The voice of blind and partially sighted people in Europe

Driverless Vehicles: Minding the Visually Impaired from the Start

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Preliminary remarks

Autonomous and connected transport will probably constitute the mobility landscape of tomorrow. It brings new benefits for all, including for visually impaired people, but it also carries risks that particularly concern them. There is the security risk, of course, but also, if their needs are not properly addressed at the outset, a risk of exclusion rather than inclusion of visually impaired people. The development of driverless vehicles should go with a commitment to ensure that the benefits outweigh the risks for blind and partially sighted people.

In May 2022, we responded to the European Commission's public consultation on technical specifications for automated vehicles. The aim of this consultation was to collect the views of stakeholders about new EU rules governing modern technologies used in vehicles, to improve road safety and reduce pollution, namely "specific requirements for automated and fully automated ('driverless') vehicles and the systems they employ, to ensure that they are safe to use."

In our response we focused on recommendations from the perspective of blind and partially sighted people as external participants in the traffic, i.e., essentially as pedestrians.

The present position paper compiles those recommendations (see first chapter below) with further recommendations concerning blind and partially sighted people as users of driverless vehicles (see second chapter). For this, we build on the results of our participation in the PAsCAL project (Enhance driver behaviour and

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Public Acceptance of Connected and Autonomous vehicLes), a research project on Connected and Autonomous Vehicles (CAVs) implemented from June 2019 to November 2022, co-funded by the Horizon 2020 programme of the European Union.

Adapting to visually impaired participants in the traffic

As driverless vehicles[1] are likely to progressively become more frequent in the streets and roads of Europe, they are expected to obey the same principles as conventional cars. **Like drivers**, they should be able to **adapt to vulnerable road users** in the traffic, especially to consider the presence of pedestrians with a visual impairment.

Drivers are required to **understand the white cane** as a symbol and an automated vehicle should therefore do so as well. Consequently, to be allowed to use public streets, a driverless vehicle must be able to recognize the white cane, just like any traffic sign. This should be laid down explicitly in the technical regulations on CAVs.

All types of white canes and other possible visible signs of a person with visual impairment, under the applicable legislation, should be recognized as well. It should not matter that a visually impaired pedestrian is simply holding their cane or raising or waving it, even if the latter facilitates identification.

It should also be possible to detect the white cane **even when it is partially hidden** behind some person or object. CAVs being connected, they should be able to communicate with other vehicles—driverless or equipped with the necessary IT—to share information about the presence of a visually impaired person in the area.

Let us mention some other features of adapting to visually impaired pedestrians that can be used, but **only as a complement**:

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[1] This paper focuses on driverless vehicles for the transport of passengers, and those that use roads. It does not cover for instance delivery robots and other self-driving equipment using the same areas as pedestrians – although these raise similar issues as those mentioned in the first part of the document, about adapting to visually impaired pedestrians in the traffic.

- They could be recognised through a digital signal conveyed for instance by a smartphone or a microchip, if applicable.
- The driverless vehicle being electric and therefore equipped with Acoustic vehicle alert system (AVAS), the sound level of AVAS could be raised when the presence of a pedestrian with visual impairment is detected, to alert that person (although this would require careful testing to make sure the result is not a source of confusion about the speed and distance of the vehicle).
- Technicians are discussing communication between cars and pedestrians, for a CAV to replace the fact that a human driver would signal, for example with his hand, that he stops and that the pedestrian can cross the street. The technical solutions eventually retained should not be only visual and should inform visually impaired pedestrians as well.

In any case, it is a matter of principle that it should be **driverless vehicles to adapt by design to road users, specially to vulnerable pedestrians, and not the contrary**. The technique of driverless vehicles must not interfere with the fundamental rights of safety and independent personal mobility guaranteed by articles 14 and 20 of the UN Convention on the Rights of Persons with Disabilities and articles 6 and 26 of the Charter of Fundamental Rights of the EU. It should on the contrary lead to increased protection of these rights.

Inclusive design to include visually impaired users

Transport is an area where accessibility is a priority, as it should enable any person to travel for work, social life, personal needs, etc. The young, the elderly and the disabled suffer the most from mobility restrictions. Thus, CAVs would promote social inclusion by offering greater freedom of mobility to those excluded from current transport models.

In fact, **visually impaired people seem to have a rather positive attitude towards CAVs**. A study from the PAsCAL project shows that there are differences in the acceptance of CAVs between

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sighted and visually impaired people. A survey[2] involving 5659 respondents, of which 1030 were visually impaired, revealed that visually impaired people have a greater intention to use a CAV than sighted people. In particular, independence perspectives offered by CAVs were even more positively assessed by visually impaired respondents. Furthermore, unlike sighted people, who have a decreasing intention to use a CAV with increasing age, there was no relationship between age and intention to use a CAV among visually impaired people.

But **many questions** arise: what are the conditions that need to be fulfilled to meet the specific needs of visually impaired people? How will they communicate with their cars? How will digitalisation replace the human assistance of bus and tram drivers? Who will alert the blind passenger to the number of the bus line? Who will deploy the ramp to allow access to a person in a wheelchair, and who will look after a vulnerable passenger who cannot find their seat?

The benefits of CAVs for visually impaired users could not be effective without a new comprehensive **Design for All** policy implemented by the authorities. **Otherwise, CAVs will just further increase the digital gap and social exclusion**.

Design for All aims to take users and their differential characteristics into account from the early stages of product design, while integrating them into a participatory approach. In other words, during the development of a product, possible uses by persons with various incapacities due to age or disability should be foreseen.

So, Design for All (or Universal Design) is the precondition for inclusive design, i.e., a product is designed by including the specificities of different groups of disabled populations with their specific needs in a way that will also serve non-disabled populations.

Retrofitting a product to make it accessible is usually a more expensive, less usable, and possibly more dangerous and even less reliable solution than accessibility by design at the outset.

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[2] PAsCAL interactive widget - Acceptance of autonomous vehicles, the format of which is not sufficiently accessible, but the results of which are available on demand.

Article 9 of the UN Convention on the Rights of Persons with Disabilities refers directly to accessibility and deals namely with transport. This article specifies in particular: "In order to enable persons with disabilities to live independently and participate fully in all aspects of life, States Parties shall take appropriate measures to ensure access on an equal basis with others to the physical environment, to transportation, to information and communication, including information and communication systems and technologies, and to other facilities and services open or provided to the public, in both urban and rural areas [...]".

We recall **7 main principles of Design for All**:

1. The design is useful and marketable to people with different abilities. This could be through the provision of Braille marking on push buttons, for example.
2. Flexible use, i.e., different forms of use should always be offered. For example, an application on a smartphone to communicate with the vehicle could provide an alternative to touch displays.
3. Simple and intuitive design, i.e., the product is easy to understand, regardless of the user's experience, knowledge, language skills or current concentration level. An accessible smartphone application is not in itself a guarantee of simplicity, if it does not consider how a blind person uses a smartphone.
4. Perceptible information, i.e., the product design effectively conveys the necessary information to the user, regardless of the environmental conditions or the user's sensory capabilities. This can also be called the "two-senses principle": any information should be offered in at least two ways to ensure that it reaches as many users as possible. In practice, this means that it is necessary to provide mainly aural and visual information or - if an aural announcement does not make sense or is technically limited - visual and tactile information. In addition, for partially sighted people, high contrast is important, for example for the edges of steps. And, as far as colours are concerned, it is important to remember that 8% of the male population and 1% of the female population have limited colour vision. If the vehicle is silent—as a CAV is likely to be—the presence of AVAS is an important element.
5. A tolerance for error, i.e., the hazards and negative consequences of accidental or unintended actions are minimised. This is especially important when considering the use of a CAV by a visually impaired person, where their acting

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unintentionally could injure passengers or pedestrians. For example, contrary to push buttons, touch screens have a high risk of unintentional activation, even with Braille letters on the edge, and should therefore be avoided.

6. Low physical effort, i.e., the product can be used efficiently and comfortably with minimal fatigue. For example, touch displays are not always the best solution, and touch force or touch responsive displays that offer a voice-over function adapting easily to the needs and habits of the users should be taken into account.
7. Appropriate size and space are provided for a good approach, reach, handling and use of the product, regardless of the user's size, posture or mobility. In the specific case of a visual impairment, blind passengers will need sufficient space for their guide dog, for example.

We should also add that an important factor in social acceptance of CAVs, probably for any passenger but certainly for visually impaired people, is the possibility to get **human support** from a responsible person if necessary, i.e., to interact with an operation centre, to ask questions, to ask for services or to inform about any irregularities. SOS-button and communication facility should be standardised in all CAV for public use.

Specific expertise and testing are needed to accommodate the needs of visually impaired users. With the coordination of representative organisations, visually impaired persons should be involved to provide this expertise and to test products under development.

Further reading

- PAsCAL 360° map on the acceptance of connected and automated vehicles: https://www.pascal-project.eu/deliverable/D3.2
- PAsCAL pilot implementation and evaluation, taking into account different kinds of user groups, including vulnerable road users: https://www.pascal-project.eu/deliverable/D6.3

About PAsCAL

The PAsCAL research project is co-funded by the Horizon 2020 programme of the European Union under agreement No 815098. For more information, please visit www.pascal-project.eu.

About EBU

The European Blind Union (EBU) – **Interest Representative Register number 42378755934-87** – is a non-governmental, non-profit making European organisation founded in 1984. It is one of the six regional bodies of the World Blind Union, and it promotes the interests of blind and partially sighted people in Europe. It currently operates within a network of 41 national members including organisations from 25 European Union member states, candidate countries and other countries in geographical Europe.

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