Scientific Research Publishing

Open Journal of Social Sciences, 2024, 12, 498-503
https://www.scirp.org/journal/jss
ISSN Online: 2327-5960
ISSN Print: 2327-5952

Alleviating Social Stereotypes towards Deaf Drivers through the Use of Audio-Visual Conversion Technology

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How to cite this paper: Wang, Z. (2024). Alleviating Social Stereotypes towards Deaf Drivers through the Use of Audio-Visual Conversion Technology. *Open Journal of Social Sciences, 12,* 498-503.
https://doi.org/10.4236/jss.2024.125028

Received: February 20, 2024
Accepted: May 28, 2024
Published: May 31, 2024

Abstract

Since deaf drivers can't hear audible instructions, such as sirens or alarms, leading to a much higher probability of accidents for deaf drivers than non-deaf drivers. This has triggered stereotypes against deaf drivers in society. Based on Attenuation theory, article thesis is that by applying more AVC technology in the society, a stronger visionary sensation could reduce the car accidents of deaf drivers, while eliminating the social stereotypes that deaf people could not drive. Audio-visual conversion technology allows sound to be visualized so deaf drivers can understand audible instructions. The reason for the current low penetration of AVC technology is that deaf people generally have low social economic status and some of them cannot afford the cost of AVC technology.

Keywords

Deaf Driver, Stereotype, Audio-Visual Conversion, Social Economic Status

1. Introduction

According to statistics, there are 26 countries across the world that do not allow deaf people to get a driver's license. Deaf drivers' inability to receive auditory instructions leads to significantly more crashes than non-deaf drivers. It is not the inability of deaf drivers to hear that leads to more crashes, but rather the lack of information that is transmitted only through sound, so compensating for the information gap through AVC technology will reduce the frequency of crashes. Since deaf drivers audible instructions lead to the social stereotype that their driving is inherently unsafe (Lee, 2016). Auditory deprivation makes deaf drivers' remaining senses such as vision are enhanced (Bavelier et al., 2006). Audio-visual conversion (AVC) technology converts auditory information into visual information so that deaf drivers can receive auditory instructions. According to Attenuation theory, also known as Treisman's Attenuation Model, it states that although attention can be split across several tasks, there wasn't enough cognitive capacity to do so. Treisman and Davies discovered that when a person was exposed to many information channels simultaneously at the same sensory modality, their attention would diminish (Treisman & Davies, 1973). Based on Attenuation theory, my thesis is that by applying more AVC technology in the society, a stronger visionary sensation could be beneficial for deaf drivers, while eliminating the social stereotypes that deaf people could not drive. With the help of AVC technology, the car accidents rate of deaf drivers will decline, and the social stereotype of deaf drivers will be alleviated. Limited research has been conducted with a focus on deaf drivers (Keating & Mirus, 2012). Data about different driving situations is not comprehensive enough to determine the importance of hearing in driving (Miyazaki & Ishida, 1987). Second, the field has not connected the stereotypes that society has of deaf drivers to the technology that addresses their driving problems (Hersh et al., 2010). In fact, both are closely related to the availability of deaf drivers to drive, and we need to focus on and improve both, rather than focusing only on science and technology. In today's society, AVC technology is not well promoted and utilized in the vehicles of Deaf drivers. The purpose of this paper is to make readers and developers realize that the promotion of AVC technology is not only a solution to the problem of deaf driving, but it can also involve many social factors, such as the reduction of social stereotypes. AVC technology may be of greater value than the developers anticipate, and it will serve as a lubricant between deaf people and society. The promotion of this paper can facilitate the spread of AVC technology for the benefit of deaf people.

2. Regarding Driving of Deaf Drivers

2.1. Features of the Deaf in Driving

According to the World Health Organization, "Deaf" people mostly have no hearing so they use sign language to communicate. For deaf drivers, hearing deprivation presents some unique challenges. According to a Department of Transportation assessment from 1993, it can be very crucial to hear outside noises from outside the car. A variety of warning noises, such as emergency response vehicle sirens and other cars' horns, can be included in this category. Furthermore, the study discovered that there may be instances when the car makes unusual noises, which can indicate a mechanical problem that would otherwise go undetected (Risley, 2022). However, Sivak states that 90% of driving is controlled by the visual sense. Deafness is therefore not regarded as a serious risk factor when driving (Sivak, 1996). Additionally, studies suggest that deaf drivers might have certain benefits over hearing drivers despite their loss of hearing. According to numerous studies, deaf drivers have superior ability to identify objects in their peripheral vision more quickly than non-deaf people (Bavelier, Dye, & Hauser, 2006; Chen, Zhang, & Zhou, 2006).

2.2. Formation of Stereotype toward Deaf Drivers

The stereotype of deaf drivers exists in the society as it is believed that their driving security is to be considered. Although WFD (World Federation of the Deaf, 1951) explain that deaf drivers are safer to some extent because they are not disturbed by noise, part of the non-deaf people still think deaf drivers as a safety threat (Lee, 2016). Many non-deaf people are curious about how deaf drivers driving without the presence of audible instructions. Therefore, deaf drivers are discriminated due to the driving security. Zodda et al. (2012) performed a study determine whether there was a significant difference between the way deaf and non-deaf drivers reacted to their surrounded environment. When participants had to interact with a passenger while driving, the mean mistakes for non-deaf and deaf drivers were 1.16 and 1.72, respectively. This data show that non-deaf group makes less mistakes than the deaf-driver group when there are distractions (Zodda et al., 2012). In addition, one research on deaf drivers in California declare that, when compared to a matched sample of male non-deaf drivers, deaf individuals had a notably higher amount of accidents on their driving records (Coppin & Peck, 1965). It is not know if the reason for Stereotype is a lack of skill on the part of the deaf drivers themselves or outside tech support, there is a very small sample size in this area. If stereotypes are to be alleviated, the probability of car accidents for deaf drivers needs to be reduced first.

3. Audio-Visual Conversion (AVC) Technology

3.1. What Is Audio Visual Conversion Technology (AVC)

AVC technology detects external environment through visual portrayals of sound patterns, such as warning sounds of emergency vehicles that is then displayed on the windshield through Head-Up Display (HUD). Not only will it display what type of sound it is, but also where the sound is located. The steering wheel is also equipped with multi-coloured LEDs which indicate navigational information while driving.

3.2. How Audio Visual Conversion Technology (AVC) Design

To pick up the auditory cues, six tiny microphones have been mounted on the outside of the car body. Every 60 degrees or so, each microphone will be positioned around the automobile to show where the sound is originating from. This kind of microphone sensor works with Arduino boards. Next, there is a microcontroller. To initiate the output signal, it is necessary to evaluate and filter the input sound signal after it is received. The signal is processed by the Arduino board. The microcontroller board has a 16 MHz ceramic resonator, 6 analog inputs, 14 digital input/output pins, a USB port, a power jack, an ICSP header, and a reset button. When it is first started, it can be powered by a battery, an AC-to-DC adapter, or a computer using a USB cable. As a result, the device that uses this board in a car can be powered by the cigarette lighter socket using a USB car converter and USB cable. The Arduino software can be used to program the Arduino board at first. It is utilized to link LED lights and a vibration device to six microphone sensors. In addition, the LED panel indication has six LED lights, each of which stands for a sensor that is typically visible on the steering wheel and HUD. Additionally, the Arduino board will be configured to recognize the sound of a car honking above the din of traffic and translate that sound into an output signal that will turn on the panel's LED lights.

4. Exploration and Use of Audiovisual Conversion (AVC) Technology in the Deaf Field

4.1. The Reason Why AVC Technology Is Suitable for Deaf Drivers

According to the WFD report, hearing is only a minority part of driving, and deaf drivers are more sensitive in visual stimuli than the non-deaf drivers (WFD, 1951). According to Attenuation theory, the attention boundaries of an individual would decrease when they were exposed to multiple information channels at the same time using the same sensory modality. Therefore, turning auditory stimuli and instruction into visual could unify most of the sources of instructions and stimuli, and avoid the distraction.

4.2. How AVC Technology Helps Deaf Drivers Reduce Stereotypes

From the country where I am living, there is no AVC technology applied in China. Even though the largest ride-hailing platform showed a large amount of deaf drivers lifting more than 20 orders per day without an accident in a three-year tracking data (Lu, 2018). Instead, the clean energy vehicles are equipped with screens, by showing the distance and road conditions visionary, mainly used by those deaf chauffeurs, as an alternatives of AVC technology. According to a study, there were 50% more blind spot-related crashes in 2009 than there were in 2011 (Millward, 2011). Honking from other cars can occasionally warn other drivers and stop collisions before they happen. When the warning sound goes off, drivers will quickly change their direction. Therefore, the same outcome is anticipated for deaf drivers when employing this AVC device and providing a visual interpretation of the sound. Thus, the car accident rate of deaf drivers will decline, and alleviate most of the stereotypes against deaf drivers oriented to high crash rates.

5. Conclusion

The article asserts that using AVC technology can assist deaf drivers and combat social stereotypes. AVC technology can convert auditory instructions into visual cues, by unifying sources of instruction then reducing distractions. Since deaf drivers gain better visual ability due to the loss of hearing, AVC technology can enhance the driving experience of deaf individuals and potentially lower the occurrence of car accidents. Implementing AVC technology can also challenge negative stereotypes surrounding the driving abilities of deaf individuals. There are some limitations in this paper, such as ignoring information about the effect on the number of car crashes in the case of sign language communication between deaf drivers and passengers. In fact, the elimination of deaf driver stereotypes does not rely solely on AVC technology. Because of the price of AVC technology and how well it fits into vehicles, AVC technology has not been popularized for use among deaf drivers. This article can make more people realize the value of AVC technology and promote the popularity of AVC technology.

6. Limitations and Future Works of AVC Technology

According to the literature analysis, Deaf drivers convert most of their sensory input to visual benefits to improve their attention. Data suggests that Deaf people generally have lower social economic status and lower incomes (Fuel-Admin, 2021). Some cannot afford the cost of AVC technology, which limits the popularity of AVC technology. However, there are still many challenges and limitations in promoting AVC technology. AVC technology still needs to be upgraded. It might distinguish tiny sound indications from surrounding noise, which can easily form misunderstanding for deaf drivers. Some of the findings could help researchers and policymakers through my literature review. First, it was suggested that the need for further or specialized training could be explored, as very few deaf drivers report having received formal driving training. As for policymakers, encouraging more car lifting companies by widely using AVC technology and employing deaf people could decrease the cognitive gap of "deaf people can not drive".

Acknowledgements

R. B. G. thanks: Ms. Zhaoming Wang.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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