Low Disturbance Sound for Electric Vehicles

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Aims and objectives

This research has aims and objectives based in 6 key areas:

- To analyse data/research to gain a deeper understanding of the construction and function of the human auditory system
- Understand the psychological and psychoacoustic qualities that affect the way humans perceive sound
- To discuss and compare the lawful requirements set by governments in various countries
- To generate Acoustic Vehicle Alerting System (AVAS) sounds for surveying purposes
- To gain understanding in the publics opinion on the topic of electric vehicles (EVs) being present in the UK
- To explore the opinions of a participants regarding what and how an AVAS should sound and why

Introduction

With the number of electric and hybrid vehicles on the road systems increasing worldwide each year (compared in Figure 1) , many governments and organisations have voiced concerns over the quiet nature of their operation. In order to enable higher levels of safety for pedestrians, many countries such as the U.S and those within the continent of Europe including the UK have issued laws which state this type of vehicle must be equipped with an Acoustic Vehicle Alerting System (AVAS). Many argue the presence of such a system is crucial due to increased pedestrian incident rates' especially when those pedestrians have partial sight or blindness (Guide Dogs, 2015) There is, however, speculation of whether adding more noise pollution into an already saturated environment is beneficial or could further increase the levels of hazard.

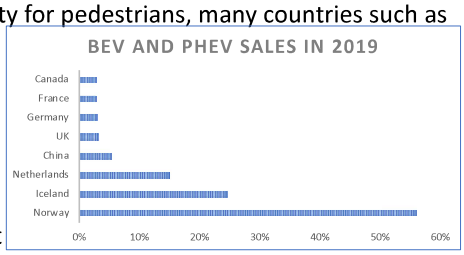

Figure 1: Percentage of new vehicles sold being EVs in various countries (EEI, 2019)

Throughout this project, primary and secondary research was undertaken in order to gain a deeper understanding of the public's view on the presence of electric vehicles as well as what comprises an effective yet pleasant AVAS system.

Methodology

A survey was created using Google Forms in order to collect data from willing participants on the subject of AVAS systems. The first section of this survey consisted of a series of questions to collect demographic based data. Amongst other questions, the age of participant, the area they live, and whether they feel it is an urban or rural setting was asked. Additionally, the participants were asked if they had any known hearing loss or issues. The second part of the survey consisted of listening tasks. The participants listen to 5 AVAS sounds that were created for the purpose and would rate the on a scale of 1 to 5 of how pleasant they felt the sound is and why. The final question asked whether the partaker felt AVAS sounds would be necessary if in an overall quieter environment. The survey was then distributed using online methods such as social media and email.

Results

The data from the survey provided the following information:

- In total there were 29 participants with an age range as shown in in Figure 2.

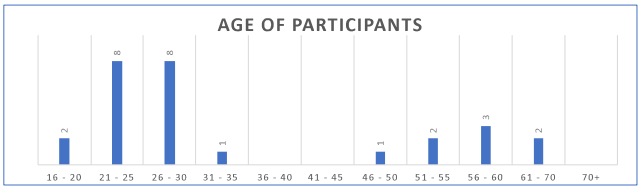

Figure 2: To show the quantity and range of participants of the survey

- 17.2% of the participants stated they had known hearing loss or damage
- 88.8% of individuals felt that AVAS sounds would still be important regardless of whether the surrounding environment was quieter
- For the listening tests, clips number 1 and 4 received the highest positive ratings, whilst clips 5 and 2 received the lowest (Figure 3).

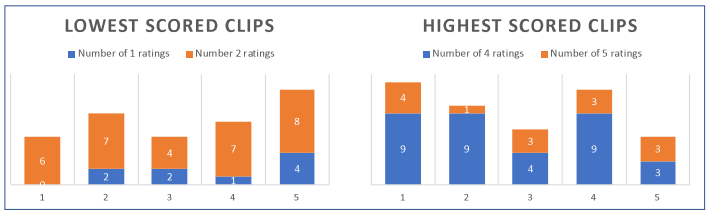

Figure 3: Lowest scored AVAS clips (left) and Highest scored clips (right)

Analysis and Future Work

Overall, most of the group, regardless of age, felt that AVAS systems were necessary for ensuring a higher level of safety as electric and hybrid vehicles become increasingly popular on the road networks. 51.8% of the responses stated that they felt as though the alerting systems should sound as a normal internal combustion engine powered vehicle sound. This, by many, was then elaborated by going on to claim that because people are well accustomed to these sounds, it would be an effective warning sign.

Following from the research completed within this dissertation, the original plan of designing and testing for a more easily localised Acoustic Vehicle Alerting System sound could be continued. The data and information gathered within the project report document would provide a solid base of which to build from.

References

-GUIDE DOGS, 2014. *Safe and Sound* Available from: https://www.guidedogs.org.uk/how-you-can-help/campaigning/our-current-campaigns/safe-and-sound
-EEI, 2019. *Electric Vehicle Sales: Facts & Figures.* EEI Available from: https://www.eei.org/issuesandpolicy/electrictransportation/Documents/FINAL_EV_Sales_Update_April2019.pdf