Design assistance interactions between the older driver and the co-pilot

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Abstract

This study explores the optimisation of in-vehicle information systems (IVIS) to enhance the safety and collaborative experience between older drivers and their co-pilots. Utilising persona development and usability tests, the research hypothesizes that a co-pilot-centric IVIS will reduce older drivers' cognitive load and increase in-car task efficiency.

Data is gathered through eye-tracking for drivers and electromyography (EMG) for co-pilots. This work aims to bridge an identified knowledge gap concerning the interaction dynamics between older drivers and co-pilots within the IVIS context.

Introduction & Background

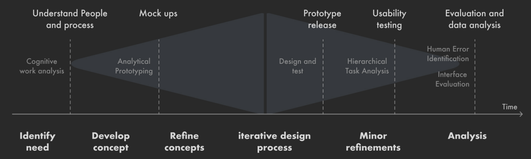
The aging population is increasing, marking older drivers as a key user group for in-car technologies. These drivers often face multitasking challenges, such as navigating unfamiliar routes. To offset this, they frequently rely on co-pilots to share the cognitive load.

Research Question and Purpose: This research centers on improving co-pilot and driver interactions to enhance safe multitasking, particularly in navigation. The primary objective is to identify effective interaction methods for safe navigation and task management. Existing studies on this topic are limited, making this research timely and relevant.

Diagram / Design

The design aims to validate issues and create a complete interaction prototype. At first, **design scenarios** to identify navigation-related problems, then create **function prototypes**. As depicted in the figure, the test confirms the co-pilot's ability to **send navigation data** to the driver. The focus is on the transmission screen and **possible** screen interactions, ultimately sending the route to the driver's **dashboard**.

Methodology

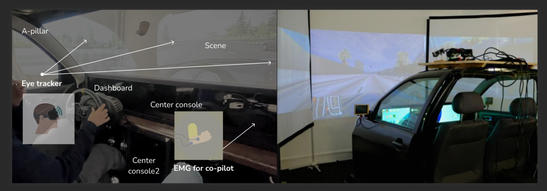


My research design phase integrates **Double diamond** with a **Comprehensive vehicle development** process.

5W1H approach: not only does it facilitate the **integration of information**, but it also stimulates the generation of fresh and innovative concepts through effective **brainstorming**.

Testing & Evaluation

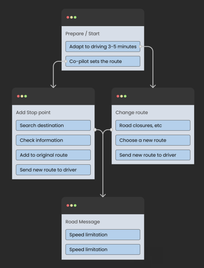
Preparation **Wizard of Oz** → Execute **Tasks Planning** → Criteria **Data analysis**



6 participants joined the study, including three older male drivers (50-65) with over 20 years of driving experience and three co-pilots (23-25) experienced in Google Maps and IVIS. All had normal colour vision.

Test Content

1. Experimental Method: Wizard of Oz, the test ran in a BeamNG-simulated driving environment.
2. During the test, the driver and co-pilot primarily execute tasks as illustrated in the figure.
3. Data collected by eye-tracking (older driver) and EMG (co-pilot).



Persona

The development of personas is key for understanding how drivers and co-pilots **interact on the road**.

This tool helps designers focus on the unique needs and challenges of users. In this study, we focus on **two main roles**: the older driver and the co-driver.

John
Age: 58 | Family
Wisdom · Tech Savvy

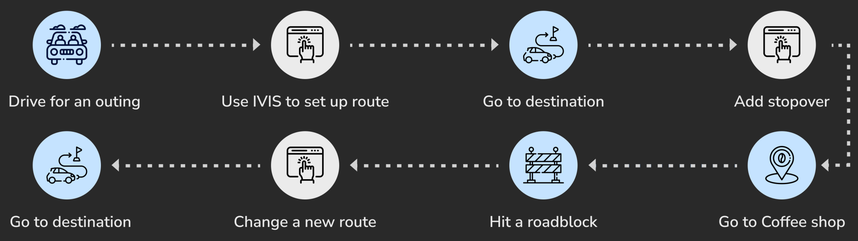
Pain points
- Driving Distractions: Operating the In-Vehicle Information Systems (IVIS) distracts him and compromises safety.
- Multitasking: Requests for non-driving tasks, like changing music, add to his difficulties.
- IVIS Complexity: Technological advances have made IVIS increasingly complex to operate.
- Slow Reaction: His reaction time has slowed down due to age.

Taylor
Age: 55 | Family
Helpful · Patient

Pain points
- Balancing Attention: Needs to find a middle ground between offering help and minimizing distractions for John.
- Learning Preferences: She needs to quickly adapt to John's preferences to offer personalized and efficient assistance.

Journey map

Using a user journey helps pinpoint key interactions between older drivers and co-pilots, identifying areas for IVIS improvement. It provides a structured way to test and validate design changes.



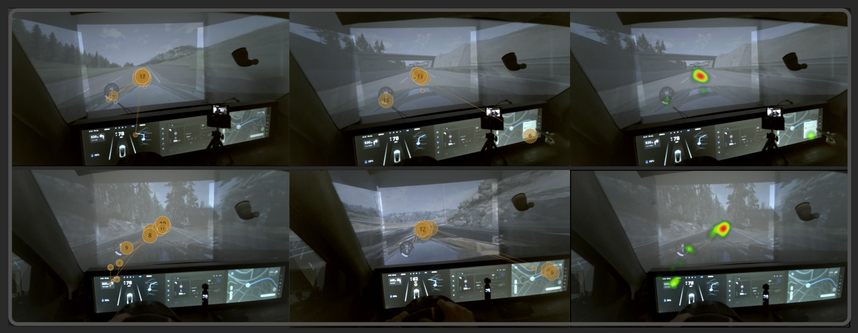
Research Results Describe

In-depth Interview

Through in-depth interviews, I can gather **valuable feedback from tests** for qualitative analysis.

The average System Usability Scale score of 73.33 falls into the **'B' grade**, indicating good usability and potential for minor improvements.

Data collection and analysis



Eye-tracking data shows that drivers typically **glance** at the transmitted information for no more than two seconds, which aligns with **safe driving practices**.

Due to limitations in EMG data detection, we relied on fluctuation analysis. However, videos have helped identify certain **human-factor issues** related to driving.

Conclusions & Future

In conclusion, both design and testing phases have validated the project's feasibility. Feedback from older drivers indicated that co-pilot assistance significantly eased the driving experience, making it more relaxing.

To refine the prototype, more qualitative research is planned to address uncontrolled variables and explore autonomous driving.