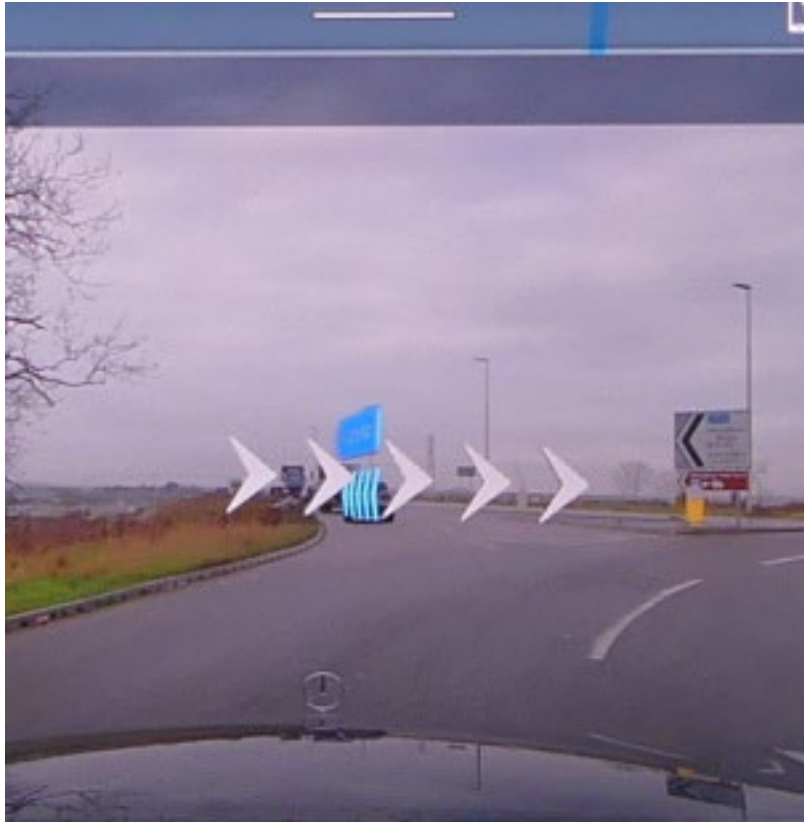| What the system **does** well	What the system **doesn't** do well
• OTA system updatability provides the ability to significantly alter the GUI and functionality including major features such as piloted driving.	• Lane guidance demonstrates some inaccuracies and is easy to miss in the turn-by-turn box in the top-left of the display. Ideally, it should be more prominent.
• Intelligent automatic Supercharger stopovers take some of the burden away from the user planning stops manually. This remains a leading example.	• The solution remains heavily dependent on a data connection, resulting in functionality limitations in areas of low or no data coverage. Navigation is a leading example of this, as the system features no offline mapping so map data cannot be shown.
• Video streaming integration with a selection of four popular service providers.	
• Piloted Driving demonstrates good implementation with regard to clear system status, warning situations and proactive suggestions.	• Lane Departure Warning is the least well implemented system. An unintuitive activation method and lack of clarity with system status and color usage prevent a higher rating in implementation.
• The audio media interface matches other areas of the Tesla UI, but also manages to offer the expected functionality and folder structure of different streaming providers.	

# Wow features exist but implementations feel incomplete

AR navi both a wow feature & misleading

Augmented reality navigation features are likely to be viewed by the end consumers as a wow feature. However, the final implementation is lacking with directions being frequently ambiguous, lacking necessary information or incorrect, often conflicting with the correct instruction shown elsewhere. The stability of the arrow in relation to the outside environment is sub optimal as it has sufficient movement to spoil the illusion that it is fixed.

Ambient lighting also an effective feedback HMI

The S-Class features lighting strips that extend across the width of the instrument panel and across all four doors. These are more than just ambient illumination and provide feedback for certain use cases such as interactions with the voice recognition system and ADAS alerts such as lane keep assist and blind spot monitoring.
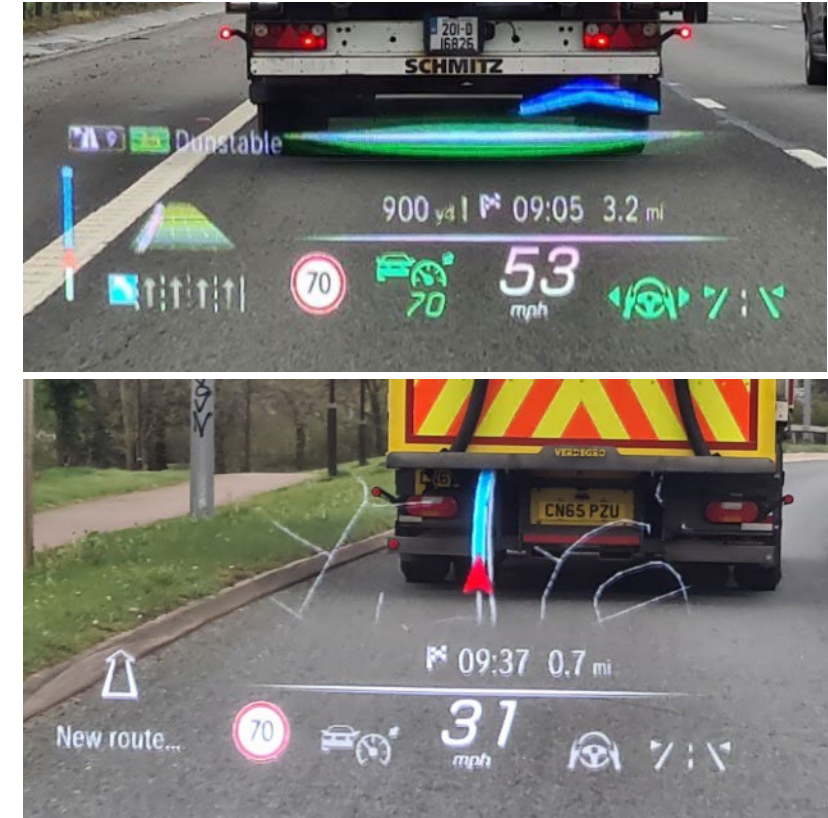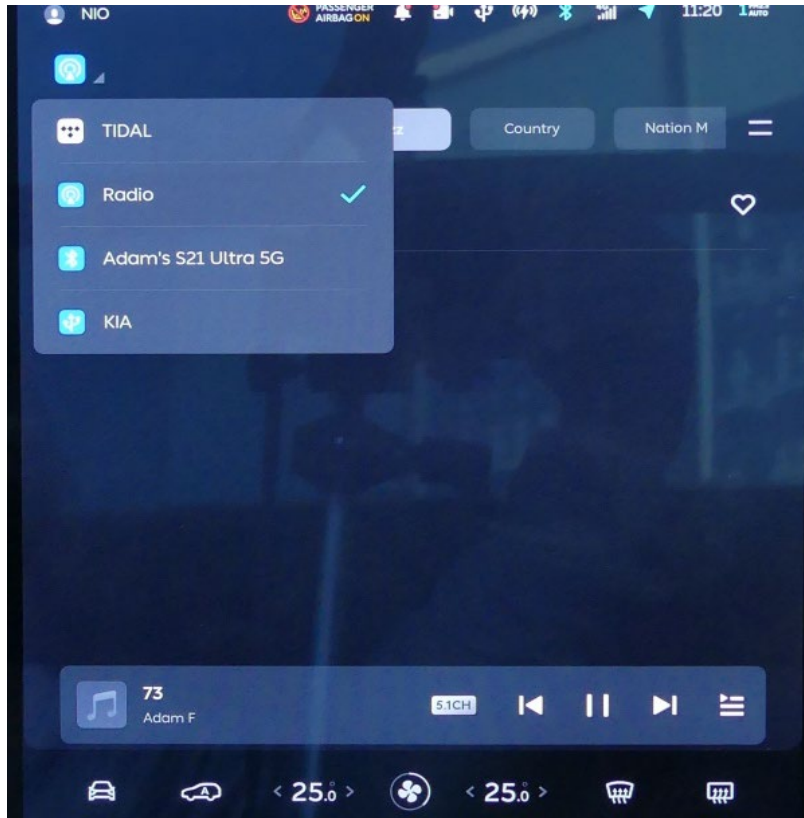
Cluttered HUD appearance

Due to the AR HUD element taking up a large portion of the display, the conventional content is tightly packed in the lower part of the display, giving a cluttered appearance. Additionally, AR elements sometimes overlap conventional elements.

# Some issues within all core elements of system

Media inconsistencies

In several cases, the media interface lacks continuity between different media sources. This becomes annoying and can result in a fragmented listening experience. Additionally, there are further issues with the interface such as the unintuitive access to the media section from screens with no direct link e.g. phone and settings.
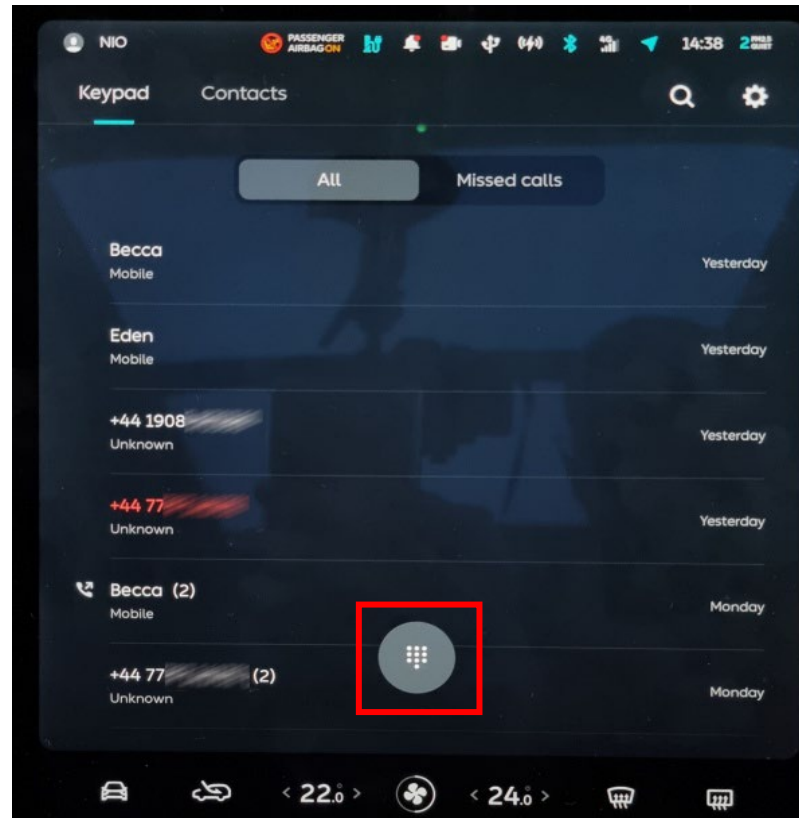
Issues with phone implementation

The phone section layout is unnecessarily complex and lacks some core functionality.
For example, favourites functionality is missing, the keypad screen is not actually a phone keypad, but is instead a list of recent calls, and additionally, recent calls can only be filtered by missed calls.
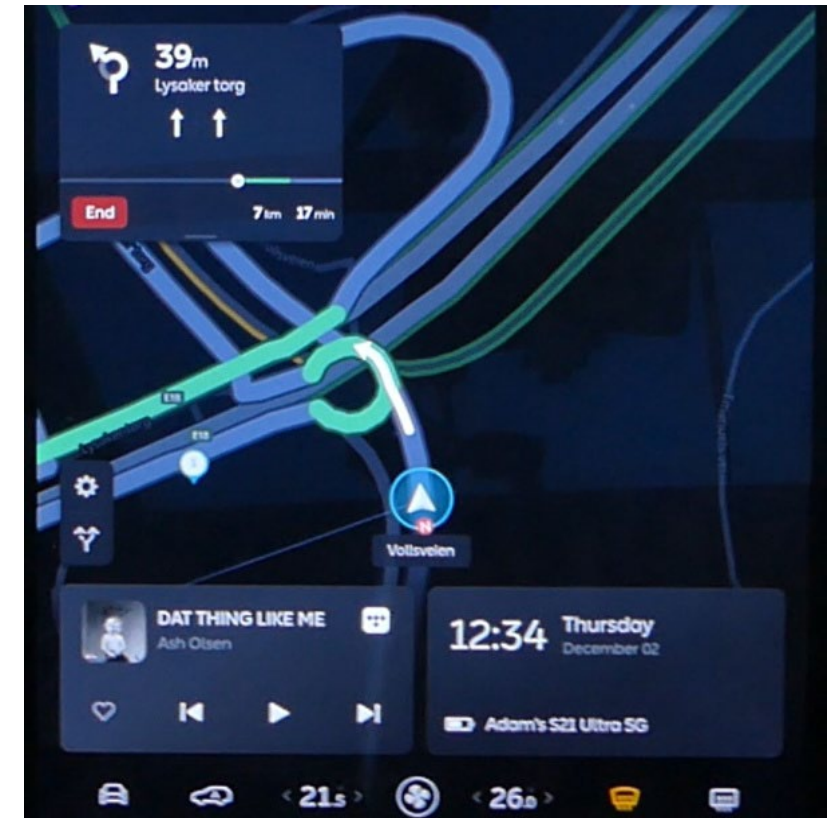
Unclear route guidance

With route guidance active, the route can be very hard to follow. This is particularly prominent when traffic level is not shown. In this case, the road colouring for the route ahead is almost identical to the standard colouring of some roads. This caused many confusing situation at complex junctions throughout testing.

Request the price for the full report

Report Preview

Contact SBD Automotive

Do you have any questions?

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