Investigating the Subjective Effectiveness of AVAS (Acoustic Vehicle Alert System), from Different Manufacturers, in comparison to ICE (Internal Combustion Engine)

Jo Criddle: 3cridj06@solent.ac.uk; jo.criddle@outlook.com

Abstract

This research shows the analysis of subjective tests of AVAS sounds and ICE sound of different vehicles. The EVs used were the Renault Zoe, Nissan Leaf, Jaguar i-pace, BMW 330e, Tesla S and the VW GTE. The ICE vehicles were the Ford Fiesta and the VW GTI. The experiment was hindered by the 2020 pandemic, Covid-19, and, therefore, the method of testing had to be revised.

The results showed that participants could identify the direction of the vehicles better if the vehicles were approaching from their left or right, rather than in front of or behind them. The difficulty identifying vehicles direction also seems to have impacted their popularity among the participants, but more tests would have to be done to prove this. One of the ICE was significantly preferred to all of the other vehicle sounds with 53% of the participants in that test choosing it as their favourite.

Introduction

As the sales of electric vehicles (EV) increases the danger to blind and vulnerable road users increases also (European Blind Union, 2019). New legislation such as the UK governments decision to be carbon neutral by 2050 and the subsequent ban on new ICE vehicle sales by 2035 mean that the number of EVs on roads will increase. The six EV sounds and two ICE sounds were split into two tests. They were not told which vehicle was which. This was to see if they preferred the real engine sound to the synthesised AVAS sounds or if they were able to locate the vehicle better.

Method

The audio clips were paired with questions about the vehicles speed, direction and distance. The participants were also asked their age, gender, and occupations to see if there was any correlation. Audio of both EV and Internal Combustion Engines were used to see if the traditional engine sound was preferred/more effective. The audio clips had a doppler shift filter applied to them, using adobe audition, and were combined with synthesised background noise. The participants completed the test at home with their own headphones and their own phone, tablet, or laptop.

Questions for each audio clip:
- How far away do you think the vehicle was when you first noticed it?

Answers: Less than 10 meters, 11-20 meters, 21-30 meters, 31 or above, I do not know

- What direction was the vehicle travelling from?

Answers: From my Left, from my Right, from in front of me, from behind me, I do not know
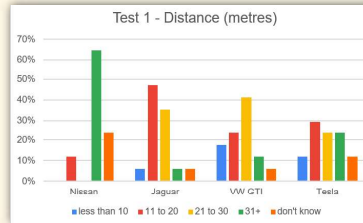
- What speed was the car travelling at?

Answers: Less than 10mph, 11-20mph, 21-30mph, 31mph or above, I do not know
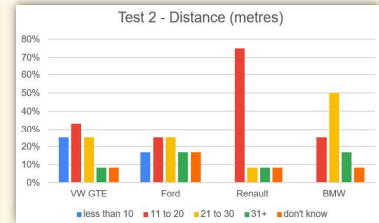
Final Question:
- Which car sound did you like the best?

Answers: Vehicle A, Vehicle B, Vehicle C, Vehicle D

Results

Graph 1: Answers from 17 participants as to how far away the vehicle was when they first heard it. All Vehicles started 100 metres away.
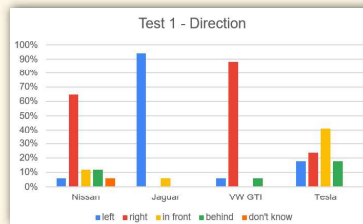

Graph 2: Answers from 12 participants as to how far away the vehicle was when they first heard it. All Vehicles started 100 metres away.
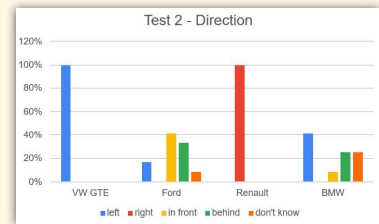

Graph 3: Answers from 17 participants as to how fast the vehicle was travelling. All vehicles were travelling at 15m/s (33 mph).

Graph 4: Answers from 12 participants as to how fast the vehicle was travelling. All vehicles were travelling at 15m/s (33 mph).

Graph 5: Answers from 17 participants as to which direction the vehicle approached them. Nissan: Behind, Jaguar: Left, VW: Right, and Tesla: In front.

Graph 6: Answers from 12 participants as to which direction the vehicle approached them. VW: Left, Fiesta: Behind, Renault: Right, and BMW: In front.

Conclusion

The results showed that participants could identify the direction of the vehicles better if the vehicles were approaching from their left or right, rather than in front of or behind them. The difficulty identifying vehicles direction also seems to have impacted their popularity among the participants, but more tests would have to be done to prove this. One of the ICE was significantly preferred to all of the other vehicle sounds with 53% of the participants in that test choosing it as their favourite. Only one person with a hearing impairment took both tests and their score was not an anomaly. A larger sample size would have been needed to see any major differences. The error of the testing method may have also impaired able hearing participants reducing out weighing the error of the hearing impairment.

References

European Blind Union, 2019. *Silent Cars and AVAS,* s.l.: EBU.