“There’s no one in the whole haulage industry who says, damn, that was well driven”

An Interaction Design Study of Eco-Driving Support for Professional Truck Drivers

Master’s thesis in Computer science and engineering

Julia Forslund, Erika Witte

Department of Computer Science and Engineering
CHALMERS UNIVERSITY OF TECHNOLOGY
UNIVERSITY OF GOTHENBURG
Gothenburg, Sweden 2026

Master's thesis 2026

"There's no one in the whole haulage industry who says, damn, that was well driven"

An Interaction Design Study of Eco-Driving Support for Professional Truck Drivers

Julia Forslund, Erika Witte

UNIVERSITY OF GOTHENBURG

CHALMERS
UNIVERSITY OF TECHNOLOGY

Department of Computer Science and Engineering
Chalmers University of Technology
University of Gothenburg
Gothenburg, Sweden 2026

“There’s no one in the whole haulage industry who says, damn, that was well driven”
An Interaction Design Study of Eco-Driving Support for Professional Truck Drivers
Julia Forslund, Erika Witte

Supervisor: Sara Ljungblad, Computer Science and Engineering
Advisor: Anders Eriksson, Volvo Group Trucks Technology & Industrial Division
Examiner: Josef Wideström, Computer Science and Engineering

Master’s Thesis 2026
Department of Computer Science and Engineering
Chalmers University of Technology and University of Gothenburg
SE-412 96 Gothenburg
Telephone +46 31 772 1000

Typeset in LaTeX
Gothenburg, Sweden 2026

“There’s no one in the whole haulage industry who says, damn, that was well driven”
An Interaction Design Study of Eco-Driving Support for Professional Truck Drivers
Julia Forslund, Erika Witte
Department of Computer Science and Engineering
Chalmers University of Technology and University of Gothenburg

Abstract

This thesis explores how eco-driving support for professional truck drivers can be designed from an interaction design perspective. Existing eco-driving systems in the commercial vehicle domain are often retrospective, score-based, visually oriented, and weakly contextualised, which may limit their usefulness in the safety-critical, demanding, and organisationally complex context of truck driving. At the same time, recent advances in sensing, connectivity, voice interaction, and large language models (LLMs) have created new possibilities for more adaptive driver coaching. However, research on such emerging concepts in the truck eco-driving domain remains fragmented. Conducted in collaboration with Volvo Group Trucks Technology & Industrial Division (TTI), the thesis emerged from an ongoing exploration of these possibilities, but approached them through a user-centred interaction design process in order to ground them in truck drivers’ needs and real use conditions. Against this background, the thesis addressed the following exploratory research question: *What can an interaction design lens reveal about the challenges and opportunities of designing eco-driving support for professional truck drivers?*

The design process was inspired by the first three phases of the Double Diamond: Discover, Define, and Develop. Methods included literature review, industry benchmarking, semi-structured interviews with truck drivers and fleet managers, reflexive thematic analysis, ideation, prototyping, and prototype evaluation. The resulting mid-fidelity prototype applied generative LLM capabilities across both on-board and off-board components, combining a user-initiated, voice-based eco-driving coach with a manager-facing view for contextualised follow-up and recognition.

The findings show that eco-driving support should be understood as a socio-technical and organisational design problem rather than only an interface problem. Four main results were identified: organisational conditions shape how eco-driving support is experienced; one-size-fits-all coaching is inadequate in diverse driving contexts; eco-driving feedback must balance tone, explainability, timing, and flow control; and user acceptance functions as the final filter for system success. The study also highlights several tensions between context-aware adaptation and privacy, explainability and limited attention, and feedback timing and driver control.

Rather than validating AI or voice interaction as definitive solutions, the thesis contributes user-centred design knowledge about the conditions, tensions, and opportunities that future eco-driving support could address in professional truck driving.

Keywords: Eco-Driving Support, Truck Driving, Interaction Design, Large Language Models (LLMs), Artificial Intelligence (AI), User-Centred Design Process, In-Vehicle Technology.

Acknowledgements

First, our gratitude goes out to Volvo Group TTI for the opportunity to carry out this Master's thesis in an industrial context. In particular, we are grateful to our industry advisor, Anders Eriksson, for his valuable input, encouragement, and guidance throughout the project.

We sincerely thank the Volvo employees who generously shared their time, knowledge, and support with us during the process.

We also give special thanks to all interview and test participants who contributed their experiences, reflections, and feedback. Your willingness to share your perspectives was essential to this user-centred design process and forms the foundation of this thesis.

To our partners, thank you for your patience, encouragement, and unwavering support throughout these months.

Finally, we would like to thank our academic supervisor, Sara Ljungblad, for her valuable guidance and support in helping us navigate this challenging but enlightening research process.

Julia Forslund & Erika Witte, Gothenburg, 2026-06-18

Contents

List of Figures

List of Tables

1 Introduction

Road transport plays a central role in reducing emissions and meeting global and national climate policy efforts. Truck manufacturers, such as Volvo Group, are actively driving decarbonisation within the transport industry through the development of products and solutions aimed at reducing CO_2 emissions. These efforts can target either the vehicle-level, for example through technical optimisation and cleaner energy sources, or the driver-level, through technologies and products that encourage fuel-efficient driving behaviours.

Eco-driving refers to the use of fuel-efficient driving techniques, and eco-driving support systems represent one such driver-level approach by providing feedback and guidance intended to help drivers adopt and sustain these practices. From an interaction design perspective, this is not only a technical or sustainability-related issue, but also a question of how driver-system interaction should be designed. For professional truck drivers, the effectiveness of eco-driving support depends not only on what information is provided, but also on how feedback is communicated, when it is delivered, how much attention it demands, and whether it is experienced as relevant and trustworthy in the safety-critical driving context.

Despite advances in sensing, connectivity, and artificial intelligence, many existing driver coaching solutions remain static, visually oriented, and based on generic performance indicators. Such approaches may be poorly aligned with the realities of professional truck driving, where time pressure, safety demands, varying driving conditions, and organisational context all shape whether feedback has the intended effect. As a result, even well-intended systems may struggle to support behaviour change or gain user acceptance if they are not adapted to these real-world constraints.

This thesis was carried out in collaboration with Volvo Group Trucks Technology & Industrial Division (TTI). It emerged from an ongoing exploration of voice-based, LLM-enabled driver coaching as a possible way to move beyond generic, text-heavy feedback, but approaches the topic from a user-centred interaction design perspective in order to ground the concept in drivers' needs and real operational constraints. On that basis, the following research question is posed:

What can an interaction design lens reveal about the challenges and opportunities of designing eco-driving support for professional truck drivers?

1.1 Approach

To address the research question, this thesis adopts an interaction design approach. In this context, an interaction design lens means that eco-driving support is examined not only in terms of technical functionality, but in terms of how support is experienced, interpreted, and used by truck drivers in context. Therefore, the work focuses on identifying user needs, exploring design challenges and opportunities, and evaluating how interaction concepts are perceived under the constraints of truck driving.

The thesis follows a user-centred and iterative design process inspired by the Double Diamond, moving from understanding and defining the problem space (Discover- and Define-phases) to developing and evaluating design concepts (Develop-phase). Through this process, the thesis generates insight into the challenges and opportunities of designing eco-driving support for professional truck drivers.

1.2 Delimitations

This thesis is situated within interaction design and focuses on the design and evaluation of user interaction with eco-driving support, rather than on developing fully autonomous systems or underlying AI models. Formal algorithmic development and system-level properties, such as scalability, computational efficiency, robustness, and energy consumption, are outside the scope of this work.

The thesis also focuses on short-term interaction and immediate responses to eco-driving support rather than long-term behavioural change or sustained fuel-efficiency effects. It therefore does not address whether potential effects persist over time or how drivers' practices evolve through prolonged use.

Finally, the study is limited in scale and context. It does not constitute a large-scale or cross-cultural investigation, and the findings should be understood in relation to the specific users and context studied.

1.3 Thesis Outline

The thesis is structured broadly in line with the Double Diamond design process. Chapters 2 and 3 partly represent the Discover phase by introducing the context, related research, and theoretical foundations of the work, while Chapter 4 describes relevant methods for answering the research question.

Chapter 5 presents the design process and its activities and findings. Chapter 6 synthesises these insights into the identified challenges and opportunities of designing eco-driving support for professional truck drivers. Chapter 7 reflects on the findings, limitations, and implications for future work, and Chapter 8 summarises the main contributions.

2

Background

This chapter provides the background for the thesis and clarifies the context in which the work takes its starting point. It outlines the sustainability context of heavy-duty transport, introduces the professional truck driving profession and its working conditions, and describes eco-driving as a strategy for reducing energy use and emissions. The chapter also presents interaction design as the lens guiding the thesis, before reviewing current industry approaches to eco-driving support, including Volvo Trucks' existing solutions.

2.1 Sustainability Context

Despite global and national policy efforts to address climate change and achieve net-zero emissions, reports from the International Energy Agency indicate that fossil fuel consumption reached record levels in 2024, along with continued growth in energy-related emissions [1]. Therefore, actors within the automotive and industrial transport sectors have a critical role to play in meeting the objectives of the Paris Agreement [2] and the 2030 Agenda for sustainable development [3]. Within the heavy-duty transport sector, in particular, policy-driven trends and development efforts have focused largely on the transition to clean energy sources as the primary pathway to achieve net-zero emissions and reduce peak warming [1], [4]. Continued innovation is still required to reduce climate pollutants and maximise clean energy deployment in long-distance transport [1].

As signatories of the United Nations Global Compact [5], [6] and supporters of the Paris Agreement [2], Volvo Group states that it is actively driving decarbonisation within the transport industry, with the primary focus of its climate strategy being the development of products and solutions that reduce CO_2 emissions [7]. Innovation within the transport sector extends beyond vehicle energy sources and production processes to include technologies and products that encourage and sustain more environmentally responsible driving behaviours.

2.2 The Truck Driving Profession

Truck driving is a profession embedded in broader logistical, organisational, and societal systems. Road freight transport plays a major economic role, and professional truck drivers constitute a distinct road-user group [8], [9]. Unlike private motorists, truck drivers spend prolonged periods on the road as part of their work and operate under substantial cognitive, physical, and safety-related demands [8]. Long hours, monotonous driving environments, night work, irregular shifts, and extended driving time contribute to fatigue, drowsiness, and stress, all of which are associated with elevated crash risk [8], [9]. Drivers must also manage large and heavy vehicles whose braking distance, blind spots, turning radius, and sensitivity to load and terrain differ significantly from passenger cars [8].

Truck driving is also increasingly shaped by digitalisation and connected management systems. Ongoing technological development and automation place new demands on drivers' digital skills, adaptability, and ability to coordinate with increasingly advanced in-vehicle systems [9]. While the profession has historically been associated with typical masculine attributes, such as autonomy, mobility, and responsibility, telematics and fleet management systems have enabled more continuous oversight of both vehicles and drivers [10]. Research suggests that this can affect power relations and reduce the sense of freedom associated with the profession [10].

Another important change concerns the transition in truck powertrains. Internal combustion engine (ICE) trucks still dominate freight transport, but battery electric vehicles (BEVs) are becoming increasingly relevant [4]. Compared with ICE trucks, BEVs differ in driving range, charging needs, and operating conditions, which can influence how driving is planned and carried out. Although the value proposition of electric trucks is improving, their adoption remains constrained by higher purchase costs and limited charging infrastructure, especially for heavy-duty and long-haul use [4]. Heavy-duty charging infrastructure is still at an early stage and requires substantial investment, meaning that the transition to cleaner energy sources is shaped not only by vehicle technology but also by the availability of supporting infrastructure [4].

2.3 Eco-Driving

Eco-driving, also known as green driving or environmentally friendly driving [11], is commonly defined as the application of a set of fuel-efficient driving techniques aimed at reducing energy consumption, emissions and operating costs without compromising safety [12]. More broadly, eco-driving encompasses a range of pre-trip, during the trip, and post-trip behaviours that together can lead to reductions in fuel consumption, CO_2 emissions, air pollutants, and noise [12].

During the trip, eco-driving is characterised by smooth, anticipatory, and steady driving behaviour [12]. Core practices include moderate acceleration, early gear changes, and maintaining an even driving pace, for example, through the appropriate use of cruise control on motorways [11], [13]. Anticipating traffic flow, road conditions, and signal changes allows drivers to minimise unnecessary stopping and reduce sharp braking, thereby avoiding inefficient 'stop-and-go' driving [11], [12]. Similarly, maintaining speeds at or safely below posted limits is important, as fuel consumption increases disproportionately at higher speeds due to the exponential relationship between vehicle speed and aerodynamic drag [11], [12]. Additional eco-driving behaviours during driving include limiting auxiliary energy use, such as operating air conditioning only when necessary, and eliminating excessive idling by switching off the engine during prolonged stops [12], [13]. Efficient deceleration is also central to eco-driving practice. Engine braking can significantly reduce fuel consumption, especially in modern vehicles equipped with fuel cut-off systems [12].

While the foundational principles of eco-driving are broadly applicable across vehicle types, their implementation varies depending on vehicle characteristics and driving context. For heavy-duty vehicles, factors such as vehicle mass, slower acceleration, and braking demands make anticipation, speed management, and topographical awareness particularly important [14]. Moreover, motivational factors differ between private and commercial drivers. Whereas private drivers may directly benefit from fuel cost savings, commercial drivers operating under time constraints may require organisational incentives or feedback mechanisms to support sustained eco-driving behaviour [14]. Achieving eco-driving benefits at scale therefore requires not only individual behavioural change but also systematic support through education, feedback, and organisational or societal reinforcement [13].

2.4 Interaction Design

Interaction design (ID) concerns the design of interactive systems that facilitate the ways in which people communicate and act in everyday and professional contexts, with particular attention to the user experiences these interactions produce [15]. In this sense, ID is not only concerned with functionality, but with shaping how interaction unfolds in context.

A central characteristic of ID is its structured and iterative process. It involves discovering user requirements, designing solutions that fulfil those requirements, as well as producing and evaluating designs [15]. Importantly, ID places explicit attention on users and their goals throughout this process. Rather than starting from technological possibilities alone, it begins with an understanding of human needs, tasks, and contexts of use [15]. Consequently, ID overlaps with related disciplines such as human-computer interaction (HCI), cognitive engineering, cognitive ergonomics, and human factors, which all share a concern about designing systems for human use, but differ in scope and methodology [15].

In this thesis, ID serves as the subject area and basis of the methodological approach for developing and evaluating eco-driving support. It informs how user needs are identified, how interaction mechanisms are designed, and how prototypes are assessed. The specific design process adopted in this thesis is described in detail in Chapter 5.

2.5 Industry Benchmarks

Truck manufacturers provide a range of services focused on eco-driving and fuel-efficiency. In the following sections, we outline current industry benchmarks derived from internal reports at Volvo Group (personal communication, February 12, 2026).

2.5.1 Post-Hoc Telematics-Based Evaluation and Scoring

A common approach within the commercial vehicle industry is post-hoc eco-driving support based on telematics data, where driver behaviour is analysed after driving and translated into performance scores or reports. This approach is used by Renault Trucks, Scania, and PACCAR who provide platforms and models in which driver behaviour is evaluated after driving and summarised in scores. Feedback is often rule-based and unable to take individual drivers' context into account.

2.5.2 Vehicle-Centric Automation and Predictive Control

In addition to post-hoc and driver-focused feedback, several truck manufacturers have embedded eco-driving optimisation directly into vehicle control systems through predictive automation. By enabling automated coasting and using GPS and topographical data to anticipate upcoming road gradients, these systems can adjust vehicle speed and gear selection to support more fuel-efficient driving.

As a result, efficiency gains are achieved primarily through automation, with limited contribution to drivers' situational understanding or long-term skill development.

2.5.3 Decision-Support and Optional In-Vehicle Guidance

A third approach can be seen in Mercedes-Benz Trucks that positions eco-driving primarily as a decision-support task. Their system combines telematics-based evaluation with optional, non-intrusive, real-time, in-vehicle guidance related to accelerator use and anticipatory driving. Importantly, this guidance does not override driver input and can be disabled at the driver's discretion.

A combined approach can also be found at IVECO. Their system contains both a voice-based human-machine interface focused on accessing vehicle and service information, and a post-drive evaluating tool that uses safety and efficiency key performance indicators (KPIs) and vehicle system data.

Overall, current eco-driving solutions across the industry predominantly rely on post-hoc telematics analysis, fixed scoring models or vehicle-level automation. Real-time driver coaching that dynamically adapts to context, driver state, and situational demands remains limited.

2.5.4 Volvo Trucks Driver Coaching

Volvo Trucks currently provides eco-driving support through its Driver Coaching functionality within Volvo Connect subscriptions. The system evaluates fuel-efficient and environmentally friendly driving and generates performance scores across four dimensions: Engine & Gear, Speed, Anticipation, and Standstill, based on predefined KPIs [16]. Feedback is primarily retrospective and score-based, placing the system within a post-hoc performance evaluation paradigm.

Driver Coaching combines limited on-board guidance with off-board performance analysis. While driving, visual driving tips are presented in the instrument cluster when the system detects a potential improvement [16]. Additional performance feedback is available in the secondary information display, where the default Results view presents the driver's performance in each assessment area, an overall score, and a trend graph showing how the total score has changed during the last two hours of driving [16]. Off-board, more detailed summaries and comparisons are accessible through the Volvo Connect web interface, primarily supporting follow-up and fleet management. As such, the system functions mainly as a telematics-driven decision-support tool rather than as a continuously adaptive in-vehicle coaching system.

In parallel, Volvo Academy represents a training-oriented approach to driver development. The programme consists of a two-day course combining theoretical instruction with supervised practical driving, focusing on the effective use of existing vehicle systems such as cruise control, engine braking, and traction control. While this model supports conceptual understanding and skill development, it relies on scheduled training and retrospective feedback rather than continuous context-aware support during everyday driving.

Together, Volvo Trucks' current eco-driving support strategy combines on-board driving tips, score-based assessment, and formal driver training. Although these approaches highlight improvement areas, provides education, and follow-up, they offer limited immediacy and contextual sensitivity during real-world driving. This leaves room for more interactive and adaptive forms of in-vehicle eco-driving support.

3

Theory

This chapter provides the theoretical foundation for investigating the design of eco-driving support for professional truck drivers. It reviews research on approaches to supporting more sustainable road transport, emerging work on AI-based in-vehicle systems and eco-driving support, and key interaction design constraints in driving contexts. The chapter concludes by summarising the literature and identifying the knowledge gap to which this thesis responds.

3.1 Approaches to Supporting Sustainable Road Transport

Efforts to reduce fuel consumption and emissions in road transport can broadly be understood as operating at two complementary levels: vehicle-level optimisation and driver-level behavioural support. While both contribute to more sustainable trucking operations, they differ fundamentally in where control and responsibility for efficiency improvements are located.

Vehicle-level approaches focus on technological optimisation through automation, control systems, and intelligent vehicle functions. These solutions aim to improve energy efficiency by adjusting vehicle performance parameters. They establish an important technical foundation for more sustainable road transport, but do not eliminate the need for human decision-making during active driving.

Driver-level approaches, in contrast, seek to influence driving behaviour through interaction, feedback, and coaching. These interventions assume that drivers remain central actors in achieving fuel-efficient performance and that behaviour can be shaped through appropriately designed eco-driving support. This section first reviews vehicle-level technologies briefly, and then examines driver-level eco-driving support in greater detail.

3.1.1 Vehicle-Level Optimisation for Fuel Efficiency

Contemporary vehicles incorporate a wide range of in-vehicle technologies aimed at improving fuel efficiency, reducing emissions, and enhancing road safety through vehicle-level optimisation and automation. Advanced Driver Assistance Systems (ADAS) constitute a central component of this landscape, leveraging sensors, radar, cameras, and connectivity to support functions such as adaptive cruise control, lane keeping, collision avoidance, navigation assistance, and driver state monitoring [17]. These systems span varying levels of automation and driver authority, from advisory and assistive functions to more advanced control features [17]. However, despite ongoing advances, many ADAS remain largely rule-based and reactive, offering limited flexibility in dynamic or contextually complex driving situations [18]. Moreover, a substantial portion of current systems are semi-automated, requiring continuous driver supervision and the ability to retake control when system limitations are reached [19].

While such technologies contribute significantly to safety-first vehicle design and operational efficiency, their effectiveness ultimately depends on how they are integrated with, interpreted by, and acted upon by the human driver. This dependence highlights the limits of vehicle-level optimisation alone and motivates closer attention to the driver's role in achieving sustainable and efficient driving outcomes.

3.1.2 Driver-Level Behavioural Support

Beyond technological optimisation at the vehicle level, a large body of research identifies driver behaviour as a critical factor in reducing fuel consumption and emissions [12], [20], [21], [22]. Despite continued advances in vehicle technology, driving behaviour remains a cost-effective and influential lever for improving energy efficiency in road transport [20], [21]. As a result, many interventions focus on actively supporting and guiding drivers towards more fuel-efficient driving practices rather than relying solely on automated optimisation [20].

Across both private and commercial transport contexts, driver behaviour is closely linked to efficiency, profitability, and safety outcomes [22]. This relationship is particularly pronounced in the heavy-duty transport sector, where rising fuel costs and operational pressures have led to increased reliance on driver monitoring and coaching as integral components of efficient fleet management [22].

3.1.2.1 Eco-Driving Coaching and Feedback Systems

The literature identifies eco-driving coaching as a central approach to encouraging more fuel-efficient driving behaviour. Three primary strategies for influencing driver behaviour are commonly distinguished: education, training, and feedback [12]. Among these, feedback-based interventions, defined as the continuous provision of information reflecting driver performance, have been shown to be the most effective [20].

Empirical reviews of eco-driving feedback information systems (EDFIS) indicate that such systems can contribute to reductions in fuel consumption, although reported effects vary widely, ranging from negligible impact to reductions exceeding 30% [20]. In a meta-analysis, Sanguinetti et al. [23] found that onboard eco-driving feedback can result in a 6.6% average improvement in fuel economy.

Eco-driving feedback systems employ a range of sensory modalities, most commonly visual, auditory, and tactile channels [20], [21], [24], [25]. Visual feedback remains the dominant modality and is typically presented through dashboards or dedicated eco-displays that convey instantaneous or aggregated fuel-efficiency metrics [20], [21], [25], [26].

Auditory feedback has been widely applied in in-vehicle contexts, ranging from warning signals and navigation guidance to verbal eco-driving advice and speech-based interaction with intelligent vehicle agents [24]. In eco-driving applications, auditory systems have been used to translate driving performance data into verbal cues or sound-based feedback that encourages smoother and more efficient driving behaviour [24].

In the heavy-duty transport domain, driver coaching systems typically integrate data on vehicle state and driver behaviour, and in some cases limited environmental information, to generate feedback via visual or auditory channels [22]. However, many commercially available solutions remain constrained by restricted sensing capabilities and rely on generic, threshold-based key performance indicators (KPIs), such as harsh braking, rapid acceleration, or speeding events [22]. Consequently, feedback is often decoupled from situational context, limiting its explanatory power and perceived relevance for drivers. Industry analyses similarly note that current coaching systems tend to depend on such generic KPIs and do not account for external factors that influence driving behaviour, including traffic conditions, road geometry, and situational demands [27]. According to Xu et al. [25] a fair evaluation index for drivers' eco-driving capability should only be based on driving behaviour and not be influenced by such external factors.

These constraints point to more adaptive and personalised coaching approaches that better account for driver differences and real-time driving context [27].

3.2 AI- and LLM-Enabled In-Vehicle Interaction

At the time of writing, artificial intelligence (AI) occupies a highly visible position in both public and industrial discourse, driven by rapid technological advances as well as expansive claims about its transformative potential. The automotive sector is no exception, with AI increasingly framed as a means of enabling more adaptive, data-driven, and personalised solutions [27]. This context is directly relevant to the present thesis, which takes as its point of departure the emerging area of LLM- and voice-enabled driver coaching.

The growing availability of vehicle sensor data, connectivity, and on-board computational resources has broadened the scope of AI-enabled in-vehicle systems [27]. These systems can process large volumes of contextual and behavioural data to provide adaptive, accurate, and personalised support [18], [22]. In heavy-duty transport, this development is particularly relevant for driver coaching, where more timely, precise, and situation-specific support may improve both performance and driving experience [27].

Recent advances in large language models (LLMs) further extend in-vehicle AI by enabling natural language interaction, contextual reasoning, and explanation generation without task-specific parameter updates [28]. Compared with traditional rule-based voice interfaces, LLM-based systems can support multi-turn dialogue, contextual grounding, and deliver more adaptive responses to driver queries and traffic scenarios [29].

However, realising these benefits in driving contexts requires more than a conversational model. As argued by Cui et al. [29], an effective LLM-driven assistant must be supported by a broader system architecture that can sense and represent the traffic environment and vehicle state, account for the in-cabin context, and maintain memory mechanisms that enable adaptation to prior interactions and individual driver preferences.

Within automotive research, LLM-augmented conversational systems have been explored as interfaces to ADAS [18], [30]. For example, Scene-Aware Conversational ADAS (SC-ADAS) combines an LLM with structured function calling to provide interpretable, real-time assistance while retaining explicit human validation before actuation [18]. Similarly, Adasa allows drivers to query and command ADAS functionality through voice interaction [30].

Conversational AI has also been studied as a mechanism for performance feedback and learning rather than direct vehicle control. ApexTrainer integrates telemetry, video analysis, and LLM-generated explanations to provide personalised post-drive coaching, reporting short-term performance improvements and increased engagement [31]. Related findings suggest that pairing performance analytics with natural language explanations can support learning retention even after feedback is withdrawn [32].

3.2.1 AI-Based Eco-Driving Support

Despite growing interest in AI-enabled in-vehicle interaction, research focusing specifically on AI-based eco-driving support for commercial truck drivers remains limited [14], [31], [33].

One of the few studies to evaluate LLM-generated feedback in safety-critical driving contexts is Markelius et al. [34]. Using a driving rig and the CARLA simulator, they examined how different forms of feedback produced by GPT-4 affected subjective and bio-behavioural measures of stress and related cognitive states across scenarios designed to induce workload (e.g., adverse weather, vulnerable road users, and overtaking situations) [34]. Feedback was delivered via text-to-speech, and the authors frame the work as an initial step towards understanding how LLMs might be utilised in driving situations considered safety-critical [34]. They also outline a longer-term vision in which driver monitoring (e.g. bio-behavioural markers) informs when and how an LLM provides contextualised feedback during driving [34].

Closer to the eco-driving domain, Gjona [14] investigate explainability requirements for AI-powered eco-driving in a commercial truck context. Using scenario-based interviews anchored in Volvo's Driver Coaching, the study employed visual scenarios to help participants imagine an AI-powered coaching loop and reflect on the relationship between targets, results, and actionable tips[14]. Rather than evaluating specific interfaces, the scenarios were used to elicit end-users' expectations and explanation needs. The findings suggest that drivers' intention to use AI-powered eco-driving recommendations depends on how explanations are designed across presentational, content-related, and temporal dimensions, including format, completeness, perceived accuracy, contextual grounding, and timeliness [14].

Finally, evidence on voice interaction in heavy-duty settings is provided by Sugule [33], who used a Wizard-of-Oz design to compare one-way communication, two-way dialogue, and proactive guidance in high-stress, range-critical electric truck scenarios. Proactive interaction was generally preferred under uncertainty, and drivers emphasised the value of explanations that clarify not only what action to take but also why [33]. Although the study concerns range and route support rather than eco-driving, it highlights interaction patterns and explanation needs that are directly relevant to voice-based coaching concepts in commercial vehicles.

Overall, research on AI-based eco-driving support appears fragmented, and technical capability alone does not guarantee practical value. Realising the potential of AI-enabled solutions therefore requires a clear user-centred rationale and careful attention to how support is designed and delivered under driving constraints.

3.3 Interaction Design Constraints in Driving Contexts

Designing eco-driving support systems for safety-critical driving environments requires more than accurate data analysis or persuasive intent. Such systems operate under distinct human-centred constraints that shape how, when, and whether feedback can effectively influence behaviour.

First, driving remains the primary task, requiring interaction designs that respect fluctuating cognitive workload and interruptibility. Second, behaviour change depends not only on feedback content, but also on how guidance is timed, framed, and aligned with drivers' motivational and organisational conditions. Third, individual differences and operational contexts demand adaptive solutions that account for driver expertise, goals, and situational variability. Fourth, user acceptance and perceived autonomy determine whether coaching systems are embraced or resisted in practice. Finally, transparency and explainability are essential for building trust and enabling informed decision-making in system-mediated driving contexts.

The following subsections elaborate these interaction design constraints as foundational considerations for eco-driving support systems.

3.3.1 Driving as a Primary Task: Cognitive Workload and Interruptibility

Modern driving involves not only executing the primary driving task in dynamic and often complex traffic environments, but also interacting with multiple in-vehicle systems that compete for drivers' limited cognitive resources [26], [35]. These concurrent demands contribute to driver mental workload, which may manifest as mental overload - resulting in distraction and reduced information-processing capacity - or mental underload, which can decrease alertness and vigilance [35], [36]. Mental overload, underload, and high multitasking demands have been associated with impaired driving performance and increased accident risk [35], [36].

Cognitive workload is not determined solely by task demands. It also depends on individual characteristics, prior experience, and coping strategies, meaning that the same task may be experienced differently between drivers [37]. When the combined demands of driving and secondary tasks exceed available cognitive resources, performance degradation may occur in one or both tasks [35], [38]. Although drivers can reallocate attention between tasks, such redistribution involves performance trade-offs and may result in adaptive behaviours, such as reducing speed, increasing headway, or limiting manoeuvres like lane changes or overtaking [35], [39], [40], [41]. Notably, even when drivers recognise demanding traffic conditions, they tend to initiate secondary interactions, underscoring the importance of interaction designs that adapt to fluctuating attentional capacity [35].

Interruptibility is therefore a central consideration in automotive interaction design because it captures when a driver can safely accommodate additional information or actions. Kim et al. [35] show that driving and secondary-task performance declines as secondary-task duration increases, indicating that prolonged interactions are less compatible with periods of high demand. Design implications include keeping interactions short and adapting their timing to the driving situation. In practice, content can be summarised, decomposed into brief steps, or deferred until the driver reaches a more interruptible state [35]. Consistent with this view, Gong and Jia Wang [42] report that novice drivers prefer brief, functional feedback in demanding situations, whereas longer and more supportive exchanges are better received under low-demand conditions.

For voice-based systems, managing interruptibility is closely tied to interaction pacing because spoken output is transient and often progresses without the natural pauses available in human conversation. Consequently, flow control mechanisms have been proposed to regulate when and how a system speaks, including system-initiative, user-initiative, and mixed-initiative strategies [35]. With system-initiative flow control, the assistant can postpone guidance during unsafe or high-demand periods; with user-initiative control, the driver has full control over when interactions start and stop, similar to many current in-vehicle interfaces. Mixed-initiative approaches combine driver input with system predictions to balance safety, effectiveness, and convenience [35]. Participants in the study by Kim et al. [35] expressed the need to pause system-initiated conversations when driving conditions became demanding, even after initially accepting the interaction. Providing simple voice controls such as “Hold on”, “Repeat”, and “Resume” may therefore support more natural management of these interactions [35].

The choice of feedback modality further shapes cognitive demand. Visual interfaces are often intuitive and non-aggressive, but increase visual load and can introduce distraction and safety risks [20], [25]. Auditory feedback, by contrast, does not compete directly with visual attention and can provide timely and context-sensitive guidance, which can be particularly valuable in cognitively demanding contexts such as trucking operations [21], [25], [33]. Research suggests that speech-based interaction, under appropriate conditions, can reduce cognitive load and improve user satisfaction compared to visually demanding modalities [24], [25]. However, auditory systems can also be perceived as intrusive or irritating, particularly when feedback is command-like or interferes with concurrent conversation, and their effectiveness depends on clarity, timing, and driver comprehension [21], [25], [33]. Combined audio-visual approaches could balance these trade-offs, but can also introduce overlapping demands if not carefully designed [25].

Regardless of modality, the central constraint remains unchanged: secondary interactions, such as in-vehicle eco-driving support, must respect the primacy of the driving task and accommodate the variability of drivers' available cognitive resources.

3.3.2 Designing Eco-Driving Feedback for Behaviour Change

To understand how the design of eco-driving feedback can support behaviour change, Sanguinetti et al. [43] identify three core behavioural mechanisms through which eco-feedback operates: attention, learning, and motivation. They argue that designers should assess target users' levels of motivation, knowledge, and awareness in relation to the desired behaviours, and use this assessment to determine which design dimensions, connected to learning, motivation, or attention, respectively, should be prioritised (see Fig. 3.1). When users possess high levels of knowledge but low motivation, design dimensions that foster or sustain motivation become particularly important. Conversely, when motivation is high but knowledge is limited, greater emphasis should be placed on dimensions that support learning. In cases where users are both knowledgeable and motivated yet lack awareness - for example, when they know how and want to act but forget - design dimensions addressing attention are critical [43].

The design of in-vehicle feedback is particularly critical for influencing behaviour during driving, where attention is limited. Design principles therefore emphasise multimodal feedback to minimise visual demand, alignment with drivers' mental models, and the use of both positive and negative feedback to support behaviour change [11]. Effectiveness depends not only on *what* information is presented but also on *how* it is communicated: behaviour change is shaped by how feedback is framed within the decision context [12]. Consistent with this, Gjona [14] suggests that explanations should use vocabulary aligned with drivers' terminology and a positive, evaluative tone to reinforce learning and behaviour change. Given that drivers remain in the control loop, even well-founded recommendations can be ignored if they are perceived as unreasonable, poorly timed, or inadequately explained [44].

More broadly, specific feedback features influence whether eco-driving support promotes attention, learning, and sustained motivation. Feedback that reflects specific driving behaviours, such as acceleration patterns, can be effective in learning new behaviours, but can draw attention away from other aspects of driving performance [26]. In contrast, aggregate feedback that combines multiple variables

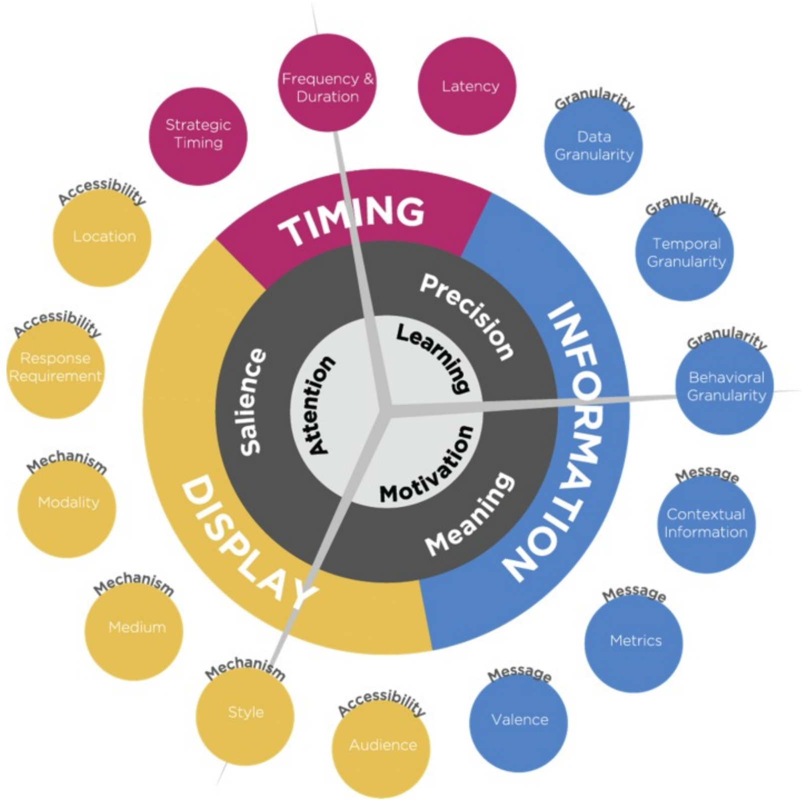

Figure 3.1: The design-behaviour framework by Sanguinetti et al. [43]. Reprinted from Energy Research & Social Science, Vol. 39, Sanguinetti, A., Dombrovski, K., & Sikand, S., Information, timing, and display: A design-behavior framework for improving the effectiveness of eco-feedback, pp. 55-68, Copyright (2018), with permission from Elsevier.

may encourage motivated drivers to explore a wider set of eco-driving strategies, although it can obscure the causal link between specific actions and outcomes [26]. Timing further influences effectiveness: real-time feedback can serve as immediate reinforcement during driving, whereas delayed or accumulated feedback may better support reflection and goal setting, but is less effective as direct reinforcement [26], [43]. Because the effects of eco-driving training tend to diminish over time and driving habits can be resistant to change, regular reinforcement is often necessary to support sustained behaviour change[12], [25].

Evidence for reinforcement mechanisms in operational contexts is provided by Pinchasik et al. [45]. They report significant reductions in fuel consumption that persisted longer than is commonly observed in comparable studies, and suggest the presence of an 'eco-driving learning curve' [45]. Importantly, they argue that active follow-ups between driver and manager, alongside 'carrots' (in the form of non-monetary rewards), may help reinforce and induce more efficient driving behaviour among truck drivers [45]. Related evidence indicates that coaching delivered by human supervisors can produce stronger behavioural improvements than purely technological feedback, partly due to higher trust and respect for human expertise [46].

Taken together, these findings suggest that sustained eco-driving improvements depend not only on in-vehicle feedback design, but also on organisational reinforcement through ongoing evaluation, managerial involvement, and supportive incentives.

3.3.2.1 Self-Determination Theory

Self-Determination Theory (SDT) provides a useful framework for understanding how workplace interventions may initiate eco-driving and how engagement may be sustained over time [47]. SDT distinguishes between controlled motivation and autonomous motivation. Controlled motivation refers to behaviour driven by external demands, rewards, or sanctions, while autonomous motivation refers to behaviour that is experienced as self-endorsed and aligned with personal values or goals [47]. Autonomous motivation includes intrinsic motivation, where the activity is experienced as inherently interesting or satisfying, and integrated extrinsic motivation, where the behaviour is not necessarily enjoyable in itself but is accepted as personally important and consistent with one's values or identity [47].

In work settings, eco-driving may therefore begin primarily under controlled motivation, for example, when managers emphasise efficiency targets or when incentives and evaluations make fuel-efficient driving more noticeable. However, SDT suggests that externally regulated behaviours can become increasingly internalised when individuals adopt the underlying value of the activity as personally meaningful [47]. Over time, this can shift eco-driving from mere compliance towards a more self-determined form of engagement, for instance, when drivers integrate efficient driving into their professional identity.

Whether such internalisation occurs depends partly on the social context. SDT argues that autonomy-supportive environments, characterised by acknowledging individuals' perspectives, providing meaningful rationales, encouraging self-initiation, and minimising controls, are associated with stronger autonomous motivation and more durable behavioural engagement [47]. In organisational terms, this suggests that managers play an important role not only by setting efficiency expectations, but also by explaining why eco-driving matters and by recognising drivers' professional judgement. For eco-driving support systems, the implication is that feedback and coaching features may support eco-driving most effectively when they complement organisational conditions that facilitate internalisation rather than control.

To summarise, behaviour change in eco-driving depends not only on what feedback communicates, but also on how it is designed and delivered: its specificity and timing, its framing and tone, and the extent to which it is reinforced through training and organisational follow-up in ways that support autonomous, internalised motivation.

3.3.3 Individual Differences and Contextual Adaptation

Individual differences among drivers, as well as variations in operational context, have significant implications for the design of eco-driving coaching systems. Empirical research demonstrates that car and truck drivers differ in perceived stress levels and cooperative behaviour patterns, suggesting that traffic situations are experienced and evaluated differently between user groups and should therefore be considered separately in interface design [48]. Moreover, the effectiveness of feedback varies depending on drivers' prior goals, such as prioritising safety, efficiency, or speed [26].

Differences in prior knowledge, profession, and driving experience further influence the effectiveness of eco-driving coaching. Drivers who are already highly energy-efficient benefit only marginally from eco-driving training, whereas less efficient drivers show substantially greater improvements [25]. Similarly, non-professional drivers tend to demonstrate stronger willingness towards behaviour change and greater fuel savings than professional drivers [25].

Industry studies reinforce this requirement for contextual and individual tailoring. An evaluation of Volvo Trucks' on-board driver coaching system revealed that drivers perceived the scoring as unfair when fixed vehicle profiles (e.g. long-haul or distribution) did not match the actual operating context, indicating that feedback algorithms must provide meaningful customisation [49].

Context-awareness in automotive interaction can be approached from two complementary perspectives. User-focused awareness considers aspects of driver state, such as stress, fatigue, mood, or frustration, to adapt how information is presented [24]. System-focused awareness draws on vehicle and environmental data to estimate attentional availability and adjust the timing or modality of interaction accordingly [24]. By integrating multiple data sources and predictive models, systems may identify more opportune intervention moments and adapt the timing, modality, and content of feedback to the driving situation [22], [44]. External factors such as weather conditions may further influence energy consumption and should be incorporated to support meaningful interpretation of feedback [43], [45]. Consistent with this, Gjona [14] report that truck drivers perceived explanations from AI-powered eco-driving as more comprehensive when they were explicitly grounded in situational context, including time, location, weather, vehicle load, and road conditions. They also note that whether drivers perceive the system as reliable depends on the consistency and accuracy of the information provided [14].

Recent research on conversational and voice-based systems further illustrates the importance of adaptive interaction behaviour. Voice assistants that adjust emotional tone and dialogue style according to driving situation and user personality increase user satisfaction, trust, likeability, and perceived effectiveness [33], [50], [51]. However, a mismatch between the character of the voice assistant and the personality of the user can cause displeasure [51].

Context-sensitive adaptation is especially relevant in safety-critical scenarios: voices should be brief and serious during security-relevant and performance-related situations, while more expressive styles may be acceptable in non-critical contexts [50], [51]. During manual driving, shorter and more concise feedback is found to be more relevant and less stressful than longer detailed feedback [34]. Fatigue levels also shape preferences, with heavily fatigued drivers favouring more stimulating interaction and non-fatigued drivers preferring minimal intervention [52]. For novice drivers, emotionally perceptive AI capable of adaptive feedback can support emotion regulation and improve driving confidence and safety during learning processes [42]. In trucking contexts specifically, dialogue and context-aware voice interfaces have been proposed as a means of transforming passive voice assistants into supportive co-driving agents [33]. Ultimately, no single interaction style is universally optimal; it should adapt to task demands and emotional stakes [33].

Taken together, these findings demonstrate that eco-driving coaching cannot rely on static feedback mechanisms. Instead, effective systems must account for driver expertise, motivational orientation, fatigue and stress levels, vehicle configuration, environmental conditions, and situational demands. Interaction designs that are adaptive, context-aware, and responsive to individual driver characteristics are therefore essential for supporting eco-driving behaviour in safety-critical driving environments.

3.3.4 User Acceptance and Autonomy in Driver Coaching

Technical capability alone does not ensure practical viability: user acceptance is also a central determinant of the success of an information system [53], [54], particularly in safety-critical and emotionally charged domains such as driving [21]. Systems intended to influence behaviour are especially vulnerable to rejection if perceived as intrusive, risky, or overly disturbing [21]. In the automotive context, rejection may not only reduce system effectiveness but also lead to frustration, intentional override, or unsafe compensatory behaviour [21].

Empirical evidence from commercial trucking illustrates these risks. Loske and Klumpp [55] found that forcing professional drivers to use ADAS was associated with intentional system overriding and lower compliance than in contexts where drivers retained control. They further report that drivers were significantly less likely to follow navigation recommendations when use was mandatory rather than optional, suggesting that perceived loss of autonomy can foster resistance [55].

Guidance is more likely to be received positively when interventions are timely, relevant, and allow user oversight [28], [56]. However, higher levels of system autonomy raise concerns about privacy, misinterpretation of context, and loss of agency [56], [57]. Consistent with this, drivers tend to prefer supportive but non-controlling assistance [42]. Gjona [14] suggests that human agency and intention to use AI-powered eco-driving coaching can be supported by allowing drivers to accept, edit or deny system recommendations.

Effective eco-driving support therefore requires balancing persuasive intent with respect for autonomy, ensuring that feedback is contextually appropriate, and ultimately experienced as supportive rather than controlling.

3.3.5 Transparency and Explainability in Driver Coaching Systems

A central challenge in the interaction between the driver and the in-vehicle systems is the "black-box" problem, whereby neither developers nor end-users fully understand how decisions are calculated [14], [22]. For AI-powered coaching in particular, transparency and explainability are therefore essential to support informed action and meaningful sense-making between drivers and technology [14].

In commercial vehicle contexts, embedded coaching systems have been criticised for opaque scoring, where drivers lack visibility into the underlying assumptions and decision criteria, limiting their ability to understand and improve their performance [22], [49]. Similarly, advisory systems perceived as issuing unexplained or alarm-like recommendations are described as “cold” or “suspicious”, possibly leading to disengagement [33].

Gjona [14] emphasises that explanations from the system should address uncertainty, especially in situations where drivers’ expectations do not match the system’s recommendation. Brief, optional, and well-justified micro-explanations can increase trust and legitimacy and help bridge knowledge gaps by clarifying why a recommendation is given [33].

Effective driver coaching systems must therefore move beyond opaque feedback delivery by providing concise, context-sensitive rationales that enhance trust, reduce suspicion, and support informed decision-making.

3.4 Summary and Knowledge Gap

Taken together, the reviewed literature shows that effective eco-driving support depends not only on the technical accuracy of recommendations, but also on their contextual sensitivity and on how interaction with the system is designed. This is especially important in professional truck driving, where safety demands, workload, operational pressure, and organisational conditions shape drivers’ motivation and ability to apply eco-driving behaviours. The identified interaction design constraints further show that such support must account for timing, adaptability, user acceptance, autonomy, and explainability to influence behaviour effectively.

At the same time, current eco-driving coaching systems remain largely retrospective, score-based, visually oriented, and only weakly contextualised. Emerging AI- and voice-based approaches suggest possibilities for more adaptive and conversational support, but research in this area remains fragmented and rarely addresses commercial truck driving specifically. As a result, there is limited knowledge of how context-sensitive eco-driving support should be designed for professional truck drivers, particularly when combining AI-enabled capabilities, voice interaction, and the interaction design constraints of driving contexts.

This points to a knowledge gap at the intersection of eco-driving support, applied AI and voice interaction, and professional truck driving. To address this gap, the thesis adopts a user-centred interaction design approach, applying user research, prototyping, and evaluation to explore the challenges and opportunities of designing eco-driving support for professional truck drivers.

4

Methods

Through a user-centred interaction design process, the study aims to investigate how eco-driving support systems for professional truck drivers is experienced, interpreted, and used within the realities of truck driving, and how these insights can reveal key challenges and opportunities for the design of future systems. The research question addressing this aim is: *What can an interaction design lens reveal about the challenges and opportunities of designing eco-driving support for professional truck drivers?*

This chapter presents the methodological approaches that could be used to address the research question. The chapter begins by outlining the overall interaction design process and then presents methodological approaches for literature research, user research and user evaluation, data analysis, ideation, and prototyping, before concluding with considerations concerning evaluation in driving simulators and real-world driving contexts.

4.1 Double Diamond Design Process

The Double Diamond is an approach to design captured by The Design Council of the United Kingdom [15]. The approach includes four phases (see Fig. 4.1) starting with the diverging Discover-phase in which the problem space is explored by the designers. The approach then moves on to the Define-phase. Here designers work to converge the design challenge into a clear design brief or frame. The third phase is another diverging one: Develop. In this phase the aim is to create solutions or concepts which is followed by prototyping, testing and iteration of the solutions. The final phase is Deliver, a converging phase in which the product resulting from the design process is finalised and launched. A strength of this approach is its involvement of users throughout the process [15].

4.2 Literature Research

Literature reviews are commonly used to provide an overview of a research topic or problem, particularly when knowledge is spread across different disciplines [58]. However, literature reviews can be time-consuming, as they require careful searching, selection, and interpretation of a potentially large body of work [59]. Different

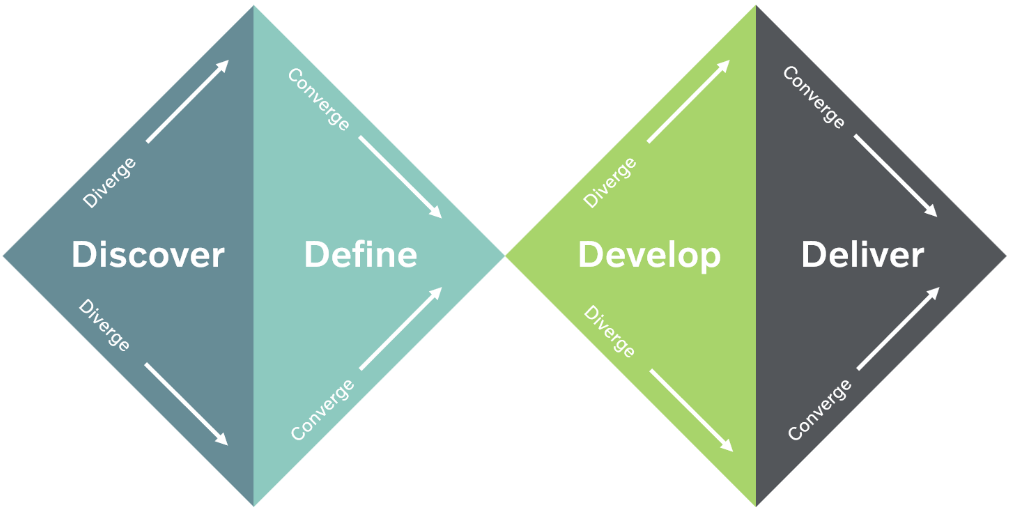

Figure 4.1: The Double Diamond design process.

strategies exist for conducting literature reviews, systematic, semi-systematic, and integrative reviews being common ones [58].

Systematic reviews follow a highly structured process with strict search strategies and inclusion criteria. However, this approach can be difficult to apply when research on a topic is conceptually diverse or distributed across multiple disciplines [58]. In cases when a systematic review is hindered by topics having been studied by various groups of researchers within diverse disciplines, a semi-systematic, or narrative review, may be more appropriate [60]. A semi-systematic review allows researchers to map theoretical perspectives and uncover gaps in fragmented or interdisciplinary research fields. It can be highly effective in covering broader topics [58]. The downside of this approach is that it has fewer clear steps to follow than the systematic one, and is in addition in need of more tailoring to the specific project [58], [60].

Finally, integrative reviews provide a more flexible approach in which literature from different perspectives is combined to develop new conceptual understandings or theoretical models, rather than attempting to include all available studies on a topic [58]. In contrast with the two previous approaches, integrative reviews places a higher demand on the researchers responsibility and skills as guidelines and standards to rely upon when developing a strategy are fewer [61].

In practice, there are many more forms of literature reviews, and literature reviews often combine elements from several approaches and may be adapted to suit the scope and objectives of a particular research project [58].

4.3 User Research and User Evaluation

Assessing user experience (UX) and user acceptance (UA) is essential [48] because the quality of interaction with an interactive system encompasses more than functional performance alone, extending to aspects such as usability, aesthetics, emotional appeal, and overall experiential qualities [15]. It is particularly important in the automotive context, where safety concerns, emotional factors, and drivers' desire for autonomy can strongly influence system adoption [21]. Prior research emphasises that UX is inherently multifaceted and subjective, involving both users' perceptions of a system and their affective responses during interaction, as noted by Hornbæk and Hertzum [62]. Owing to this complexity, UX evaluations typically require a combination of complementary methods that together account for context of use, types of activity, and the specific UX goals relevant to the system under investigation [15].

4.3.1 Interviews

Interviews constitute a method for gaining insight into the needs, experiences, and perspectives of users, stakeholders, and domain experts. They can be conducted in various formats: structured, semi-structured, or unstructured, depending on the research objective. Semi-structured interviews are particularly well suited for exploring broad or complex issues, as they allow participants to elaborate on their responses and introduce unanticipated themes, while structured interviews are more appropriate when the aim is to assess the consistency or strength of specific opinions across participants [63].

In the context of user research and prototype evaluation, interviews enable the collection of rich, qualitative insights into users' subjective experiences with an interface. This includes both pragmatic qualities, such as perceived usability, and hedonic aspects, such as comfort and trust, which may not be fully captured through quantitative methods alone. Although the analysis of qualitative interview data can be time-consuming, interviews are particularly valuable when working with small participant samples, as they can provide detailed and nuanced perspectives that can inform and support design-oriented evaluation [24], [64].

4.3.2 Surveys and Questionnaires

Surveys and questionnaires are commonly used to collect mainly quantitative data, covering insights into users' attitudes, needs, and experiences through a structured set of written questions. The method is considered to be a time-efficient way to assess user experience, though the insights are limited to the aspects explicitly covered by the questions. Typically, these instruments combine closed-ended questions with predefined response options and open-ended questions that allow respondents to elaborate in their own words [24], [63].

Although the depth of insight is generally more limited compared to qualitative methods (such as interviews), surveys and questionnaires are particularly effective for gathering data from a large number of participants [24], [63].

To ensure reliability and comparability of results, standardised instruments are generally preferred to self-constructed measures [64]. The System Usability Scale (SUS) is widely used due to its robustness and ease of administration, providing a reliable measure of perceived usability, although it offers limited diagnostic detail and is said to contain unnecessary redundancy [65], [66]. Shorter alternatives, such as the Usability Metric for User Experience (UMUX) and UMUX-Lite, reduce respondent burden and show strong correspondence with SUS, although at the cost of reduced depth [66], [67], [68]. The UMUX-Lite is an especially compact instrument intended to capture the central dimensions of perceived usefulness and perceived ease of use [69].

Beyond usability, broader aspects of user experience can be assessed using instruments such as AttrakDiff and INTUI, while affective states may be captured through tools like PANAS and AffectGrid [24]. Additionally, the Technology Acceptance Model (TAM) can be applied to evaluate perceived usefulness and ease of use, particularly in early design stages, although it provides limited guidance for concrete design improvements [21], [70].

4.3.3 Observation

Observation involves systematically studying users as they perform tasks, with the researcher documenting activities, behaviours, and interactions as they occur [63]. This method can be applied both in early user research and in the evaluation of prototypes, providing insight into how users naturally engage with a system. By focusing on actual behaviour rather than relying solely on self-reported accounts, observation enables the identification of usability issues, errors, and unmet needs, as well as an assessment of how effectively an interface supports task completion [24], [71]

Observations may be conducted directly, with the researcher present, or indirectly through video recordings analysed at a later stage. They can take place in controlled laboratory settings to isolate specific variables, or in real-world contexts to capture situational factors influencing interaction, which is particularly relevant in the evaluation of automotive prototypes [24], [63]. The observer should remain as unobtrusive as possible to avoid influencing participants' behaviour, intervening only when clarification is necessary. As naturalistic behaviour is central to the validity of this method, establishing trust and cooperation with participants is essential, making the observer's interpersonal skills an important methodological consideration [63].

Observation can be conducted as a stand-alone method or combined with conversational approaches and is often used alongside other methods to provide a more comprehensive understanding of user experience across both exploratory research and prototype evaluation phases [24].

4.4 Data Analysis

As research on user experience and driver interaction often involves multiple forms of data, it may call for different analytical approaches to capture both measurable assessments and more interpretive accounts of use [24], [72]. Quantitative data, for example from standardised questionnaires, can be analysed using established scoring procedures and descriptive statistics in order to assess constructs such as usability, usefulness, or acceptance [69], [73]. Qualitative material, including interview transcripts, observation notes, and open-ended responses, can be analysed using interpretive approaches that enable the identification of recurring patterns, themes, and tensions in participants' accounts and interactions [72], [74]. Taken together, such analyses can provide complementary perspectives on the research question and support a richer understanding of the design challenges and opportunities in eco-driving support [24].

4.4.1 Analysis of Surveys

Standardized instruments differ in the extent to which they have been adopted in prior research. As a result, analysis sometimes involves translating scores between instruments or scales to support comparison with earlier studies [73]. This consideration is particularly relevant for UMUX-Lite, which is a comparatively less established measure than instruments such as TAM or SUS. Accordingly, published transformation equations have been proposed to estimate equivalent scores across scales, most notably to relate UMUX-Lite results to SUS-based interpretations [68]. UMUX-Lite data can therefore be analysed both in its original form and through established conversion formulas to facilitate comparison with prior literature.

4.4.2 Thematic Analysis

Thematic analysis (TA) is a qualitative analytic method used to identify, analyse, and interpret recurring patterns of meaning, or themes, within a dataset [74]. It is often described as a foundational approach to qualitative analysis, as it can be applied across a wide range of research questions, epistemological positions, and types of qualitative data [72]. A key strength of thematic analysis lies in its flexibility: its relative theoretical freedom allows researchers to adapt the method to different analytical aims while still producing rich, detailed, and potentially complex accounts of the data [72]. This combination of structure and adaptability has contributed to TA becoming one of the most widely used methods for qualitative data analysis [72]. However, this flexibility also constitutes a limitation. Without careful methodological rigour, thematic analysis risks being reduced to surface-level coding rather than a meaningful interpretive process. In particular, novice researchers may mistake TA for simple categorisation, thereby overlooking its conceptual depth [75]. To ensure credibility and analytical validity, thematic analysis must therefore be conducted systematically, with explicit attention to reflexivity, transparency, and theoretical alignment, as well as thorough documentation of interpretive decisions throughout the analytic process [75].

4.4.3 Reflexive Thematic Analysis

Reflexive thematic analysis (reflexive TA) is a specific approach within thematic analysis that distinguishes itself from more positivist or method-driven variants [76]. Reflexive TA treats qualitative analysis as an interpretative and meaning-making process rather than a procedure aimed at discovering objective truths in the data [76]. A central characteristic of reflexive TA is its explicit embrace of researcher subjectivity as a resource rather than a source of bias, thereby rejecting positivist assumptions that neutrality or objectivity can be achieved in qualitative analysis [76]. Coding is understood as inherently interpretative, with meanings constructed through the researcher's engagement with the data rather than residing fixed within it. When the analytic process is conducted by multiple researchers, coding is approached collaboratively and reflexively, with the aim of enriching the interpretation of the data rather than achieving consensus on a single, fixed meaning [77]. Consequently, reflexive TA places strong emphasis on ongoing reflexivity, transparency, and critical awareness of how researchers' theoretical positions, experiences, and assumptions shape analytic decisions.

4.5 Ideation

Ideation does not follow a single standardised approach; rather, methods should be adapted to the specific context and goals of the project [78]. Brainstorming is a widely used technique for generating and refining ideas, encouraging participants to suspend judgement and build on each other's suggestions in order to foster creativity and explore a broad solution space [15], [63]. Its strength lies in enabling rapid idea generation and establishing a shared understanding of the design space; however, outcomes can vary depending on group dynamics, and there is a risk of converging too quickly on familiar ideas if not carefully facilitated [63], [79].

To increase diversity in design proposals, parallel design can be employed, where multiple designers or groups work independently to develop alternative concepts before comparing and combining them [63]. This approach supports exploration of a wider range of solutions and reduces early fixation on a single idea, though it can be more time and resource intensive.

Structured sketching methods such as Crazy 8 further promote divergent thinking by requiring participants to rapidly generate multiple ideas within a limited time-frame. By pushing beyond initial, often less innovative concepts, the method encourages variety and creativity, while its low-fidelity format lowers the barrier to participation for non-designers. However, the sketching aspect and the time pressure may intimidate some participants [80].

4.6 Prototyping

Through turning abstract design concepts into tangible representations, prototyping enables designers to express ideas in more concrete forms. Prototyping allows users and stakeholders to experience and evaluate the design as prototypes often allow for easier communication than their preceding concepts. Prototypes can serve purposes, like helping designers compare alternative solutions, evaluating the concepts technical feasibility and as a probe for user testing. What sort of prototype is best to create depends on the aim of the prototype [15]. It can take the form of scale models, software featuring parts of the design product or a paper-based mock-up. The prototype is also likely to develop alongside the process itself, often becoming more polished and more clearly resembling the finished product in the final stages [15].

Prototypes are often described in terms of fidelity. Fidelity refers to a spectrum ranging from low-fidelity prototypes, which commonly consist of simple sketches or other paper-based representations, to high-fidelity prototypes, which more closely resembles the final product. High-fidelity prototypes also tend to provide more advanced functionality than low-fidelity alternatives [15].

4.6.1 Wizard-of-Oz

Wizard-of-Oz (WoZ) methods are commonly used to simulate unfinished system functionality by having a hidden operator supplement missing services [71]. The setup rely on the operator, or wizard, delivering responses that are consistent in content, style, and pace, with response times closely matching user expectations; deviations may lead users to mistrust the system or alter their behaviour. Reliance on manual real-time intervention may also introduce unintended variability between participants and experimental conditions [71].

4.6.2 Driving Simulator Versus Real-World Driving Contexts

Driving simulators are widely recognised as a reliable and valid method for studying the interaction between perception, cognition, and behaviour in driving contexts [81]. Compared to on-road field studies, a driving simulator could offer advantages in terms of safety, controllability, and practical feasibility [24], [82]. Simulators further allow systematic manipulation of experimental conditions and repeated exposure to identical scenarios, which is difficult to achieve in real-world driving contexts. Prior research indicates that although simulators may elicit higher subjective workload due to unfamiliarity, overall patterns of driving behaviour and responses to in-vehicle interaction are largely comparable to those observed in on-road studies [24], [82].

However, simulator-based evaluation also involves important limitations. Although simulators provide practical, economic, and safety-related advantages, they do not produce results that are as realistic as those obtained through real-world experiments [83]. Because simulators lack certain real-world factors, such as physical vehicle motion and vibration, engine noise, and other environmental stimuli, simulator studies may underestimate cognitive load. Consequently, the driver's experience in a simulator differs from that of real-world driving [82].

As a result, findings related to usability and trust from simulator studies may not be directly transferable to operational driving contexts [33]. In addition, understanding how a user interface is used within its actual context is better supported through field studies, since driving simulators cannot fully replicate the complexity and uncertainty of real-world driving [24].

5 Process

This chapter presents the process through which the thesis investigated the research question: *What can an interaction design lens reveal about the challenges and opportunities of designing eco-driving support for professional truck drivers?*

In line with the aim of the study, this chapter documents how a user-centred interaction design process was used to explore how eco-driving support is experienced, interpreted, and situated within the realities of truck driving. The process followed an altered version of the Double Diamond design model [15], as can be seen in Fig. 5.1. The process started with Discover, which involved literature review, industry benchmarking, and user research. The focus during this first phase was on truck driving, eco-driving support, AI and LLMs, and design constraints in driving contexts. The next phase was Define, which focused on synthesising insights and framing the initial design brief. During these first two phases the importance of the organisational context for eco-driving motivation and awareness was discovered. This prompted more exploration into the organisational context and motivational factors in a second Discover phase. The user group and research was widened to include an important stakeholder within that context, namely fleet managers. The combined insights from the first three phases informed the refinement of the design brief in a second Define phase. The last phase, Develop, involved ideation, development of a mid-fidelity prototype combining on-board driver coaching with an off-board fleet manager view, and user evaluations of the concept.

The final Deliver phase of the standard Double Diamond model, which focuses on production and implementation, was excluded because this thesis was exploratory and aimed to generate design knowledge rather than a deployable product.

The sections below present each phase in more detail and justify the methodological choices made.

5.1 Discover: Truck Driving, Eco-Driving Support and Design Constraints

The first Discover phase combined a literature review, industry benchmarking and exploratory user research through interviews to gain insight and understanding into the subject area and the intended end users.

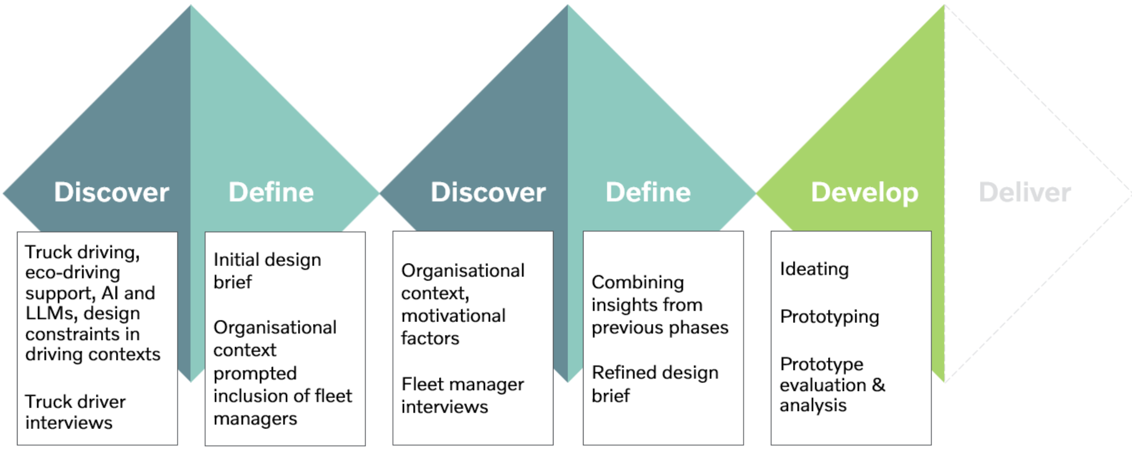

Figure 5.1: Overview of the adapted Double Diamond design process, showing the main activities and outcomes of each phase.

5.1.1 Literature Study and Benchmarking

As the topic had been examined across multiple disciplines and from a range of perspectives, a semi-systematic review was conducted [60]. The aim of the review was to better understanding the research topic, identify key themes, uncover gaps in an interdisciplinary research field, and identify potentially relevant implications [58], [60].

The review followed a structure inspired by Webster and Watson [59], whose approach, developed for the interdisciplinary field of information systems, aligned with the conditions of this study. This included scanning journals and conference papers on Google Scholar and databases accessible through the Chalmers Library. Search terms included combinations of: truck, automotive, AI, LLM, sustainability, eco-driving, coaching, feedback, cognitive load, acceptance, and distraction. Following this, connected papers from relevant publications complemented database searches. Existing commercial solutions were also benchmarked through consultation with Volvo Group to contextualise current industry practices. In line with the thesis' sustainability focus, relevant policies and strategic goals related to sustainable transport were reviewed. The results of the literature review and benchmarking inquiries are presented above in Chapters 2 and 3.

5.1.2 Truck Driver Interviews

To gain contextual insight into the problem area and the everyday experiences of the main end-users (e.g. professional truck drivers), semi-structured interviews were conducted with seven truck drivers (2 female, 5 male) aged 28-66 years (M=42.7), referred to as P1-P7. All participants had at least a class CE driving licence. Each interview lasted approximately 30-40 minutes and was conducted by telephone or video meeting. The interviews were recorded and notes were taken concurrently during each session.

Participants were recruited partly through convenience sampling within personal networks, but mainly through email contact with distribution and haulage companies operating in Sweden. Recruitment was not restricted to Volvo truck drivers; instead, participants operated a range of truck brands, and consequently used different in-vehicle systems. Participation was entirely voluntary, and no compensation was provided.

Prior to, or in connection with, the interview session, participants received a link to a Google Forms questionnaire covering informed consent and demographic information. Informed consent followed the guidelines and template established by Chalmers University of Technology [84]. Swedish and English versions of the form were prepared; however, all participants were Swedish speakers and therefore completed the Swedish version. The questionnaire included three demographic questions, each presented as an open-ended text field: *Enter your age* (*Fyll i din ålder*), *Enter your gender identity* (*Fyll i din könstillhörighet*) and *Enter the type of driving licence you hold* (*Fyll i vilken typ av körkort du har*).

The semi-structured interview guide was partly adapted from Gunnarsson & Jansson [49] and further developed around the themes of motivation, knowledge, and awareness proposed by Sanguinetti et al. [43]. The interview guide is given in Appendix A.

5.1.3 Thematic Analysis of Truck Driver Interviews

To analyse the user interviews, we conducted a reflexive thematic analysis (TA). In alignment with the exploratory purpose of the user research in this thesis, the reflexive TA treated qualitative analysis as an interpretative process, rather than a procedure aimed at identifying objective truths in the data, as mentioned by Braun and Clarke [76].

As student researchers and interaction designers, we recognise that our analysis was shaped by our motivation to deliver a successful project, our solution-oriented focus on identifying designable problem spaces, our outsider position relative to the drivers' organisations and work culture, and the interpretative effects of working across Swedish and English. Further, our interpretations were likely primed by Volvo-related organisational context as well as by the literature, benchmarking, and frameworks such as the Double Diamond design process and the design-behaviour framework from Sanguinetti et al. [43]. This reflexive process is inherently shaped by researcher subjectivity, and we acknowledge our own role in interpreting the interview data, conducting the coding, and developing and describing the themes.

The process followed the steps outlined by Ahmed et al. [75] and was guided by three overall aims: to understand the everyday realities of end-users, to assess levels of motivation, knowledge, and awareness as recommended by Sanguinetti et al. [43], and to identify key challenges related to truck driving, eco-driving, and in-vehicle systems.

To support both depth and reflexivity in accordance with Braun and Clarke [77], the analysis began with an initial division of work, where we separately familiarised ourselves with the interview transcripts and conducted preliminary coding. We then worked collaboratively to compare and group codes into broader themes and consolidate our interpretations. The process also evolved from analogue methods, such as taking notes, marking, and coding on printed transcripts, to digital methods of coding, data grouping, theme development, and theme description using the software Miro.

Thematic analysis resulted in the following five themes:

- Enduring work dedication despite internal and external pressures.
- Systems misaligned with real-world conditions and driver priorities.
- Organisational recognition drive motivation for eco-driving more than technology alone.
- Designing for driver agency, individuality, and variable and demanding operating contexts.
- Knowledge is not the primary barrier: motivation and attention as key concerns.

Each theme is presented in the corresponding sections below. Supporting extracts from the data have been translated from Swedish into English, while the original quotations are provided in Appendix B.

5.1.3.1 Enduring Work Dedication Despite Internal and External Pressures

This theme captures the truck driving profession as a double-edged sword. On the one hand, drivers describe a demanding everyday reality marked by high stress and psychological strain. They also face expectations and pressures both within their organisation and from external actors, which they find difficult to balance. Many drivers express a sense of being opposed or undermined by, for example, traffic police, lawmakers, other road users, people in the industry, and customers:

> P7: "[...] it's probably the toughest job I've had."

> P7: "When you spend so much time in traffic with such a large vehicle, you have to be really alert. I feel that many motorists don't understand how big the truck is, how heavy it is, how much space it takes up. So I often have to keep an eye on everything around me. And that is very mentally draining [...]"

> P6: "What's hardest right now is, for example, the police and the witch-hunt[1] that's going on, all the laws, all the rules, and cars that are basically like, we can exist but we shouldn't be seen."

[1] Here, P6 uses "witch-hunt" to describe what they perceive as intensified police enforcement targeting enthusiast vehicle culture. They refer to police checks in connection with truck meets and exhibitions, where participants are stopped and fined for non-compliant modifications, especially auxiliary lights and other aesthetic add-ons. P6 notes they personally have rarely been stopped, but frequently hear about friends being fined, which makes the hobby feel policed and creates a sense of having to avoid being visible.

> P1: “You get a remark on the tachograph, then you get stopped and the police say, ‘Well, you should plan better.’ But you can’t plan for every variable between heaven and Earth. They have zero understanding, then you get a 14,000 fine, and you’re completely fed up with everything.”

> P2: “Sometimes it feels like politicians are tying themselves in knots. They fixate on certain things, like, right, it has to be tyres with particle requirements here, then studded tyres there, then Stockholm city centre here, then it has to be like that there, and in the end it just becomes, well too much. I don’t think any computer even knows which other computer it’s supposed to talk to for things to improve out there.”

For female drivers, these pressures can extend further through sexism from stakeholders both within and outside the organisation. P6 and P7 illustrate this:

> P6: “There’s been a lot of people not believing in you, especially when you’re a female truck driver. It took me, I think it took four or five jobs before I found a manager who saw me as a driver, not a female driver.”

> P7: “[...] my male colleagues get a different kind of respect as soon as they arrive at a job, which I might not get. More often, they’re not questioned about how things should be done. If you go to a customer and say, ‘Right, we’ll do it like this and like that,’ it’s more often me who gets questioned [...]”

On the other hand, despite these demanding conditions, drivers also express strong professional pride and enduring commitment. They value the freedom, independence, and responsibility that come with the job:

> P3: “A job with freedom, but also responsibility. You get out and get to look around.”

> P7: “Above all, you’re also driven by quite a strong sense of professional pride, at least I am, that it’s a very important task for society. [...] For society to function, we’re genuinely needed. [...] You really are important to society through your work.”

> P1: “Some see it as a lifestyle and some see it as a job. For me it’s a bit of both, depending on which day you ask me and what time of day.”

> P6: “This is our hobby, it’s more of a lifestyle than a job.”

This theme shows that truck driving is experienced as both demanding and meaningful. Despite stress, external pressures, and, for some, sexism, drivers express strong dedication rooted in professional pride, responsibility, and a sense of social importance. Their commitment appears to endure because the work is experienced not only as a job, but also as part of identity and lifestyle.

5.1.3.2 Systems Misaligned With Real-World Conditions and Driver Priorities

This theme reflects how drivers experience eco-driving systems as poorly aligned with the realities of professional driving. Real-world conditions and driver priorities vary with season, weather, road quality, traffic, vehicle load, time pressure, familiarity with the vehicle and stress, while many systems appear to be designed for more predictable contexts such as highway or long-haul driving. In practice, this can make eco-driving expectations feel unrealistic or hard to apply when safety and operational demands must take priority.

Several participants described situations where eco-driving is difficult or secondary to the driving task:

> P7: “I’ve got colleagues, for example, who say it’s very difficult, if you’re in central Stockholm during rush hour, to drive in an energy-efficient and environmentally friendly way there. It’s almost impossible.”

> P2: “Yes you’re more restricted [in winter] because there’s so much to think about with the slippery conditions, keeping more distance, roundabouts, preparing for hills so you don’t get stuck going up. So you might not be able to coast those extra hundred metres like you do in Midsummer week. [...] Then you might not really want to think about savings all the time, you want to, that’s when the safety mindset comes in instead.”

> P7: “So no, it’s more that you forget about it, I’d say, driving energy-efficiently, if you’re stressed, or at least I get worse at it then. If you’ve got a lot to do and you’re stressed, you end up forgetting to drive and, oh right, I’m meant to think about this as well, not wasting too much energy by braking, using the retarder and all of those parts.”

Current systems seem to judge drivers against predefined parameters that fit only a narrow type of driving, without adapting to real-world conditions. This makes them appear unfair:

> P2: “That system versus reality [...] doesn’t always match up.”

> P4: “[...] it [the eco-driving coach] isn’t always fair. [...] It is more suited to, like I keep coming back to, but driving on rural roads and driving in the forest are two completely different things.”

In this sense, the issue is not only that the systems fail to fit the varying configurations of professional truck driving, but also that they fail to reflect the variability that many drivers value as part of the job:

> P5: “When I’m driving it varies, it’s new places almost every day. So it’s interesting. It’s not the same, the same route.”

> P7: “Being out on the roads and seeing new places is what I enjoy the most.”

> P1: "Sometimes you're out in the middle of the forest, and the next hour you're right in the middle of an industrial area [...] You never know, that's what's fun about this."

To mitigate the shortcomings and the unfairness of the systems, drivers have suggested that eco-driving feedback should account for changing conditions, for example by adapting expectations to season or driving environment:

> P2: "[...] maybe it could take into account what season it is, like I mentioned earlier. If the vehicle notices that it's the winter season, then maybe it could relax the requirements a bit when it comes to coasting [...]"

This suggests that eco-driving support should not be based on a single idealised driving scenario. Instead, it needs to recognise that professional driving occurs under changing and sometimes conflicting conditions, where safety, efficiency, and work demands must be balanced. A useful and fair system should therefore adapt its expectations and coaching to context, rather than judge drivers against standards that only fit a narrow range of driving situations.

5.1.3.3 Organisational Recognition Drive Motivation for Eco-Driving More Than Technology Alone

From the drivers' answers, it was interpreted that organisational recognition is more effective than technological systems in creating motivation and incentives for eco-driving. Some drivers did describe statistics, scoring, and an element of competition as motivating, because it makes progress visible and reinforces "doing it right":

> P4: "[...] so then I get an assessment, I think it's five stars. It pops up like, right, this is how much, this is how well you did this, and you get three out of five stars for that thing. And then it's added up so it becomes a percentage for the whole day, how you've driven. It's actually really good, it is [the in-vehicle driver coaching]. Then you can follow it during the day and adjust it, sort of, to make it better."

> P7: "And then it's always a carrot when you see, when you get, like, five stars and it thinks you've driven well. It's also nice to know, that was good, OK, then I know I've done something right, and I can keep trying to do it this way."

However, the overall message was that to sustain motivation and eco-driving behaviours, drivers need organisational support and encouragement. Several also highlighted a lack of such appreciation from their employers:

> P1: "The best thing you can do in the society we have is to motivate, to offer a little carrot in some way. You drove the cheapest this year, well maybe you get an extra week of paid holiday, or you get certain things, 1,500 extra in your salary because you won that bonus [...] That's the only way to make people understand, because as long as they don't own

> anything or aren't the ones paying for anything, it doesn't matter what happens."
>
> P7: "[...] I still don't think it's a bad idea to, like, since people get to meet up, have a party or a get-together once a year and, like, who's been, who are in the top five of our, our drivers who've been the best at eco-driving this year, and things like that. I think that would give a push, and maybe there could be some kind of prize, like a gift card or something symbolic, to raise the conversation and the focus, and also maybe encourage the drivers themselves, like, that it can be a bit of a carrot and that."
>
> P2: "But when you're fighting day in, day out, and you try and this and that, and then you feel you never get a thank you, or a sandwich cake, even once every six months, then unfortunately that's how people are, if you never get any appreciation, I mean, then you sort of stop giving a shit about it, unfortunately."

When employers do show appreciation, it can be pivotal, helping drivers reframe negative experiences and strengthening their confidence:

> P6: "[...] what a difference it made for me when I had a manager who believed in me, trusted me, and genuinely believed I could develop. All of a sudden I could handle absolutely anything."

The interviews also indicate strong confidence in personal driving ability, which can shape whether and how much drivers trust in-vehicle systems such as driver coaching. For some, system feedback conflicts with autonomy and professional judgement, making it easier to dismiss or experience as irritating:

> P1: "There's nothing that can come from a vehicle saying you should do this or that. A lot of people, like me, have a bit too much ego. If I'm driving, then I'm the one who decides."
>
> P6: "[...] but I'm also very much like, don't interfere, I can do it myself, I'll handle it myself. So it's mostly that it just becomes an irritation, really."

Finally, this theme links back to the recurring issue of variable operating conditions and competing demands from different stakeholders. Trust in the systems is undermined when drivers experience a mismatch between the system's logic and real-world driving. While in-vehicle feedback, scores, and visible performance metrics can encourage drivers by making improvement tangible, lasting motivation seems to depend more on employer appreciation, encouragement, and meaningful rewards. The findings also suggest that drivers' strong sense of professional autonomy can limit the motivational effect of technological systems when these are perceived as intrusive or as challenging their own judgement.

5.1.3.4 Designing for Driver Agency, Individuality, and Variable and Demanding Operating Contexts

This theme centres on drivers' values and working conditions, and how these shape the design space for eco-feedback and in-vehicle coaching.

Drivers described how constant feedback, both visual and audible, can become irritating and distracting:

> P3: "[...] it's phones pinging and making noises everywhere, so you've got quite a lot of things around you that mean, erm, you can end up feeling a bit empty-headed sometimes from everything that's coming at you."
>
> P1: "Volvo has audio notifications, and sure, you can switch them off too. But because everything today is digital displays, something flashes and your eyes are drawn to it and you think, what the hell was that. And concentration is the most important thing we have [...]"
>
> P6: "It's mostly that it, like it beeps. It irritates me."

Linking to the theme *Organisational recognition drives motivation for eco-driving more than technology alone*, drivers also conveyed strong confidence in their own ability and varying levels of trust in the truck's systems. For example, P6 frames the job in terms of autonomy and earned trust:

> P6: "But like, I come to work, I do what I'm supposed to do, I manage myself, and I have my manager's trust that I can handle things and look after the truck [...]"

In light of the theme *Systems misaligned with real-world conditions and driver priorities*, irritation and mistrust towards feedback systems can be interpreted partly as a result of poorly calibrated modality, timing, or volume of feedback, which clashes with the realities of truck driving. It may also reflect a perceived loss of agency: if the system's coaching is experienced as intrusive or prescriptive, it can conflict with drivers' self-image as competent professionals with strong pride in their work, as reflected in *Enduring professional pride under internal and external pressures*.

Because current in-vehicle systems are often experienced as poorly aligned with real-world conditions, introducing new system versions or additional functionality becomes particularly challenging in a context shaped by individual differences, variable operating conditions, and an already demanding day-to-day work reality.

5.1.3.5 Knowledge is not the Primary Barrier: Motivation and Attention as Key Concerns

Additionally, the thematic analysis was informed by the framework developed by Sanguinetti et al. [43]. Following their recommendations, we sought to characterise drivers' knowledge, motivation, and awareness in relation to eco-driving, in order to identify which framework dimensions should be prioritised when designing eco-feedback.

The analysis indicates that eco-driving knowledge is generally well established among drivers, while motivation and awareness emerge as more decisive factors for whether such knowledge is applied consistently in practice. Several accounts suggest that the main challenge is not a lack of understanding but rather competing priorities and choices in practice:

> P1: "[...] lots of people know what it can cost to drive these vehicles like a race, and lots of people don't care."

This indicates that learning-focused dimensions may be less critical than those addressing other aspects relevant in designing effective eco-feedback.

Looking at motivation through the lens of self-determination theory (SDT), drivers' motivation for eco-driving was interpreted as primarily extrinsic, often rooted in organisational expectations and cost awareness [47]. At the same time, some accounts suggest that externally introduced motives may become increasingly internalised over time. P6 describes how a manager's emphasis on fuel costs and eco-driving initially shaped their approach, but that it later developed into something personally engaging:

> P6: "[...] where I started driving timber, that's when I discovered eco-driving, because it was basically the first thing he [the manager] said to me. He said, we push eco-driving hard here, diesel is expensive."

> P6: "[...] and since I think eco-driving is really enjoyable, it's very easy for me to optimise my driving, which was basically the first thing I did when I started working here. I started optimising my driving so it would be as energy-efficient as possible, more or less to bring down the percentage per load.[2]"

This account by P6 suggests a movement from externally introduced regulation toward more autonomous motivation. The manager's emphasis on fuel efficiency appears to have provided an initial external rationale, while continued engagement allowed eco-driving to become personally meaningful. Whether this reflects integrated extrinsic motivation or intrinsic motivation is difficult to determine conclusively, but the account illustrates how organisational reinforcement may support internalisation over time.

Taken together, this suggests that motivation-related dimensions should be prioritised in eco-feedback design. This further aligns with the third theme, *Organisational recognition drives motivation for eco-driving more than technology alone*, and implies that eco-feedback should be designed to complement or enhance, not replace, organisational support and reinforcement in such a way that drivers can move from controlled to autonomous motivation towards eco-driving.

[2] P6 refers to the truck's measured energy use for each load ("percentage per load") and explains that drivers can lower this score by adapting their driving style to be more energy-efficient. In practice, P6 describes learning the route and vehicle well enough to time when to release the accelerator (e.g., at specific road signs), regulate speed, brake strategically, and use coasting (lifting off before a crest and letting the vehicle roll to carry momentum into the next incline), thereby reducing the energy consumption per load.

Drivers' awareness of eco-driving, in the sense of consistently remembering to apply eco-driving behaviours, varies considerably and depends on work conditions and individual differences, as evident in the above mentioned themes. Some drivers explained that performance statistics can temporarily increase awareness, and that awareness also changes depending on the balance between manual and automated driving:

> P7: "Erm, on a Monday morning, when you've just read your index for the previous week, so to speak [laughter]. Then you think a lot about how you're driving."

> P6: "Otherwise, it's probably like this, like on major roads you usually let the cruise control take care of itself, and sometimes you catch yourself thinking, I should have switched it off there, because I should have coasted like that there [...]"

This points to the importance of carefully considering attention-related dimensions of the framework and balancing them against the driver's specific operating context, so that eco-feedback supports awareness without becoming distracting or burdensome.

5.2 Define: Framing the Initial Design Challenge

In the Define phase, insights from the literature study, benchmarking, and truck driver interviews conducted during the first Discover phase were analysed and synthesised into a design brief, in line with the Double Diamond design process [15]. Across these materials, several patterns converged. The interview findings aligned well with insights from prior research and with the interaction design constraints presented earlier, such as those presented in Section 3.3, which strengthened confidence that these constraints were relevant for guiding the continued design process.

The analysis showed that this challenge was shaped by several recurring tensions. In demanding and variable driving conditions, drivers' attention was often directed toward safety and completing the task at hand, making eco-optimisation difficult to prioritise. Drivers also expressed a strong sense of autonomy and professional pride, which could make prescriptive in-vehicle coaching feel intrusive, poorly timed, or disconnected from the realities of driving. Related to this, there was a tension between the ambition to compare scores and targets across drivers and routes and the need for evaluations to reflect the specific context in which driving took place. Current systems were often perceived as not accurately representing real-world conditions.

Another important insight was that long-term motivation did not appear to depend on technology alone. Rather, it was closely tied to organisational recognition, trust, and encouragement from employers and managers. This implied that eco-feedback should support awareness in a way that is non-distracting and non-irritating, while also being embedded in a broader organisational context that reinforces and legitimises eco-driving efforts.

All in all, the findings pointed to a central design challenge: how to design eco-driving coaching that motivates and raises awareness of eco-driving, while still respecting driver agency, prioritising safety, and accounting for contextual factors so that feedback is perceived as fair and appropriate.

Based on these insights, the design brief identified the following design requirements: explainable and transparent, agency-first, context-aware, safe and non-distracting, motivating rather than patronising, and supportive of organisational reinforcement.

5.3 Discover: Exploring Organisational Context and Fleet Manager Perspectives

Drivers' accounts made it clear that sustained eco-driving is shaped not only by in-vehicle feedback, but also by organisational reinforcement and the immediate work context. Participants repeatedly described how appreciation, trust, and meaningful incentives from employers and managers influence whether eco-driving efforts feel worthwhile over time. Because fleet managers affect both the practical conditions of work, such as assignments, vehicles, and follow-up routines, and the social conditions that support motivation, such as recognition, communication, and norms, they emerged as critical stakeholders.

For this reason, the scope of the project was expanded to include fleet managers as a secondary user group. This led to an additional, targeted Discover phase consisting of a literature review on organisational context and incentives, as well as interviews focused on managers' perspectives, constraints, and practices. Theoretical findings from this phase are included in Chapters 2 and 3, while the fleet manager interviews are described below.

5.3.1 Fleet Manager Interviews

Due to time constraints, recruitment of the managers was conducted through the email-list we had compiled previously. Recruitment was not limited to companies using Volvo systems. Participation was voluntary and no compensation was provided.

Semi-structured interviews were conducted with two fleet managers (1 female, 1 male) aged 41 and 55 years (M=48), referred to as F1 and F2. The interviews lasted around 20 minutes each and were conducted through video meeting with the software Microsoft Teams. The interviews were recorded, and transcriptions were provided by Microsoft Teams AI transcription feature during each session. These generated transcriptions were double checked for accuracy and adjusted after the meetings.

The interviews were preceded by an informed-consent questionnaire distributed via Google Forms. The consent procedure followed Chalmers' guidelines for research data handling and informed consent [84]. In addition to informed consent, the form included demographic questions presented as open text fields: *Enter your age*

(*Fyll i din ålder*), and *Enter your gender identity* (*Fyll i din könstillhörighet*). The questionnaire was provided in Swedish, as it was the participants' preferred language.

The interview guides for the semi-structured interviews were based on the data gathered through the first Discover phase. It consisted of questions that can be seen in Appendix C. The aim of the interviews was to expand our knowledge of fleet managers, their work, needs, and attitudes.

5.3.2 Thematic Analysis of Fleet Manager Interviews

The interviews were analysed similarly to the analysis in Section 5.1.3, using a reflexive thematic analysis aligning with the steps of Ahmed et al. [75]. Further, this analysis was closely shaped by the findings from the preceding analysis, and should be understood as something of an extension rather than an entirely separate, independent analysis.

The following themes were derived from the analysis:

- Motivation and trust gap.
- Efficiency-first management.
- Manager-driver dynamics shape engagement.
- Decontextualised metrics hide reality, shifting interpretation burden to managers.

All four themes are described in the following sections. The quotations have been translated into English from their original Swedish form, and both can be found in Appendix D

5.3.2.1 Motivation and Trust Gap

This theme describes a gap between what eco-driving systems measure and what drivers experience as meaningful and fair. Managers describe that drivers often do not see any personal "win" from eco-driving, which makes it difficult to motivate sustained effort. When feedback is reduced to monthly rankings or scores without tangible benefits, it can feel pointless rather than motivating, as can be seen in the following quotes:

> F2: "As an employee, you might not really see the gain in it [eco-driving], whereas I see a very big [gain]"
>
> F2: "I know myself, when I was an employee a number of years ago, we got these lists every month [...] Then you were sort of scored based on how you drove, and you'd get something like, 'these [drivers] are at the top,' but that was all. It was like... that list was just posted on the staff room wall, and then, well... it was kind of like, 'yeah, but why should we even do it?' "

Another aspect that creates friction is the amount of data gathered by current fleet management systems. Managers appreciate the richness and accessibility of data, while they notice that drivers may perceive the amount of monitoring as intrusive, creating a trust challenge that organisations must handle carefully (including formal agreements about non-surveillance use):

> F1: "We have a system [...] then it's like a driving score, and it includes speed monitoring and fuel and everything. [...] All the vehicles are equipped with hardware that measures braking, acceleration, driving behaviour, and GPS positioning, of course. [...] We also... download the tachograph data automatically and everything, and maps and driving style and all that. We get everything in there as well."

> F2: "And Volvo's... well, the portal where you can get reports and things like that, it's very easy to see, like, how they've driven. You get it very easily. Yeah, it's scored, and you can see idling and speeding and basically everything, so really it's just a click and you can see, like, 'yeah, she's doing well now,' or, you know, like that, so it's very easy to follow up."

> F1: "[...] where's the line between surveillance and praise? You have to be a bit careful there too, because when we installed this system there were quite a lot of comments that we were going to monitor them [the drivers]. And... so, and on top of that we also had to sign [an agreement] with the union that it would not be for monitoring their work."

Managers also recognise that the continued use of eco-driving practices depends less on knowledge and more on managerial recognition. They believe that acknowledgement and praise would help, and some say the main problem is that drivers are not noticed when they perform well. However, they find it difficult to build new routines for recognition and feedback because of limited time and the challenge of communicating consistently:

> F2: "I know that this [attention and praise from the manager] is absolutely what's required for any change to happen. So I agree with that."

> F1: [*in response to what they think about many drivers wanting more praise from their manager to increase motivation*] "I understand, I can imagine that it's like that, I absolutely can."

This theme overlaps with the first Discover phase theme *Organisational recognition drive motivation for eco-driving more than technology alone* by highlighting that sustained eco-driving behaviour is shaped less by technological feedback and more by organisational reinforcement. Across both themes, recognition and acknowledgement emerge as key motivational levers. Similarly to drivers, managers describe praise as necessary for behaviour change, yet note practical barriers to delivering consistent feedback due to limited time and the difficulty of establishing routines. In addition, the themes converge on a trust-related tension concerning monitoring and control: while fleet systems provide vast and accessible data, drivers may perceive extensive monitoring as intrusive or surveillance-like, prompting the need for clear safeguards and, in some cases, formal agreements to prevent misuse.

5.3.2.2 Efficiency-First Management

This theme describes how fleet managers approach eco-driving primarily as an efficiency investment that must yield visible results. Because managers have limited time and many competing priorities, eco-driving follow-up is easily de-prioritised unless it is simple to oversee and clearly “worth it”. As a result, they value systems that provide quick, high-level overviews and straightforward indicators that help them decide when action is needed:

> [*in response to a question about advantages with a system with driver profiles and the possibility to configure settings*] F1: “[...] I think you’re spending a lot of time for very little effect. [...] How much time and how much energy, and what resources are you going to put into it? Is there a payback on those hours?”
>
> F2: “I’d say we would like to spend more time on it [eco-driving]. I... maybe I’m a bit bad at following it up. It ends up maybe a bit too far down the priority list, but that’s only because there’s so much else that comes first.”

Managers therefore question whether the time spent configuring, segmenting, or tailoring evaluations is worth the expected benefit. They prefer simple ways to track progress, ideally by comparing performance over time rather than using resource-intensive individual calibration:

> [*in response to a question about advantages with a system with driver profiles and the possibility to configure settings*] F1: “Yes, maybe, but I’m not... I’m not that nerdy and obsessed that I can be bothered to spend the time splitting up each driver, then assigning a vehicle, and creating different rating scales. This is what this driver, with this vehicle and this kind of driving, has to do to reach ‘approved’. It becomes a huge job.”

This theme aligns with *Enduring work dedication despite internal and external pressures* in that both drivers and managers describe time pressure and competing demands as common features of everyday work. Drivers describe high levels of stress and cognitive load associated with operating conditions and external scrutiny. Managers similarly emphasise limited time and resource constraints, which encourages a focus on efficiency and demonstrable payback. In this context, managers tend to favour systems that provide rapid, high-level overviews of performance.

5.3.2.3 Manager-Driver Dynamics Shape Engagement

Eco-driving efforts and performance follow-up are strongly shaped by the manager’s day-to-day conditions. Differences in available time, physical proximity to drivers, the number of drivers in the fleet, and what the manager role actually includes determine how much relationship-building and ongoing coaching is realistically possible. In smaller fleets where the manager is also an owner or active driver, communication can be frequent and informal. In larger or geographically distributed operations, contact might be more sporadic and mediated through phone calls and occasional visits, making day-to-day coaching and recognition harder to sustain. Distance also affects recognition: managers note that it is easier to praise drivers they regularly meet than those they rarely see, which risks uneven feedback and engagement across the fleet:

> F1: "We have about two thirds of everyone here in [location a], so I see them almost every day."
>
> F1: "The ones who are in [locations b or c], I try to call a couple, three times a year, just to check in and talk, and then I'm down in [location b] at least once a year, and I try to be in [location c] at least once a year and try to meet them then."
>
> F1: "It's much easier... easier to... I feel like I praise the ones who are here, more than the ones I never meet and can only contact by phone. It's not like I call and say, 'damn, today you improved by a tenth.' "
>
> [*Is communication with the drivers something that usually happens every day? How often are you in touch?*] F2: "Yes, more or less. Maybe not everyone every day, but... at least two, three times a week I'd say. Sometimes it's more and sometimes less, but you usually check in about something, like, several times a week. So yes."

The managers further differ in their view on communication, as straightforward or as an organisational challenge forcing reliance on system data to identify issues:

> F1: "[Communication] is among the hardest things we have in a company. Yeah. There are always some who want more, and always some who hardly want anything at all, so. Yeah, communication is difficult."
>
> [*In response to the question of whether there is anything that could make communication with the drivers easier*] F2: "But nothing really that's like, 'I'm missing that.' I think we have quite straightforward communication."

Another difference is whether eco-driving is approached as collaboration or competition. Some managers emphasise appreciation and mutual goals, framing eco-driving as a shared ambition. Others seem to view eco-driving feedback and progress as something that should be framed through some form of competition, even though fair comparisons are difficult to achieve:

> F2: "But I think all three are quite aware that I have a... or that we have a shared ambition that we should drive as economically as possible [...]"
>
> F2: "If we can reduce fuel [consumption] by one or two decilitres, that generates this much, and then I can pay out a bonus at Christmas instead."
>
> F1: "[...] Everyone can see their own [...] numbers and instead compete against themselves. Then there are 20% who get motivated, 60% who are like 'yeah, yeah,' and 20% who don't care about it at all."

> [*regarding whether anything could make communication with the drivers about their eco-driving easier*] F1: "It would be if, in some way, you get everyone's approval to publish some kind of statistics [...] and if you have the energy and the time, you could set up some kind of competition where you're constantly competing against yourself: if you improve by 0.5%, or 0.5, or five units, or whatever you want in a given measure, then you can get something."

> [*Regarding the idea that drivers' lack of motivation is a bigger barrier to eco-driving than a lack of knowledge.*] F1: "[...] you can do different competitions and things, but it's so hard to compare drivers... Or comparing driver to driver isn't hard in itself, but it depends on what they drive [...] I mean, it's not fair to compare them in a competition. Then you'd have to introduce, find, some assessment system that makes it fair with handicaps or something like that, kind of like in golf, and there's a big risk it's perceived as unfair instead of becoming a carrot."

5.3.2.4 Decontextualised Metrics Hide Reality, Shifting Interpretation Burden to Managers

This theme describes how current eco-driving and fleet follow-up systems reduce complex, situational driving to simplified scores, colour codes, and thresholds, making performance easier to monitor but also stripping away important context. Managers receive numbers that seem objective, yet the drivers' actual operating conditions are often missing, which can make the distinction between "approved" and "not approved" in the system feel arbitrary and lead to a one-sided view of performance:

> [*about the current system*] F1: "[...] the events are classified as green, yellow, and red. If you move up to red, then it starts to get serious, and then you start looking: what is it that... I mean, you can swerve to avoid something with a vehicle and then you get a red event, but if you have the same driver with three red events per week on average, then you have to have a talk."

> F1: "Yes, and then for each vehicle you have the vehicle's average fuel consumption. [...] And then I've said 3.7 is green and everything above 3.7 is red. [...] [*So this is for the whole fleet then, that you set a number that counts as approved and so on?*] Yes, it's for the whole fleet [...] and the only thing I differentiate is diesel vehicles and gas vehicles."

As a consequence, managers cannot rely on the metrics alone and must supply the missing context themselves, for example by remembering routes, traffic environments, vehicle differences, and exceptional events, before they can judge whether a result indicates a real issue or just difficult conditions:

> F1: "I can't just look at the numbers, I have to know why as well."

> F1: [*looking at the current fleet management system*] "Don't know who the hell has been driving today. Yeah, it's [driver]. Yeah, yeah, and in Gothenburg, you see. [...] A red event: right turn 26 km/h 3.1

> [severity level]. It's not that bad, but it's over 3 [severity level] so it becomes a red. [...] But it's not... it's not that bad. It's not like I'm going after him for this. [...] Now he's been given a vehicle he doesn't like driving, plus it's in Gothenburg, where the traffic is unpleasant to drive in."

Because drivers work in very different contexts, fleet comparisons that do not take that into account can easily become misleading. Rankings, competitions, or simple red-yellow-green classifications risk rewarding "easy" assignments and penalising "hard" ones (city traffic, night work, unfamiliar routes). This creates a fairness problem and pushes managerial attention toward identifying outliers and "worst performers" that the system flags, rather than supporting improvement opportunities tailored to each driver's conditions. At the same time, using system data to question performance can intensify surveillance sensitivity, meaning managers must balance follow-up with maintaining trust:

> F1: "And then there are different... newer vehicles as well, so it's not entirely fair to just look [at the numbers]"

> F1: "[...] this system means you can see and catch those... who are doing the worst, and you can see those in the middle and the best too, of course, but most often you end up focusing on the ones who are doing the worst, unfortunately maybe. No, but without the system, they wouldn't have gotten any praise at all."

This theme closely aligns with *Systems misaligned with real-world conditions and driver priorities* from the first analysis. Both themes emphasise that eco-driving performance cannot be meaningfully evaluated without accounting for contextual factors such as route characteristics, traffic, season and weather, vehicle load, assignment type, vehicle differences, and time pressure or stress. They further suggest that simplified thresholds and colour-coded indicators can obscure these conditions, making fleet-wide boundaries appear arbitrary and, at times, unfair when identical metrics are applied across fundamentally different driving situations. Consequently, both themes point toward a common implication: eco-driving metrics and coaching should be more sensitive to operating conditions.

5.4 Define: Updating the Design Brief

Due to the extension of the user group and the new information from the second Discover phase, we conducted an additional Define phase in which an updated brief framing the design challenge was created. This combined the findings of the first analysis with the findings of the second, in accordance with the Double Diamond design process [15]:

The design challenge is to provide eco-driving feedback that drivers experience as fair, timely, and non-intrusive in real working conditions, where safety, stress, weather, load, and traffic often make "ideal" eco-driving unrealistic. At the same time, the system must give managers quick, meaningful overviews without turning complex driving into decontextualised scores or increasing drivers' sense of surveillance, so that trust and motivation are maintained.

The tensions identified in the updated design space include drivers having to prioritise safety and task completion in stressful, variable conditions, which can make eco-optimisation unrealistic or easy to forget, while their strong sense of autonomy and professional pride can conflict with coaching that feels intrusive, poorly timed, or disconnected from real-world driving.

The drivers' motivation tends to depend less on technology than on trust and organisational reinforcement, yet recognition is hard for managers to deliver consistently, especially in larger or distributed fleets.

Managers prefer quick, comparable overviews and clear payback, but fleet-wide scores and thresholds often decontextualise performance and feel unfair for drivers when individual conditions are ignored. Adding the missing context is difficult because it typically requires either more data, which risks feeling like increased surveillance to drivers, or more time, which managers might not have.

The updated design brief led to the following updated design requirements:

- Explainable and transparent: Make scoring and feedback triggers understandable to both drivers and managers, including why something was flagged and what context was assumed.
- Agency-first: Let drivers retain control over when coaching is delivered.
- Context-aware: Take operating conditions into account so feedback feels credible and fair.
- Safe and non-distracting: Prioritise safety by minimising cognitive load.
- Motivating not patronising: Help drivers see tangible value, not just monthly scores or rankings.
- Supports lightweight, consistent organisational reinforcement: Make it easy for managers to notice good performance and give timely praise across distributed fleets, not only to identify worst performers.

5.5 Develop: Ideation, Prototyping, and Evaluation

The Develop phase included ideation, followed by prototype development and evaluation. This section provides a detailed account of these activities and the resulting outcomes.

5.5.1 Ideation

Building on the updated design brief and the tensions of the design space, the ideation activities began with revisiting the original concept that motivated this thesis, namely voice-based and LLM-enabled in-vehicle driver coaching. At this stage, it became clear that the initial concept needed to be reconsidered in light of the broader role of organisational recognition, trust, and contextual fairness in supporting eco-driving motivation. This raised concerns that only focusing on introducing new forms of in-vehicle feedback mechanisms, particularly auditory ones, could miss the requirement of supporting motivation towards eco-driving altogether, and instead be perceived as intrusive or irritating. Ultimately, we felt that a shift in design direction might be the advisable option, in order to remain aligned with the user-centred approach guiding the thesis.

These concerns were carried into the ideation activities and shaped the brainstorming process around the design brief and design challenge. Ideation was conducted using an adapted version of the Crazy 8 method [85], [86]. We independently generated at least six ideas during a 20-minute session. The ideas were then presented and discussed collectively to clarify their meaning and explore possible extensions. Several of the concepts focused on recognition, the manager-driver relationship, and social or organisational incentives for eco-driving.

After the initial discussion, similar ideas were grouped into broader concept directions. A dot-voting exercise [86] was then conducted, in which each author allocated three votes to the ideas considered most promising for further development.

The direction of the resulting concept departed from in-vehicle coaching and instead focused more on an off-board fleet management tool. This concept aimed to support fleet managers in recognising and motivating drivers' eco-driving behaviours by providing reminders for check-ins and including more contextual information than existing solutions, thereby aiming to make performance statistics more transparent and explainable.

The shift in direction was discussed with TTI advisors. While the concern about introducing additional potentially intrusive technology into the truck remained, the advisors encouraged further exploration of whether the original voice-based concept could still contribute through its social and motivational potential. In particular, they pointed to the possibility that natural language interaction might support more human-like and socially meaningful feedback. It was also discussed whether driver agency could be supported and unwanted distractions reduced by allowing the driver to control if and when voice coaching was activated (e.g. user-initiative flow control), rather than relying on continuous system-initiated interaction.

These discussions led to a compromise with a final concept that combined an off-board fleet management solution with an on-board voice coaching component, both supported by LLM capabilities. The concept was intended to connect individual eco-driving support with organisational recognition, while preserving driver agency and keeping the interaction context-aware and non-intrusive. This concept would then include both our user groups: the on-board eco-driving coaching mainly designed for the sake of drivers and the off-board fleet-manager facing view for supporting managers in checking-in on and recognising their drivers' eco-driving performance. Next, we present the prototyping process of developing the first iteration of this concept and further elaborate how it meets the defined design requirements.

5.5.2 Prototyping

Prototyping the chosen concept began with sketching and wire-framing in Figma to explore user interface (UI) layouts and interaction flows. The implementation was deliberately scoped as a mid-fidelity prototype, aiming to approximate realistic interaction and information presentation without full production integration. Given time and resource constraints, direct access to vehicle sensors and in-vehicle systems was beyond the scope of the study. Instead, the prototype employed a Wizard-of-Oz (WoZ) approach [71], where we, as wizards, observed and injected simulated driving events and contextual updates. For similar practical reasons, the prototype ran on a stand-alone Android tablet instead of the truck's secondary information display.

5.5.2.1 Implementation Choices and Development Process

To achieve a mid-fidelity user interface with interactive behaviour, the prototype was implemented as an Android application using Flutter, Dart, and Python. This choice aligned with our existing competencies and enabled rapid iteration across interface layouts, state handling, and interaction logic.

Development proceeded from pseudocode describing the intended behaviour, followed by iterative implementation and testing. Coding was supported by GPT-5.2 through Volvo's internal GPT platform, primarily for architecture exploration, small-step code generation, and debugging. To reduce the risk of introducing opaque logic, the collaboration was limited to incremental changes, which we reviewed and integrated.

The implementation was based on Flutter's standard application structure [87]. Beyond this baseline, the final system consisted of modules for WoZ event handling, UI components, session logging and persistence, calls to an internal generative AI API, and a text-to-speech pipeline.

5.5.2.2 Prototype Workflow

Fig. 5.2 provides an overview of the twelve-step prototype workflow. The same sequence is described in detail in the numbered list below, and the numbered elements in the figure correspond directly to the steps in the list. Screenshots of additional app interface states are provided Appendix E.

1. The prototype runs from a laptop used by the wizard and is connected to a stand-alone tablet that is the user interface.
2. When launched, the application opens in the driver-facing view, which initially shows an empty screen (see also Fig. E.1).
3. The wizard starts a driving session and enters stable session context, such as driver name, vehicle type, season, weather, and outside temperature.
4. During the session, the wizard triggers driving events with optional tags for where they occurred, and updates dynamic context, such as road type and traffic conditions.

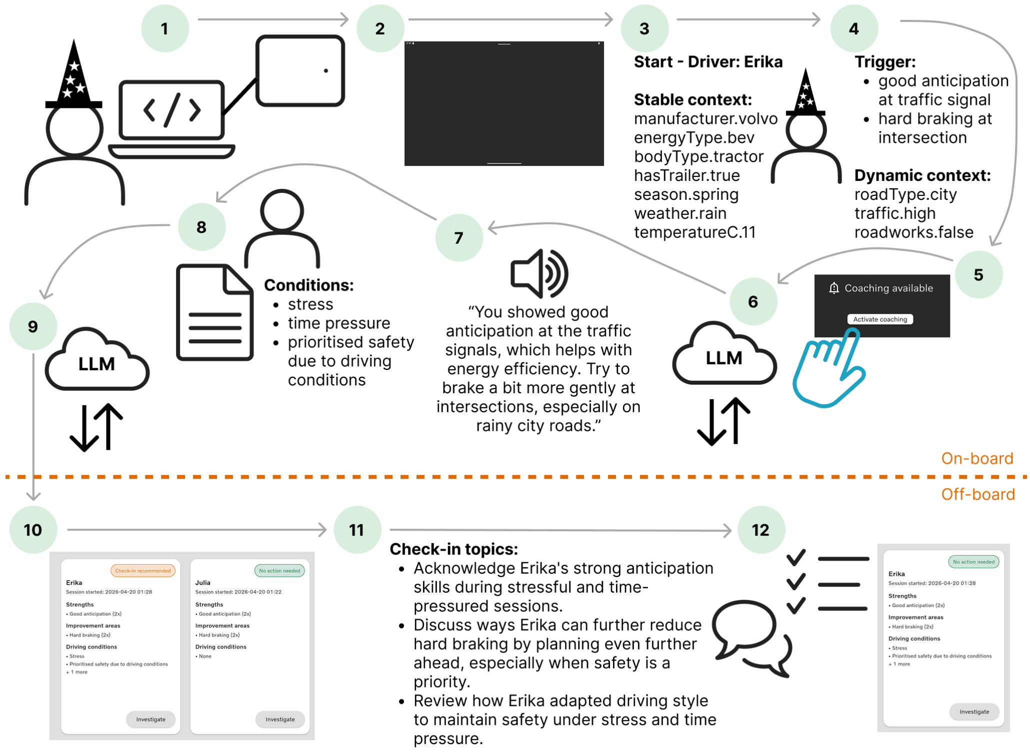

Figure 5.2: Overview of the twelve-step prototype workflow, distinguishing between on-board use while driving, and off-board use in the fleet management context.

5. When predefined thresholds are reached, the driving view shows that coaching is available and allows the driver to request it by pressing an activate button (see also Fig. 5.3).
6. If the driver activates coaching, the system sends API requests to generate a coaching message and convert it to speech.
7. When the requests are complete, the audio coaching message is played on the tablet.
8. At the end of the drive, the wizard stops the session and the interface changes to a post-drive form, where the driver can optionally report factors that affected eco-driving ability (see also Fig. E.2).
9. After the form is submitted or skipped, the system requests LLM-generated check-in topics for the fleet manager and stores them with the session.
10. Using a hidden navigation drawer (see also Fig. E.3), the wizard can switch to the off-board fleet manager view, which shows completed driving sessions and flags those where a check-in is recommended (see also Fig. E.4).
11. Selecting a session opens a detailed summary with driving strengths, improvement areas, contextual information, driver-reported conditions, the number of coaching interactions, and the generated check-in topics (see also Fig. 5.4).
12. The manager can mark check-in topics as discussed and complete the follow-up,

after which the session is no longer flagged in the overview (see also Fig. E.4).

During each driving session, all app interactions were logged together with a session ID, geodata, timestamp, event type, and payload. In the twelve-step workflow outlined above, examples of this logging behaviour include `coachingButtonPressed`, which was logged when the driver pressed the button to request coaching, and `coachingDelivered`, which stored the generated coaching message as payload. After a session ended, these logs were exported to JSON files for prototype evaluation purposes.

Figure 5.3: On-board driving view when notification has been triggered.

5.5.2.3 Generative AI Integration

A central capability of the prototype was its use of Volvo's internal API to access generative AI models for both chat completions (used to compose coaching messages and manager-facing discussion topics) and text-to-speech (used to render coaching messages as audio). Because the tablet operated outside the corporate firewall while the generative AI services were hosted within it, proxy services running on a corporate laptop relayed requests and responses.

To support context-aware coaching and reduce contradictory or repetitive feedback, the system maintained a session context comprising stable descriptors (entered once per session) and dynamic updates (entered during the session). The included parameters were derived from findings in the Discover phases. They therefore captured contextual factors that both the literature and the interview findings described as influencing the eco-driving ability in practice, such as vehicle configuration, road conditions, traffic, and weather. For each coaching request, a snapshot of the current context, event counts, and previously covered coaching topics was serialised and included in the prompt.

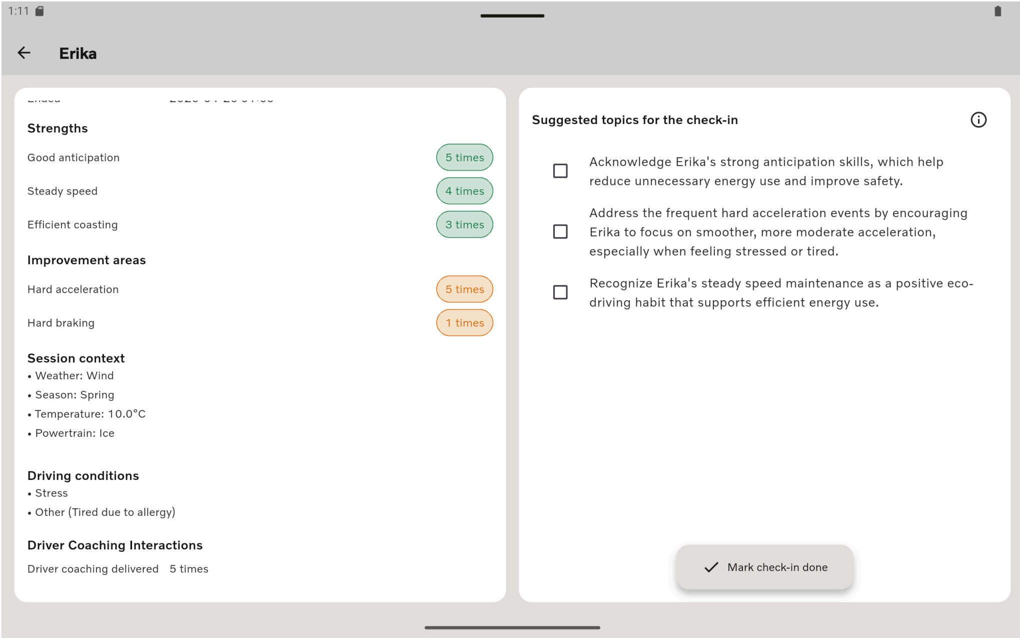

Figure 5.4: Off-board detailed driving session summary view where a check-in has not occurred yet.

The post-drive conditions form was intended to support fairer interpretation by capturing constraints that a wizard (or vehicle sensors) may not be able to observe reliably (e.g., intrinsic or situational factors affecting eco-driving). The response options were also grounded in the Discover findings and include factors such as stress, time pressure, fatigue, familiarity with the road and vehicle, and priorities. These self-reported factors were stored with the session and were used both to contextualise the session summary in the fleet manager view and to prompt the generative model to produce meeting topics that were more context-aware and less likely to rely on incomplete assumptions.

Full versions of the prompts used for chat completions in the prototype are provided in Appendix F.

5.5.2.4 User Interface Considerations and Alignment With Design Requirements

The prototype was developed to operationalise the updated design requirements through its overall interaction flow and division between on-board and off-board functionality. Several requirements were addressed directly through the generative AI integration and session-context handling described above. Explainability was supported by making both the driver-facing and manager-facing outputs dependent on explicit session data and contextual inputs, rather than presenting isolated scores. The combined on-board and off-board components also aimed to avoid a patronising tone by presenting strengths alongside improvement areas both in the manager view and in the voice coaching for the driver. The intention was to make the feedback feel constructive rather than corrective. Another important aspect included the aim of providing drivers and managers with context-aware and relevant feedback to support fairness in the system.

The on-board driver component was further designed to support driver agency through user-initiated activation of coaching, meaning that feedback was not delivered automatically. This was intended to reduce unwanted interruptions and allow the driver to decide when coaching should be received.

In line with participants' views, and to further support safety and minimise distraction during driving, the on-board interface was also designed to reduce the risk that interaction with the system would distract from the primary task of driving. In order to achieve this, the on-board interface was intentionally kept minimal (see Fig. 5.3).

The off-board fleet manager view was intended to support lightweight organisational reinforcement by helping managers identify sessions that could benefit from follow-up and by providing suggested topics for discussion with drivers. This was intended to reduce manager effort by translating session data into actionable conversation prompts, thereby lowering the threshold for communication. As shown in Fig. 5.4, the detailed session summary view also included the driver's name, identified strengths and improvement areas, session context, self-reported driving conditions, and interactions with the coaching system. Its relatively simple design, consisting of only a single view, reflected managers' limited time and their need for information that could be quickly interpreted and acted upon. The colour scheme was based on guidelines from the Volvo Group Design System, with functional colours used to indicate positive and negative eco-driving behaviours. The choice of orange, together with framing negative eco-driving behaviours as areas for improvement, was deliberate and intended to soften both the visual expression and the message conveyed compared to existing systems.

5.5.3 Prototype Evaluation Process

We initially planned to evaluate the prototype in a driving simulator, but as the design space became clearer it became evident that the simulator setup could not realistically capture several of the driver-context factors identified during the Discover phase. Because truck drivers operate under highly variable and demanding real-world conditions that likely influence their attention and perception of in-vehicle systems, we concluded that a simulator-based evaluation would risk producing insights that were insufficiently grounded in actual use. We therefore shifted the focus toward conducting evaluations in settings closer to real operations, as studies in real trucks were assessed to better reflect the conditions under which the system would be used.

To enable this, we explored opportunities to gain internal access to both drivers and trucks within Volvo. In addition, the inclusion of fleet managers as a second user group through the fleet manager component created the need to evaluate not only the driver-facing component, but also the manager-facing side of the concept. As the thesis was situated within interaction design, user involvement, particularly that of truck drivers, was considered central to the evaluation process, since it provided essential insights into how the interactions proposed by the concept were understood and experienced in practice.

5.5.3.1 Pilot Testing and Prototype Refinement

Pilot testing was conducted with one participant recruited internally from Volvo to evaluate the intended prototype evaluation process. The test drive took place in a battery electric Volvo truck and consisted of a round trip from Gothenburg to Borås, lasting approximately 2 hours and 45 minutes, including a short break. During the drive, we took observation notes to capture the participant's comments as well as any issues or improvement opportunities related to the prototype behaviour.

The pilot revealed several insights:

- The Wizard-of-Oz setup for triggering events appeared convincing, as the participant believed we were reading data from the truck in real time.
- The activate coaching button was too small, which made it difficult for the participant to press it on the first attempt.
- Notifications were experienced as easy to notice on the tablet and did not feel overly stressful or distracting.
- The participant responded positively to the voice-based format, noting that reading messages of similar length while driving would not be practical.
- The participant appreciated the balance between positive and negative feedback, which was seen as motivating for eco-driving.
- Coaching on idling was not perceived as relevant for a battery electric truck.
- The limited set of triggerable driving events for highway driving made the coaching repetitive, and in some cases the repetition safeguard prevented notifications from being triggered.
- Additional context was requested, such as whether a driving event occurred in a roundabout, at a traffic signal, or during city or highway driving.
- Feedback on hard braking was perceived as unfair when it occurred in heavy traffic and was therefore unavoidable. This reinforced the importance of making driving conditions visible to both the driver and the manager.
- Some interview questions needed to be refined for clarity.
- The amount of feedback provided through the suggested check-in topics was perceived as appropriate.

Further feedback was gathered during an internal presentation and discussion with Volvo advisors. The main points raised were as follows:

- Lane keeping may overlap too strongly with safety coaching and may therefore be less relevant for eco-driving feedback.

- Idling is not relevant for battery electric trucks, suggesting a need to adapt triggerable events to the vehicle powertrain.
- Providing coaching only in English could create an unnecessary barrier, particularly for participants who prefer Swedish.

Based on the pilot test and internal discussions, several refinements were made prior to the final prototype evaluation:

- The set of triggerable driving events was updated by removing lane keeping and adding a powertrain-dependent idling condition. “At”-tags were also introduced to capture where events occurred, in order to improve context-awareness and reduce repetition in coaching messages.
- A language toggle was added so that the UI could adapt to the selected language, and the LLM was prompted to generate coaching messages and check-in topics in Swedish when required.
- The interview questions were revised to better align with the research question, reduce leading formulations, and avoid yes/no questions to a larger extent.
- Additional eco-driving knowledge was incorporated into the LLM prompts to improve coaching accuracy.
- Driving session context parameters were added to the Wizard-of-Oz pipeline and the LLM prompting.

5.5.3.2 Final Prototype Evaluation

The final prototype evaluation was conducted at a Volvo truck proving ground with internal test drivers and employees. The participants were six truck drivers, aged 28-40 years (M=33.3) referred to as D1-D6, and two participants assigned to the role of fleet manager, 38 and 45 years (M=41.5), referred to as M1 and M2. All participants were male. The prototype evaluation coincided with other tests and therefore the conditions differed in terms of driving time, route, truck configurations and powertrain, time of day, and whether drivers had other tasks to perform simultaneously when they evaluated the prototype. The evaluations were conducted over the space of a week and the sampling was determined through participant availability.

Prior to participation, all participants received test instructions and completed a consent form aligning with the guidelines established by Chalmers [84], and a brief demographic questionnaire. The questionnaire included two questions with open-ended text fields: *Enter your age* (*Fyll i din ålder*) and *Enter your gender identity* (*Fyll i din könstillhörighet*).

The participants received instructions and questions in Swedish with the exception of one driver who preferred to receive them in English. The prototype UI and coaching messages were also set to be in the participant’s preferred language (either Swedish or English). The English version of the evaluation protocol, including instructions, and interview questions are provided in Appendix G.

The drivers carried out on-road testing of the on-board coaching component described in Section 5.5.2.2. Each evaluation session lasted approximately 30 to 90 minutes. Before each session, the tablet was mounted near the secondary information display using a suction holder and connected via USB to a laptop running the prototype code (see Fig. 5.5). The wizard then started the driving session in the system and entered the static context. During the drive, dynamic context and observed driving events were provided to the system through the Wizard-of-Oz setup. The wizard also noted any comments and observations related to the interaction between the driver and the coaching system.

Figure 5.5: Example of the prototype evaluation setup inside the truck cabin. Parts of the image have been edited using generative AI tools to preserve confidentiality.

Following the on-road testing, the driver filled out the standardised questionnaire UMUX-Lite. This was used to quantitatively evaluate the perceived usefulness and ease of use, as it is especially suitable for use in time-constrained studies [66], [69]. It consisted of two items: *This system's capabilities meet my requirements* (*Systemets funktioner uppfyller mina behov*), associated with usefulness, and *This system is easy to use* (*Systemet är lätt att använda*), associated with ease of use [73], rated on a 7-point agreement scale from one: *Strongly disagree* (*Instämmer inte alls*), to seven: *Strongly agree* (*Instämmer helt*) [66]. As the simplicity of the method limited the diagnostic depth of the feedback it provided [66], [69], the UMUX-Lite was used in combination with semi-structured interviews in which follow-up questions on the UMUX-Lite ratings were included to let the participant elaborate and motivate the reasoning behind their rating.

Post-drive semi-structured interviews were designed to further evaluate the driver's

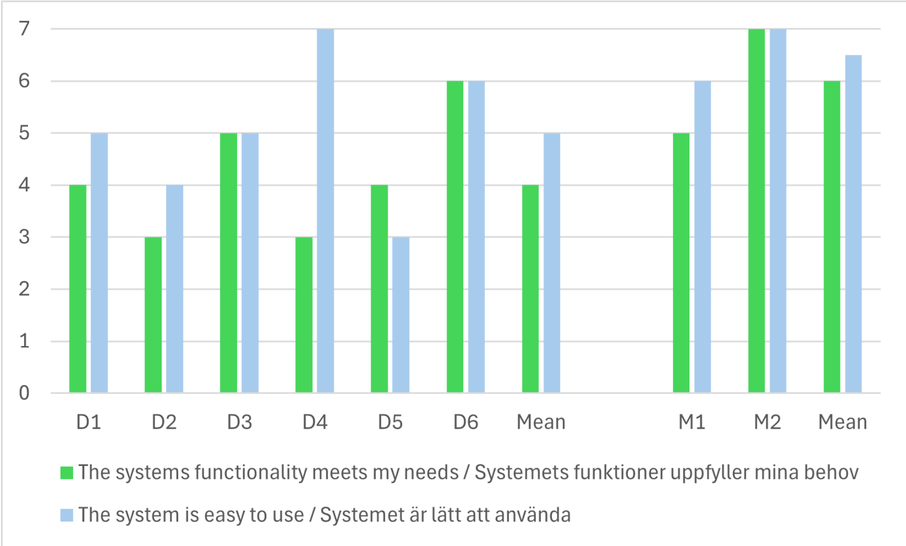

Figure 5.6: UMUX-Lite responses.

experience of the on-board coaching component (see Appendix G).

The driver then participated in a brief simulated conversation with a manager. Due to the limited availability of both driver participants and participants acting as fleet managers, only three simulated meetings were held. M1 acted as the manager for D1 and M2 for D2. For D3, one of us acted as the fleet manager. Additionally, D6 was shown the fleet manager view and asked to think aloud regarding their impressions of the concept. This was followed by semi-structured interviews held separately with the manager and driver, focusing on how the interaction was perceived. To quantitatively evaluate the usability and ease of use for the off-board component, the managers also answered the UMUX-Lite questionnaire after the conversation.

5.5.4 Quantitative Analysis of Prototype Evaluation

The UMUX-Lite responses shown in Fig. 5.6 were converted into estimated System Usability Scale (SUS) scores using Equation 5.1 [88]. This was done because SUS is widely used and there are several established grading scales (see Table 5.1) for interpreting what the SUS score says about a system [68], [89]. The estimated SUS scores and their corresponding grades in accordance with Sauro, Lewis and Sauro [89], [90], are shown in Fig. 5.7.

$$\text{Estimated SUS from UMUX-Lite} = 0.65\left(\frac{([Item\ 1\ score] + [Item\ 2\ score] - 2)\cdot 100}{12}\right) + 22.9 \tag{5.1}$$

Fig. 5.6 and 5.7 depict the drivers' experience of the on-board coaching component and the fleet managers' experience of the off-board component of the system.

Fig. 5.6 further shows that ease of use received higher ratings overall than usability among the drivers, with mean values of 5 and 4, respectively. The manager partic-

Grade	SUS score	Adjective	Acceptable
A+	84.1–100	Best imaginable	Acceptable
A	80.8–84.0	Excellent	Acceptable
A-	78.9–80.7		Acceptable
B+	77.2–78.8		Acceptable
B+	74.1–77.1		Acceptable
B-	72.6–74.0		Acceptable
C+	71.1–72.5	Good	Acceptable
C	65.0–71.0		Marginal
C-	62.7–64.9		Marginal
D	51.7–62.6	OK	Marginal
F	25.1–51.6	Poor	Not Acceptable
F	0–25	Worst Imaginable	Not Acceptable

Table 5.1: Grades, adjectives, and acceptability categories for SUS scores. Adapted from Sauro [89].

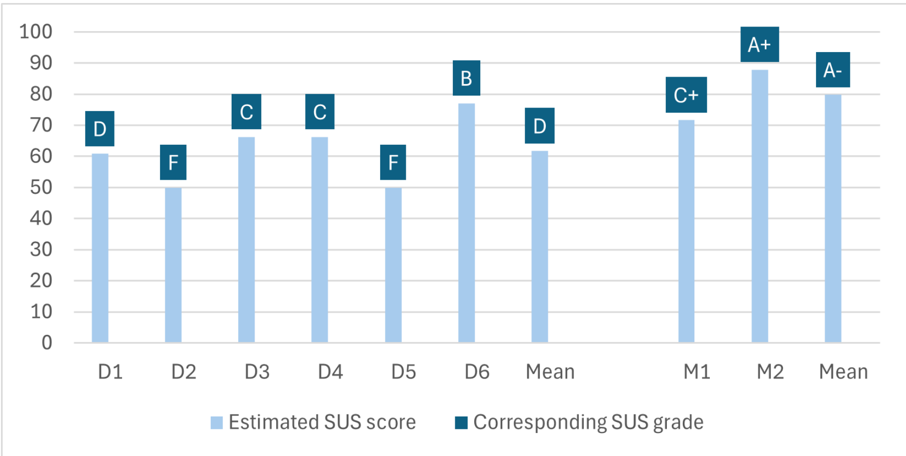

Figure 5.7: Estimated SUS scores from UMUX-Lite.

ipants rated the off-board component more positively overall, with mean values of 6 for usability and 6.5 for ease of use. This suggests that the concept was generally perceived as relatively easy to use, and that it may have been seen as particularly valuable from a managerial perspective.

Fig. 5.7 shows the estimated SUS scores and corresponding grades for both driver participants and manager participants. The mean estimated SUS score for the drivers was 61.72, corresponding to grade D, which according to Sauro [89] can be interpreted as *OK* on the adjective scale and *marginal* on the acceptance scale (see Table 5.1). In contrast, the mean estimated SUS score for the managers was 79.78, corresponding to grade A-, which can be interpreted as *good*, close to *excellent* on the adjective scale and *acceptable* on the acceptance scale (see Table 5.1) [89], [90].

Driver ratings also showed greater variation, ranging from grade F to B, while manager ratings ranged from C+ to A+, suggesting a more consistently positive assessment of the manager-facing component, although the findings should be interpreted with caution given the small sample size. This indicates that, in this iteration, the driver component still leaves room for improvement, while the fleet manager part appears to better meet user needs and ease of use expectations.

These quantitative results provide only part of the evaluation analysis. To gain a broader understanding of users' actual experiences with the prototype, the qualitative analysis of the user interviews is presented next.

5.5.5 Thematic Analysis of Prototype Evaluation Interviews

The interviews were examined using the same approach described in Section 5.1.3, applying reflexive thematic analysis in accordance with the procedure outlined by Ahmed et al. [75]. Our interpretation was likely shaped by insights and decisions from earlier stages of the Double Diamond process, such as Sections 5.1.3 and 5.3.2, which likely influenced how we attended to, coded, and grouped the prototype interview data into themes.

The analysis was based on several data sources: transcripts from drivers' post-drive interviews, transcripts from drivers' and managers' post-conversation interviews, the think-aloud transcript from participant D6, and system logs and observation notes from the on-road testing. For participants who spoke Swedish, all quoted material has been translated into English; the original Swedish quotations are provided in Appendix H.

The analysis resulted in the following themes:

- The fine line between a motivating, accepted system and a rejected, turned-off one.
- Individual factors and differing preferences call for high customisability and personalisation.
- Flow control as a trade-off between autonomy, interruption, attention, and timing.
- Balancing context-awareness and privacy to build a fair and motivating experience.

These four themes are presented in more detail in the following sections.

5.5.5.1 The Fine Line Between a Motivating, Accepted System and a Rejected, Turned-Off One

The coaching system's ability to sense context, identify driving events correctly, and deliver feedback at the right moment shaped whether drivers experienced it as motivating and useful or as confusing and ultimately rejectable. Every mismatch or successful match seemed to move the system closer to one side of this line. When the coaching felt accurate, timely, and grounded in the actual driving situation, it was appreciated and could strengthen both motivation and attention to improve eco-driving. But when the system misread the situation, used the wrong timing, or seemed to comment on something that had not happened, trust quickly decreased and the system moved toward rejection, including the possibility of being turned off entirely.

This implies a very narrow design space in which each coaching event can either reinforce acceptance or push the system toward rejection. The difference between the two is small, and balancing on this line to achieve the continuous use needed for eco-driving coaching to have its intended effect is challenging.

A central issue was that the coaching sometimes did not match how drivers understood their own driving, or what they knew about eco-driving. When that happened, the feedback did not simply become less useful, it pulled the system further toward confusion, reduced respect, and potential rejection:

> D6: "Because if it's wrong, you'll just get annoyed, and then you'll feel that you don't ehm care, I was going to say, but because this is a bit of what's important with diesel and BEV [battery electric vehicle] and this that, for example with speed, it's not always negative to brake with electric because you get something back, you don't get that with diesel. So it needs to be the right information that comes, otherwise you'll get tired of it."

Observation notes from the tests with D1 and D6 showed several examples where the coaching felt technically wrong or poorly aligned with the situation:

- Lower speed downhill coaching felt incorrect, because the driver was only rolling and not using energy.
- Small inaccuracies mattered, such as not recognizing whether a curve was actually present.
- Roundabout coaching on a rural road was poorly timed and felt wrong.
- Coaching about downhill driving was triggered when the driver was not actually in a downhill context, which made the system seem unready and unreliable.

D1 further described the system as jumping around too much in time and context, and that the feedback was inaccurate:

> D1: "[...] it feels like he [the eco-driving coach] jumps around a lot. Eh, suddenly he is here and now, and then suddenly he is three or four intersections back. [...] it felt very much like, sort of, jumping back and forth, and in the end you didn't know where you were anymore."

> D1: "[...] as before during the trip, you felt that some things just became question marks rather than a helping hand, because for example, 'take it easier in the roundabout', we hadn't driven through any roundabout or anything like that. Or the downhill bit when we were accelerating, then he said 'that was well rolled', even though we throttled, and that is bad, basically. So it became more confusion, a bit more in that direction I felt, in that case."

D3 also suggested that feedback should be more tied to the current driving situation and less spread across other contexts:

> D3: “[...] less city or the other situations feedbacks, and maybe more feedbacks of the current driving, you know like when eh, it’s good to have some reminders when you are driving the motorway, but perhaps it’s a little bit more useful when you, if you have like feedbacks for the motorway-driving, yeah.”

D5 showed that even when you view the proposed concept in a positive manner, disagreement with the feedback reduced its credibility:

> D5: “But I didn’t often agree with what it said. Eh, I did a bit of kickdown sometimes just to see what answer I would get, and then I still got praise, so I’m positive about it [the concept], but I didn’t agree with her, so to speak.”

In contrast, when the coaching aligned with the driver’s actions and the actual driving context, it moved the system toward the accepted side of the line and was experienced much more positively. Drivers described it as more updated, and like a collaboration between driver and truck:

> D6: “[...] yeah, because I think it gives more positive feedback than what exists today, and that it feels more eh, ah, but live and updated, like it is actually a, it’s me and the truck actually doing something together. Or I do it, but the truck praises me for doing it.”

D6 further described a motivational effect when the praise was correct and tied to actual driving behaviour:

> D6: “[...] very good [effect on motivation] when it was right and when I felt like, ‘ah, but now you drove well in the roundabout’, ah, but I actually did that, then I felt, nice, then I’ll test the next roundabout too.”

Some participants wanted the coach to show what their eco-driving actually saved, preferably through concrete statistics and real-time numbers. This mattered not only for understanding whether they were doing something beneficial, but also for keeping the feedback credible enough to possibly sustain acceptance and motivation.

D6 suggested that the coach could be linked to energy consumption, for example regeneration in battery electric vehicles, and show that the driver is making a difference by indicating how much energy was saved through eco-driving strategies. More broadly, participants wanted feedback that helped them understand if they were on track to achieve something meaningful, whether that meant actual energy savings or progress toward a better score in the current system.

The prototype was appreciated compared with previous systems because it could vary its messages and give positive feedback, not only predefined negative warnings. At the same time, drivers were sensitive to whether praise felt sincere. If the system praised them without clear basis, the praise could feel fake or overly flattering, which could move the system toward rejection rather than acceptance.

This suggests that the coach should adapt its tone to the driver's actual performance. Some drivers even indicated that a firmer tone might be more engaging and motivating, especially if it made them want to prove the coach wrong:

> D5: "So if she [the eco-driving coach] had been a bit harder on me, I would have just, ah, now I'll have to show that I can do better [...]"

> D1: "I think it [the eco-driving coach] was almost a bit too nice (hehe). I wanted it to be a bit more straight to the point and a bit harder, just like 'good, but you didn't do this well' [...] I like it when it gets straight to the point, so, a serious tone. This one feels like, 'good', 'very good', like a bit too positive almost [...] it would actually have been kind of fun, in a way, if when you drive very well it is very kind in tone and then when you drive badly you get a serious tone [...]"

The implication of this theme is that drivers want coaching that stays on the accepted and motivating side of the line by being non-repetitive, matching the actual driving situation and performance level, and incorporating concrete energy-saving data examples. For feedback to be experienced as sincere and engaging, it should also adapt its tone of voice and provide both positive and negative feedback in a balanced way. When these conditions are met, the system may support motivation and attention to improve eco-driving. When they are not, it risks causing confusion, reduced trust, and possible rejection.

5.5.5.2 Individual Factors and Differing Preferences Call for High Customisability and Personalisation

This theme captures how drivers do not respond to an in-vehicle coaching system in the same way. Instead, they described different preferences for how the system should appear, behave, and adapt to them.

Some drivers preferred voice because it helped them keep their eyes on the road, while others preferred text or notifications because voice was seen as adding to an already noisy cabin environment and potentially becoming irritating or distracting:

> D3: "There's a lot of stuff to pay attention in the cluster so probably the voice one would be a good option."

> D5: "Eh, positive [to get feedback from a voice-based system] because then I don't have to, I mean if I get the feedback here in [points to the SID] it's not good to sit and read it while driving, maybe [...]"

> D4: "I wouldn't like it. Hm. Better that it comes up as a small pop-up in the IC then. Eh, because this becomes a sort of soft mute together with everything else that beeps in the truck, so then it becomes so many distractions overall [...] So it can become an irritation in the end, which might make you want to just turn it off instead. I'm afraid."

> D2: “It feels like it was probably a bit too much to have it in voice form specifically. There’s so much else that beeps in here, so it could be, eh, an extra thing that I think some people might get annoyed by.”

What became apparent was that drivers differed in what they considered distracting. Some wanted the option to use either modality or both depending on the situation, suggesting that flexibility is needed to accommodate these preferences.

The same pattern of split preferences appeared in relation to flow control mechanisms. Some wanted the system to speak automatically, while others valued the user-initiative approach because it gave them full control over when feedback appeared:

> D4: “But it’s good to be able to choose whether you want to hear them or not by pressing this button then.”

> D2: “Yeah, but it was better, ehm. Eh, in a way that you get it when you want it. [...] I would almost rather have it so that you turn it on and then it is on and you get tips, and then you can turn it off and then you get no tips at all, so then they come if you have approved and turned it on.”

> D6: “I like that you choose, I also said that I would have liked it if you could choose for it to be like, ehm, what’s it called, that it comes automatically, that is, speaks without you needing to press, as one option, or if I just want it to come as a notification, or that I want to be able to turn it off completely then.”

This suggests that flow control should be configurable according to individual preference.

Another important aspect lies in adaptation to the individual driver, vehicle, and context. This was already highlighted in the themes from the first Discover phase (Section 5.1.3), which indicated that eco-driving coaching should be designed from the realities of professional driving rather than as a one-size-fits-all solution. Comments from the prototype evaluation further suggest that eco-driving coaching should not be static, since appropriate feedback depends on the driver’s current mission, priorities, driving style, expertise, competitiveness, and powertrain.

Because the solution already uses applied AI and LLMs, there is an opportunity to let the system learn from the user over time, as highlighted by Cui et al. [29]. With the required technological framework in place, drivers could potentially teach the coach what they prefer, what kind of feedback they find useful, and how much support they want. This could include remembering their driving style, improvement areas, and how much intervention they want.

At the same time, this raises a question about tolerance. If the system needs time to adapt, will drivers accept a period where the coaching is not yet well tuned to them? The previous theme suggests that early mismatches may only be tolerated for a limited time, so a learning-by-doing approach may need to be combined with some degree of user controlled tuning from the start.

Overall, this theme points to the need for strong user configurability and personalisation. Together with the previous theme, which also highlights the need for an adaptive system, a useful and motivating eco-driving coaching system should let drivers choose modality, timing, and tone, while also adapting over time to their driving style and preferences.

5.5.5.3 Flow Control as a Trade-Off Between Autonomy, Interruption, Attention, and Timing

The user-initiative flow control mechanism that the prototype implemented fit moments when the driver was busy with other tasks, because it allowed them to postpone interaction until they had attention available. At the same time, as mentioned above, the drivers were not unanimous in preferring this approach. Their comments show that flow control is a trade-off: giving the driver control can reduce interruption, but it can also introduce friction, new attention demands, and timing problems.

During the test, there were clear moments when drivers chose not to request coaching immediately upon spotting the notification, because they were occupied with something else. That behaviour was actually well aligned with the intended purpose of the prototype. For example, D4 commented: “Just take some corners before pressing the button here”, and D5 was observed not to activate coaching while in a phone call.

This suggests that user-initiative can work well as a way of respecting the driver’s current task and letting them defer interaction with the eco-driving coach until the situation is safer or less demanding.

Although the drivers’ mean ease of use rating in the UMUX-Lite was relatively low (see Fig. 5.6), the interview accounts further suggest that the drivers generally perceived the tested interaction as simple and manageable:

> D5: “[...] it was just a click, basically, and yeah, it really wasn’t any more difficult than that, I think.”

> D2: “[...] yeah with the way it is now is still fairly easy, ehm. There are no advanced things that need to be done while driving.”

This supports the idea that, at a basic level, user-initiative through button clicks can be a low-complexity way of controlling when voice coaching is delivered.

However, even though the interaction was seen as easy, several drivers also pointed out that needing to notice a notification and then press a button on a secondary information display (SID) could itself become distracting:

> D4: “But at the same time, it becomes a distraction from driving when you have to press something to decide that you want to hear it.”

> D2: “But also that all the time, I mean if we say it had been on this screen [points to the SID] and it comes up, then you have to keep pressing to get it. Because, I think many drivers can be like that, that ‘ah now something came up’, and then you focus more on it.”

In other words, the very mechanism meant to reduce unsolicited interruption and distraction may still draw attention away from the road and introduce cognitive load, depending on the medium chosen to handle the activation.

Another key challenge with user-initiative is that the system no longer controls when feedback is delivered, which makes timing and contextual alignment harder to maintain. If the driver requests coaching after the relevant driving event has already passed, the system may end up commenting on a situation that is no longer current, or on one that is less relevant than the one the driver is facing at that moment. This can make the feedback feel delayed, disconnected, or focused on something that happened several turns earlier. As discussed in *The fine line between a motivating, accepted system and a rejected, turned-off one*, this kind of misalignment can reduce trust and motivation, and in a user-initiated setup the risk may be even more pronounced because the moment of feedback is controlled by the driver rather than the system.

In short, a user-initiative approach gives the driver control and can reduce unwanted interruptions, but may cause delay, missed timing, and new attentional demands.

5.5.5.4 Balancing Context-Awareness and Privacy to Build a Fair and Motivating Experience

Due to previous negative experiences with how driver data has been used, many drivers described a wariness toward systems that give managers extensive access to their driving data. Their scepticism is not primarily about feedback itself, but about how data can be interpreted and used within unequal workplace relationships. Present monitoring practices were connected to earlier experiences of managerial authority:

> D6: "I mean, I started driving when I was nineteen, and I didn't dare say anything to my boss. If he said I was going to work twelve hours on a Saturday, then that was just how it was. If he told me to do something, I was told, 'don't brake, it wears out the brakes, just roll, like, what are you thinking?', okay, then that's what you did. I mean, you get shaped by that, and you are afraid [...]"

This suggests that monitoring technologies risk being understood not as supportive tools, but as extensions of a workplace structure in which the driver is expected to comply rather than be heard. Aligning with findings in the first Discover phase (Section 5.1.3), a central concern was that current systems are experienced as unfair because they do not adequately capture driving context. Drivers emphasized that feedback becomes problematic when it ignores the situational reasons behind specific manoeuvrers. This is especially evident in traffic situations where a driver must prioritize safety, or when the systems in the vehicle itself (ADAS for example) contributes to the event being measured:

> D6: "[...]. I know, uh, there can be traffic situations where I need to do something that isn't good, and then I shouldn't, like, get told, ehm, 'think about not doing that' no, I know, but I had to, because a tractor

> pulled out here and I didn't want to crash, like."

> D1: "[...] I only used the retarder and got feedback saying that I braked too hard (hehe), so it felt like I got criticised for something that wasn't really completely accurate."

Together, these examples show that drivers do not reject eco-driving coaching as such. Rather, they object to feedback that appears inaccurate or disconnected from what actually happened. This was also reflected in how one driver described Volvo's current eco-driving coaching (DECO) as a system that rigidly penalizes behaviour without accounting for surrounding circumstances:

> D6: "And the DECO today is very, like I said, rigid, and basically just slaps you on the fingers as soon as you do something it considers you shouldn't do, if you want to get high scores."

Participants described monitoring systems with some ambivalence, acknowledging that it may provide useful insight while still feeling intrusive. It was pointed out that because drivers operate under very different conditions, monitoring may be beneficial in some situations, but unfair in others. The same metric may therefore not be equally meaningful across routes, loads, vehicles, and driving environments:

> D6: "So this, there are a lot of people for whom this [fleet view of the app prototype] is very, very good, because it can also be used as a basis for pay, but there can also be extreme unfairness depending on what kinds of routes you have, what vehicle you have, uh, what load you have, and so on."

> D5: "Like when I worked in Norway painting road lines, I probably would never have used it, because that kind of driving wasn't really relevant for it, since there were trucks that had the engine on all the time, and well. Or when I drove a concrete truck there, no, but for, like, general cargo and long-distance driving, I probably would have been a big fan of it."

> D3: "[How does it feel that your "manager" can see summaries of your driving?] [...] I don't know can be used as a, depending on how the feedback comes from the manager can be, one can feel either ehm pressed or even harassed sometimes. Or it could be an opportunity for having explain yourself or getting good feedback, yeah and discuss why this or that needs to be improved."

> D2: "It [the conversation] is probably 50/50 [for the manager's or the driver's sake], both in that you find out what you did well and what you could have done better. And that the manager can see that the employee did their job properly."

This ambivalence is important: drivers could see possible benefits in monitoring, but once data became visible to management it entered a relationship already shaped by authority, pressure, and limited trust.

This concern was reinforced by how drivers described the broader communicative culture of the industry. Matching the comments in the first Discover phase (Section 5.1.3), several accounts in the prototype evaluation also suggested that managers were perceived as focusing primarily on costs, mistakes, and deviations, while positive feedback was rare. In such a context, monitoring systems are easily understood as tools for fault-finding rather than support:

> D1: "[...] there's no one in the whole haulage industry who says, damn, that was well driven, damn, great job, no, no one says that. If you do your job and handle things properly, it's just silence, and if you drive really damn badly, then you get told off (hehe). So, that's the only thing that happens."

This helps explain why visibility to management could feel psychologically burdensome rather than supportive:

> D1: "[...] when the manager can see it, I think it becomes psychologically stressful too. Then it's like, maybe you're already stressed on the way to a customer, and then the manager sees that you've been driving really badly and you get criticised for that as well, so you've already had a damn shitty day and then the manager complains that you drove really badly, so yeah."

> D2: "[...] as a driver, it maybe doesn't feel that great that the manager can see how you're driving, if you've had a stressful or difficult day."

This tension also became visible in responses to the prototype. Although the system was intended to support driver feedback and encouragement, some interface choices resulted in an immediate focus on problems. In particular, polarised driving events and colour coding drew attention to undesirable outcomes first:

> M2: "[...] the first thing I saw was these red numbers when I went in, and that made me, like, feel that I maybe became a bit questioning about why we have these, uh, violations then, or these aggressive behaviours. You want your drivers to be the best in the world."

> M1: "Yeah, well, I suppose that a system like that is meant to tell me and, like, help me and guide the drivers to become better and safer drivers and maybe more energy-efficient. And then we do that with systems, because it tells you how much brakes and how much- It also tells you what is good, and maybe that's something you should bring up with the people driving too. I didn't do that though, because I went straight to the negative."

These responses suggest that even a system containing balanced information can reproduce a surveillance logic if its visual hierarchy foregrounds negative performance cues. What managers notice first may shape how the whole system is used and how follow-up conversations with drivers are framed.

At the same time, the findings do not suggest that manager-driver check-ins should be removed. Rather, they suggest that such conversations need to be reframed so that they are not only triggered by problems, but can also support mutual understanding and recognition.

A central priority is therefore that fleet management systems must be more context-aware. Both drivers and managers wanted more contextual grounding around driving events, particularly to distinguish unavoidable situations and external factors from actual driver mistakes. For drivers, this was important to avoid unfair feedback and the repeated burden of having to defend themselves:

> D6: "I've myself been at haulage companies where you got called and given verbal warnings because you had a hard braking event, and you're like, 'but I had to, otherwise I would have crashed your vehicle instead'."

> D1: "But it feels like the whole truth wasn't really there either, why it was the way it was [...] That you could have been given a reason why I made that kind of acceleration there, or why I maybe did a hard braking."

> D1: "You feel that, well, you don't want to have to defend yourself every time [...]. Then it becomes a defence mechanism every day, why I did this, why I did that, then you almost have to explain yourself every day."

Those who had the manager-role expressed a similar need, to support fairer and more meaningful follow-up conversations:

> M1: "It all depends on how you approach it [the manager-driver discussion]. If you handle it well instead of coming in and controlling everything with a heavy hand, then I think it goes wrong. You need to try to open up the discussion, talk- not make it a monologue, but have a discussion with the driver. There may be other reasons why he drove the way he did."

> M2: "What I would have liked to add in that case is a dash-cam, so you can also see what is happening. [...] what caused it. Is it the traffic in [city], or is it like him himself."

Together, these accounts suggest that contextual data should not be seen only as protection for drivers, but as a shared resource for fairer interpretation and better dialogue.

Finally, D1 emphasized a preference for a distinction between data access by suggesting that drivers should have full access to their own detailed driving data, while managers should receive only limited, summarized views:

> D1: "But for yourself, then you can set it every day, you can see it every day, and like your percentage- potential improvement and do this and that. And then there's a final summary, and then the manager gets to see it. So it's once a month that the manager sees it, but you always see the whole process, no one else sees it except you yourself."

All in all, these findings suggest that the key issue is not simply whether driving data should be collected, but how it is contextualised, visualised, distributed, and used in practice. A driver coaching system that aims to be accepted therefore needs to make driving events interpretable in context, support balanced and fair check-ins, and carefully consider how managerial oversight is enacted through the interface.

6

Results

Through an interaction design process, this thesis explored the challenges and opportunities of designing eco-driving support for professional truck drivers. The prototype produced by following the design process consisted of two connected parts: an on-board component for LLM-powered, user-initiated, voice-based driver coaching implemented through a Wizard-of-Oz setup, and an off-board component for fleet managers, presenting driving data, contextual information, and LLM-generated meeting topics to support organisational recognition and fairer follow-ups between managers and drivers.

The sections below present the findings that answer the research question: *What can an interaction design lens reveal about the challenges and opportunities of designing eco-driving support for professional truck drivers?*

These findings are based on the entire design process, including the literature review, benchmarking, user interviews with drivers and managers, and the prototype evaluation outcomes.

6.1 Organisational Conditions Shape How Eco-Driving Support Is Experienced

An interaction design perspective highlighted a central challenge: eco-driving support for professional truck drivers is introduced into an organisational context already shaped by time pressure, competing demands, psychological strain, power asymmetries between managers and drivers, and an efficiency-first logic. In such a setting, eco-driving systems risk being understood not as driver support, but as tools for surveillance or compliance, especially when drivers have previously encountered negative uses of their data.

This context can also help explain why fleet management systems appear to reduce complex, situational driving to simplified scores, colour codes, and thresholds. For busy managers, these representations might offer quick overviews and make follow-up easier. However, our findings suggest that they can also strip away situational context and reproduce a fault-finding logic by drawing attention primarily to negative events. In this way, interface design does not simply present performance data, but shapes how managerial attention and organisational follow-up are directed.

Although, the findings revealed a clear opportunity: drivers expressed a strong need for recognition, encouragement, and motivation from their organisation to sustain eco-driving behaviours. Both the interviews and prior literature suggest that eco-driving is unlikely to be supported effectively by technology alone. Organisational reinforcement, especially through interpersonal follow-up and appreciation, appears to be an important condition for maintaining motivation [45], [46], [47].

This need is made more significant by what appeared to be a communication gap between drivers and managers, found through the interviews. Drivers described mistakes as often receiving attention, while good performance often go unnoticed. Managers, in turn, described communication as difficult to maintain. Together, these findings suggest that the challenge is not only how eco-driving data is collected or visualised, but how it becomes part of everyday organisational relationships and communication.

Overall, the theme shows that eco-driving support is embedded in workplace structures and power relations that shape whether data is experienced as supportive or controlling. It also points to a design opportunity: systems should not only monitor performance, but also help create conditions for recognition, motivation, and constructive human follow-up.

6.2 One-Size-Fits-All Eco-Driving Support is Inadequate in Diverse Driving Contexts

An important finding from this design process is the disadvantages of treating eco-driving coaching as a one-size-fits-all solution. Both literature and empirical material show substantial variation among drivers, managers, vehicles, and operating contexts. For drivers, this variation includes emotional state, fatigue, stress, driving experience, eco-driving proficiency, mission type, time pressure, road conditions, weather, vehicle configuration, powertrain, load, and personal priorities such as safety, efficiency, or speed [26], [52]. Our prototype evaluation could also reveal that drivers differed in what they considered distracting, how much control they wanted, which modality they preferred, and how much trust they placed in technology and data collection. For managers, relevant differences included fleet size, available time, geographical proximity to drivers, and whether they themselves have worked as truck drivers.

These differences shape whether eco-driving support and its feedback, interaction style, and modality fit the intended user and context, and thereby whether the system is experienced as fair and used in ways that can effectively influence eco-driving behaviour. This was illustrated by P4: “[...] it [the eco-driving coach] isn’t always fair. [...] It is more suited to, like I keep coming back to, but driving on rural roads and driving in the forest are two completely different things.”

The findings therefore point to a major challenge in designing eco-driving support that can accommodate diverse users and situations. At the same time, they also reveal an opportunity in providing adaptive and context-aware support that can be configured to individual users and contexts.

However, the findings also identify a tension in this opportunity. Greater adaptation and context-awareness would require more extensive data collection, sensing, and monitoring [22], [24], [44], which some drivers perceived as intrusive, especially when they lacked control over the data or when the primary beneficiary of the data collection appeared to be management rather than the driver.

6.3 Eco-Driving Feedback Must Balance Tone, Explainability, Timing, and Flow Control

Across the design process, a consistent finding was that eco-driving feedback must address several cross-cutting interaction constraints related to: evaluative tone, explainability, attentional demand, timing, and flow control.

A recurring issue, echoing the finding in Section 6.1, was that the lack of appreciation evident in organisational and interpersonal feedback was also present in eco-driving support systems themselves. Many existing coaching systems were experienced as focusing too heavily on negative driving events, leaving drivers wanting more positive feedback alongside suggestions for improvement, in line with Young et al.'s [11] findings. This points to an opportunity to design systems with a more balanced evaluative tone.

However, balance alone appears insufficient. Both positive and negative feedback need to be clearly grounded in actual driving performance to be perceived as genuine, fair, and motivating. Consistent with earlier research, drivers were sensitive to whether praise and criticism felt deserved [14], [44]. Feedback lacking a clear basis risked being seen as fake or unfair, which could undermine trust and lead to rejection. At the same time, the prototype evaluation, together with prior literature, suggests an opportunity in adaptive tone of voice, where some drivers may respond positively to feedback that adjusts its tone in relation to actual performance [33], [50], [51].

Explainability and transparency further appeared to strengthen perceptions of feedback as genuine. In both interviews and prior literature, current driver-coaching systems were criticised for opaque scoring and limited explainability [22], [49]. Drivers wanted transparency to assess fairness and accuracy, while managers needed it to evaluate driver performance fairly.

Both interviews and literature also highlighted the value of making the personal benefits of eco-driving explicit. Feedback that includes concrete outcomes such as energy savings, regeneration, emissions reduction, or progress toward a goal could possibly make improvement visible and meaningful [33].

However, the design process findings can reveal a tension connected to explainability. For fleet managers, time constraints can make lengthy performance explanations impractical, while for drivers the challenge lies primarily in the limited cognitive resources available during driving [26], [35]. This suggests that although explainability is important, it must be delivered in ways that remain manageable within the practical and cognitive constraints of use.

The timing of feedback also affects whether it is attended to, understood, and trusted, creating a clear tension in flow control design. The prototype used user-initiated flow control, which supported driver agency and allowed adaptation to varying attentional capacity [14], but at the cost of occasional delayed feedback. Both the evaluation and prior work indicate that real-time feedback is generally more effective than delayed feedback in eco-driving contexts [26], [43], since feedback delivered after a driving event may feel less timely and less clearly connected to the situation, potentially reducing understanding and trust.

6.4 User Acceptance Functions as the Final Filter for Eco-Driving Support

Across the opportunities and challenges presented above, user acceptance emerges as the overarching design challenge that ultimately determines whether an eco-driving system succeeds or fails, confirming prior literature that emphasises the central role of user acceptance in system success [53], [54].

Reaching user acceptance appears particularly challenging in the present context of eco-driving support that aims to influence truck drivers' behaviour. Literature and design process findings align in indicating that such systems enter a safety-critical and emotionally charged domain shaped by strong professional identity and judgment, and ingrained driving habits [12], [25]. Combined with the risk of such systems being rejected due to being perceived as intrusive on autonomy and agency [21], [55], this suggests a design space that is highly sensitive in terms of how user acceptance may be achieved and rejection avoided. The prototype evaluation findings further illustrate that, in such a sensitive design space, even relatively minor interaction flaws or mismatches between user expectations and actual system behaviour can undermine acceptance.

In short, acceptance functions as a final filter through which all other aspects of eco-driving support are judged, and achieving acceptance in the context of influencing truck drivers' behaviour appears inherently challenging.

7

Discussion

This chapter discusses the findings through an interaction design lens and considers their implications for the future design and development of eco-driving support for professional truck drivers. It begins with the design and engineering implications derived from the results, then reflects on the design process and industry setting, and finally outlines limitations and future work.

The discussion builds on the four main findings from Chapter 6: that organisational conditions shape how eco-driving support is experienced, that one-size-fits-all eco-driving support is inadequate in diverse driving contexts, that eco-driving feedback must balance tone, explainability, timing, and flow control, and that user acceptance functions as the final filter for eco-driving support.

7.1 Design and Engineering Implications

A central implication of the findings is that eco-driving support for professional truck drivers should be understood as a socio-technical and organisational design problem rather than only an interface problem. Regardless of the chosen modality, feedback type, or interaction style, such systems are introduced into existing organisational conditions and social practices that shape how they are interpreted and used. This means that even well-intended systems can be experienced as instruments of monitoring, fault-finding, or compliance rather than as support. Designers and engineers should therefore consider not only interface design, but also the organisational context and social practices into which the system is deployed, including how the systems they introduce may reinforce unequal workplace dynamics, intensify pressure on drivers, or normalise particular organisational cultures through their design and use.

The findings further suggest that eco-driving support should be designed to enable constructive interaction between drivers and managers, rather than reinforce existing practices of blame and fault-finding. A key opportunity lies in designing systems that help create conditions for positive reinforcement, appreciation, and recognition, both through organisational follow-up and through the feedback provided by the system itself.

Another implication is that eco-driving coaching should not be designed as a one-size-fits-all solution. The variation identified across drivers, managers, vehicles, and operating contexts points to the need for configurability, adaptation, and context-awareness. However, this design direction also introduces tension, since greater adaptation typically requires more data collection, sensing, and monitoring, which may threaten perceptions of privacy, agency, and trust.

At the interaction level, feedback should be grounded in actual performance and context, as poorly timed, decontextualised, or undeserved feedback risks being perceived as unfair and unhelpful. Eco-driving systems should therefore not only flag negative events, but also recognise good performance and make the personal benefits of eco-driving more explicit. Explainability is also important, but should be calibrated to practical and cognitive constraints. Prior work suggests that this may be addressed through brief micro-explanations in the moment and more detailed follow-up when conditions allow [33], [35]. Similarly, the value of user-initiated interaction depends on whether it supports agency without imposing excessive attentional demand or weakening the timing of feedback.

Finally, the findings indicate that user acceptance is the primary success condition for eco-driving support in this domain. Because acceptance appears fragile, systems should be designed to support rather than challenge the driver's professional authority and judgement. If a system fails to align with users' expectations, autonomy, and sense of competence, it risks rejection regardless of its intended benefits.

7.2 Reflections on the Process and Industry Context

Conducting this thesis in collaboration with Volvo Group TTI strengthened the industrial relevance of the work and provided access to an ongoing exploration of future eco-driving support. At the same time, it also introduced tensions that are important to acknowledge. Although the thesis aimed to take a user-centred interaction design approach, the project began with a relatively clear product direction in the form of voice-based, LLM-enabled coaching. This direction had largely been formulated on the basis of technological possibilities rather than grounded user needs. As a result, the work may have been shaped by assumptions established early in the process.

At the same time, one possible contribution of the design process was precisely to question and refine those assumptions. Through user research, prototyping, and evaluation, the work shifted attention from what these technologies could potentially enable to questions of what users actually need, what problem should be solved, and for whom such a system should be designed. In this sense, the interaction design process functioned not only as a means of developing a concept, but also as a way of critically examining the rationale behind it.

7.2.1 Stakeholder Asymmetry

One issue concerns the possible asymmetry between the customer and the end user. The interviews suggest that eco-driving and fleet management systems are generally purchased by fleet managers or transport companies, while drivers are the ones expected to live with these systems in everyday work. This creates a potential tension between designing for the needs of the paying customer and designing for the needs of the people who actually use the system in practice.

From this perspective, a critical question is who current solutions are primarily intended to serve. If the ambition is to create fair and effective eco-driving support for drivers, this may at times conflict with managerial interests in oversight, benchmarking, and control. This foregrounds the issue of stakeholder asymmetry and raises the question of how designers and engineers can negotiate between competing stakeholder interests without losing sight of the driver as the end user.

7.2.2 The Prototype as a Probe

When reflecting on the design process as a way of generating design knowledge in the domain of eco-driving support, the prototype ultimately served less as a validation of LLM-powered, voice-based coaching as a future design direction and more as a probe for eliciting reflection. It surfaced participants' needs, concerns, and experiences with existing solutions, while also making visible the broader current and historical context in which such systems are encountered and interpreted.

The prototype's level of fidelity also shaped the kind of knowledge the evaluation generated. Because the system relied on Wizard-of-Oz input rather than real truck sensor data, mismatches sometimes occurred between the driving situation and the system's interpretation of it. While this limited the prototype's realism, it also made visible how drivers responded when the system failed to align with their lived experience of the situation. In this way, the evaluation helped reveal how sensitive acceptance was to inaccuracies in timing, event detection, and contextual fit. In addition, the relatively unfinished, mid-fidelity character of the user interface may have made participants more willing to provide open and critical feedback, as the concept was likely perceived as exploratory and still open to revision.

As such, the process did not provide strong claims about how applied AI can realise its potential in this use context. Instead, it contributes more general insights into the conditions and tensions that future eco-driving support, regardless of technological implementation, should take into account.

7.2.3 Promises and Risks of AI

The potential of AI and LLMs should be considered critically in relation to how such technologies fit within the context of eco-driving support. Although this thesis did not evaluate system-level properties such as energy consumption, the likely wider environmental cost of cloud-hosted AI systems, including training, storage, data centres, electricity use, hardware production, and global infrastructure, remains relevant. Any integration of AI or LLMs into eco-driving support therefore needs to be weighed against the resources such technologies themselves require, particularly when the stated purpose of the system is to contribute to more sustainable transport.

Another concern relates to bias and opacity in third-party AI models. Because such models are often trained on large datasets that are not fully transparent, they may reproduce social biases that are difficult to detect or control. One example relevant to this thesis is that truck driving has historically been associated with masculine norms and identities [10]. As a result, an AI system prompted with the term “truck driver” may be more likely to reproduce associations linked to men and masculinity. Given that female drivers in our user research described experiences of sexism and discrimination in their work, there is a risk that AI-enabled systems may unintentionally reproduce similar patterns if these issues are not explicitly addressed in design and development. This underlines the need for critical awareness of how AI is integrated into systems intended to be fair, supportive, and inclusive.

7.3 Limitations

This thesis should be understood in light of several limitations related to scope, study context, participants, and the prototype used in the evaluation.

7.3.1 Temporal Scope and Study Scale

The study focused on short-term interaction and participants’ immediate responses to eco-driving support. It did not examine long-term behavioural change, learning effects, or sustained impacts on fuel efficiency. Consequently, it remains unclear how driving practices might evolve through prolonged real-world use.

The study was also limited in scale and context. It did not constitute a large-scale investigation, nor did it include cross-cultural comparison. This is important because Volvo operates globally and road transport is an international industry, meaning that aspects such as perceptions of support systems, driving practices and technology literacy may vary across countries and contexts. The findings should therefore be understood in relation to the specific users and setting studied.

A further limitation concerns participant selection in the prototype evaluation. The drivers involved were internal Volvo test drivers rather than members of the intended target group of commercial truck drivers. This may have influenced the results in several ways. Test drivers might be more accustomed to new vehicle technologies, more familiar with structured testing situations, and possibly more aware of human-machine interaction concepts such as cognitive load and contextual influences than typical end users. Similarly, the participants who acted as fleet managers were not actual fleet managers, which limits the validity of findings related to that role.

7.3.2 Evaluation Conditions and Real-World Complexity

The evaluation setting also introduced constraints. Some drivers were simultaneously involved in other test activities during the same session, which may have affected attention, fatigue, or how they engaged with the prototype.

Another important limitation is that the task-, and operational demands in the study were not fully representative of actual road freight transport operations. The possible demands that were not captured in their full complexity included aspects such as time pressure, route constraints, delivery responsibilities and traffic variability. This limits how far the findings can be transferred to actual use contexts.

Similarly, the sound environment in the truck cabin may not either have been representative of real-world use. For example, few prototype evaluation participants interacted with the voice-system while simultaneously having to attend to other competing auditive tasks commonly present in trucking operations such as radio, navigation instructions, or phone calls. This likely made the voice feedback easier to perceive and follow than it would be in everyday driving. As a result, the study did not fully address how the coaching would work in combination with other auditory inputs, warning sounds, or integrated vehicle system feedback. The implications regarding voice-based systems should therefore be interpreted cautiously in terms of generalisability.

7.3.3 Wizard-of-Oz Influence

The evaluation relied partly on a Wizard-of-Oz setup, which meant that system behaviour was not fully automated. In this setup, the wizard's subjective judgement had substantial influence over what the system chose to coach on and how often coaching was available. Because the wizard was not a truck driver and had limited familiarity with truck driving practices, their judgements may not always have aligned with how professional drivers would interpret the situation. This may have affected the consistency of event detection and feedback timing which may have introduced variability and limited consistency across sessions. It also means that the evaluated experience may differ from how a future implemented system would behave if driven by stable and explicit logic. In addition, the results may have been influenced both by participants' attitudes toward the wizard and by how the testing was conducted, including how tasks were introduced, how the support was explained, and how participants' responses were followed up during the session.

Overall, these limitations mean that the findings should be interpreted as indicative rather than conclusive. They provide insight into how eco-driving support may be experienced in an early interaction design context, but they do not establish how such support would perform in large-scale, long-term, cross-cultural, or fully operational deployment.

7.4 Future Work

This thesis points to several directions for future design and research on eco-driving support in truck driving contexts.

7.4.1 Sensing Capabilities for Context-Awareness

The prototype developed in this thesis represents a first iteration for exploring interaction with LLM-powered eco-driving support. Future iterations should therefore examine how actual vehicle, driver, and environmental data can be incorporated to support more context-sensitive coaching. Such work could help explore whether richer sensing improves the relevance and perceived fairness of feedback. At the same time, future developments must carefully consider how increased sensing and data collection may affect drivers' privacy, autonomy, and trust.

7.4.2 Voice Interaction and Flow Control

Further research is needed to explore different forms of flow control in voice-based eco-driving support during truck driving. In particular, future work should examine whether and under what conditions voice interaction can reduce distraction while supporting motivation and awareness related to eco-driving. Open questions remain regarding how to balance timely and relevant feedback with the need to avoid intruding on the primary driving task and on drivers' sense of control.

7.4.3 Explainability and Transparency

The Wizard-of-Oz setup used in this first prototype iteration was limited in its ability to provide richer explanations of system recommendations. Future work should therefore investigate how explainability and transparency can be incorporated into AI-powered eco-driving support in ways that fit the attentional constraints of truck driving. This includes exploring how recommendations can be made understandable and trustworthy without overloading the driver.

7.4.4 Personalisation and User Control

Future research should also investigate how eco-driving support can be tailored to individual drivers' preferences and needs with respect to modality, timing, feedback content, and tone of voice. One possible direction is to explore adaptive tone of voice in greater detail, including whether firmer feedback in situations of poor eco-driving performance affects motivation and behaviour differently than more consistently supportive feedback. AI-enabled systems with memory mechanisms may also create opportunities for giving drivers greater control over how support is configured, which is another relevant direction for future work.

7.4.5 Longitudinal, Organisational, and Cross-Cultural Studies

Because this thesis is limited in both duration and sample, further research is needed to examine how organisational context shapes drivers' motivation and awareness in relation to eco-driving over time. In particular, the relationship between managers, drivers, feedback practices, and workplace conditions should be studied in real operational settings and over longer periods. Broader studies across different organisational and cultural contexts would also help strengthen understanding of how eco-driving support is shaped by the environments in which it is introduced.

8

Conclusion

Against ongoing efforts to improve energy efficiency in road transport and recent advances in applied AI, this thesis examined the interaction design constraints and opportunities involved in designing eco-driving support to encourage truck drivers towards more sustainable driving habits.

Adopting a user-centred interaction design perspective, it addressed limitations in existing solutions, many of which remain static, visually oriented, and insufficiently attuned to the realities of truck driving. Through an iterative design process, the thesis examined current experiences and conditions of use, identified central design requirements, and developed a prototype concept for LLM-powered, voice-based eco-driving support for both on-board and off-board contexts. The concept was subsequently evaluated with users to explore its perceived usability and to surface broader implications for future systems. In this way, the thesis addressed the following research question:

What can an interaction design lens reveal about the challenges and opportunities of designing eco-driving support for professional truck drivers?

The contributions of this thesis can be understood in terms of the following challenges and opportunities:

- Organisational conditions shape how eco-driving support is experienced. In workplaces marked by pressure, power asymmetries, and data-driven oversight, eco-driving support can be perceived as surveillance rather than help. At the same time, drivers expressed a need for more recognition and constructive human follow-up to maintain eco-driving behaviours.
- One-size-fits-all eco-driving support is inadequate in diverse driving contexts. Because professional truck driving varies across drivers, vehicles, routes, and situations, generic coaching is often insufficient. This points to a need for more adaptive support, while also raising concerns around data collection, trust, privacy, and control.
- Eco-driving feedback must balance tone, explainability, timing, and flow control. To gain the truck drivers' trust and increase motivation, feedback needs to feel fair, well grounded, and appropriately timed. Explainability and flow control are important, but must be balanced against attentional and practical

constraints.

- User acceptance functions as the final filter for eco-driving support. Regardless of technical capability, support that does not align with drivers' expectations, autonomy, and professional judgement is unlikely to succeed.

All in all, these findings show that eco-driving support should be understood primarily as a socio-technical design problem rather than only an interface problem. Although the prototype explored LLM-powered, voice-based support, the contribution should not be understood as a validation of AI or voice interaction as a definitive design direction. Instead, the interaction design process generated broader insight into how eco-driving support is perceived in professional driving contexts, as well as into the conditions, tensions, and design implications that future eco-driving support needs to consider, regardless of technological implementation.

However, this work has clear limitations, meaning that its findings should be understood as indicative rather than conclusive. The study was exploratory, limited in scale, and focused on short-term interaction rather than long-term use. The prototype evaluation relied on a Wizard-of-Oz setup and did not capture the full complexity of real freight operations. Future work could therefore build on this exploratory study through higher-fidelity development, richer sensing capabilities, and evaluations in real operational settings.

Future research should also investigate how the design of eco-driving support can balance the tensions identified in this thesis. These include tensions between context-aware and individually tailored feedback, on the one hand, and driver autonomy and privacy, on the other; between feedback modality and timing, and driver control and distraction; and between explainability and attentional constraints. In addition, further research should examine how such interaction design choices are shaped by and can be adapted to different organisational contexts and workplace dynamics over time and across cultural settings.

By highlighting both significant constraints and meaningful opportunities in the design of eco-driving support for professional truck drivers, this thesis showed that the domain is a complex one, but also one in which an interaction design perspective could make a difference. Importantly, the perspective applied in this thesis was a step toward bringing wider organisational practices into view, as part of the context that shapes how eco-driving support is experienced in use. It also raised the broader question of whether such systems should accommodate these practices or be designed to actively challenge and shift them. In this sense, interaction design can play a role in reshaping feedback, communication, and follow-up in ways that better support truck drivers' eco-driving awareness and motivation.

Bibliography

[1] International Energy Agency, “World Energy Outlook 2025,” en, International Energy Agency, Paris, Tech. Rep., 2025. [Online]. Available: https://iea.blob.core.windows.net/assets/81980a53-9716-47f1-904e-b92a2c4d2ea4/WorldEnergyOutlook2025.pdf.

[2] United Nations, “Paris Agreement,” United Nations, New York, NY, USA, UN Treaty Treaty No. XXVII-7-d, 2016. Accessed: Jan. 27, 2026. [Online]. Available: https://treaties.un.org/doc/Treaties/2016/02/20160215%2006-03%20PM/Ch_XXVII-7-d.pdf.

[3] United Nations, Department of Economic and Social Affairs - Sustainable Development, “Transforming our world: The 2030 Agenda for Sustainable Development,” en, United Nations, General Assembly A/RES/70/1, Oct. 2015. Accessed: Jan. 26, 2026. [Online]. Available: https://docs.un.org/en/A/RES/70/1.

[4] International Energy Agency, “Global EV Outlook 2025,” en, International Energy Agency, Paris, Tech. Rep., 2025. [Online]. Available: https://iea.blob.core.windows.net/assets/7ea38b60-3033-42a6-9589-71134f4229f4/GlobalEVOutlook2025.pdf.

[5] United Nations, *United Nations Global Compact: Corporate Sustainability in the World Economy*, Brochure, New York, NY, USA, 2014. Accessed: Jan. 26, 2026.

[6] Volvo Group, *External Initiatives and Pledges*, en. Accessed: Jan. 27, 2026. [Online]. Available: https://www.volvogroup.com/en/sustainable-transportation/collaborative-approach/mobility-transformation-forum/pledges-and-commitments.html.

[7] Volvo Group, *Climate*, en. Accessed: Jan. 27, 2026. [Online]. Available: https://www.volvogroup.com/en/sustainable-transportation/responsible-business/climate.html.

[8] T. Rosenbloom, “Professional Drivers,” en, in *Handbook of Traffic Psychology*, B. E. Porter, Ed., Academic Press, 2011, pp. 389–399. DOI: 10.1016/B978-0-12-381984-0.10028-1. Accessed: May 19, 2026. [Online]. Available: https://linkinghub.elsevier.com/retrieve/pii/B9780123819840100281.

[9] C. Neto and A. Simoes, “Fitting New Needs and Requests of Transport-Related Professions: The Freight Industry and Truck Drivers’ Profession,” en, in *Social and Occupational Ergonomics*, H. Kalkis and Z. Roja, Eds., vol. 152, USA: AHFE Open Access, 2024, pp. 34–43. DOI: 10.54941/ahfe1005318. Accessed: May 19, 2026. [Online]. Available: https://openaccess.cms-

conferences.org/publications/book/978-1-964867-28-1/article/978-1-964867-28-1_3.

[10] H. Wallengren and M. Ottosson, Eds., *Truckers: A profession in change* (Skrifter från Centrum för arbetarhistoria), English. Centrum för Arbetarhistoria, May 2019, vol. 10. Accessed: May 19, 2026. [Online]. Available: https://lucris.lub.lu.se/ws/portalfiles/portal/71205397/CFA10_9789197966160.pdf#page=48.

[11] M. S. Young, S. A. Birrell, and N. A. Stanton, "Safe driving in a green world: A review of driver performance benchmarks and technologies to support smart driving," *Applied Ergonomics*, Applied Ergonomics and Transportation Safety, vol. 42, no. 4, pp. 533–539, May 2011. DOI: 10.1016/j.apergo.2010.08.012. Accessed: Feb. 2, 2026. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0003687010001262.

[12] I. Wengraf, "Easy on the Gas - The effectiveness of eco-driving," *RAC Foundation*, 2012. Accessed: Jan. 27, 2026. [Online]. Available: https://www.racfoundation.org/assets/rac_foundation/content/downloadables/easy_on_the_gas-wengraf-aug2012.pdf.

[13] J. N. Barkenbus, "Eco-driving: An overlooked climate change initiative," *Energy Policy*, vol. 38, no. 2, pp. 762–769, Feb. 2010. DOI: 10.1016/j.enpol.2009.10.021. Accessed: Feb. 2, 2026.

[14] E. Gjona, "Human-Centered Explainability Attributes In Ai-Powered Eco-Driving : Understanding Truck Drivers' Perspective," eng, M.S. thesis, Högskolan i Halmstad, 2023. Accessed: Jan. 16, 2026. [Online]. Available: https://urn.kb.se/resolve?urn=urn:nbn:se:hh:diva-51060.

[15] H. Sharp, *Interaction Design: Beyond Human-Computer Interaction*. Indianapolis, IN: John Wiley and Sons, 2019.

[16] Volvo Trucks, *Volvo Trucks Driver Guide*. Accessed: Feb. 9, 2026. [Online]. Available: https://driverguide.volvotrucks.com/lang/en/chassi/A00FH16/topic/370072/.

[17] M. Galvani, "History and future of driver assistance," *IEEE Instrumentation & Measurement Magazine*, vol. 22, no. 1, pp. 11–16, Feb. 2019. DOI: 10.1109/MIM.2019.8633345. Accessed: Feb. 6, 2026. [Online]. Available: https://ieeexplore.ieee.org/document/8633345.

[18] K. Han, Y. Chen, R. Gupta, and O. Altintas, *Scene-Aware Conversational ADAS with Generative AI for Real-Time Driver Assistance*, en, arXiv:2507.10500 [cs], Jul. 2025. DOI: 10.48550/arXiv.2507.10500. Accessed: Jan. 15, 2026. [Online]. Available: http://arxiv.org/abs/2507.10500.

[19] J. Orlovska, C. Wickman, R. Söderberg, D. Bark, C. Carlsson, and P. Gustavsson, "Design and implementation of driver coach application for pilot assist: A first validation study," *Transportation Research Interdisciplinary Perspectives*, vol. 25, p. 101 130, May 2024. DOI: 10.1016/j.trip.2024.101130. Accessed: Jan. 15, 2026. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2590198224001167.

[20] A. Dahlinger and F. Wortmann, "Towards the Design of Eco-Driving Feedback Information Systems - A Literature Review," in *MKWI 2016 Energieinformatik, Erneuerbare Energien und Neue Mobilität*, Ilmenau: Universitätsverlag,

Mar. 2016, pp. 801–812. Accessed: Jan. 29, 2026. [Online]. Available: https://www.alexandria.unisg.ch/handle/20.500.14171/104567.

[21] A. Meschtscherjakov, D. Wilfinger, T. Scherndl, and M. Tscheligi, "Acceptance of future persuasive in-car interfaces towards a more economic driving behaviour," in *Proceedings of the 1st International Conference on Automotive User Interfaces and Interactive Vehicular Applications*, ser. AutomotiveUI '09, New York, NY, USA: Association for Computing Machinery, Sep. 2009, pp. 81–88. DOI: 10.1145/1620509.1620526. Accessed: Jan. 23, 2026. [Online]. Available: https://dl.acm.org/doi/10.1145/1620509.1620526.

[22] V. Gikas, K. Spiliotakopoulos, I. Stratakos, P. Sotiriou, H. Perakis, and D. Pelekoudas, "Development of a prototype, self-trained truck driver coaching system based on geolocation, IoT and BI: Preliminary results and analyses," in *2021 7th International Conference on Models and Technologies for Intelligent Transportation Systems (MT-ITS)*, Jun. 2021, pp. 1–6. DOI: 10.1109/MT-ITS49943.2021.9529292. Accessed: Jan. 15, 2026. [Online]. Available: https://ieeexplore.ieee.org/abstract/document/9529292.

[23] A. Sanguinetti, E. Queen, C. Yee, and K. Akanesuvan, "Average impact and important features of onboard eco-driving feedback: A meta-analysis," *Transportation Research Part F: Traffic Psychology and Behaviour*, vol. 70, pp. 1–14, Apr. 2020. DOI: 10.1016/j.trf.2020.02.010. Accessed: Feb. 12, 2026. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1369847819300737.

[24] A. Riener, M. Jeon, I. Alvarez, and A. K. Frison, "Driver in the Loop: Best Practices in Automotive Sensing and Feedback Mechanisms," en, in *Automotive User Interfaces: Creating Interactive Experiences in the Car*, G. Meixner and C. Müller, Eds., Cham: Springer International Publishing, 2017, pp. 295–323. DOI: 10.1007/978-3-319-49448-7_11. Accessed: Feb. 2, 2026. [Online]. Available: https://doi.org/10.1007/978-3-319-49448-7_11.

[25] N. Xu, X. Li, Q. Liu, and D. Zhao, "An Overview of Eco-Driving Theory, Capability Evaluation, and Training Applications," en, *Sensors*, vol. 21, no. 19, p. 6547, Jan. 2021. DOI: 10.3390/s21196547. Accessed: Feb. 12, 2026. [Online]. Available: https://www.mdpi.com/1424-8220/21/19/6547.

[26] K. S. Kurani, A. Sanguinetti, and H. Park, ""Actual Results May Vary": A Behavioral Review of Eco-Driving for Policy Makers," en, UC Davis: National Center for Sustainable Transportation, White Paper, Jul. 2015. Accessed: Jan. 29, 2026. [Online]. Available: https://escholarship.org/uc/item/39z9766p.

[27] Volvo Trucks, *How technology contribute to efficient driving*, Jun. 2022. Accessed: Feb. 4, 2026. [Online]. Available: http://volvotrucks.com/content/dam/volvo-trucks/markets/master/home/news/insights/articles/2022/jun/how-technology-contributes-to-efficient-driving/How-technology-contribute-to-efficient-driving-White-paper.pdf.

[28] H. Du et al., "Towards Proactive Interactions for In-Vehicle Conversational Assistants Utilizing Large Language Models," in *Proceedings of the Thirty-Third International Joint Conference on Artificial Intelligence, IJCAI-24*, K. Larson, Ed., International Joint Conferences on Artificial Intelligence Organi-

zation, Aug. 2024, pp. 7850–7858. DOI: 10.24963/ijcai.2024/869. [Online]. Available: https://doi.org/10.24963/ijcai.2024/869.

[29] C. Cui, Y. Ma, X. Cao, W. Ye, and Z. Wang, "Receive, Reason, and React: Drive as You Say, With Large Language Models in Autonomous Vehicles," *IEEE Intelligent Transportation Systems Magazine*, vol. 16, no. 4, pp. 81–94, Jul. 2024. DOI: 10.1109/MITS.2024.3381793. Accessed: Feb. 23, 2026. [Online]. Available: https://ieeexplore.ieee.org/abstract/document/10491134.

[30] S.-C. Lin et al., "Adasa: A Conversational In-Vehicle Digital Assistant for Advanced Driver Assistance Features," in *Proceedings of the 31st Annual ACM Symposium on User Interface Software and Technology*, ser. UIST '18, New York, NY, USA: Association for Computing Machinery, 2018, pp. 531–542. DOI: 10.1145/3242587.3242593. Accessed: Jan. 15, 2026. [Online]. Available: https://dl.acm.org/doi/10.1145/3242587.3242593.

[31] J. Costa et al., "From Dashboards to Dialogue: Evaluating a Conversational AI Coach for Performance Driving Skill Development," in *Proceedings of the 17th International Conference on Automotive User Interfaces and Interactive Vehicular Applications*, ser. AutomotiveUI '25, New York, NY, USA: Association for Computing Machinery, 2025, pp. 9–18. DOI: 10.1145/3744333.3747811. Accessed: Feb. 10, 2026. [Online]. Available: https://dl.acm.org/doi/10.1145/3744333.3747811.

[32] J. Bae et al., "Data-Driven Driver Training via Counterfactual and Language-Based Guidance in Racing Scenarios," en, *IEEE Access*, vol. 13, pp. 170 181–170 199, 2025. DOI: 10.1109/ACCESS.2025.3615128. Accessed: Jan. 15, 2026. [Online]. Available: https://ieeexplore.ieee.org/document/11184112/.

[33] F. Sugule, "Investigating Voice-Based Co-Driver Support for EV Truck Drivers - Evaluating Interaction Styles for Navigation, Well-Being, and Eco-Driving.," en, Masters thesis, Aalto University, Nov. 2025. Accessed: Jan. 16, 2026. [Online]. Available: https://aaltodoc.aalto.fi/handle/123456789/141061.

[34] A. Markelius et al., "Investigating theăMitigation ofăStress inăAutonomous andăNon-autonomous Vehicles Using LLM Feedback," en, in *HCI in Mobility, Transport, and Automotive Systems*, H. Krömker, Ed., Cham: Springer Nature Switzerland, 2025, pp. 108–127. DOI: 10.1007/978-3-031-92692-1_7.

[35] A. Kim, J.-M. Park, and U. Lee, "Interruptibility for In-vehicle Multitasking: Influence of Voice Task Demands and Adaptive Behaviors," *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.*, vol. 4, no. 1, 14:1–14:22, Mar. 2020. DOI: 10.1145/3381009. Accessed: Feb. 2, 2026.

[36] K. A. Brookhuis and D. de Waard, "Monitoring drivers mental workload in driving simulators using physiological measures," *Accident Analysis & Prevention*, Assessing Safety with Driving Simulators, vol. 42, no. 3, pp. 898–903, May 2010. DOI: 10.1016/j.aap.2009.06.001. Accessed: Feb. 11, 2026. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S000145750900116X.

[37] E. Ktistakis et al., "COLET: A dataset for COgnitive workLoad estimation based on eye-tracking," *Computer Methods and Programs in Biomedicine*, vol. 224, p. 106 989, Sep. 2022. DOI: 10.1016/j.cmpb.2022.106989. Ac-

cessed: Jan. 19, 2026. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0169260722003716.

[38] C. Wickens, "Multiple Resources and Mental Workload," *Human factors*, vol. 50, pp. 449–55, Jul. 2008. DOI: 10.1518/001872008X288394.

[39] O. Oviedo-Trespalacios, M. M. Haque, M. King, and S. Washington, "Effects of road infrastructure and traffic complexity in speed adaptation behaviour of distracted drivers," *Accident Analysis & Prevention*, vol. 101, pp. 67–77, Apr. 2017. DOI: 10.1016/j.aap.2017.01.018. Accessed: Feb. 12, 2026. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0001457517300453.

[40] B. Metz, A. Landau, and V. Hargutt, "Frequency and impact of hands-free telephoning while driving Results from naturalistic driving data," *Transportation Research Part F: Traffic Psychology and Behaviour*, vol. 29, pp. 1–13, Feb. 2015. DOI: 10.1016/j.trf.2014.12.002. Accessed: Feb. 12, 2026. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1369847814001788.

[41] G. Fitch, K. Grove, R. Hanowski, and M. Perez, "Compensatory Behavior of Drivers When Conversing on a Cell Phone," *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2434, pp. 1–8, Dec. 2014. DOI: 10.3141/2434-01.

[42] W. Gong and S. Jia Wang, "Driving with Empathy: Understanding Novice Drivers Emotional Needs in Interaction with In-Vehicle AI Systems," en, 2025. DOI: 10.54941/ahfe1006975. Accessed: Jan. 15, 2026. [Online]. Available: https://openaccess.cms-conferences.org/publications/book/978-1-964867-75-5/article/978-1-964867-75-5_163.

[43] A. Sanguinetti, K. Dombrovski, and S. Sikand, "Information, timing, and display: A design-behavior framework for improving the effectiveness of eco-feedback," *Energy Research & Social Science*, vol. 39, pp. 55–68, May 2018. DOI: 10.1016/j.erss.2017.10.001. Accessed: Jan. 29, 2026. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2214629617303286.

[44] M. Henzler, A. Boller, M. Buchholz, and K. Dietmeyer, "Are Truck Drivers Ready to Save Fuel? The Objective and Subjective Effectiveness of an Ecological Driver Assistance System," in *2015 IEEE 18th International Conference on Intelligent Transportation Systems*, ISSN: 2153-0017, Sep. 2015, pp. 2007–2012. DOI: 10.1109/ITSC.2015.325. Accessed: Jan. 15, 2026. [Online]. Available: https://ieeexplore.ieee.org/abstract/document/7313417.

[45] D. R. Pinchasik, I. B. Hovi, E. Bø, and C. S. Mjøsund, "Can active follow-ups and carrots make eco-driving stick? Findings from a controlled experiment among truck drivers in Norway," *Energy Research & Social Science*, vol. 75, p. 102 007, May 2021. DOI: 10.1016/j.erss.2021.102007. Accessed: Mar. 19, 2026. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2214629621001006.

[46] J. M. Mase, S. Majid, M. Mesgarpour, M. T. Torres, G. P. Figueredo, and P. Chapman, "Evaluating the impact of Heavy Goods Vehicle driver monitoring and coaching to reduce risky behaviour," *Accident Analysis & Prevention*,

vol. 146, p. 105 754, Oct. 2020. DOI: 10.1016/j.aap.2020.105754. Accessed: Jan. 15, 2026. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0001457520315748.

[47] M. Gagné and E. L. Deci, "Selfdetermination theory and work motivation," en, *Journal of Organizational Behavior*, vol. 26, no. 4, pp. 331–362, Jun. 2005. DOI: 10.1002/job.322. Accessed: Mar. 18, 2026. [Online]. Available: https://onlinelibrary.wiley.com/doi/10.1002/job.322.

[48] J. Fank, C. Knies, F. Diermeyer, L. Prasch, J. Reinhardt, and K. Bengler, *Factors for User Acceptance of Cooperative Assistance Systems: A Two-Step Study Assessing Cooperative Driving*. Nov. 2017.

[49] J. Gunnarsson and V. Jansson, "A TRUCK DRIVERS GUIDE TO SUSTAINABLE DRIVING," en, Bachelor's thesis, University of Gothenburg, 2022.

[50] W. Zhang and C. Jiaxin, "Future automobile driving space voice interaction: Adapt to the driving scenarios and user personalities," eng, in *Ergonomics In Design*, vol. 77, AHFE Open Acces, 2023. DOI: 10.54941/ahfe1003420. Accessed: Jan. 23, 2026. [Online]. Available: https://openaccess.cms-conferences.org/publications/book/978-1-958651-53-7/article/978-1-958651-53-7_62.

[51] M. Braun, A. Mainz, R. Chadowitz, B. Pfleging, and F. Alt, "At Your Service: Designing Voice Assistant Personalities to Improve Automotive User Interfaces," in *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, ser. CHI '19, New York, NY, USA: Association for Computing Machinery, 2019, pp. 1–11. DOI: 10.1145/3290605.3300270. Accessed: Jan. 23, 2026. [Online]. Available: https://dl.acm.org/doi/10.1145/3290605.3300270.

[52] C. Zhou, L. Wang, and Y. Yang, "Dialogue at the Edge of Fatigue: Personalized Voice Assistant Strategies in Intelligent Driving Systems," en, *Applied Sciences*, vol. 15, no. 12, p. 6792, Jan. 2025. DOI: 10.3390/app15126792. Accessed: Jan. 23, 2026. [Online]. Available: https://www.mdpi.com/2076-3417/15/12/6792.

[53] F. D. Davis, "User acceptance of information technology: System characteristics, user perceptions and behavioral impacts," *International Journal of Man-Machine Studies*, vol. 38, no. 3, pp. 475–487, Mar. 1993. DOI: 10.1006/imms.1993.1022. Accessed: Jan. 23, 2026. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0020737383710229.

[54] J. D. Van Der Laan, A. Heino, and D. De Waard, "A simple procedure for the assessment of acceptance of advanced transport telematics," en, *Transportation Research Part C: Emerging Technologies*, vol. 5, no. 1, pp. 1–10, Feb. 1997. DOI: 10.1016/S0968-090X(96)00025-3. Accessed: Jan. 23, 2026. [Online]. Available: https://linkinghub.elsevier.com/retrieve/pii/S0968090X96000253.

[55] D. Loske and M. Klumpp, "Intelligent and efficient? An empirical analysis of humanAI collaboration for truck drivers in retail logistics," en, *The International Journal of Logistics Management*, vol. 32, no. 4, pp. 1356–1383, Oct. 2021. DOI: 10.1108/IJLM-03-2020-0149. Accessed: Jan. 30, 2026. [On-

line]. Available: http://www.emerald.com/ijlm/article/32/4/1356-1383/134069.

[56] N. Zargham et al., "Understanding Circumstances for Desirable Proactive Behaviour of Voice Assistants: The Proactivity Dilemma," in *Proceedings of the 4th Conference on Conversational User Interfaces*, ser. CUI '22, New York, NY, USA: Association for Computing Machinery, Sep. 2022, pp. 1–14. DOI: 10.1145/3543829.3543834. Accessed: Feb. 2, 2026. [Online]. Available: https://dl.acm.org/doi/10.1145/3543829.3543834.

[57] L. Reicherts, N. Zargham, M. Bonfert, Y. Rogers, and R. Malaka, "May I Interrupt? Diverging Opinions on Proactive Smart Speakers," in *Proceedings of the 3rd Conference on Conversational User Interfaces*, ser. CUI '21, New York, NY, USA: Association for Computing Machinery, Jul. 2021, pp. 1–10. DOI: 10.1145/3469595.3469629. Accessed: Feb. 3, 2026. [Online]. Available: https://dl.acm.org/doi/10.1145/3469595.3469629.

[58] H. Snyder, "Literature review as a research methodology: An overview and guidelines," *Journal of Business Research*, vol. 104, pp. 333–339, Nov. 2019. DOI: 10.1016/j.jbusres.2019.07.039. Accessed: Mar. 13, 2026. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0148296319304564.

[59] J. Webster and R. T. Watson, "ANALYZING THE PAST TO PREPARE FOR THE FUTURE: WRITING A LITERATURE REVIEW," en, 2020.

[60] G. Wong, T. Greenhalgh, G. Westhorp, J. Buckingham, and R. Pawson, "RAMESES publication standards: Meta-narrative reviews," en, *BMC Medicine*, vol. 11, no. 1, p. 20, Jan. 2013. DOI: 10.1186/1741-7015-11-20. Accessed: Mar. 13, 2026. [Online]. Available: https://doi.org/10.1186/1741-7015-11-20.

[61] R. J. Torraco, "Writing Integrative Literature Reviews: Guidelines and Examples," EN, *Human Resource Development Review*, vol. 4, no. 3, pp. 356–367, Sep. 2005. DOI: 10.1177/1534484305278283. Accessed: Mar. 13, 2026.

[62] K. Hornbæk and M. Hertzum, "Technology Acceptance and User Experience: A Review of the Experiential Component in HCI," *ACM Transactions on Computer-Human Interaction*, vol. 24, pp. 1–30, Oct. 2017. DOI: 10.1145/3127358.

[63] M. Maguire, "Methods to support human-centred design," en, *International Journal of Human-Computer Studies*, vol. 55, no. 4, pp. 587–634, Oct. 2001. DOI: 10.1006/ijhc.2001.0503. Accessed: Jan. 15, 2026. [Online]. Available: https://linkinghub.elsevier.com/retrieve/pii/S1071581901905038.

[64] E. Le and X. Shi, "User Study for In-Vehicle Displays: Exploring Driver Behaviour and the Inuence of HUD During Trafc Navigation Using Eye-Tracking," en, Masters thesis, Chalmers University of Technology, Gothenburg, 2025.

[65] J. Sauro, *10 Things to Know About the System Usability Scale (SUS)*, en-US, Jun. 2013. Accessed: Feb. 12, 2026. [Online]. Available: https://measuringu.com/10-things-sus/.

[66] J. Sauro, *Measuring Usability: From the SUS to the UMUX-Lite*, en-US, Oct. 2017. Accessed: Feb. 12, 2026. [Online]. Available: https://measuringu.com/umux-lite/.

[67] J. Lewis, B. Utesch, and D. Maher, "Measuring Perceived Usability: The SUS, UMUX-LITE, and AltUsability," *International Journal of Human-Computer Interaction*, vol. 31, p. 150 625 095 336 004, Jun. 2015. DOI: 10.1080/10447318.2015.1064654.

[68] J. R. Lewis, B. S. Utesch, and D. E. Maher, "Investigating the Correspondence Between UMUX-LITE and SUS Scores," en, in *Design, User Experience, and Usability: Design Discourse*, A. Marcus, Ed., Cham: Springer International Publishing, 2015, pp. 204–211. DOI: 10.1007/978-3-319-20886-2_20.

[69] J. Sauro, *10 Things to Know about the Technology Acceptance Model*, en-US, May 2019. Accessed: Feb. 12, 2026. [Online]. Available: https://measuringu.com/tam/.

[70] V. Venkatesh and F. Davis, "A Model of the Antecedents of Perceived Ease of Use: Development and Test*," *Decision Sciences*, vol. 27, pp. 451–481, Jun. 2007. DOI: 10.1111/j.1540-5915.1996.tb00860.x.

[71] D. Salber and J. Coutaz, *Applying the Wizard of Oz Technique to the Study of Multimodal Systems*. Aug. 1993, Pages: 230. DOI: 10.1007/3-540-57433-6_51.

[72] V. Braun and V. Clarke, "Using thematic analysis in psychology," *Qualitative Research in Psychology*, vol. 3, no. 2, pp. 77–101, Jan. 2006. DOI: 10.1191/1478088706qp063oa. Accessed: Feb. 24, 2026. [Online]. Available: https://doi.org/10.1191/1478088706qp063oa.

[73] J. R. Lewis, B. S. Utesch, and D. E. Maher, "UMUX-LITE: When there's no time for the SUS," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ser. CHI '13, New York, NY, USA: Association for Computing Machinery, Apr. 2013, pp. 2099–2102. DOI: 10.1145/2470654.2481287. Accessed: Mar. 30, 2026. [Online]. Available: https://dl.acm.org/doi/10.1145/2470654.2481287.

[74] V. Clarke and V. Braun, "Thematic analysis," *The Journal of Positive Psychology*, vol. 12, no. 3, pp. 297–298, May 2017. DOI: 10.1080/17439760.2016.1262613. Accessed: Feb. 24, 2026. [Online]. Available: https://doi.org/10.1080/17439760.2016.1262613.

[75] S. K. Ahmed et al., "Using thematic analysis in qualitative research," *Journal of Medicine, Surgery, and Public Health*, vol. 6, p. 100 198, Aug. 2025. DOI: 10.1016/j.glmedi.2025.100198. Accessed: Feb. 24, 2026. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2949916X25000222.

[76] V. Braun and V. Clarke, "Toward good practice in thematic analysis: Avoiding common problems and be(com)ing a knowing researcher," *International Journal of Transgender Health*, vol. 24, no. 1, pp. 1–6, Jan. 2023. DOI: 10.1080/26895269.2022.2129597. Accessed: Feb. 24, 2026. [Online]. Available: https://doi.org/10.1080/26895269.2022.2129597.

[77] V. Braun and V. Clarke, "Reflecting on reflexive thematic analysis," *Qualitative Research in Sport, Exercise and Health*, vol. 11, no. 4, pp. 589–597, Aug. 2019. DOI: 10.1080/2159676X.2019.1628806. Accessed: Mar. 2, 2026. [Online]. Available: https://doi.org/10.1080/2159676X.2019.1628806.

[78] A. Harley, *Ideation in Practice: How Effective UX Teams Generate Ideas*, en, Oct. 2017. Accessed: Mar. 26, 2026. [Online]. Available: `https://www.nngroup.com/articles/ideation-in-practice/`.

[79] IDEO.org, *Design Kit*. Accessed: Mar. 26, 2026. [Online]. Available: `https://www.designkit.org/methods/brainstorm-rules.html`.

[80] G. D. Sprint, *Share and engage with the Design Sprint Community*. Accessed: Mar. 26, 2026. [Online]. Available: `https://designsprintkit.withgoogle.com/methodology/phase3-sketch/crazy-8s`.

[81] L. Meuleners and M. Fraser, "A validation study of driving errors using a driving simulator," *Transportation Research Part F: Traffic Psychology and Behaviour*, vol. 29, pp. 14–21, Feb. 2015. DOI: `10.1016/j.trf.2014.11.009`. Accessed: Feb. 23, 2026. [Online]. Available: `https://www.sciencedirect.com/science/article/pii/S1369847814001764`.

[82] I.-M. Jonsson, "Social and Emotional Characteristics of Speech-based In-Vehicle Information Systems : Impact on Attitude and Driving Behaviour," eng, PhD dissertation, Linköping University Electronic Press, Linköping, 2009. Accessed: Jan. 23, 2026. [Online]. Available: `https://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-51969`.

[83] A. Riener and J. Noldi, "Cognitive load estimation in the car: Practical experience from lab and on-road tests," in *Adjunct Proceedings of the 7th International Conference on Automotive User Interfaces and Interactive Vehicular Applications*, Nottingham, UK, Sep. 2015.

[84] Chalmers, *Handling of personal data*, en, Mar. 2024. Accessed: Mar. 17, 2026. [Online]. Available: `https://www.chalmers.se/en/education/your-studies/masters-and-bachelors-thesis/handling-of-personal-data/`.

[85] Google, *Crazy 8's*. Accessed: Mar. 17, 2026. [Online]. Available: `https://designsprintkit.withgoogle.com/methodology/phase3-sketch/crazy-8s`.

[86] Google, *Crazy 8's Sharing and Voting*. Accessed: Mar. 17, 2026. [Online]. Available: `https://designsprintkit.withgoogle.com/methodology/phase3-sketch/crazy-8s-sharing-and-voting`.

[87] A. Kumar, *Flutter - File Structure*, en, Section: Flutter, Apr. 2025. Accessed: Apr. 29, 2026. [Online]. Available: `https://www.geeksforgeeks.org/flutter/flutter-file-structure/`.

[88] J. R. Lewis, "Critical Review of The Usability Metric for User Experience," *Interacting with Computers*, vol. 25, no. 4, pp. 320–324, Jul. 2013. DOI: `10.1093/iwc/iwt013`. Accessed: May 12, 2026. [Online]. Available: `https://doi.org/10.1093/iwc/iwt013`.

[89] J. Sauro, *5 Ways to Interpret a SUS Score*, en-US, Sep. 2018. Accessed: May 12, 2026. [Online]. Available: `https://measuringu.com/interpret-sus-score/`.

[90] J. Lewis and J. Sauro, "Item Benchmarks for the System Usability Scale," *Journal of Usability Studies*, vol. 13, no. 3, pp. 158–167, May 2018.

A

User Research Interview Guide: Truck Drivers

Bakgrund - Allmänna frågor

- Antal år som yrkesförare (lastbil)
- Din vanligaste typ av körning? (distribution, long-haul, anläggning, annat)
- Din vanligaste typ av last?
- Vad kör du på för typ av vägar? (motorväg, landsväg, stadstrafik, på byggarbetsplats, i skogen)
- Hur långt (i timmar) är ett vanligt skift för dig?
- Ta oss igenom en vanlig arbetsdag för dig
  - Vilka arbetsuppgifter har du under en vanlig dag?

Motivation

- Hur är det att vara lastbilsförare? / Vad tycker du om ditt jobb?
- Vad motiverar dig i ditt arbete?
  - Är det något som gör att du känner dig mindre motiverad i ditt arbete?
- Hur upplever du balansen under en arbetsdag? Vad gäller att hinna med det man ska, köra energisnålt och genomföra arbetet på ett säkert sätt?

Knowledge

- Vad innebär eco-driving för dig?

Awareness

- I vilka situationer är det lättast att komma ihåg att köra eco?

  - När är det svårast att komma ihåg att köra eco?

Organisational factors

- Upplever du några förväntningar eller krav från chefer eller kollegor kring hur du ska köra? Om ja, utveckla (Vilka förväntningar? Hur känner du av det?)
  - Om inte eco-driving förväntningar: Finns det förväntningar kopplade till bränsleförbrukning eller eco-driving?

Eco-driving frågor

- Har du driver coaching eller ett eco-driving system i lastbilen du kör idag?
  - Använder du det? Varför/Varför inte?
- Vad motiverar/hade motiverat dig att använda en eco-driving coach?

Övrigt

- Finns det något du vill lyfta som inte tagits upp?

B

Translations of Truck Driver Quotes

P7: “[...] it’s probably the toughest job I’ve had.”

P7: “[...] det är nog det tuffaste jobbet jag har haft.”

P7: “When you spend so much time in traffic with such a large vehicle, you have to be really alert. I feel that many motorists don’t understand how big the truck is, how heavy it is, how much space it takes up. So I often have to keep an eye on everything around me. And that is very mentally draining []”

P7: “När man spenderar så mycket tid i trafiken med ett så stort fordon så måste man ju också vara väldigt på tårna. Jag upplever att många bilister har inte koll på hur stor bilen är, hur tung den är, hur mycket plats den tar. Och det blir ju ofta att jag får ju hålla koll runtom. Och det, ehm. Så det är ju väldigt påfrestande psykiskt [...]”

P6: “What’s hardest right now is, for example, the police and the witch-hunt that’s going on, all the laws, all the rules, and cars that are basically like, we can exist but we shouldn’t be seen.”

P6 “Det som är jobbigast nu är ju ah men till exempel polisen och den häxjakten som är där, det är alla lagar, det är alla regler och det är, och så personbilar som verkligen, vi ska finnas men vi ska inte synas.”

P1: “You get a remark on the tachograph, then you get stopped and the police say, ‘Well, you should plan better.’ But you can’t plan for every variable between heaven and Earth. They have zero understanding, then you get a 14,000 fine, and you’re completely fed up with everything.”

P1: “Får en anmärkan på skrivaren, sen blir du stoppad och polisen säger ah du ska planera bättre. Ja men alltså man kan inte planera för varje variabel som finns mellan himmel och jord. Det har dom noll överseende med, sen får man 14000 i böter och då är man väldigt less på allting.”

P2: “Sometimes it feels like politicians are tying themselves in knots. They fixate on certain things, like, right, it has to be tyres with particle requirements here, then studded tyres there, then Stockholm city centre here, then it has to be like that there, and in the end it just becomes, well too much. I don’t think any computer even knows which other computer it’s supposed to talk to for things to improve out there.”

P2: “Det känns som ibland att politikerna slår knut på sig själva. Dom stirrar blint på vissa saker att ja då ska det va däcken med partiklar där och sen ska det vara dubb där och sen ska det va Stockholms innerstad där och sen ska det va så där och sen så till slut så blir det, ah för mycket det, jag tror inte nån dator vet vilken dator dom ska prata med för att det ska bli bättre ute.”

P6: “There’s been a lot of people not believing in you, especially when you’re a female truck driver. It took me, I think it took four or five jobs before I found a manager who saw me as a driver, not a female driver.”

P6: “Det har varit väldigt mycket att folk, ingen tror på en det är just det här när man liksom va en kvinnlig lastbilschaufför, det tog mig, jag tror det tog fyra eller fem jobb innan jag hittade en chef som såg mig som en chaufför och inte en kvinnlig chaufför.”

P7: “[...] my male colleagues get a different kind of respect as soon as they arrive at a job, which I might not get. More often, they’re not questioned about how things should be done. If you go to a customer and say, ‘Right, we’ll do it like this and like that,’ it’s more often me who gets questioned [...]”

P7: “[...] mina manliga kollegor får en annan respekt direkt dom kommer till ett jobb som jag kanske inte får. Jag hör oftare till exempel att dom blir inte ifrågasatta på hur man ska göra, om man kommer till en kund och liksom så här, ja vi ska göra så här och så här. Så är det ju oftare jag som blir ifrågasatt [...]”

P3: “A job with freedom, but also responsibility. You get out and get to look around.”

P3: “Fritt jobb, under ansvar. Man kommer ut och får se sig om.”

P7: “Above all, you’re also driven by quite a strong sense of professional pride, at least I am, that it’s a very important task for society. [...] For society to function, we’re genuinely needed. [...] You really are important to society through your work.”

P7: “Framförallt så drivs man ju ändå också av en ganska, i alla fall jag, en ganska stor yrkesstolthet i att det är en väldigt viktig arbetsuppgift för samhället, alltså.

[...] För att samhället ska gå runt så behöver, så behövs vi verkligen. [...] Man verkligen är viktig för samhället, i sitt jobb."

P1: "Some see it as a lifestyle and some see it as a job. For me it's a bit of both, depending on which day you ask me and what time of day."

P1: "Vissa ser det som en livsstil och vissa ser det som jobb. Jag ser mig lite både och, det beror på vilken dag du frågar mig på och vilken tid på dygnet."

P6: "This is our hobby, it's more of a lifestyle than a job."

P6: "Det här är våran hobby, det här är liksom, mer en livsstil än vad det är ett jobb."

P7: "I've got colleagues, for example, who say it's very difficult, if you're in central Stockholm during rush hour, to drive in an energy-efficient and environmentally friendly way there. It's almost impossible."

P7: "Men jag har ju kollegor till exempel som säger att det är väldigt svårt, är du i centrala Stockholm under rusning att du ska köra energisnålt där och på ett miljövänligt sätt det är nästan omöjligt."

P2: "Yes you're more restricted [in winter] because there's so much to think about with the slippery conditions, keeping more distance, roundabouts, preparing for hills so you don't get stuck going up. So you might not be able to coast those extra hundred metres like you do in Midsummer week. [...] Then you might not really want to think about savings all the time, you want to, that's when the safety mindset comes in instead."

P2: "Ah man är mer hindrad [på vintern] för man har så mycket, med halkan, tänka sig för, mer avstånd, rondell, förbereda i backar, så att man inte fastnar i backen så man liksom inte, man kanske inte kan rulla dom hundra meterna extra som man gör midsommarveckan. [...] då kanske inte man precis vill tänka sparmässigt alltid, man vill ju, där kommer mer säkerhetstänket in istället."

P7: "So no, it's more that you forget about it, I'd say, driving energy-efficiently, if you're stressed, or at least I get worse at it then. If you've got a lot to do and you're stressed, you end up forgetting to drive and, oh right, I'm meant to think about this as well, not wasting too much energy by braking, using the retarder and all of those parts."

P7: "Så att nej, det är mer att man glömmer bort det skulle jag säga, att köra energisnålt om man är stressad eller i alla fall jag blir sämre på det då. Om man har mycket att göra och är stressad så blir det att man glömmer bort att köra, och just det jag ska tänka på det här också, inte bromsa bort för mycket energi, använda retarden och alla dom delarna.”

P2: “That system versus reality [...] doesn’t always match up.”

P2: “Det systemet kontra verkligheten [...] stämmer inte alltid.”

P4: “[...] it [the eco-driving coach] isn’t always fair. [...] It is more suited to, like I keep coming back to, but driving on rural roads and driving in the forest are two completely different things.”

P4: “[...] den [eco-driving coachen] är ju inte alltid rättvis. [...] Den är ju mer anpassad för som sagt, nu kommer jag till det igen, men landsvägskörning och skogskörning är ju två helt olika saker.”

P5: “When I’m driving it varies, it’s new places almost every day. So it’s interesting. It’s not the same, the same route.”

P5: “När jag kör är det olika, det är nya ställen, nästan varje dag. Så det är intressant. Det är inte samma, samma sträcka.”

P7: “Being out on the roads and seeing new places is what I enjoy the most.”

P7: “Vara ute på vägarna och se nya ställen är ju det som jag tycker är absolut roligast.”

P1: “Sometimes you’re out in the middle of the forest, and the next hour you’re right in the middle of an industrial area [...] You never know, that’s what’s fun about this.”

P1: “Ibland är man mitt ute i skogen, och nästa timme är man mitt uppe i ett industriområde [...] Man vet aldrig, det är det som är roligt med det här.”

P2: “[...] maybe it could take into account what season it is, like I mentioned earlier. If the vehicle notices that it’s the winter season, then maybe it could relax the requirements a bit when it comes to coasting [...]”

P2: “[...] kanske tar hänsyn till, vilken årstid det är, som jag var inne på lite innan. Alltså märker bilen att det är vinterhalvår så kanske dom kan släppa lite på kraven just med rullningen [...]”

P4: "[...] so then I get an assessment, I think it's five stars. It pops up like, right, this is how much, this is how well you did this, and you get three out of five stars for that thing. And then it's added up so it becomes a percentage for the whole day, how you've driven. It's actually really good, it is [the in-vehicle driver coaching]. Then you can follow it during the day and adjust it, sort of, to make it better."

P4: "[...] men då får jag bedömning, det är väl fem stjärnor, det kommer liksom upp att ah men såhär mycket, såhär bra gjorde du det här. Och liksom du får tre stjärnor utav fem, för den grejen då. Och så läggs det på så att det blir en procent liksom på hela dagen, hur man har kört. Det är ju jäkligt bra egentligen, det är det [in-vehicle driver coaching systemet]. Då kan du följa under dagen och justera det liksom för att få det bättre."

P7: "And then it's always a carrot when you see, when you get, like, five stars and it thinks you've driven well. It's also nice to know, that was good, OK, then I know I've done something right, and I can keep trying to do it this way."

P7: "Och sen är det ju alltid en morot när man ser, när man får liksom fem stjärnor och den tycker man har kört bra. Det är ju också najs att veta, det var bra då okej då vet jag att jag har gjort nåt bra, det är rätt då kan jag fortsätta försöka göra på det här sättet."

P1: "The best thing you can do in the society we have is to motivate, to offer a little carrot in some way. You drove the cheapest this year, well maybe you get an extra week of paid holiday, or you get certain things, 1,500 extra in your salary because you won that bonus [...] That's the only way to make people understand, because as long as they don't own anything or aren't the ones paying for anything, it doesn't matter what happens."

P1: "Det bästa man kan göra i det samhället vi har det är ju att motivera, att ge en liten morot på något vis. Fan du har kört billigast detta året, ja men du kanske får en vecka extra betald semester eller du får vissa grejer, 1500 extra på lönen för att du vann den bonusen [...] Det är enda sättet att få folk att förstå, för så länge dom inte äger någonting eller är skyldiga att betala någonting så spelar det ingen roll vad som händer."

P7: "[...] I still don't think it's a bad idea to, like, since people get to meet up, have a party or a get-together once a year and, like, who's been, who are in the top five of our, our drivers who've been the best at eco-driving this year, and things like that. I think that would give a push, and maybe there could be some kind of prize, like a gift card or something symbolic, to raise the conversation and the focus, and also maybe encourage the drivers themselves, like, that it can be a bit of a carrot and that."

P7: "[...] jag tycker det är ändå inte en dålig idé att liksom så här kanske ha i och med att folk får ses, ha en fest eller sammankomst en gång om året att liksom vem har varit, vilka ligger liksom topp 5 av våra mest, våra chaufförer som har varit liksom bäst på eco-driving i år och såna saker, tror jag skulle pusha och kanske att det finns nåt pris där, ett presentkort liksom eller en symbolisk grej, för att lyfta samtalet och fokuset och också kanske pusha chaufförerna själva liksom att man, att det kan vara en morot och så."

P2: "But when you're fighting day in, day out, and you try and this and that, and then you feel you never get a thank you, or a sandwich cake, even once every six months, then unfortunately that's how people are, if you never get any appreciation, I mean, then you sort of stop giving a shit about it, unfortunately."

P2: "Men, när man kämpar dag ut och dag in och man försöker och ditten och datten. Men sen när man känner att man aldrig får ett tack eller nån smörgåstårta eller nån gång i halvåret då, så är ju tyvärr människan att får man aldrig någon uppskattning, jag menar, liksom då lite skiter man i det tyvärr."

P6: "[...] what a difference it made for me when I had a manager who believed in me, trusted me, and genuinely believed I could develop. All of a sudden I could handle absolutely anything."

P6: "[...] liksom vilken skillnad det gjorde för mig när jag hade en chef som trodde på mig, som litade på mig och som verkligen trodde att jag kunde utvecklas. Helt plötsligt så klarade jag precis vad som helst."

P1: "There's nothing that can come from a vehicle saying you should do this or that. A lot of people, like me, have a bit too much ego. If I'm driving, then I'm the one who decides."

P1: "Det är ingenting som kan komma från en bil som säger du ska göra si och så. För många har lite som jag själv, lite för mycket ego att om jag kör då är det jag som ska bestämma."

P6: "[...] but I'm also very much like, don't interfere, I can do it myself, I'll handle it myself. So it's mostly that it just becomes an irritation, really."

P6: "[...] men jag är också mycket så att lägg dig inte i, kan själv, jag sköter det själv. Så det är nog mest det att det bara är ett irritationsmoment liksom."

P3: "[...] it's phones pinging and making noises everywhere, so you've got quite a lot of things around you that mean, erm, you can end up feeling a bit empty-headed sometimes from everything that's coming at you."

P3: "[...] det är ju telefoner som plingar och har sig överallt, så det är ju man har ju ganska mycket saker runt som gör att, ah, man kanske blir tom i huvudet ibland utav allt som kommer."

P1: "Volvo has audio notifications, and sure, you can switch them off too. But because everything today is digital displays, something flashes and your eyes are drawn to it and you think, what the hell was that. And concentration is the most important thing we have [...]"

P1: "Volvo har ju ljudnotiser och visst man kan ju stänga av också. Men eftersom att allting idag är digitala displayer så blir det att nånting blinkar till och då dras blicken dit och tänker vad fan var det. Och koncentrationen är ju det viktigaste vi har [...]"

P6: "It's mostly that it, like it beeps. It irritates me."

P6: "Alltså det är mest att det, alltså den plingar. Den irriterar mig"

P6: "But like, I come to work, I do what I'm supposed to do, I manage myself, and I have my manager's trust that I can handle things and look after the truck [...]"

P6: "Men alltså jag kommer till jobbet, jag gör det jag ska, jag sköter mig själv, jag har liksom förtroendet av min chef att jag kan liksom sköta mig själv och ta hand om bilen [...]"

P1: "[...] lots of people know what it can cost to drive these vehicles like a race, and lots of people don't care."

P1: "[...] många vet vad det kan kosta att köra rally med bilarna, och många skiter i det."

P6: "[...] where I started driving timber, that's when I discovered eco-driving, because it was basically the first thing he [the manager] said to me. He said, we push eco-driving hard here, diesel is expensive."

P6: "[...] där jag började köra timmer, som jag börja, som jag upptäckte eco-driving för det var typ det första han [chefen] sa till mig sa han att eco-driving vi kör stenhårt med det här, det är liksom dieseln är dyr."

P6: "[...] and since I think eco-driving is really enjoyable, it's very easy for me to optimise my driving, which was basically the first thing I did when I started working here. I started optimising my driving so it would be as energy-efficient as possible, more or less to bring down the percentage per load."

P6: “[...] och eftersom att jag tycker att eco-driving är väldigt roligt så är det ju väldigt lätt för mig att optimera körningen vilket är typ det första jag gjorde när jag började jobba här, var ju att jag började att optimera körningen för att det skulle bli ett så energisnålt som möjligt för att få ner procenten per lass mer eller mindre.”

P7: “Erm, on a Monday morning, when you’ve just read your index for the previous week, so to speak [laughter]. Then you think a lot about how you’re driving.”

P7: “Ehm måndag morgon när man precis har läst sitt index för föregående vecka höll jag på att säga [skratt]. Då tänker man väldigt mycket på hur man kör.”

P6: “Otherwise, it’s probably like this, like on major roads you usually let the cruise control take care of itself, and sometimes you catch yourself thinking, I should have switched it off there, because I should have coasted like that there [...]”

P6: “Annars är det nog så, alltså på stora vägar för då låter man ju oftast farthållaren sköta sig själv och ibland kommer man på sig att där skulle jag stängt av för att där skulle jag rullat så där [...]”

C

User Research Interview Guide: Fleet Managers

Generellt

- Vilka arbetsuppgifter brukar du ha under en vanlig arbetsdag?
- Hur jobbar du/ni generellt med att kommunicera med förarna?
  - Hur ofta sker det?
  - Vad brukar diskuteras då?
- Hur arbetar ni idag med frågor som rör ekonomisk körning/eco-driving?
  - Har ni något system som man kan ha koll på förarnas körstatistik i/ som mäter eco-driving, så kallat "fleet management system"? T.ex. Volvo Connect eller liknande?
  - Vad tycker du om det? Motivera.

Om teman från förar-intervjuer

Jag kommer berätta lite om de teman vi har hittat från våra intervjuer med lastbilsförare, det är inte enskilda personers åsikter utan mer generella teman som vi har identifierat

- Vi utfört intervjuer med lastbilsförare som tyder på att det i många fall inte är bristande kunskap utan oftare bristande motivation som gör att förare inte kör lika mycket eco som man hade önskat och att de inte alltid följer körtipsen i sina bilar. Vad tänker du kring det?
- Många förare har nämnt att mer uppmärksammande/beröm från chefer eller organisationen hade kunnat göra dem mer motiverade att anstränga sig, hur ser du på det?
  - *Tror du att det hade kunnat göra skillnad?*

Om deras arbete med kommunikation med förarna

- Hur jobbar du/ni med att uppmärksamma när förarna presterar bra/dåligt?
  - Gäller det även för prestationer kring ekonomisk körning/eco-driving?
- Kommer du på något som hade kunnat underlätta för kommunikationen kring förarnas prestationer/med förarna generellt?
  - Vad tror du om ett system som påminner dig om att berömma förarnas styrkor och diskutera deras förbättringspotential när det kommer till eco-driving? Hade det haft någon effekt på kommunikationen?

D

Translations of Fleet Manager Quotes

F2: “As an employee, you might not really see the gain in it [eco-driving], whereas I see a very big [gain]”

F2: “Som anställd ser man ju inte kanske vinningen i det [eco-driving], medans jag ser ju väldigt stor [vinning]”

F2: “I know myself, when I was an employee a number of years ago, we got these lists every month [...] Then you were sort of scored based on how you drove, and you’d get something like, ‘these [drivers] are at the top,’ but that was all. It was like... that list was just posted on the staff room wall, and then, well... it was kind of like, ‘yeah, but why should we even do it?’ ”

F2: “Jag vet själv när jag var anställd för ett antal år sedan och vi fick ut listor varje månad [...] Då blir du ju så här poängsatt efter hur du kör och då fick man ju ut liksom att ‘de här ligger i topp’ men det var ju inget mer än så. Det var liksom så här den listan satt där på personalrummet, men sen ja, så det var väl liksom så här ‘ja, men varför ska vi ens göra det?’ ”

F1: “We have a system [...] then it’s like a driving score, and it includes speed monitoring and fuel and everything. [...] All the vehicles are equipped with hardware that measures braking, acceleration, driving behaviour, and GPS positioning, of course. [...] We also... download the tachograph data automatically and everything, and maps and driving style and all that. We get everything in there as well.”

F1: “Vi har ju ett system [...] då är det ju körbetyg och det är så hastighetsövervakning och bränsle och det är allt. [...] alla bilar är utrustade med en hårdvara som då mäter bromsning, gas, körning och GPS positionering, förstås då. [...] Vi har ju... tankar ju ner färdskrivare i data automatiskt och allting och kartor och körsätt och allt. Vi får ju med allting där också.”

F2: “And Volvo’s... well, the portal where you can get reports and things like that, it’s very easy to see, like, how they’ve driven. You get it very easily. Yeah, it’s scored, and you can see idling and speeding and basically everything, so really it's just a click and you can see, like, 'yeah, she's doing well now,' or, you know, like that, so it's very easy to follow up."

F2: "Och Volvos... ja men portal där man man kan få ut rapporter och sånt där det är väldigt enkelt att se, liksom hur de hur de har kört. Man får väldigt lätt. Ja, men det är poängsatt och man ser liksom tomgång och överhastighet och liksom allting så där så där är det ju egentligen bara ett knapptryck så ser man ju att 'ja, men nu ligger hon bra till,' eller ja så där så att den är ju väldigt lätt att följa upp."

F1: "[...] where's the line between surveillance and praise? You have to be a bit careful there too, because when we installed this system there were quite a lot of comments that we were going to monitor them [the drivers]. And... so, and on top of that we also had to sign [an agreement] with the union that it would not be for monitoring their work."

F1: "[...] var går gränsen mellan övervakning och beröm? Man får vara lite försiktig där också, för att när vi installerade det här systemet så var det rätt mycket synpunkter att vi skulle övervaka dem [förarna]. Och... så, och så att dels fick vi ju skriva på [ett avtal] med facket att det skulle inte vara för övervakning av deras arbete så."

F2: "I know that this [attention and praise from the manager] is absolutely what's required for any change to happen. So I agree with that."

F2: "Jag vet ju att det är ju absolut det [uppmärksamhet och beröm från chefen] är det som krävs för att det ska ske någon förändring liksom. Så att det håller jag med om."

F1: [*in response to what they think about many drivers wanting more praise from their manager to increase motivation*] "I understand, I can imagine that it's like that, I absolutely can."

F1: [*på fråga om vad de tänker om att många förare hade velat ha mer beröm från chefen för ökad motivation*] "jag förstår ju, jag kan tänka mig att det är så det kan jag absolut göra. "

[*in response to a question about advantages with a system with driver profiles and the possibility to configure settings*] F1: "[...] I think you're spending a lot of time for very little effect. [...] How much time and how much energy, and what resources are you going to put into it? Is there a payback on those hours?"

[*Som svar på en fråga om fördelarna med ett system med förarprofiler och möjligheten att konfigurera inställningar.*] F1: "[...] jag tror att du lägger ner väldigt mycket tid på väldigt lite effekt. [...] Hur mycket tid och mycket energi, och vad ska du lägga ner för resurser? Är det en payback på de timmarna?"

F2: "I'd say we would like to spend more time on it [eco-driving]. I... maybe I'm a bit bad at following it up. It ends up maybe a bit too far down the priority list, but that's only because there's so much else that comes first."

F2: "Jag skulle vilja säga att vi skulle vilja lägga mer tid på det [eco-driving]. Jag... kanske är lite dålig på att följa upp det. Det hamnar väl kanske lite för långt ner i i prio listan, men det är endast för att det finns så mycket annat som kommer först."

[*in response to question about advantages with a system with driver profiles and the possibility to configure settings*] F1: "Yes, maybe, but I'm not... I'm not that nerdy and obsessed that I can be bothered to spend the time splitting up each driver, then assigning a vehicle, and creating different rating scales. 'This is what this driver, with this vehicle and this kind of driving, has to do to reach approved'. It becomes a huge job."

[*Som svar på en fråga om fördelarna med ett system med förarprofiler och möjligheten att konfigurera inställningar.*] F1: "Ja kanske, men jag är inte... Jag är inte så så nördig och insnöad så att jag orkar lägga den tiden på och dela upp varje chaufför på, och sen tilldela en bil och göra olika betygsskalor. 'Det här ska den här chauffören, med den här bilen och den här körningn göra för att komma upp i godkänt'. Det blir ett jättejobb"

F1: "We have about two thirds of everyone here in [location a], so I see them almost every day."

F1: "Vi har ju två tredjedelar av alla är ju här i [plats a], så dem träffar jag ju nästan varje dag. "

F1: "The ones who are in [locations b or c], I try to call a couple, three times a year, just to check in and talk, and then I'm down in [location b] at least once a year, and I try to be in [location c] at least once a year and try to meet them then."

F1: "De som är på [plats b eller c] försöker jag ju ringa ett par-tre gånger om året, bara att stämma av och prata med, och så är jag nere i [plats b] minst en gång om året, och jag försöker vara i [plats c] minst en gång om året och försöker träffa dem då."

F1: "It's much easier... easier to... I feel like I praise the ones who are here, more than the ones I never meet and can only contact by phone. It's not like I call and say, 'damn, today you improved by a tenth.' "

F1: “Det är ju mycket, lättare... lättare att... jag känner att jag berömmer ju dem som är här, mer än de som jag aldrig träffar som jag bara att kontakta på telefon. Det är inte så att jag ringer upp och säger ‘fan idag höjde du dig med en tiondel.’ ”

[*Is communication with the drivers something that usually happens every day? How often are you in touch?*] F2: “Yes, more or less. Maybe not everyone every day, but... at least two, three times a week I’d say. Sometimes it’s more and sometimes less, but you usually check in about something, like, several times a week. So yes.”

[*Är kommunikation med förarna någonting som brukar ske varje dag? Hur ofta hörs ni av?*] F2: “Ja mer eller mindre. Kanske inte alla varje dag, men... minst två tre gånger i veckan skulle jag säga, ibland är det ju mer och ibland mindre, men man stämmer ju oftast av någonting, liksom flera gånger i veckan. Så att ja.”

F1: “It [communication] is among the hardest things we have in a company. Yeah. There are always some who want more, and always some who hardly want anything at all, so. Yeah, communication is difficult.”

F1: “Det [kommunikation] är ju bland det svåraste vi har i ett företag. Ja. Det är alltid några som vill ha mer, och alltid några som, som inte vill ha någonting alls knappt så att. Ja, det är svårt med kommunikation.”

[*In response to the question of whether there is anything that could make communication with the drivers easier*] F2: “But nothing really that’s like, ‘I’m missing that.’ I think we have quite straightforward communication.”

[*på fråga om det finns något som skulle kunna underlätta för kommunikationen med förarna*] F2: “Men ingenting liksom som är så här att ‘det saknar jag’. Jag tycker vi har en ganska enkel kommunikation.”

F2: “But I think all three are quite aware that I have a... or that we have a shared ambition that we should drive as economically as possible [...]”

F2: “Men jag tror att alla tre är ganska medvetna om att jag har en... eller att vi har en ambition tillsammans om att vi ska köra så ekonomiskt som möjligt [...]”

F2: “If we can reduce fuel [consumption] by one or two decilitres, that generates this much, and then I can pay out a bonus at Christmas instead.”

F2: “Kan vi sänka bränslet [förbrukningen] med en eller två deciliter, så genererar det så här mycket, och då kan jag betala ut en bonus till jul istället.”

F1: “[...] Everyone can see their own [...] numbers and instead compete against themselves. Then there are 20% who get motivated, 60% who are like ‘yeah, yeah,’ and 20% who don’t care about it at all.”

F1: “[...] Alla kan se sina egna [...] siffror och däremot tävlar mot mot sig själv istället. Sen är det ju 20% som blir motiverade, och 60% som är ‘ja ja’, och 20% som är skiter i det fullständigt.”

[*Regarding whether anything could make communication with the drivers about their eco-driving easier*] F1: “It would be if, in some way, you get everyone’s approval to publish some kind of statistics [...] and if you have the energy and the time, you could set up some kind of competition where you’re constantly competing against yourself: if you improve by 0.5%, or 0.5, or five units, or whatever you want in a given measure, then you can get something.”

[*Angående om något hade kunnat underlätta ikommunikationen med förarna kring deras eco-driving*] F1: “Det är ju, om man på något sätt, får godkännande av alla att lägga ut någon sorts statistik [...] orkar man och har tid, så kan man ju sätta upp någon tävling att att man hela tiden tävlar mot sig själv: att förbättrar du dig 0,5% eller 0,5 eller fem enheter eller vad du vill i ett visst mått så kan du få någonting då”

[*Regarding the idea that drivers’ lack of motivation is a bigger barrier to eco-driving than a lack of knowledge.*] F1: “[...] you can do different competitions and things, but it’s so hard to compare drivers... Or comparing driver to driver isn’t hard in itself, but it depends on what they drive [...] I mean, it’s not fair to compare them in a competition. Then you’d have to introduce, find, some assessment system that makes it fair with handicaps or something like that, kind of like in golf, and there’s a big risk it’s perceived as unfair instead of becoming a carrot.”

[*Angående idén att förares motivationsbrist är en större barriär till eco-driving än kunskapsbrist*] F1: “[...] man kan ju göra olika tävlingar och grejer, men men det är ju så svårt att jämföra chaufför... Eller chaufför och chaufför är inte svårt, men beroende på vad de kör [...] Alltså, det är ju inte rättvist att jämföra dem i en tävling. Då måste du införa, hitta, något bedömningssystem som gör det rättvist med handikapp eller något sådant, ungefär som i golf, och risken är stor att det upplevs orättvist istället för att det blir en morot.”

F1: “Yes, and then for each vehicle, you have the vehicle’s average fuel consumption. [...] And then I’ve said 3.7 is green and everything above 3.7 is red. [...] [*So this is for the whole fleet then, that you set a number that counts as approved and so on?*] Yes, it’s for the whole fleet [...] and the only thing I differentiate is diesel vehicles and gas vehicles.”

F1: “Ja, och sen har har du varje bil då, bränsleförbrukning på bilen i snitt. [...]

Och då har jag sagt 3.7 är grönt och allt som är över 3.7 är ju rött sen.[...] [*Det här är för hela flottan då att du ställer in, en siffra som är godkänd och så?*] Ja det är för hela flottan [...] och det enda som jag skiljer på är dieselbilar och och gasbilar."

[*about the current system*] F1: "[...] the events are classified as green, yellow, and red. If you move up to red, then it starts to get serious, and then you start looking: what is it that... I mean, you can swerve to avoid something with a vehicle and then you get a red event, but if you have the same driver with three red events per week on average, then you have to have a talk."

[*Angående nuvarande systemet*] F1: "[...] händelserna klassas som grön, gul och röd. Går du upp på röd då börjar det bli allvarligt och då då börjar man ju titta: vad är det som... alltså det kan ju svänga ut en bil och då får du röd händelse men men har du en och samma chaufför med tre röda händelser i veckan i snitt? Då måste man ju ta ett snack. "

F1: "I can't just look at the numbers, I have to know why as well."

F1: "Så att jag kan ju inte bara titta på siffrorna, utan jag måste ju veta varför också."

F1: [*looking at the current fleet management system*] "don't know who the hell has been driving today. Yeah, it's [driver]. Yeah, yeah, and in Gothenburg, you see. [...] A red event: right turn 26 km/h 3.1 [severity level]. It's not that bad, but it's over 3 [severity level] so it becomes a red. [...] But it's not... it's not that bad. It's not like I'm going after him for this. [...] Now he's been given a vehicle he doesn't like driving, plus it's in Gothenburg, where the traffic is unpleasant to drive in."

F1: [*tittar på nuvarande fleet management systemet*] "vetifan vem som har kört idag. Ja, det är [förare]. Ja, ja, och i Göteborg ser du. [...] En röd händelse: högersväng 26 km timmen 3.1 [allvarlighetsgrad]. Det är inte så farligt, men det är ju över 3 [allvarlighetsgrad] så det blir en röd. [...] Men det är ju inte... det är inte så farligt. Det är inte så att jag går på honom för det här. [...] Nu har han fått en bil som inte han gillar att köra, plus att det är i Göteborg, med att trafiken är otrevligt att köra i."

F1: "And then there are different... newer vehicles as well, so it's not entirely fair to just look [at the numbers]"

F1: "Sen är det ju olika... moderna bilar också, så att det är ju inte helt rättvist att bara titta [på siffrorna]"

F1: "[...] this system means you can see and catch those... who are doing the worst, and you can see those in the middle and the best too, of course, but most often you end up focusing on the ones who are doing the worst, unfortunately maybe. No, but without the system, they wouldn't have gotten any praise at all."

F1: "[...] det här systemet gör ju att man ser ju och fångar upp dem... som är sämst, och man kan se de som är mellan och de bästa också, förstås, men oftast kokar man ju på de som är sämst, tyvärr kanske då. Nej, men men utan systemet, så hade de ju inte fått något beröm alls."

E

User Interface Screenshots

Figure E.1: On-board driver-facing view at session start and when thresholds for coaching is not yet reached.

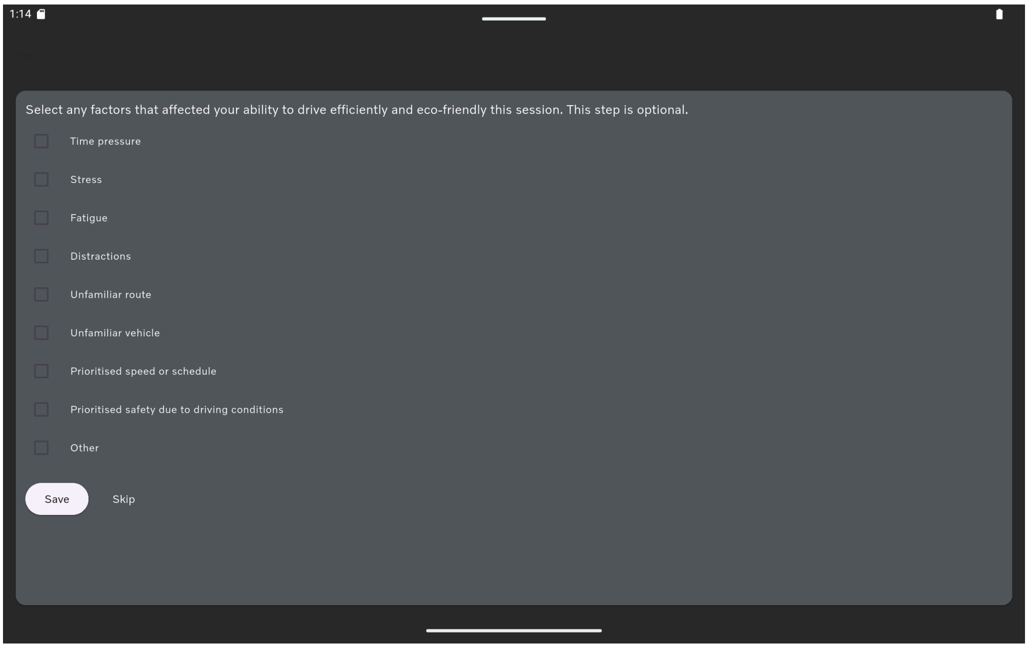

Figure E.2: Post-drive form for optionally filling in factors that affected efficient and eco-friendly driving during the session. Selecting 'Other' opens up a text-field for providing input.

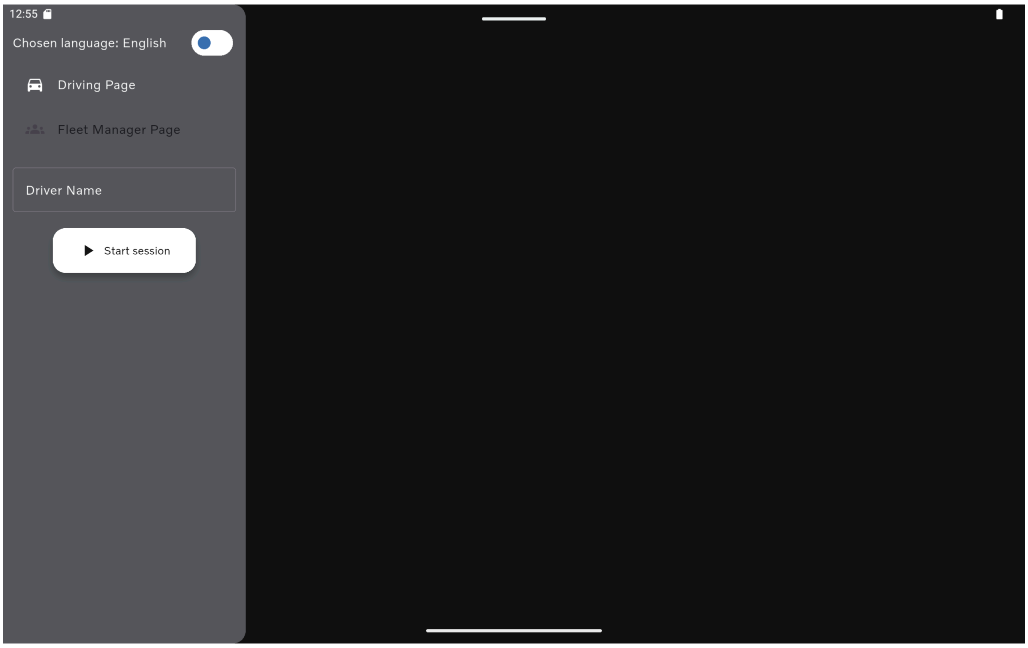

Figure E.3: The hidden navigation drawer that the wizard can use to switch between views and language settings.

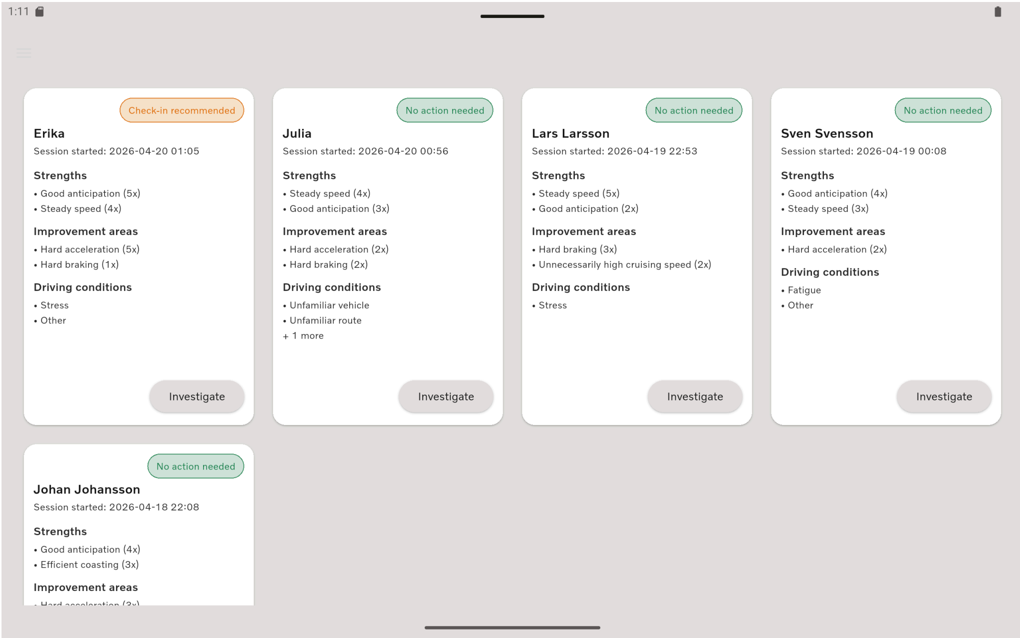

Figure E.4: Starting page for the off-board fleet view with an overview of all driving sessions and flags for whether check-in is recommended.

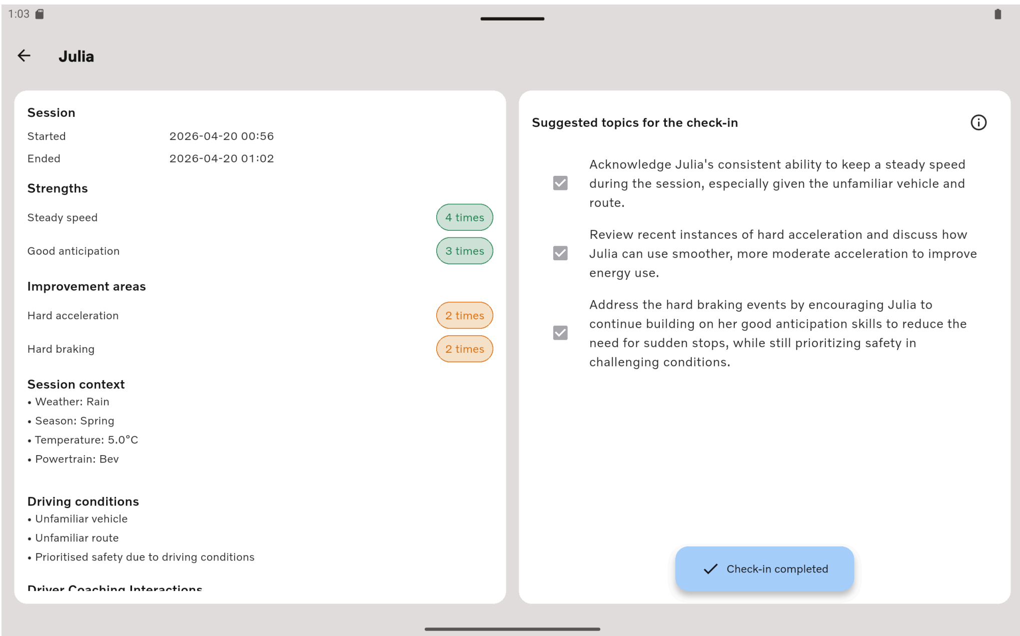

Figure E.5: Detailed fleet view for a session where a check-in has occurred and meeting topics have been checked.

F

LLM Prompting Used in the Prototype

Shared prompt components

Both chat completion prompts, used to generate driver coaching messages and suggested manager check-in topics, include a shared knowledge base covering powertrain specific constraints and eco-driving recommendations. Both prompts also incorporate tone of voice and language guidelines, ensuring that the output is adapted consistently to the selected application language (Swedish or English). The tone of voice prompt was adapted from Volvo's internal tone of voice and UX writing guidelines.

Eco-driving knowledge base and vehicle-specific constraints

```
final vehicleRule = () {
  switch (energyType) {
    case VehicleEnergyType.bev:
      return isSv
          ? 'Fordonet är batterielektriskt. Använd termer
          som energianvändning och energieffektivt.
          Nämn aldrig bränsle, diesel, bensin,
          tomgång eller att stänga av motorn.'
          : 'Vehicle is battery electric. Use terms like
          energy use and energy efficiency.
          Never mention fuel, diesel, gasoline,
          idling, or switching off the engine.';
    case VehicleEnergyType.ice:
      return isSv
          ? 'Fordonet har förbränningsmotor. Det är okej
          att nämna bränsleförbrukning och
          tomgång när det är relevant.'
          : 'Vehicle is internal combustion. You may mention
          fuel consumption and idling when relevant.';
    case VehicleEnergyType.hydrogen:
      return isSv
```

```
          ? 'Fordonet är vätgasdrivet. Använd
          energianvändning. Nämn inte bränsleförbrukning.'
          : 'Vehicle is hydrogen. Use energy use.
          Do not mention fuel consumption.';
    default:
      return isSv
          ? 'Om energityp är okänd, använd neutralt språk:
          energianvändning.'
          : 'If energy type is unknown, use
          neutral wording: energy use.';
  }
}();

final kbCore = isSv
    ? '''
    Kunskapsbas för ekokörning:
    - Ekokörning är mjuk, förutseende och jämn körning.
    - Undvik frekventa hårda inbromsningar
        genom att läsa trafiken och planera.
    - Accelerera måttligt och håll jämn fart
        när det är säkert.
    - Anpassa hastigheten efter trafik och skyltning.
    - Använd farthållare på motorvägar och landsvägar
        om lämpligt för att hålla jämnt tempo.
        Farthållare är inte lämplig för
        stop-and-go trafik, stadskörning, regn,
        snö eller på hala vägar.
    - Bromsa genom att sakta ner tidigt och mjukt
        när det är möjligt.
    - Utrullning är när fordonet rullar
        utan drivmoment. Använd när det är säkert.
    - Begränsa extra energianvändning, till exempel
        luftkonditionering, när det inte behövs.
    - Vid halt väglag eller svåra förhållanden
        går säkerhet ofta före ekokörning.
    '''
            : '''
    Eco-driving knowledge base:
    - Eco-driving is smooth, anticipatory, steady driving.
    - Avoid frequent hard braking by reading traffic
        and planning ahead.
    - Use moderate acceleration and keep a steady speed
        when safe.
    - Adapt speed to traffic flow and limits.
    - Use cruise control on highways and rural roads
        if appropriate to help maintain even pace.
```

```
        Cruise control not appropriate for
        stop-and-go traffic, city driving, rain,
        snow or on slippery roads.
    - Decelerate early and smoothly when possible.
    - Coasting is rolling without driving torque.
        Use when safe.
    - Limit auxiliary energy use such as
        air conditioning when not necessary.
    - In poor grip or difficult conditions,
        safety often comes first.
    ''';

return '$vehicleRule\n$kbCore'.trim();
```

Tone of voice and language constraints

```
final languageRule = language == AppLanguage.svSE
    ? '''
    Language requirement:
    - Write ALL output in Swedish (sv-SE).
    - Banned words: komfort, marschhastighet.
    - Do NOT use English.
    '''
    : '''
    Language requirement:
    - Write ALL output in US English (en-US).
    - Do NOT use Swedish.
    ''';

return '''
    $languageRule

    Tone of voice guidelines:
    - Trustworthy: Be factual, clear and
        avoid exaggerations.
    - Approachable: Use simple, relatable language
        to involve the reader.
    - Intelligent: Be rational and pragmatic.
        Clarify without over-explaining.
    - Positive: Encourage and offer
        improvements respectfully.
    - Use familiar words and simple sentences.
    - Never arrogant, indifferent, careless or robotic.
  ''';
```

Driver coaching message generation

Purpose

The driver coaching message was intended to be tailored to the current driving context, avoid repetitive coaching within a session, include both strengths and improvement areas (if available), and remain suitable for text-to-speech playback.

Inputs

- Driver name
- Session context snapshot and coaching memory context
- Event counts since session start
- Language setting (English or Swedish)
- Optional tagged event context summary (including `at=` tags)
- Optional preferred positive and improvement focus keys
- Eco-driving and vehicle knowledge base

Coaching system prompt

```
${_systemToneOfVoicePrompt(language)}

You are an in-vehicle driver coaching assistant.
The message will be read aloud via TTS
    while the truck is moving.

$swedishTermRule

Output requirements (TTS safe):
- Output plain text only. No markdown, no emojis, no quotes.
- Avoid abbreviations and acronyms. Spell words out.
- Avoid symbols and shorthand. Spell words out.
- Avoid numbers when possible. If a number is necessary,
    use simple words, not digits.
- Avoid parentheses.
- Avoid long or complex sentences.
    Aim for clear speech rhythm.

Content requirements:
- Maximum two short sentences.
- Include at least one specific praise
    if any positive focus is provided.
- Include at most one improvement suggestion,
```

```
    phrased respectfully.
- Only refer to behaviors that are explicitly present
    in the provided event counts or
    in the provided focus event keys. Do not invent events.
- Do not mention that you are an AI.
- Do not shame or blame. Be calm and respectful.
- Do not distract the driver: no questions,
    no multi-step instructions, no lists.

Safety requirement:
- If the context suggests poor grip or difficult conditions,
    prioritise safety and stability over
    eco-driving optimisation.

Use context intelligently:
- You may tailor advice to the current driving context
    snapshot (road type, traffic, weather, vehicle).
- If tagged event context includes "at", interpret it as the
    situation where the behavior occurred
    (example: at=redLight, at=merge).
- Mention the situation only if it makes the message
    more specific and still safe for TTS.

Return only the final message.
```

Coaching user prompt

```
Driver: $driverName

Context:
- Coaching is delivered only when the driver
    presses the coaching button.
- The system accumulates driving events until then.
- Avoid being repetitive across coaching messages
    in the same session.
- Be fair: if an improvement event happened only once,
    do not overreact.

Eco-driving guidance (follow strictly):
$ecoKb

Coaching memory and context:
$memoryContext

Event counts since session start
(array of objects with key and count):
```

```
$countsJson

Focus guidance:
- Preferred positive focus event key:
    ${focusPositiveEventKey ?? 'none'}
- Preferred improvement focus event key:
    ${focusNegativeEventKey ?? 'none'}

Focus situation tags (at=...):
- Positive at: ${focusPositiveAt ?? 'none'}
- Improvement at: ${focusNegativeAt ?? 'none'}

Tagged event context
(recent observations, may include at=...):
${(eventContextSummary == null ||
    eventContextSummary.trim().isEmpty)
    ? 'none' : eventContextSummary.trim()}

Task:
Write the maximum two sentence TTS safe
coaching message now.
```

Manager check-in topic generation

Purpose

The generated check-in topics for the fleet manager view were intended to provide actionable, easy-to-scan items grounded in session data, including strengths, improvement areas, and relevant driving conditions. These topics were designed to support brief follow-up conversations and enable timely organisational recognition.

Inputs

- Driver name
- Strengths (key, count)
- Improvement areas (key, count)
- Driving conditions (including post-drive self-report, if included)
- Language setting (English or Swedish)
- Eco-driving and vehicle knowledge base

Topics system prompt

```
${_systemToneOfVoicePrompt(language)}

You are a truck fleet manager assistant.
Create conversation topic suggestions a
manager can bring up in a short
check-in about a driving session.

$swedishTermRule

Output MUST be valid JSON: an array of strings.
Return only the JSON. No extra text.

Hard rules:
- Output language MUST follow the Language
    requirement above.
- Provide 3 to $maxTopics items.
- Each item is ONE sentence and starts with a verb.
- Write as a manager-facing suggestion,
    NOT a script or spoken dialogue.
- Do NOT use quotes and do NOT write
    "Let's..." or "Talk about..." or
    "How do you feel..." phrasing.
- Refer to the driver in third person using the provided
    driver name. If name is missing or blank,
    use "the driver".
- Mention concrete themes grounded in the provided data.
- Make items easy to check off.

Coverage rules:
- If strengths are provided, include
    at least 1 item praising a strength.
- If improvement areas are provided, include at least
    1 item addressing one improvement area
    with a concrete next step.
```

Topics user prompt

```
Driver: $driverName

Eco-driving guidance (follow strictly):
$ecoKb

Strengths (top events) (key -> count):
    ${jsonEncode(strengths)}
Improvement Areas (top events) (key -> count):
    ${jsonEncode(improvementAreas)}
```

```
Driving conditions: ${jsonEncode(drivingConditions)}

Hard grounding rule:
- Only mention situations that appear in the "Most frequent
    situations" section. Do not invent situations.

Return the JSON array now.
```

G

Prototype Evaluation Protocol

Driver

Instructions

We have developed a voice-based system that provides feedback and support for eco-driving during active driving. The driver's eco-driving strengths and areas for improvement are also summarised in a system for the fleet manager. The purpose of this study is to investigate the user experience of the system, as well as how it is perceived in comparison to existing solutions, which typically provide automated feedback in the form of scores, indicators, or continuous feedback during driving.

In this test, you will have the opportunity to try our solution in a real driving situation. A key aspect of the system is that you choose when to receive feedback, rather than it being delivered continuously.

A tablet placed near the side display will show notifications during driving indicating that coaching is available. The screen also includes a button that you can press when you consider it safe and appropriate to receive voice-based feedback. Once the feedback message has finished, the system returns to its default state, and a new notification appears when additional feedback is available.

Test procedure:

- You complete a consent form and a demographic questionnaire
- You drive a route and use the system at times of your choosing (During the entire drive, we will be present in the vehicle and observe)
- After the drive, we will ask a few short questions about your experience
- You will participate in a short simulated conversation with a fleet manager
- Finally, we will ask some follow-up questions

Important:

- Safety always comes first
- Only use the system when you feel it is safe to do so
- There are no right or wrong answers - we are interested in your experience

Do you have any questions?

Conducting driving test

UMUX-Lite

Follow-up questions - Step 1 (after driving test & UMUX-Lite)

1. Why did you give this rating? Please motivate your answer (x2)
    - *The system's capabilities meet my requirements (1-7)*
    - *The system is easy to use (1-7)*
2. What is your experience with existing eco-driving coaching systems?
3. How did you experience being able to choose when to receive coaching?
4. How would you describe your experience of receiving feedback from a voice-based system?
5. How did you perceive the tone of the coaching?
    - *Did it feel respectful or, for example, condescending?*
6. How did the system affect your motivation to improve your eco-driving?
7. Were you able to focus on what was being said in the coaching? Please elaborate
8. If you could change one thing about the system, what would it be?

Conversation with fleet manager

Instruction before conversation

You will now participate in a conversation about your eco-driving with a person acting as a fleet manager in this test.

The conversation is based on the information that the system has compiled about your driving. We would like you to participate in the conversation as naturally as possible, based on how you would respond in a real work situation.

Please keep in mind that you are encouraged to:

- reflect on the feedback you receive
- ask questions if something feels unclear or unfair
- express whether you agree or disagree with what is being said

There are no right or wrong ways to participate in the conversation - we are interested in your experience and your spontaneous reactions.

Conducting conversation with fleet manager

Follow-up questions - Step 2 (after conversation)

1. How did it feel to have this conversation with your “manager”?
2. In your role as a driver, did you feel that the conversation was primarily for your sake or for the sake of the fleet “manager”? Please elaborate
3. Did the conversation make you more motivated to improve your driving? Please explain
4. How important is it for you to receive feedback or encouragement from your manager in your work?
5. How does it feel that your “manager” can see summaries of your driving?
   - *Does it feel like monitoring/surveillance?*
6. How would you prefer to receive feedback or recognition for your driving?

Fleet Manager

Instructions

We have developed a voice-based system that provides feedback and support for eco-driving during active driving. The driver’s eco-driving strengths and areas for improvement are summarised in a system for the fleet manager. The purpose of this study is to investigate the user experience of the system, as well as how it is perceived in comparison to existing solutions.

In this test, you will take on the role of a fleet manager and participate in a conversation with the driver. The conversation is based on a summary of the driver’s eco-driving presented in the system’s fleet manager view.

Test procedure:

- You complete a consent form and a short demographic questionnaire
- The driver completes a driving session using the system
- After the drive, we ask a few questions about the driver’s experience
- You participate in a short simulated conversation with the driver in the role of fleet manager
- Finally, we ask follow-up questions

We would like you to conduct the conversation as realistically as possible, based on how you imagine such a conversation would take place in a real work setting.

Suggested structure for the conversation:

- Navigate to the relevant driver's page in the overview
- Base the conversation on the information presented in the system
- Ask the driver questions about their driving
- Highlight both strengths and areas for improvement
- Discuss possible actions or development

You are free to decide how to phrase your feedback and what to focus on.

There are no right or wrong ways to conduct the conversation - we are interested in your experience of both the system and the interaction.

Do you have any questions?

Conducting conversation with driver

UMUX-Lite

Follow-up questions (after conversation & UMUX-Lite)

1. Why did you give this rating? Please motivate your answer (x2)
    - The system's capabilities meet my requirements (1-7)
    - The system is easy to use (1-7)
2. How did it feel to have this conversation with the driver?
3. In your role as a manager, did you feel that the conversation was primarily for you or for the driver? Please elaborate
4. How did the system affect your motivation to engage in conversations with drivers about eco-driving?
5. If you could change something about the system, what would it be?
6. Do you have any additional comments on any part of the system?

H

Translations of Prototype Evaluation Quotes

D6: “Because if it’s wrong, you’ll just get annoyed, and then you’ll feel that you don’t ehm care, I was going to say, but because this is a bit of what’s important with diesel and BEV [battery electric vehicle] and this that, for example with speed, it’s not always negative to brake with electric because you get something back, you don’t get that with diesel. So it needs to be the right information that comes, otherwise you’ll get tired of it.”

D6: “För blir det fel kommer man bara störa sig och då kommer man känna att man inte ehm bryr sig tänkte jag säga men, för det är ju lite det här som är viktigt med diesel och BEV [battery electric vehicle] och det här att med till exempel hastighet så är det ju inte alltid negativt att bromsa med el för du får ju tillbaka nånting, det får du inte på diesel. Så att mer att det är rätt info som kommer annars så tröttnar man.”

D1: “[...] it feels like he [the eco-driving coach] jumps around a lot. Eh, suddenly he is here and now, and then suddenly he is three or four intersections back. [...] it felt very much like, sort of, jumping back and forth, and in the end you didn’t know where you were anymore.”

D1: “[...] den känns som att han [eco-driving coachen] hoppar väldigt mycket. Eh plötsligt är han här och nu, och helt plötsligt så är han tre fyra korsningar längre bak. [...] det kändes som att det var väldigt så här flängande fram och tillbaka och till slut visste man inte var man var nånstans.”

D1: “[...] as before during the trip, you felt that some things just became question marks rather than a helping hand, because for example, ‘take it easier in the roundabout’, we hadn’t driven through any roundabout or anything like that. Or the downhill bit when we were accelerating, then he said ‘that was well rolled’, even though we throttled, and that is bad, basically. So it became more confusion, a bit more in that direction I felt, in that case.”

D1: “[...] som innan under resan att man kände vissa blev bara frågetecken mer än att det blev en eh hjälpande hand, på grund av exempelvis ‘ta det lugnare i rondellen' vi har inte kört igenom nån rondell eller nån så här. Eller nedförsbacken när man accelererade så sa han 'det va bra rullat' fast vi gasade ju och det är illa typ. Så det blev mer en förvirring lite mer åt det hållet kände jag, i det då."

D5: "But I didn't often agree with what it said. Eh, I did a bit of kickdown sometimes just to see what answer I would get, and then I still got praise, so I'm positive about it [the concept], but I didn't agree with her, so to speak."

D5: "Men jag höll inte med ofta vad den sa. Eh jag gjorde ju lite kickdown ibland bara för att se vad jag fick för svar och då fick jag ändå beröm så jag är positiv till det [konceptet] men jag höll inte med henne om man säger så."

D6: "[...] yeah, because I think it gives more positive feedback than what exists today, and that it feels more eh, ah, but live and updated, like it is actually a, it's me and the truck actually doing something together. Or I do it, but the truck praises me for doing it."

D6: "[...] jo för att jag tycker att den ger mer positiv feedback än dagens liksom, och att den känns mer eh ah men live och uppdaterad alltså som att det är, faktiskt är en, det är jag och lastbilen som faktiskt gör nånting tillsammans. Eller jag gör det men att lastbilen berömmer mig för att jag gör det."

D6: "[...] very good [effect on motivation] when it was right and when I felt like, 'ah, but now you drove well in the roundabout', ah, but I actually did that, then I felt, nice, then I'll test the next roundabout too."

D6: "[...] väldigt bra [påverkan på motivation] när det var rätt och när jag kände att så här 'ah men nu körde du bra i rondellen' ah men det gjorde jag faktiskt då kände jag men gött då ska jag testa nästa rondell med."

D5: "So if she [the eco-driving coach] had been a bit harder on me, I would have just, ah, now I'll have to show that I can do better [...]"

D5: "Så hade hon [eco-driving coachen] varit lite hårdare mot mig så hade jag bara ah nu ska nog få se att jag kan bättre [...]"

D1: "I think it [the eco-driving coach] was almost a bit too nice (hehe). I wanted it to be a bit more straight to the point and a bit harder, just like 'good, but you didn't do this well' [...] I like it when it gets straight to the point, so, a serious tone. This one feels like, 'good', 'very good', like a bit too positive almost [...] it would actually have been kind of fun, in a way, if when you drive very well it is very kind in tone and then when you drive badly you get a serious tone [...]"

D1: “Jag tycker den [eco-driving coachen] nästan var lite för snäll (hehe). Jag ville den skulle va lite rakt på sak och lite hård, bara ‘bra men du gjorde inte det här bra typ’ [...] jag gillar när det går rakt på sak alltså det, allvarlig ton. Den här känns som att, ‘bra’, ‘väldigt bra’, så här lite för positiv nästan [...] hade faktiskt varit lite kul i och för sig när man kör väldigt bra är den väldigt snäll i tonen och sen när man kör illa får man allvarlig ton [...]”

D5: “Eh, positive [to get feedback from a voice-based system] because then I don’t have to, I mean if I get the feedback here in [points to the SID] it’s not good to sit and read it while driving, maybe [...]”

D5: “Eh positivt [att få feedback från ett röstbaserat system] för då slipper jag, jag tänker att om jag får feedbacken här i [pekar på SID] det är ju inte bra att sitta och läsa det när man kör kanske [...]”

D4: “I wouldn’t like it. Hm. Better that it comes up as a small pop-up in the IC then. Eh, because this becomes a sort of soft mute together with everything else that beeps in the truck, so then it becomes so many distractions overall [...] So it can become an irritation in the end, which might make you want to just turn it off instead. I’m afraid.”

D4: “Jag skulle inte tycka om det. Hm. Bättre det kommer upp som en liten pop-up i såna fall i IC:et. Eh för det här blir ju en soft mute ihop med allt annat som plingar i bilarna så då blir det så mycket distraktioner överlag [...] Så det blir ju ett irritationsmoment kanske till slut som gör att man måste, hellre stänger av den så. Är jag rädd.”

D2: “It feels like it was probably a bit too much to have it in voice form specifically. There’s so much else that beeps in here, so it could be, eh, an extra thing that I think some people might get annoyed by.”

D2: “Det känns som att det blev nog lite för mycket att just ha det i röst- röstform. Det är så mycket annat som plingar här inne så att det kan nog bli eh, det blir ett moment extra som jag tror att en del kommer kunna störa sig på.”

D4: “But it’s good to be able to choose whether you want to hear them or not by pressing this button then.”

D4: “Men det är ju bra att kunna välja om man vill höra dom eller inte genom att trycka på den här knappen då.”

D2: “Yeah, but it was better, ehm. Eh, in a way that you get it when you want it. [...] I would almost rather have it so that you turn it on and then it is on and you get tips, and then you can turn it off and then you get no tips at all, so then they come if you have approved and turned it on."

D2: "Jo men det var ju bättre, ehm. Eh på ett sätt att man får det när man vill ha det. [...] Jag hade nästan hellre haft att man sätter på det och så är det på och så får du tips och sen kan du stänga av det och då får du inga tips alls, utan att då kommer dom om du har godkänt och satt på det."

D6: "I like that you choose, I also said that I would have liked it if you could choose for it to be like, ehm, what's it called, that it comes automatically, that is, speaks without you needing to press, as one option, or if I just want it to come as a notification, or that I want to be able to turn it off completely then."

D6: "Jag gillar att man väljer, jag sa också att jag hade önskat att man kan välja att ha den liksom ehm vad heter det att den kommer automatiskt, alltså pratar utan att man behöver trycka, som ett alternativ eller om jag bara vill att det ska komma som en notis eller att jag vill kunna stänga av den helt då."

D4: "Just take some corners before pressing the button here"

D4: "Bara ta lite kurvor innan trycker på knappen här"

D5: "[...] it was just a click, basically, and yeah, it really wasn't any more difficult than that, I think."

D5: "[...] det var ju ett klick liksom och ah det var ju inte svårare än så tänker jag."

D2: "[...] yeah with the way it is now is still fairly easy, ehm. There are no advanced things that need to be done while driving."

D2: "[...] ah så som det är nu så är det ju ändå rätt så lätt ehm. Det är ju inga avancerade saker som behöver göras under körning."

D4: "But at the same time, it becomes a distraction from driving when you have to press something to decide that you want to hear it."

D4: "Men samtidigt så blir det ju en distraktion från körningen när du ska trycka på nånting som bestämma att du vill höra den."

D2: "But also that all the time, I mean if we say it had been on this screen [points to the SID] and it comes up, then you have to keep pressing to get it. Because, I think many drivers can be like that, that 'ah now something came up', and then you focus more on it."

D2: “Men också att du hela tiden, jag tänker nu om vi säger att det hade varit i den här skärmen [pekar på SID] och den kommer upp så måste du hela tiden trycka för att få det. För att, jag tror att många förare kan bli såna att ‘ah nu kom det nånting’ så fokuserar man mer på det.”

D6: “I mean, I started driving when I was nineteen, and I didn’t dare say anything to my boss. If he said I was going to work twelve hours on a Saturday, then that was just how it was. If he told me to do something, I was told, ‘don’t brake, it wears out the brakes, just roll, like, what are you thinking?’, okay, then that’s what you did. I mean, you get shaped by that, and you are afraid [...]”

D6: “Jag menar jag började köra när jag var nitton, jag vågade inte säga till min chef nånting. Sa han att jag skulle jobba en lördag tolv timmar då var det bara så. Sa han till mig att jag skulle, jag fick ju till mig ‘bromsa inte, det sliter på bromsarna, rulla, liksom vad tänker du med?’, okej då gjorde man det. Alltså man blir ju formad och man är rädd [...]”

D6: “[...]. I know, uh, there can be traffic situations where I need to do something that isn’t good, and then I shouldn’t, like, get told, ehm, ‘think about not doing that’ no, I know, but I had to, because a tractor pulled out here and I didn’t want to crash, like.”

D6: “[...]. Jag vet eh för det kan ju finnas trafiktillfällen där jag behöver göra nånting som inte är bra, då ska jag ju inte liksom bli så här ehm ‘tänk på att inte göra så’ nej jag vet men jag var tvungen för att det kom ut en traktor här så jag vill inte krocka liksom, typ.”

D1: “[...] I only used the retarder and got feedback saying that I braked too hard (hehe), so it felt like I got criticised for something that wasn’t really completely accurate.”

D1: “[...] jag använde retarden bara och fick påbackningar att jag bromsade för hårt (hehe), så det känns som jag fick påhopp som inte riktigt stämde hundra.”

D6: “And the DECO today is very, like I said, rigid, and basically just slaps you on the fingers as soon as you do something it considers you shouldn’t do, if you want to get high scores.”

D6: “Och DECO:n då är ju idag väldigt, som jag sa, fyrkantig och ger dig egentligen bara pisk på fingrarna så fort du gör nånting som den anser att man inte ska göra, för att få höga poäng.”

D6: “So this, there are a lot of people for whom this [fleet view of the app prototype] is very, very good, because it can also be used as a basis for pay, but there can also be extreme unfairness depending on what kinds of routes you have, what vehicle you have, uh, what load you have, and so on."

D6: "Så att det här, det finns ju väldigt många som det här [åkeriöversikt i app-prototypen] är väldigt väldigt bra för, för det kan också finnas lönegrundning i det, men också en extrem orättvisa beroende på vilka körningar du har och vilken bil du har eh vilken vikt du har och så vidare."

D5: "Like when I worked in Norway painting road lines, I probably would never have used it, because that kind of driving wasn't really relevant for it, since there were trucks that had the engine on all the time, and well. Or when I drove a concrete truck there, no, but for, like, general cargo and long-distance driving, I probably would have been a big fan of it."

D5: "Som när jag jobbade i Norge och målade väglinjer då hade jag antagligen aldrig använt den för det var en körning som det var inte intressant för att det var bilar som stog på hela tiden och det va. Eller när jag körde betongbil där, nej men typ vid styckeparti och långkörningar då hade jag nog varit ett stort fan av det."

D2: "It [the conversation] is probably 50/50 [for the manager's or the driver's sake], both in that you find out what you did well and what you could have done better. And that the manager can see that the employee did their job properly."

D2: "Det [samtalet] är nog 50/50 [för chefens eller förarens skull], både att man får veta vad man gör bra och vad man kunde gjort bättre. Och att chefen ser att den anställda skötte sig."

D1: "[...] there's no one in the whole haulage industry who says, damn, that was well driven, damn, great job, no, no one says that. If you do your job and handle things properly, it's just silence, and if you drive really damn badly, then you get told off (hehe). So, that's the only thing that happens."

D1: "[...] ingen i hela åkeribranschen som säger fan vad bra kört, fan härligt, nej det är ingen som säger så. Det är att sköter man sig och gör det då är det bara tyst, och kör man förjävla illa då får man en utskällning (hehe). Så att. Det är det enda som händer."

D1: "[...] when the manager can see it, I think it becomes psychologically stressful too. Then it's like, maybe you're already stressed on the way to a customer, and then the manager sees that you've been driving really badly and you get criticised for that as well, so you've already had a damn shitty day and then the manager complains that you drove really badly, so yeah."

D1: “[...] när chefen ser jag tror det blir psykiskt påfrestande också. Då blir det att du kanske är stressad till kund och så ser chefen att du har kört väldigt illa och så få en påbackning på det också, så har du haft en jävla skitdag och så får chefen som klagar på att du har kört jävligt dåligt, så att det ah.”

D2: “[...] as a driver, it maybe doesn’t feel that great that the manager can see how you’re driving, if you’ve had a stressful or difficult day.”

D2: “[...] som chaufför känns det kanske inte jättebra att chefen kan se hur man kör, om man haft en stressig eller jobbig dag.”

M2: “[...] the first thing I saw was these red numbers when I went in, and that made me, like, feel that I maybe became a bit questioning about why we have these, uh, violations then, or these aggressive behaviours. You want your drivers to be the best in the world.”

M2: “[...] det första jag såg var ju dom här röda siffrorna när jag gick in, och då blev jag ju liksom, kände att jag kanske blev lite ifrågasättande varför vi har dom här eh överträdelserna då eller dom här aggressiva beteendena då. Man vill ju att ens förare ska vara bäst i världen.”

M1: “Yeah, well, I suppose that a system like that is meant to tell me and, like, help me and guide the drivers to become better and safer drivers and maybe more energy-efficient. And then we do that with systems, because it tells you how much brakes and how much- It also tells you what is good, and maybe that’s something you should bring up with the people driving too. I didn’t do that though, because I went straight to the negative.”

M1: “Ah men ja, jag misstänker då att ett sånt system ska tala om för mig och liksom hjälpa mig och guida förarna till att bli bättre och säkrare förare och kanske mer energieffektiva. Och då gör vi ju det på system för det talar ju om hur mycket bromsar och hur mycket- Den talar ju också om det är bra och det kanske man ska ta upp också med dom som kör. Det gjorde inte jag dock för jag gick ju rätt på det dåliga.”

D6: “I’ve myself been at haulage companies where you got called and given verbal warnings because you had a hard braking event, and you’re like, ‘but I had to, otherwise I would have crashed your vehicle instead’.”

D6: “Jag har själv varit på åkerier där liksom man har fått samtal med muntliga varningar för att man fick en hård inbromsning liksom man, ‘men jag var tvungen för annars hade jag krockat ditt ekipage istället’.”

D1: “But it feels like the whole truth wasn’t really there either, why it was the way it was [...] That you could have been given a reason why I made that kind of acceleration there, or why I maybe did a hard braking.”

D1: “Men det känns som att det, hela sanningen va inte framme heller varför det va som varför det va [...] Att man hade kunnat få en anledning varför jag gjorde en sån acceleration där eller varför gjorde jag kanske en hård inbromsning.”

D1: “You feel that, well, you don’t want to have to defend yourself every time [...]. Then it becomes a defence mechanism every day, why I did this, why I did that, then you almost have to explain yourself every day.”

D1: “Det känner man väl man vill väl inte försvara sig varje gång [...]. Då blir det en försvarsmekanism varje dag varför jag gjorde si varför jag gjorde så, då måste man nästan förklara sig varje dag.”

M1: “It all depends on how you approach it [the manager-driver discussion]. If you handle it well instead of coming in and controlling everything with a heavy hand, then I think it goes wrong. You need to try to open up the discussion, talk- not make it a monologue, but have a discussion with the driver. There may be other reasons why he drove the way he did.”

M1: “Det är ju, allting beror ju på hur man lägger upp det [samtalet mellan chef och förare]. Och tar man det på ett bra sätt istället för att gå in med en, styra med hela handen, så blir det ju fel tror jag. Man måste försöka öppna diskussionen, prat- inte ha en liksom en monolog utan ha en diskussion med föraren. Det kan ju finnas andra orsaker varför det är som han har kört som han har gjort.”

M2: “What I would have liked to add in that case is a dash-cam, so you can also see what is happening. [...] what caused it. Is it the traffic in [city], or is it like him himself.”

M2: “Det jag skulle vilja lagt till i såna fall det är ju en dash-cam i såna fall så man ser vad som händer också. [...] vad är det som orsakade det. Är det [stads]trafiken eller är det han själv liksom.”

D1: “But for yourself, then you can set it every day, you can see it every day, and like your percentage- potential improvement and do this and that. And then there’s a final summary, and then the manager gets to see it. So it’s once a month that the manager sees it, but you always see the whole process, no one else sees it except you yourself.”

D1: “Men för en själv då kan man sätta varje dag, det kan man se varje dag, och så här ens procent- potential förbättring och göra det ena och det andra. Och så får man ett slutskede till, så får chefen se det. Så det är en gång i månaden då chefen ser det, men hela processen ser du alltid, det är ingen annan som ser det än du själv.”
