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UX EVALUATION

In-car HMI UX Evaluations

#635

In-Car HMI UX Evaluation & Benchmarking

Audi Q6 e-tron

In this edition, our experts test the all-new Audi Q6 e-tron. The team praised the EV's interior and exterior lighting systems – both of which enhanced the usability of features in domains like safety and personalization. These advancements were, however, held back by some poorly implemented elements within the Q6 e-tron's navigation system that our experts felt could lead some users to resort to using Apple CarPlay or Android Auto.

COVERAGE

GLOBAL | NA | CHINA | EUROPE

FREQUENCY

ANNUALLY | QUARTERLY | 9 CARS PER YEAR

PUBLICATION FORMAT

PDF | POWERPOINT | EXCEL | ONLINE

PAGES

150+

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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).
- **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.

This research is useful for

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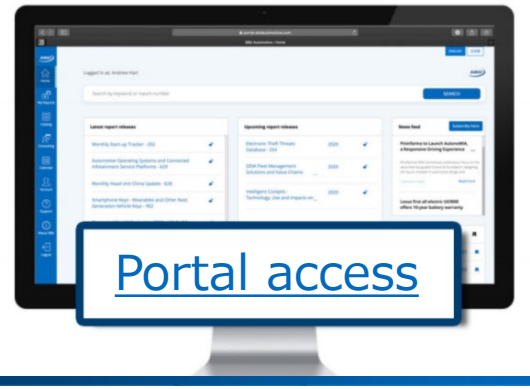

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Audi Q6 e-tron

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635-24(24g)

In-Car HMI UX Evaluation & Benchmarking Audi Q6 e-tron

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Total number of pages - 168

Introduction

Report Introduction

Welcome to the 2024 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 Chinese 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.

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.

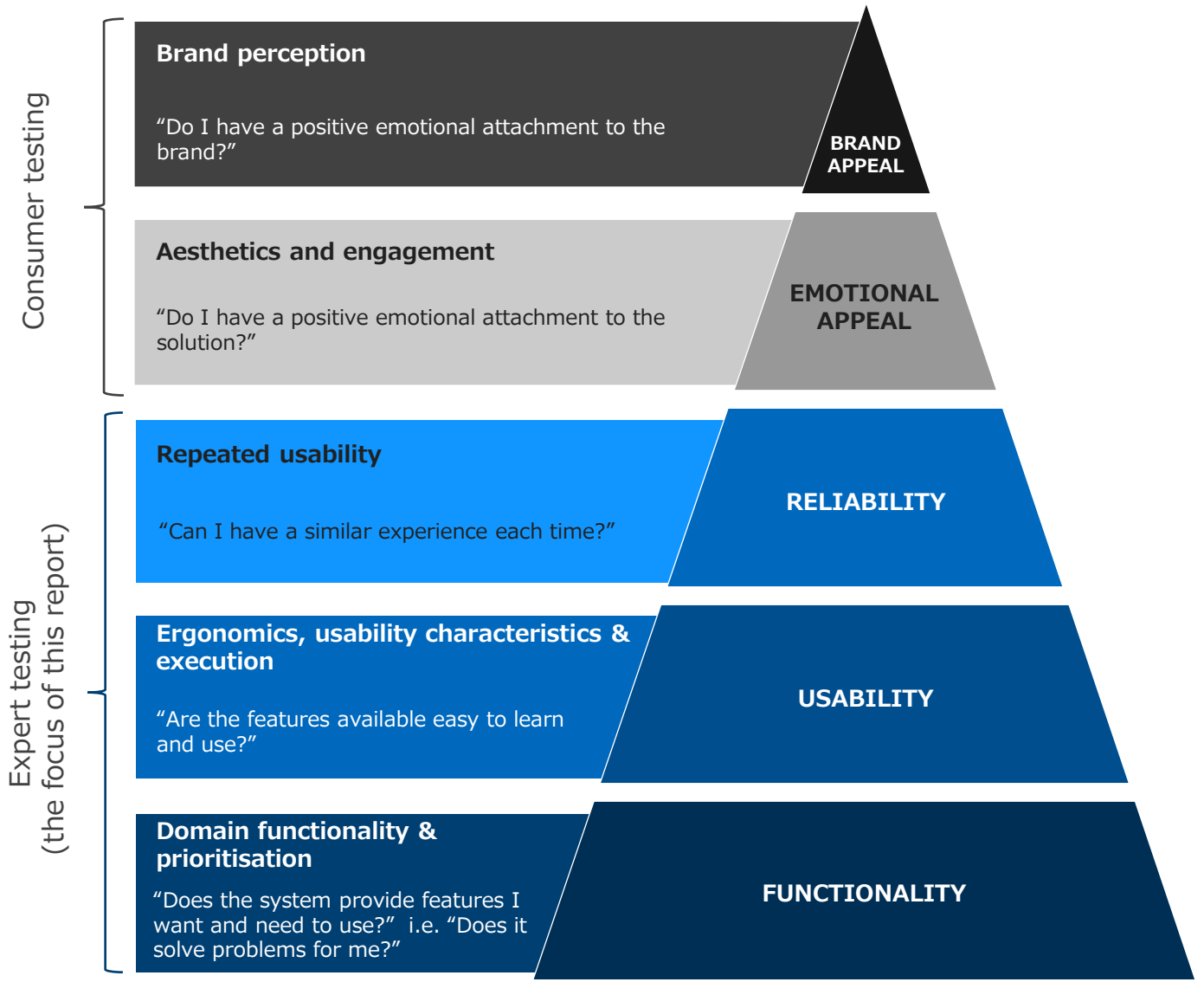
Please note that due to the ever-evolving automotive technology market, SBD updates it's methodology each year, but does not update scores from the previous years. Therefore, please assume a slight drop in scores for both user experience (UX) and functionality from the previous year.

Section	Content
Birds Eye View	An overview of the key findings from SBD's various CX related and adjacent reports.
Executive Summary	Presents key highlights and conclusions from the report.
The Basics	What do you need to know about SBD's CX evaluation methodology?
Analysis	Analysis of report findings by SBD experts.
Features and functionality	Overview of key features and functionality by domain.
Execution	Assess success of implementation and overall execution of various system elements.
Perceived quality	Scoring and analysis of interior perceived quality levels.
ADAS domain	Highlight and analysis of key positive and negative points within the ADAS domain.
Infotainment domain	Highlight and analysis of key positive and negative points within the infotainment domain.
Navigation domain	Highlight and analysis of key positive and negative points within the navigation domain.
Voice recognition domain	Summary and scoring of various aspects of the voice recognition system.
Convenience domain	Summary of various convenience focussed features.
Future Outlook	Seven UX principles are considered against drivers and barriers into the future of this reports test vehicle.
Next Steps	Can SBD help you with any unanswered questions?

Aim of this report

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:

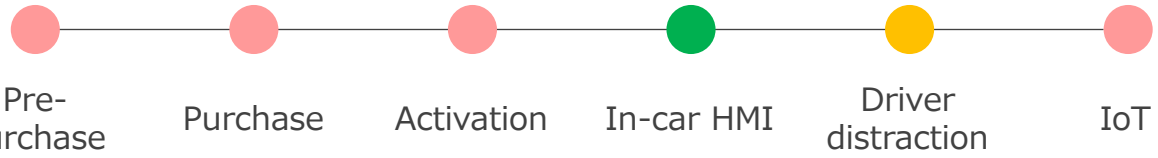
- **Features and functionality:** evaluating whether the solutions provide features that customers expect & need, and solve problems (or provide a wow factor)
- **Usability:** evaluating whether the features available are easy to learn and use. This considers areas such as ergonomics, legibility, usability 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'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
- Convenience domain

2024 vehicle list

SBD has chosen nine cars to evaluate in 2024, 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.

Group A

Cars tested & Report published

BMW X1

- First BMW to be released with iDrive9
- Android based system
- US market test

Mercedes-Benz E-Class

- All-new MBUX Superscreen
- Unique features, apps and games
- German market test

Lincoln Nautilus

- BlueCruise hands free
- Digital Experience
- All-new infotainment system
- US market test

Hyundai KONA Electric

- 12.3-inch cluster and central display
- New Bluelink+ services
- US market test

Priority target vehicles

MINI Electric Countryman

- MINI Operating System 9
- MINI Navigation AR
- Circular OLED display
- UK market test

Group B

Cars tested & Report published

Xiaomi SU7

- Xiaomi's first vehicle offering
- New vehicle from CE company
- Xiaomi Pilot MAX
- Chinese market test

Acura ZDX

- Google Built-in
- AcuraWatch 360+ with hands free cruise
- US market test

AVATR 12

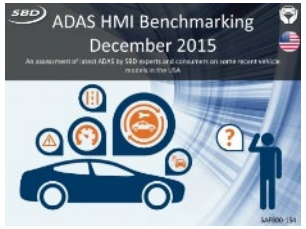
- Harmony 4.0 OS
- Huawei ADS 2.0 (ADAS)
- Innovative displays
- Chinese market test

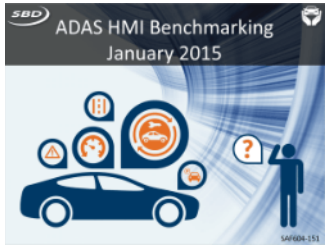
Audi Q6 e-tron

- All-new "Digital Stage" infotainment system
- AR HUD integration
- UK market test

SBD experience through years of testing in-car solutions

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

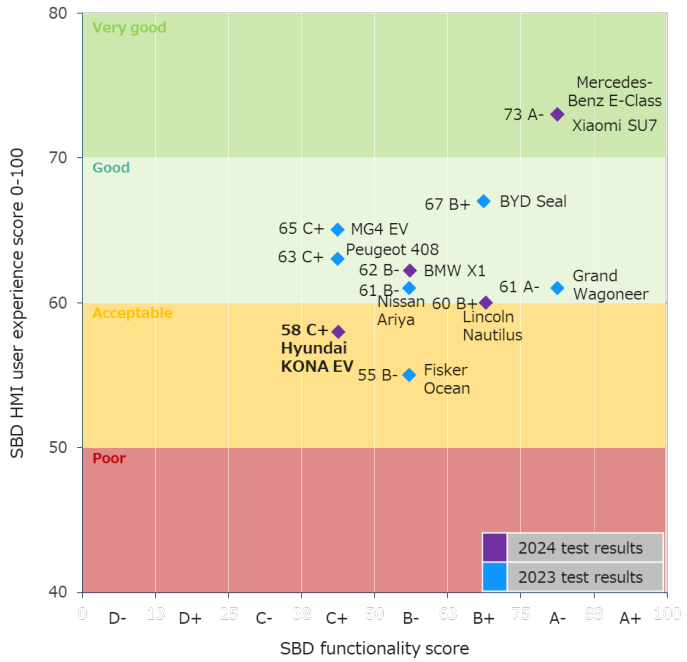
This document does not provide a detailed description of the methodology and this page serves to provide an overview of the approach.

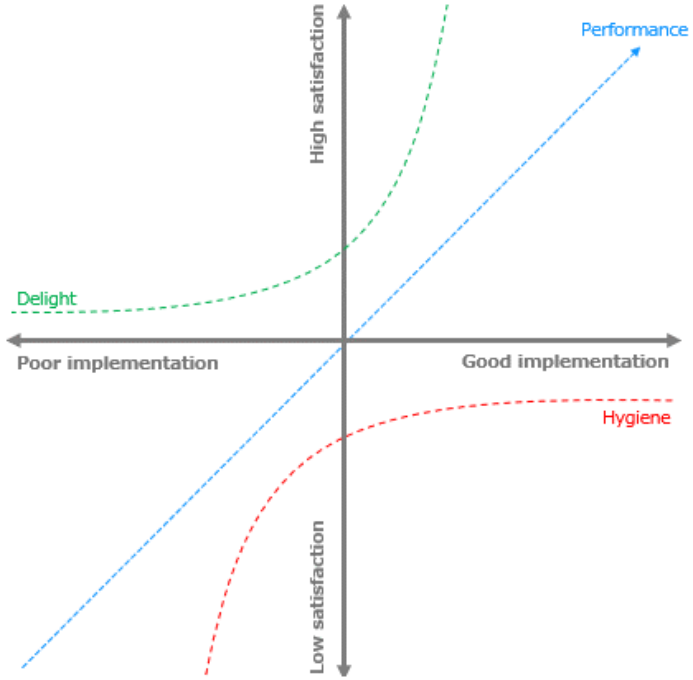
For a detailed discussion and presentation of SBD's methodology please contact us.

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)	✓	✓	✓	✓	✓	✓	✓	

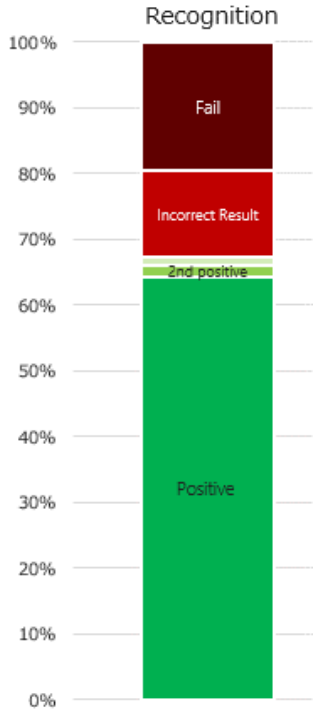
Report structure and how to interpret certain data sets

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 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



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

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

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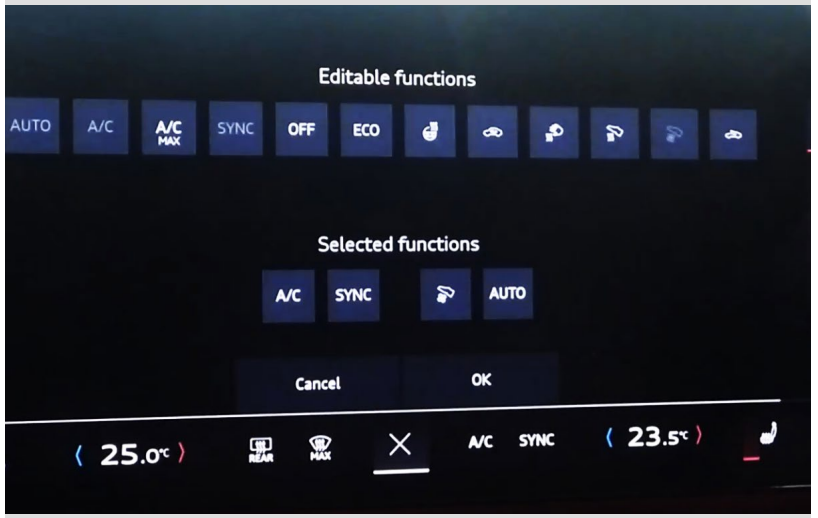
Rich and unique delight features, good customization

Rich delight feature offering

From an augmented reality (AR) head-up display (HUD) to advanced exterior lighting, the Audi Q6 e-tron offers unique delight features everywhere you look. The vehicle also includes advanced and dynamic interior ambient lighting, a passenger display, and video games in the HUD offered as default. The HUD offers supportive AR functions while driving for both navigation and ADAS.



High level of customization

The central display offers both a home screen and shortcuts along the driver's side of the display, both of which can be customized. There are a large number of options to choose from for the shortcuts, making it easy to always have the user's preferences available. The apps screen is also highly customizable with the ability to create folders to organize the apps how the user prefers.

Advanced exterior lighting

The Q6 e-tron offers unique/rare exterior dynamic and customizable lighting. The user can choose from around eight preselected lighting style designs via the vehicle's central display. The rear lights are also dynamic in providing some warnings and alerts visually, to support ADAS related features.

Traffic data does not appear

3. Navigation

For a consistent part of the test, while using the navigation, traffic data is not displayed in the map. Roads appear all in the same color and there are no visual cues signaling incoming traffic.
The feature started working only after a significant amount of time showing, when present, red sections for severe traffic and other similar visual data.

Frequency	Low	Medium	High
Severity	Minor	Major	Critical

Visual and Auditory are satisfactory but Tactile not up to par

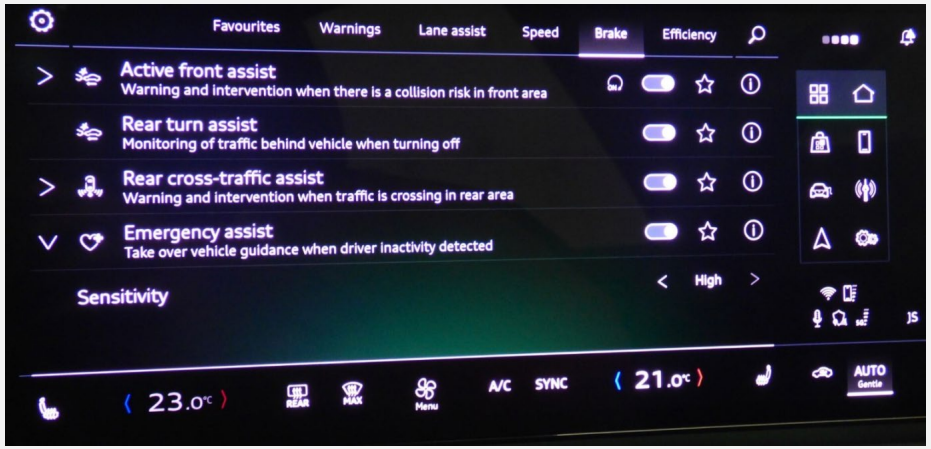
The Audi Q6 E-tron is positioned within the “Premium high segment” vehicle definition, this means each attribute must score “8, good (+)” to be defined as “acceptable” for this vehicle and segment. Ratings that are colored green are considered as meeting expectation for this vehicle type, ratings that are colored red fall below the expectation. Scores are based on three key considerations: how many times a “normal” user would experience the issue, the severity of the issues and an expectation that the concern would be experienced by 95% of users i.e. the more severe and broad the issue, the lower the score.

For the Audi Q6 E-Tron, perceived quality is good in some visual and auditory aspects and even reach excellent levels for lighting and output HMI. However, the car fails to impress in several other areas, especially in the tactile department where it falls below the expected level in all the observed criteria, which along with a few others in the other three categories impact negatively the overall user perception.

Level 1	Level 2	Very poor		Poor		Fair		Good		Excellent	
		-	+	-	+	-	+	-	+	-	+
		1	2	3	4	5	6	7	8	9	10
Visual	Harmony/alignment							✗			
	Geometric								✓		
	Spatial harmony							✗			
	Branding								✓		
	Output HMI									✓	
	Interior lighting									✓	
Tactile	Stiffness & looseness							✗			
	Force feedback							✗			
	Material quality							✗			
	Material harmony							✗			
	Geometric & positioning							✗			
Auditory	Squeak & rattle (passive)								✓		
	Solidity (active after touch)							✗			
	Active sound (from system)								✓		
Feature set (Kano model)	Delight features								✓		
	Performance features							✗			
	Basic/Hygiene features							✗			

ON by default, but unexpected color coding in settings menu

Category	**System turn ON**
System	**RCTA**
SBD viewpoint	The color-coding of the tell-tale on the RCTA toggle when turning ON is not as expected. When ON, the tell-tale is gray. This is not the expected green color normally used to indicate a system that is ON or active. This could be confusing for some users.
UX impact	Minor Negative
SBD viewpoint	The RCTA system in this vehicle is ON by default. This means that unless the user manually goes into the assistance menu and turns the system OFF, it will always be ready to support the user during reverse maneuvers. Having a safety system on by default removes the steps for having to tun the system ON every time it is required. Not only is this intuitive but it is also an implementation that adds convenience. In addition, the user can view an in-depth explanation of the system in the settings menu next to the button to turn ON the system. From here a user can learn its function and limitations.
UX impact	Minor Positive



Gray tell-tale when ON

Awkward positioning and integration of shortcuts

SBD viewpoint

The integration of shortcuts can create visibility and access issues.

- Shortcuts on the central display are presented in a 2x4 vertical grid layout positioned far over on the right-hand side (drivers' side) of the display. Because of this, they are severely obscured by the steering wheel.
- As a result, the driver often has to lean forward or sideways to peer around the steering wheel and obtain a view of the shortcuts. The customizability of these shortcuts do little to counteract this issue.
- Not only is this awkward and a source of annoyance for the driver, but it may also contribute to higher level of driver distraction.
- The shortcut area of controls is a mix of touch buttons, which the user can interact with, and status symbols for some functions that do not respond to touch input, which could cause confusion to a new user.
- The system offers 8 core shortcuts in a grid which goes against Audi's traditional and accepted layout of 5 or 6 shortcuts in a single column.

The positioning of these shortcuts should ideally be reconsidered and relocated to part of the central display that is not obscured by the steering wheel and allows easy access for the driver.

UX impact	Major negative	Minor negative	Minor positive	Major positive

Shortcut menu gets partially covered by steering wheel while driving

AR element in HUD adds depth

SBD viewpoint	The Augmented Reality implementation in the Head-up Display is effective and adds an extra layer of depth. • For upcoming turns, the HUD will feature a set of three blue chevron arrows, indicating the direction and position of the turn. • As the turn gets closer, the floating arrow moves in relation to the position of the approaching turn, getting bigger and closer while clearly communicating to the driver and not cluttering the HUD. • The AR effect is always accurate and never confusing for upcoming turns. This AR HUD implementation strikes a fine balance between clearly communicating directions to the driver with enough information and not creating and overwhelming or cluttered appearance that could create distraction.

UX impact	Major negative	Minor negative	Minor positive	Major positive

AR applied to ACC signaling distance from reference vehicle

AR in navigation indicating directions

No route preview before navigation begins

SBD viewpoint	No overview of the route is shown before route guidance is started. • The lack of a route overview means that users are not presented with alternative routes at the start of their journey and cannot compare routes that best fit their needs and preferences. • This lack of flexibility is likely to be frustrating for some users and may even persuade some to switch to third party navigation sources that do provide this level of flexibility. Providing users with choice and flexibility is key to a pleasant user experience. System that restrict user choice are likely to be met with frustration.

UX impact	Major negative	Minor negative	Minor positive	Major positive

No route preview available in the central display

Navigation in passenger display does not give route preview

Request price for the full report

Request price

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.

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