Individual Project: Audi MMI Redesign

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1 INTRODUCTION

The interface of the Audi MMI (Multi Media Interface) infotainment system for cars will be evaluated and redesigned. For pictures of the main menu of the interface, please view *Appendix 6.1: The original interface of the infotainment system.*

Figure 1—The Audi MMI (Multi Media Interface) infotainment system. Source: <u>Audi MMI infotainment system</u> (Audi MMI — Auto Interfaces, n.d.).

1.1 Description

The Audi MMI infotainment system for cars is an integrated interface that combines music players, smartphone connectivity, GPS navigation, bluetooth communication, climate control, and vehicle settings. The system is mainly displayed on an interactive touchscreen embedded in the center of the car's dashboard, providing a user-friendly experience to the driver and passengers.

Voice command and physical knobs & buttons on the steering wheel are alternative ways of interaction for the infotainment system

1.2 Access

Here is a step-by-step guidance to easily access the modern infotainment system once the user entered the vehicle:

1. Turning the ignition key or pressing the engine start button.
2. The infotainment system is activated automatically upon starting the car.
3. The main menu displays media, navigation, phone, vehicle settings, and other features.
4. For media entertainment, select the "Media" icon and pick your preferred source (bluetooth, CD, etc.) and control playback.
5. For navigation, select the "Navigation" icon and enter a destination using the on-screen keyboard or voice commands.
6. For calls, tap on the "Phone" icon to connect your smartphone via bluetooth and access your contacts.
7. To explore driver assistance features, ambient light customization, and more, you can select the "Settings" icon.
8. Additional features are also easy to explore by swiping the touchscreen.
9. Volume control, music playback, are also accessible through physical knobs & buttons on the steering wheel.
10. Phone calls, messages, volume control, music playback, navigation, are also accessible through voice command.

2 HEURISTIC EVALUATION

Principles and concepts such as discoverability, mapping, feedback, consistency, usefulness & usability, direct manipulation, reducing cognitive load, learning curve, the gulf of execution, and the gulf of evaluation are described in the heuristic evaluation.

2.1 Good aspects and reasons

2.1.1 *Aspects*

The overall layout is intuitive, with logically grouped features in the main menu. The main menu presents a limited set of options (only 8 options), **reducing cognitive load**. Integrated voice commands also provide an alternative way of interaction, reducing the need for touch interactions. Frequently used features such as radio, media, phone, navigation, and settings are prominently displayed on the main menu with enlarged rectangle icons. These icons are visually clear and colored differently with large texts, aiding both **discoverability and usefulness & usability**. Compared with the previous interface of display-only screen and physical buttons, the touchscreen interface offers touch interactions that users can **directly manipulate** the interface. In terms of **mapping**, it mimics other touchscreen such as smartphones, with similar designs of icons that correspond logically to their functionalities. These similarities of operating patterns and visual designs maintain **consistency** across different platforms. **Feedback** is provided when interacting with the touchscreen, such as tapping on any icon will display its associated interface that executes its function. Auditory feedback is provided for system notification, volume control, incoming phone calls, driver assistance, and so on.

2.1.2 *Reasons*

By focusing on essential features, the interface minimizes the cognitive effort required for users to initialize interactions on the main menu. Besides that, users have the option to offload tasks of touch interactions to voice control that can further **alleviate cognitive load** during driving. **Usefulness & usability** is provided through a straightforward simple layout, allowing users to easily locate and access desired functions. On top of that, physical knobs and buttons on the steering wheel are also part of the infotainment system that enhance **usability**. Users can quickly identify and access commonly used functionalities without extensive exploration. Large and recognizable icons with texts on the touchscreen enhance **discoverability**, making it easy for users to identify key functions. In terms of **mapping**, users can easily perceive and interact with the familiar

designs of functions and symbols that associate with their prior experience. Users can swipe around and scroll up & down just like what they usually do on their smartphones. These design elements contribute to a cohesive user experience, not only remaining **consistency** but also reducing the **learning curve**. Immediate visual and audio **feedback** reinforces user physical actions, enhancing the sense of control through touch and voice.

2.2 Bad aspects and reasons

2.2.1 *Aspects*

Some advanced features and settings are lack of **discoverability**, hidden within submenus or sub-submenus that users need to find through many steps. Because these advanced features require users to navigate through multiple menus, creating a **gulf of execution**. Some icons such as "Settings", "Help", and "Phone apps" (please view *Appendix 6.1: The original interface of the infotainment system*) may lack **mapping** due to the stylish designs. **Inconsistency** occurs in terminology between voice commands and on-screen prompts. In terms of the **gulf of evaluation**, when users' voice commands are misunderstood or not aligned with on-screen prompts, the interface does not clearly convey the error with responses back to users, leading to user confusion. These mapping issues and inconsistencies from the abstract design of icons and inaccuracy of terminology not only cause confusion but also increase the **learning curve** for novice users. **Feedback** delays occur in certain situations like: "connecting to phone" for "Media" and "Phone apps" features; "checking the current engine oil level" in the "Vehicle" feature. These delays may cause a disconnection between user actions and system responses. Also, there is no haptic **feedback** for touch interactions on the touchscreen.

2.2.2 *Reasons*

Novice users struggle to find and utilize advanced features ("Language & Keyboard settings", "Virtual cockpit configuration", "Central locking", "Parking aids", etc.), which impacts their overall user experience. Lack of clear indications for items in nested menus makes the **discoverability** of advanced features

challenging. Users also have a hard time to find specific customization options due to the lack of clear pathways. All these situations create a gap between users' goals and steps required to achieve them, widening the **gulf of execution**. The stylish design of "Settings", "Help", and "Phone apps" icons lacks **mapping**, thus users struggle to convey their intended functionality, leading to uncertainty. Moreover, this uncertainty of usage may cause users to further misinterpreting their meaning varies across different parts of the interface. Due to the lack of **consistency**, users get confused when there is a mismatch in terminology in between their voice commands and on-screen prompts, which also increases the **learning curve** and impacts the user experience. Slips and mistakes commonly happen in users voice commands and touch interaction, but lack of detailed error messages or voice guidance causes a gap between users' actions and their understanding of the system's responses, widening the **gulf of evaluation**. No **feedback** or slow response from "connecting to phone" for "Media" or "Phone apps" features and "checking the current engine oil level" in the "Vehicle" feature can lead to frustration, especially when users expect instant feedback while driving. In addition, the absence of haptic **feedback** for touch interactions on the touchscreen makes users feel less engaged and may impact the overall user experience.

3 INTERFACE REDESIGN

Design alternatives in prototyping focused on improvements of main menu and example functions. The **visual mock-ups** below simulates the **potential solutions** with textual descriptions that are provided for brief explanation. For pictures of the **original interface**, please view *Appendix 6.1: The original interface of the infotainment system*.

3.1 Discoverability & gulf of execution
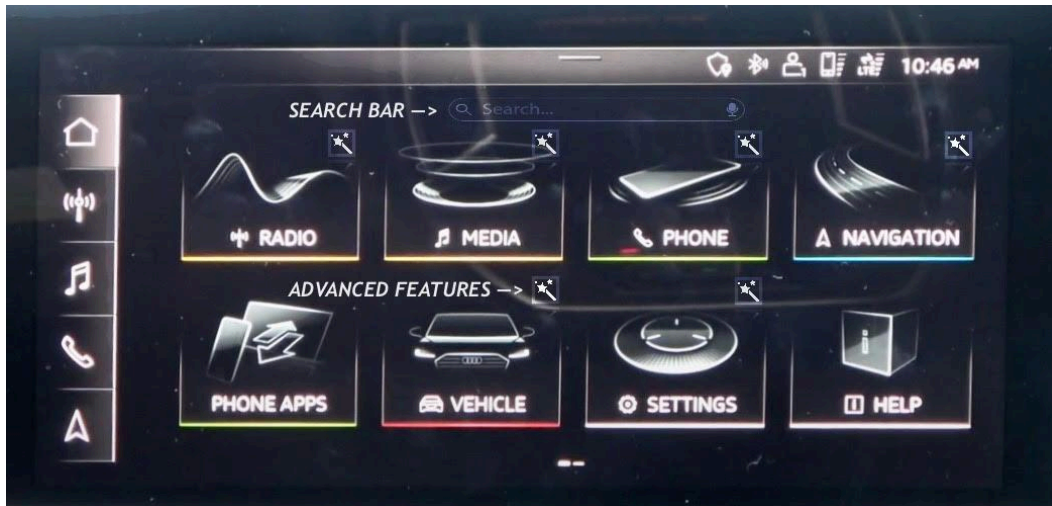
Figure 2—Users can directly access advanced features for each function. To be more specific, categorized grouping of advanced features for each function are located under dedicated **"advanced features" icons**. The search bar is also provided for users to directly find specific items they are looking for. Enable a **"search bar"** on the top center of the main menu when the car is in idle (not moving). The virtual keyboard would pop out for users to type in keywords, but users can also tap on the "microphone" icon on the search bar to enable voice commands.
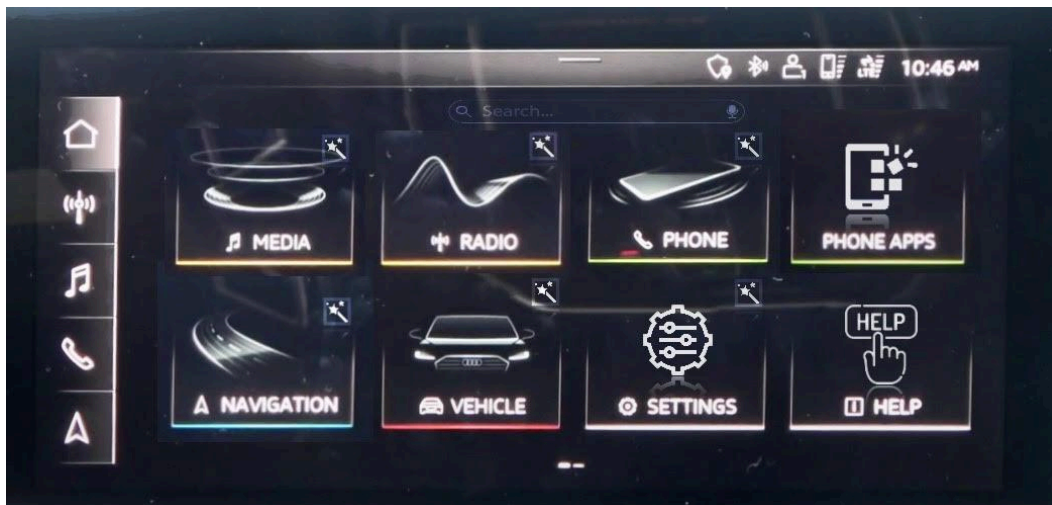
3.2 Mapping & consistency

Figure 3—**"Settings," "Help," and "Phone apps"** icons are redesigned with more **explicit representations**. **Rearranged** icon **placements** that aligned with **"frequently used features"** based on each individual usage (e.g. The "Media" function is more frequently used than the "Radio" function so they **switched** positions; The "Phone apps" function is **grouped** with the "Phone" function; The "Navigation" is **moved** to the bottom left as is also more frequently used by the driver).
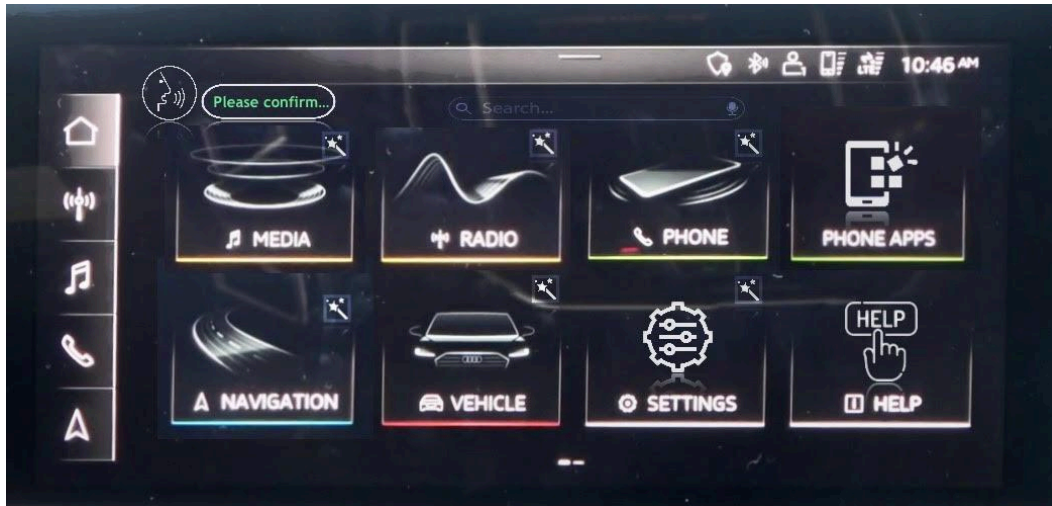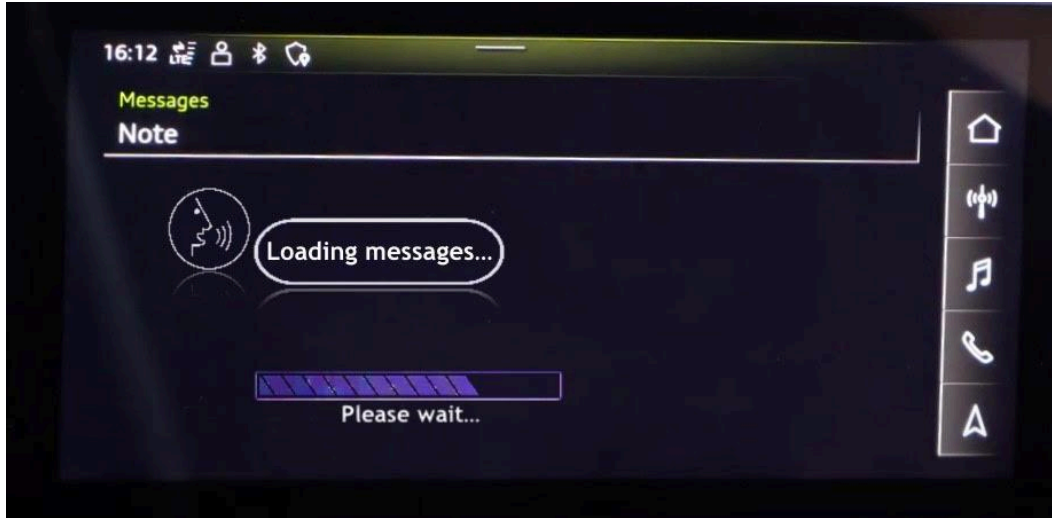
3.3 Feedback & gulf of evaluation

Figure 4—When users use voice commands, they receive confirmation feedback from **voice guidance for unclear commands before activating desired features** (e.g. Asking the user to **confirm if they said**: "Phone? or Phone apps?")**.** This redesign is also related to the auditory interface that cannot be provided in the visual form above.

Figure 5—The first example. **Auditory feedback** for loading actions such as **"Loading messages"**. Adding visual indicators **"loading bar"** for these types of features to keep users informed. This redesign is also related to the auditory interface that cannot be provided in the visual form above.

Figure 6—The second example. **Auditory feedback** for loading actions such as **"Checking the engine oil level"**. Adding visual indicators **"loading bar"** for these types of features to keep users informed. This redesign is also related to the auditory interface that cannot be provided in the visual form above.

Figure 7—**Haptic feedback** for touchscreen interactions, providing
a more engaging and responsive experience. This redesign is also
related to the haptic interface that cannot be provided in the visual
form above.

4 INTERFACE JUSTIFICATION

The redesigned interface of Audi MMI infotainment system is justified by
addressing some critical issues identified in *Heuristic evaluation 2.2: Bad aspects
and reasons*. It focuses on enhancing **discoverability**, reducing the **gulfs of
execution & evaluation**, improving **mapping**, ensuring **consistency**, and
upgrading **feedback** mechanisms to achieve a better user experience. For
pictures of the **original interface**, please view *Appendix 6.1: The original interface of
the infotainment system*.

In terms of resolving weaknesses, according to *Heuristic evaluation 2.2: Bad
aspects and reasons*, advanced features and settings for each function in the
original interface are hidden within nested menus, requiring users to navigate
through multiple steps, thereby widening the gulf of execution. The lack of clear
pathways to specific customization options in the **original** interface exacerbates
the challenge in finding these features, leading to a disconnect between users'
goals and steps to achieve the goal. However, according to *Interface redesign 3.1
Discoverability & gulf of execution*, discoverability and the gulf of execution of the
redesigned interface are improved through a redesigned main menu with every

function having **direct access** to their advanced features, addressing the **criticism** of hidden advanced features within submenus. The addition of a search bar for **quick and efficient** access also enhanced **usefulness & usability**. According to *Heuristic evaluation 2.2: Bad aspects and reasons*, the designs of icons for "Settings," "Help," and "Phone apps" in the **original** interface lack mapping due to their stylish designs, causing uncertainty and misinterpretation of their functionality across different interface sections. Placements of icons lack consistency and are fixed by default settings. However, according to *Interface redesign 3.2 Mapping & consistency*, mapping and consistency of the **redesigned** interface are enhanced with **redesigned** icons and **rearranged** placements across the main menu. These small changes not only align with users' **prior experiences**, but also **emphasize** on each user's frequently used features and categorized grouping automatically, further minimizing users' **cognitive load**. According to *Heuristic evaluation 2.2: Bad aspects and reasons*, slips and mistakes in voice commands and touch interactions, coupled with the absence of confirmation and error feedback, widen the gulf of evaluation, hindering users' understanding of the **original** interface. In the **original** interface, no responses during "loading messages", "connecting to phone", and "checking engine oil level," contribute to user frustration, especially when ongoing processes are expected. Additionally, the lack of haptic feedback for touch interactions on the touchscreen diminishes user engagement and impacts the overall user experience. However, according to *Interface redesign 3.3 Feedback & gulf of evaluation*, improved feedback mechanisms of the **redesigned** interface are designed with **active responses** for actions **confirmation** from voice commands, which also put in efforts to **minimize** potential confusion and **errors** that are addressed in the criticism about the original interface. In terms of bridging the gulf of evaluation, **auditory** feedback is combined with the "loading bar" **visual** indicator for loading actions among specific functions that may take longer time to load. This combination of feedback keeps users **informed** about ongoing processes. The integration of **haptic** feedback for touch interactions puts efforts into ensuring a comprehensive **perceptibility** (auditory, visual, and haptic simultaneously) for better user experience.

In terms of preserving strengths, according to *Heuristic evaluation 2.1: Good aspects and reasons*, **intuitive** layout with **logically grouped** features and a **limited set** of options to **reduce cognitive load** were **maintained** from the **original** interface. The **redesigned** interface augments the strength of discoverability and bridges the gulf of execution by offering a search bar and direct access to advanced features. According to *Heuristic evaluation 2.1: Good aspects and reasons*, **recognizable** icons and **overall layout** were **preserved** from the **original** interface. The **redesigned** interface augments the strength of mapping and consistency by enhancing some icons' clarity with placements of features based on users' individual usage. According to *Heuristic evaluation 2.1: Good aspects and reasons*, **auditory and visual feedback** mechanisms were **preserved** from the **original** interface. The **redesigned** interface augments the strength of feedback and bridges the gulf of evaluation with additional features like feedback combination and new haptic feedback for touchscreen interaction.

5 REFERENCES

1. Audi MMI (Multi Media Interface) — Auto Interfaces. (n.d.). https://www.autointerfaces.com/system-name/mmi

6 APPENDICES

6.1 The original interface of the infotainment system

Figure 8—The main menu of the original interface. Source: [Audi MMI infotainment system](#) (Audi MMI — Auto Interfaces, n.d.).

Figure 9—The rest of the main menu after swipe left. Source: [Audi MMI infotainment system](#) (Audi MMI — Auto Interfaces, n.d.).
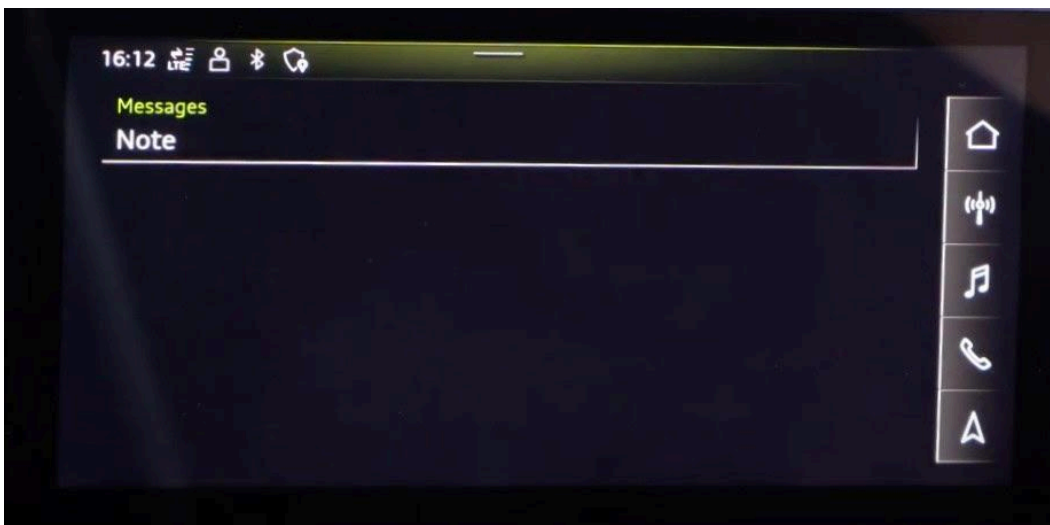

Figure 10—The original messages interface is loading. Source: [Audi MMI infotainment system](#) (Audi MMI — Auto Interfaces, n.d.).

Figure 11—The original checking oil level interface is loading.
Source: Audi MMI infotainment system.