



Electric Vehicle Drivers' Perspective on Driving Range and Thermal Comfort

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📖 Motivation

- Thermal comfort in electric vehicles (EVs) directly impacts range [2], as also discussed in the media (e.g., “Electric cars leave mail carriers freezing” [1])
- This interconnection can be unexpected for drivers and lead to dissatisfaction – a concern under investigation in human-machine interface (HMI) research (e.g., [3])
- Improving the situation for EV drivers requires understanding the challenges they face
- To address this, we qualitatively explored EV drivers' experiences with thermal comfort and range

? Research Questions

- What are EV drivers' general experiences with range, range prediction, and thermal comfort?
- What are drivers' main usage challenges, and how could they be supported?

🔧 Method

- 10 semi-structured interviews with EV drivers
 - General information about the EV in use
 - Vehicle range and range prediction
 - Climate control and thermal comfort
- Each interview lasted ~40 minutes, was recorded and transcribed (MS Teams, aTrain, and manually)

👤 Sample

- 7 male and 3 female EV drivers participated, aged 30-55 years ($M = 43.5$)
- 4 drivers had professional roles related to EVs, either directly or through associated topics
- All participants owned an EV (bought or leased)
- EVs were from six brands and in use for 0.5 to 8 years
- 3 drivers had a second non-EV in the family

Results

📍 Range (Prediction)

Drivers were generally satisfied with their EV's range, but individual drivers:

- Avoided using the EV for longer trips
- Described increased planning efforts

Two drivers were dissatisfied due to reduced range in winter. One explained:

„You don't get quite as far with it, and that's a bit disappointing, yes, but you get used to it extremely quickly”

💡 “The overnight shock” 💡

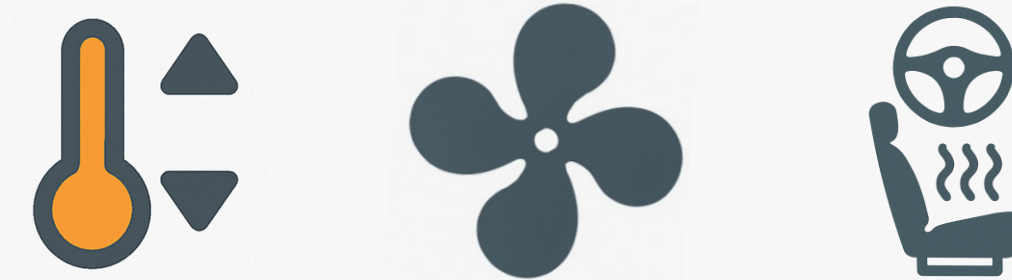
Range can drop after the EV cools down, a change not always anticipated (3 drivers)

Individual drivers learned through EV use:

- That there is no need for range anxiety
- To handle inconsistent range predictions
- The differences of battery technologies

🌡️ Thermal Comfort

Most frequent adjustments:



7 Drivers 5 Drivers 4 Drivers

- All drivers reported that these adjustments usually worked well

However, individual drivers mentioned challenges with climate automation:

- Manual adjustments were still often needed to maintain thermal comfort
- Unwanted automated actions led one driver to avoid using the automation:
“I really only use the air conditioning in summer, and in winter I don't want to have it on/off all the time [...] so that means no automatic but actually manual ventilation”

Four drivers explicitly considered the climate-range link unproblematic

🌱 Driving Modes

- All drivers were aware of driving modes – half reported active use
- Six drivers supported an eco-mode affecting climate comfort, commenting:
 - Always an option to use
 - For short trips alone
 - Should allow adjustments
 - Only in addition to the regular eco-mode
- Two drivers already had such an eco mode; two were unsure

💡 Drivers' suggestions

More personalisation of automated modes

Next day range prediction that considers weather Physical buttons instead of touch solutions

Direct display of the state of charge (SoC) Automatic adjustment to ambient temperature

💬 Discussion

- The interviews allowed us to learn about EV drivers' individual experiences with range and thermal comfort, leading to user-centred recommendations
- The complexity and novelty of EV use, combined with strong personal investment, can lead to diverse and sometimes contradictory opinions (e.g., EV drivers' range requirements can change through EV experience [4])
- Behavioural observations are a valuable next step to extend and validate the interview findings

📌 Recommendations

- Range predictions would be more useful if they incorporated predictive usage and ambient conditions
- Thermal comfort automation should be more transparent, customisable, and responsive to ambient temperature

References

- [1] ORF Steiermark. (2024, December 4). *Elektroautos lassen Postzusteller frieren* [Electric cars leave postal workers freezing]. *steiermark.ORF.at*. <https://steiermark.orf.at/stories/3283627/>
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Pictures created with ChatGPT (OpenAI, DALL·E), March 31, 2025

