

Guidelines for Haptic Interaction in a Driver Vehicle Interface

RATIONALE

This SAE Information Report is provided to establish a set of high-level guidelines for systems with haptic interactions as a means of providing information about and enabling control of select vehicle features and functions. This information report describes key aspects that vehicle designers should consider when integrating haptics into a driver vehicle interface. While not a comprehensive set of guidelines, this information report is intended to establish general guidance to promote consistency in users' experience and design of these haptic systems.

TABLE OF CONTENTS

1.	SCOPE.....	3
1.1	Purpose	3
2.	REFERENCES.....	4
2.1	Applicable Documents	4
2.1.1	SAE Publications.....	4
2.1.2	Related Publications	4
3.	DEFINITIONS	5
4.	STRENGTHS AND LIMITATIONS OF HAPTICS IN AUTOMOTIVE APPLICATIONS.....	7
4.1	Strengths of Haptic Feedback.....	7
4.2	Limitations of Haptic Feedback.....	8
5.	GUIDANCE ON WHEN TO IMPLEMENT HAPTICS – EXAMPLE APPLICATIONS	8
5.1	UI Confirmation	8
5.2	Substitution for Mechanical Controls	9
5.3	Alerts	9
5.3.1	Scenario Example: Collision Alert During a Morning Commute	10
5.3.2	Scenario Example: Pedal.....	10
5.3.3	Scenario Example: Lane Departure Warning	10
6.	IMPLEMENTATION CONSIDERATIONS.....	11
6.1	Software and UX – Key Considerations.....	11
6.1.1	Latency.....	11
6.2	Electronics - Key Considerations	12
6.2.1	Actuator Characteristics	12
6.3	Mechanical Design - Key Considerations	12
6.3.1	Floating Mass versus Grounding Mass.....	12
6.3.2	Suspension	12
6.3.3	Mounting of the Actuator	12

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7.	EFFECTIVENESS OF HAPTIC FEEDBACK.....	12
8.	SUMMARY AND DISCUSSION.....	13
9.	NOTES	13
9.1	Revision Indicator.....	13
Figure 1	High level haptic hierarchy.....	3
Figure 2	Human interaction with a haptic user interface	8
Figure 3	Mechanical controls dominating the car interiors.....	9
Figure 4	Digital touch controls are increasingly dominant	9
Figure 5	Example of a driver approaching a car at high speed	10
Figure 6	Example of a driver navigating within a lane	11

1. SCOPE

The scope of this document is to describe system design guidelines for the use of haptic interfaces to manage system safety and functional aspects of designs applicable for OEM and aftermarket systems in light vehicles. The intent of these guidelines is to help system designers determine when to use haptic interfaces and how to ensure their effectiveness. These may be stand-alone interfaces or the haptic aspects of multi-modal (audio, video, speech, haptic) interfaces. Excludes haptic systems designed for use by passengers, which may be addressed in a future version.

1.1 Purpose

To provide haptic interaction guidelines for system designers and integrators developing haptic systems intended for use by the driver of the vehicle.

Figure 1 shows the high-level haptic hierarchy that will be addressed in this document.

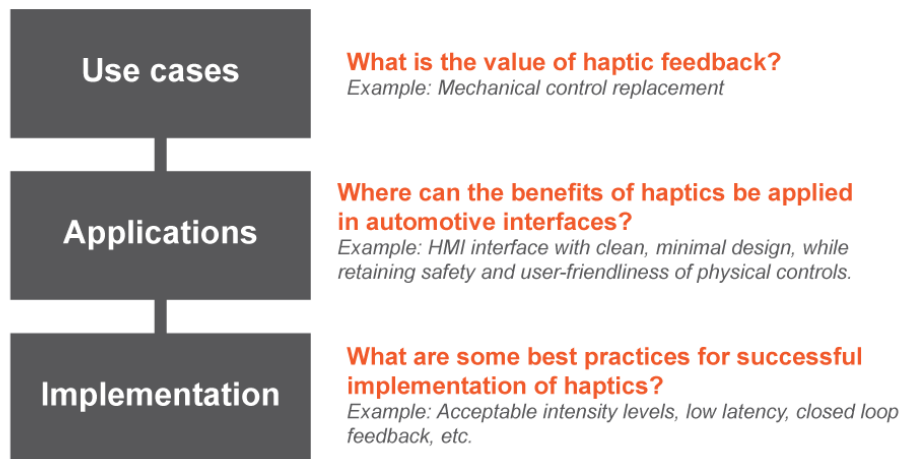


Figure 1 - High level haptic hierarchy

The hierarchy shown in Figure 1 illustrates the sequence of executing a high-level haptic evaluation.

In the “Use Cases” step, all the areas where haptic feedback could potentially be useful are enumerated and evaluated. The value proposition (i.e., advantages and disadvantages, cost versus benefit) of haptics in each use case is also examined in this stage. Questions like “does it make sense to add haptics here, just because we can?” are asked and answered. For example, while mechanical button replacement is often cited as a good use case for a haptic interface, it might not always be feasible or advisable to replace a button with a haptic surface. Sections 5 and 6 address this step.

Having established the value of haptic feedback, the next step, “Applications” is where the specific operating and interaction scenarios are defined and described (e.g., dashboard touch screen, steering wheel alerts, seatback alerts, etc.). User actions are defined for tasks requiring human participation (including sequence of activities, type of interactions, etc.), the system behaviors are described and the expected haptic responses from the system are defined, followed by the expected or desired human actions to the haptic responses. Section 6 addresses the exemplar applications of haptics.

The “Implementation” step lays out guidelines regarding haptic response characteristics such as the intensity levels of the response, the latency and duration of haptic feedback, the system considerations (actuator type, drivers, etc.) required to provide the response, any expected human responses to confirm or acknowledge the haptic response, etc. Section 7 addresses this step.

All the steps in the hierarchy shall be executed with the goal of satisfying appropriate safety requirements and user-friendliness characteristics.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J3016 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles

2.1.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

Audi AG. (2020, September 11). *Locally emission-free, efficient and fit for daily driving: Audi's formula for plug-in hybrids* [Press release]. <https://www.audi-mediacycenter.com/en/press-releases/locally-emission-free-efficient-and-fit-for-daily-drivingaudis-formula-for-plug-in-hybrids-13100>.

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Nissan Motor Corporation. (n.d.). *E-Pedal: Technology overview*. https://www.nissan-global.com/EN/INNOVATION/TECHNOLOGY/ARCHIVE/E_PEDAL/.