

Your opinion on sound, vibration, and visual interfaces in automated driving

Instructions ▲

Overview

You are invited to participate in a survey entitled "Your opinion on sound, vibration, and visual interfaces in automated driving".

The survey is being conducted by:

- – Pavlo Bazilinskyy (p.bazilinskyy@tudelft.nl (<mailto:p.bazilinskyy@tudelft.nl>)) and Joost de Winter (j.c.f.dewinter@tudelft.nl (<mailto:j.c.f.dewinter@tudelft.nl>)) from the Delft University of Technology, The Netherlands
- – Bastiaan Petermeijer (petermeijer@lfe.mw.tum.de (<mailto:petermeijer@lfe.mw.tum.de>)) from the Institute of Ergonomics, Technische Universität München, Germany
- – Veronika Petrovych (veronika.petrovych@vti.se (<mailto:veronika.petrovych@vti.se>)) from the Swedish National Road and Transport Research Institute

The purpose of this survey is to explore the public opinion on the use of sound, vibration, and visual interfaces during highly automated car driving. The survey will take approximately 15 minutes of your time.

Highly automated driving = The automated driving car controls both speed and steering. The driver is not required to look at the road. If the automation cannot handle a situation, it provides a take-over request, and the driver must take over control.

Participation in the survey

You are free to contact any of the investigators at the above e-mail addresses to ask questions about the study. You must be at least 18 years old to participate. In case you previously completed a survey entitled "Your opinion on automated driving systems", "Self-reported driving behavior", "Humans and machines", or "Your opinion on sound interfaces in automated driving systems", your responses may be combined with the results of these surveys.

The information recorded in the survey is anonymous. Participants will not be personally identifiable in any research papers arising from this study. If you agree to participate and understand your participation is voluntary, then continue. If you would not like to participate, then please close this page.

General questions

Have you read and understood the above instructions?

- ☐ Yes
- ☐ No

What is your gender?

- ☐ Male
- ☐ Female
- ☐ I prefer not to respond

What is your age?

At which age did you obtain your first license for driving a car or motorcycle?

What is your primary mode of transportation

- ☐ Private vehicle
- ☐ Public transportation
- ☐ Motorcycle
- ☐ Walking/Cycling
- ☐ Other
- ☐ I prefer not to respond

On average, how often did you drive a vehicle in the last 12 months?

- ☐ Every day
- ☐ 4 to 6 days a week
- ☐ 1 to 3 days a week
- ☐ Once a month to once a week
- ☐ Less than once a month
- ☐ Never
- ☐ I prefer not to respond

About how many kilometers (miles) did you drive in the last 12 months?

- ☐ 0 km / mi
- ☐ 1 - 1,000 km (1 - 621 mi)
- ☐ 1,001 - 5,000 km (622 - 3,107 mi)
- ☐ 5,001 - 15,000 km (3,108 - 9,321 mi)
- ☐ 15,001 - 20,000 km (9,322 - 12,427 mi)
- ☐ 20,001 - 25,000 km (12,428 - 15,534 mi)
- ☐ 25,001 - 35,000 km (15,535 - 21,748 mi)
- ☐ 35,001 - 50,000 km (21,749 - 31,069 mi)
- ☐ 50,001 - 100,000 km (31,070 - 62,137 mi)
- ☐ More than 100,000 km (more than 62,137 mi)
- ☐ I prefer not to respond

How many accidents were you involved in when driving a car in the last 3 years? (please include all accidents, regardless of how they were caused, how slight they were, or where they happened)

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ More than 5
- ☐ I prefer not to respond

How often do you do the following?: Becoming angered by a particular type of driver, and indicate your hostility by whatever means you can.

- ☐ 0 times per month
- ☐ 1 to 3 times per month
- ☐ 4 to 6 times per month
- ☐ 7 to 9 times per month
- ☐ 10 or more times per month
- ☐ I prefer not to respond

How often do you do the following?: Disregarding the speed limit on a motorway.

- ☐ 0 times per month
- ☐ 1 to 3 times per month
- ☐ 4 to 6 times per month
- ☐ 7 to 9 times per month
- ☐ 10 or more times per month
- ☐ I prefer not to respond

How often do you do the following?: Disregarding the speed limit on a residential road.

- ☐ 0 times per month
- ☐ 1 to 3 times per month
- ☐ 4 to 6 times per month
- ☐ 7 to 9 times per month
- ☐ 10 or more times per month
- ☐ I prefer not to respond

How often do you do the following?: Driving so close to the car in front that it would be difficult to stop in an emergency.

- ☐ 0 times per month
- ☐ 1 to 3 times per month
- ☐ 4 to 6 times per month
- ☐ 7 to 9 times per month
- ☐ 10 or more times per month

☐ I prefer not to respond

How often do you do the following?: Racing away from traffic lights with the intention of beating the driver next to you.

- ☐ 0 times per month
- ☐ 1 to 3 times per month
- ☐ 4 to 6 times per month
- ☐ 7 to 9 times per month
- ☐ 10 or more times per month
- ☐ I prefer not to respond

How often do you do the following?: Sounding your horn to indicate your annoyance with another road user.

- ☐ 0 times per month
- ☐ 1 to 3 times per month
- ☐ 4 to 6 times per month
- ☐ 7 to 9 times per month
- ☐ 10 or more times per month
- ☐ I prefer not to respond

How often do you do the following?: Using a mobile phone without a hands free kit.

- ☐ 0 times per month
- ☐ 1 to 3 times per month
- ☐ 4 to 6 times per month
- ☐ 7 to 9 times per month
- ☐ 10 or more times per month
- ☐ I prefer not to respond

When I start using a new device, I usually need some time to learn how it works.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

When I use a new device for the first time, I usually read the manual before using it.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

I would trust a car that drives automatically.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

I usually trust machines until there is a reason not to.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

For the most part, I DISTRUST machines.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

In general, I would rely on a machine to assist me.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

My tendency to trust machines is high.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

It is easy for me to trust machines to do their job.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little

- ☐ Agree strongly
- ☐ I prefer not to respond

I am likely to trust a machine even when I have little knowledge about it.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

Questions on sound interfaces

The automation can inform the driver about upcoming events by means of sound. You will be asked to listen to a number of sounds in this section.

Open **this link** (<http://hollgam.com/misc/survey2/Auditory/1.mp3>) to listen to recording 1.

What sound message did you hear in the recording 1 above?

- ☐ Female voice: "Please take over!"
- ☐ Male voice: "Please take over!"
- ☐ Beeps
- ☐ Bell sound
- ☐ Horn sound
- ☐ I did not hear the recording clearly
- ☐ I prefer not to respond

Open **this link** (<http://hollgam.com/misc/survey2/Auditory/2.mp3>) to listen to recording 2.

What sound message did you hear in the recording 2 above?

- ☐ Female voice: "Please take over!"
- ☐ Male voice: "Please take over!"
- ☐ Beeps
- ☐ Bell sound
- ☐ Horn sound
- ☐ I did not hear the recording clearly
- ☐ I prefer not to respond

Open **this link** (<http://hollgam.com/misc/survey2/Auditory/3.mp3>) to listen to recording 3.

What sound message did you hear in the recording 3 above?

- ☐ Female voice: "Please take over!"
- ☐ Male voice: "Please take over!"
- ☐ Beeps
- ☐ Bell sound

- ☐ Horn sound
- ☐ I did not hear the recording clearly
- ☐ I prefer not to respond

Open **this link** (<http://hollgam.com/misc/survey2/Auditory/4.mp3>) to listen to recording 4.

What sound message did you hear in the recording 4 above?

- ☐ Female voice: "Please take over!"
- ☐ Male voice: "Please take over!"
- ☐ Beeps
- ☐ Bell sound
- ☐ Horn sound
- ☐ I did not hear the recording clearly
- ☐ I prefer not to respond

Open **this link** (<http://hollgam.com/misc/survey2/Auditory/5.mp3>) to listen to recording 5.

What sound message did you hear in the recording 5 above?

- ☐ Female voice: "Please take over!"
- ☐ Male voice: "Please take over!"
- ☐ Beeps
- ☐ Bell sound
- ☐ Horn sound
- ☐ I did not hear the recording clearly
- ☐ I prefer not to respond

A take-over request should be provided by means of the female voice.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

A take-over request should be provided by means of the male voice.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

A take-over request should be provided by means of the beeps.

- ☐ Disagree strongly

- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

A take-over request should be provided by means of the bell sound.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

A take-over request should be provided by means of the horn sound.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

Which sound message do you consider as the most urgent?

- ☐ Female voice: "Please take over!"
- ☐ Male voice: "Please take over!"
- ☐ Beeps
- ☐ Bell sound
- ☐ Horn sound
- ☐ I did not hear the recording clearly
- ☐ I prefer not to respond

Which sound message do you consider as the most annoying?

- ☐ Female voice: "Please take over!"
- ☐ Male voice: "Please take over!"
- ☐ Beeps
- ☐ Bell sound
- ☐ Horn sound
- ☐ I did not hear the recording clearly
- ☐ I prefer not to respond

Some people prefer to be supported by a female voice in their cars. Why do you think this is the case?

- ☐ A female voice is easier to understand in noisy environments
- ☐ Such people drive mainly with men as passengers, and a female voice is easier to distinguish in the car
- ☐ A female voice is more pleasant

- ☐ A female voice is less commanding, and is easier to agree with it
- ☐ Other
- ☐ I prefer not to respond

If you answered "Other" in the previous question, please specify why you think that some people prefer to be supported by a female voice.

Beeps are short messages used in cars today. Please listen to 4 different kinds of beeps in 4 questions below.

Open **this link** (<http://hollgam.com/misc/survey2/Auditory/beeps-long.mp3>) to listen to a short recording of beeps with long pauses.

I consider such a sound (beeps with long pauses) as urgent.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

Open **this link** (<http://hollgam.com/misc/survey2/Auditory/beeps-medium.mp3>) to listen to a short recording of beeps with medium pauses.

I consider such a sound (beeps with medium pauses) as urgent.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

Open **this link** (<http://hollgam.com/misc/survey2/Auditory/beeps-short.mp3>) to listen to a short recording of beeps with short pauses.

I consider such a sound (beeps with short pauses) as urgent.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

Open **this link** (<http://hollgam.com/misc/survey2/Auditory/beeps-veryshort.mp3>) to listen to a short recording of beeps with very short pauses.

I consider such a sound (beeps with very short pauses) as urgent.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

A looming sound is a kind of sound that increases its volume with time. Such increase may be caused by an event in the outside world, such as another car driving towards you.

Open **this link** (<http://hollgam.com/misc/survey2/Auditory/looming-1.mp3>) to listen to a recording of a 1 second long looming sound.

I consider such a sound (1 second long looming sound) as urgent.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

Open **this link** (<http://hollgam.com/misc/survey2/Auditory/looming-25.mp3>) to listen to a recording of a 2.5 second long looming sound.

I consider such a sound (2.5 second long looming sound) as urgent .

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

Open **this link** (<http://hollgam.com/misc/survey2/Auditory/looming-5.mp3>) to listen to a recording of a 5 second long looming sound.

I consider such a sound (5 second long looming sound) as urgent.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

Sounds are a good way to get my attention back to the road.

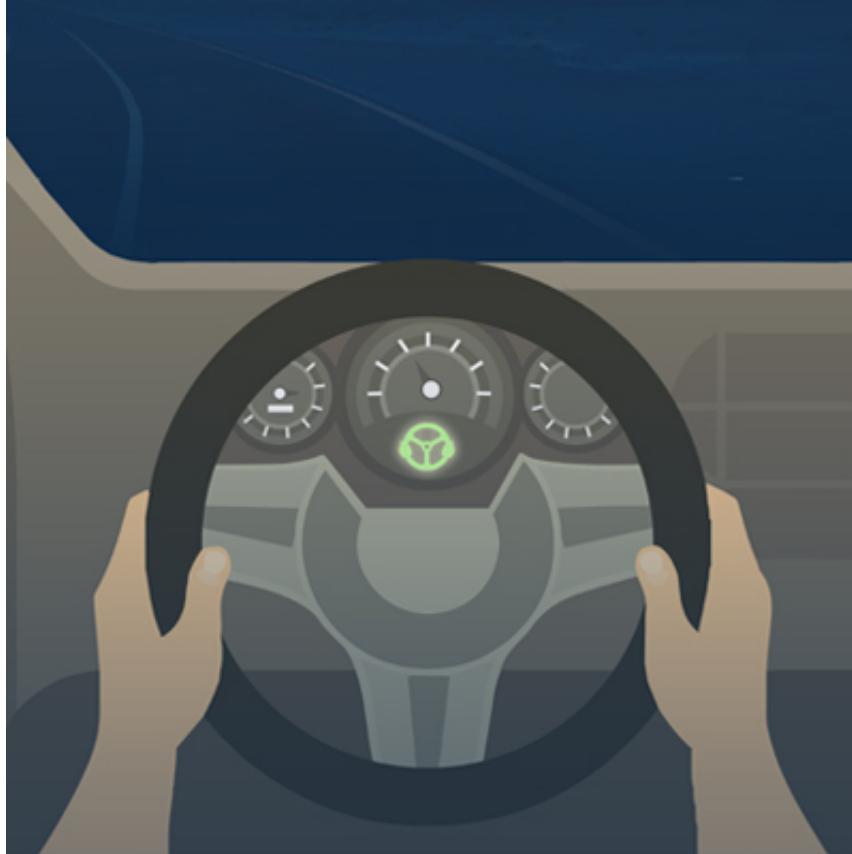
- ☐ Disagree strongly
- ☐ Disagree a little

- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

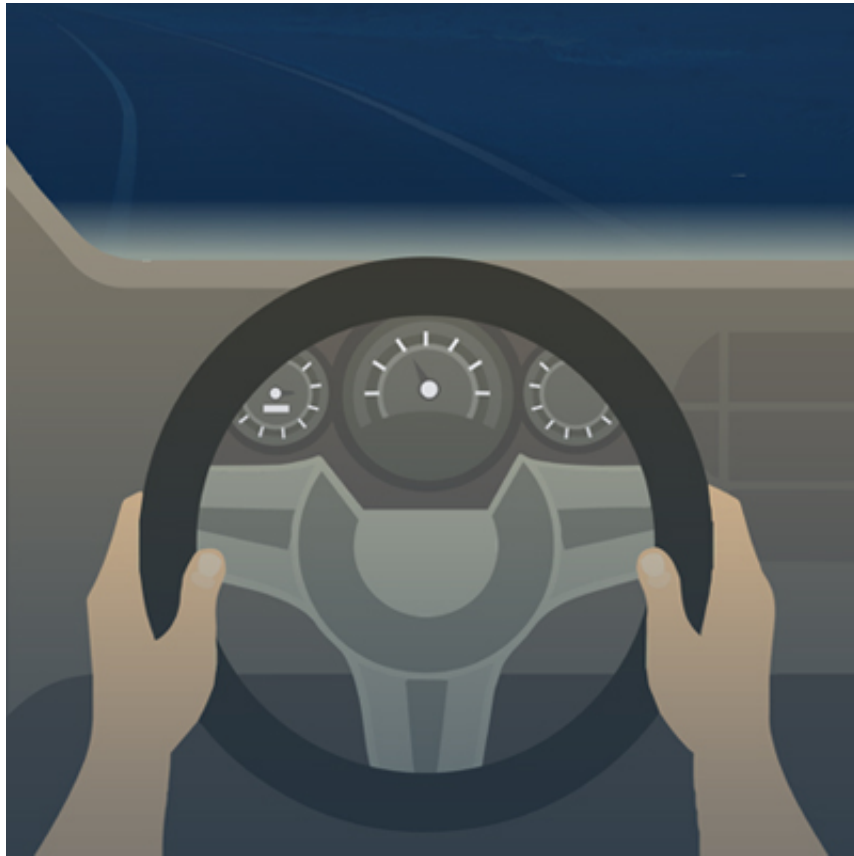
Questions on visual interfaces

The automation can inform the driver about upcoming events by means of a visual message. Four types of visual messages can be presented (see pictures):

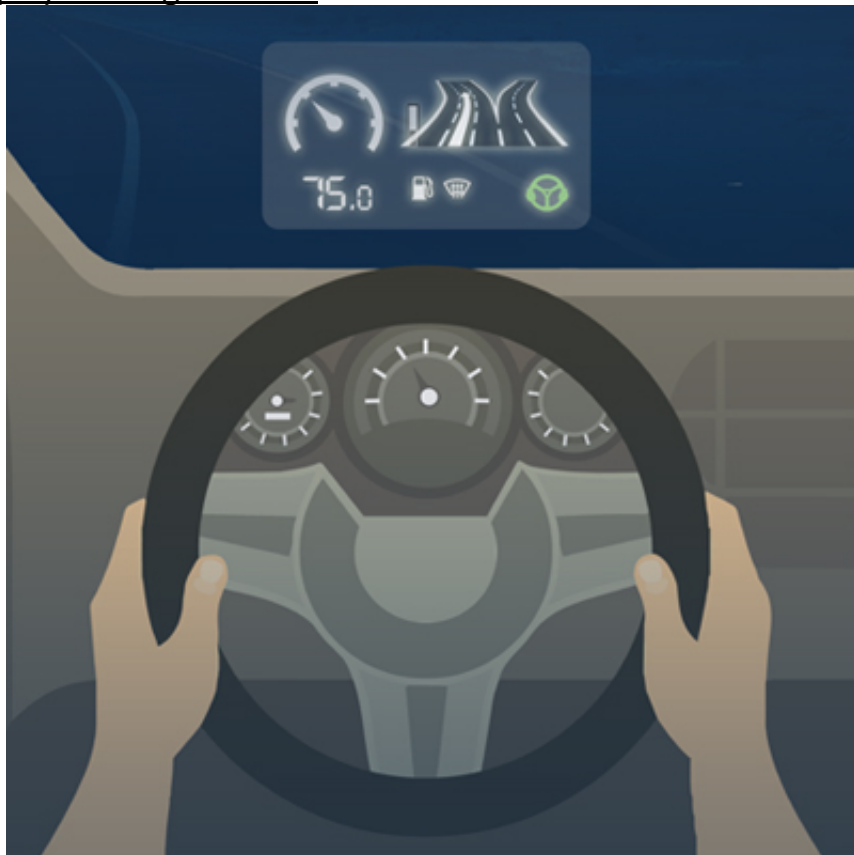
1. A green icon on the dashboard



2. A strip of lights at the bottom of the windshield



3. A head-up display with a green icon



4. A brighter dashboard



A take-over request should be provided by means of a green icon on the dashboard.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

A take-over request should be provided by means of a strip of lights at the bottom of the windshield.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

A take-over request should be provided by means of a head-up display with a green icon.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly

☐ I prefer not to respond

A take-over request should be provided by means of a brighter dashboard.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

When I am not looking at the road for over 5 seconds, I would like the automation to take over control.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

Visual messages are a good way to get my attention back to the road.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

Questions on vibration interfaces

The automation can inform the driver about the upcoming events by means of vibrations like the ones in a mobile phone. The vibrations can be presented at four different locations (see figures):

1. The seat back



2. The seat pan



3. The seat belt



4. The steering wheel



A take-over request should be provided by means of a vibration of the seat back.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

A take-over request should be provided by means of a vibration of the driver's seat pan.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

A take-over request should be provided by means of a vibration of the seat belt.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

A take-over request should be provided by means of a vibration of the steering wheel.

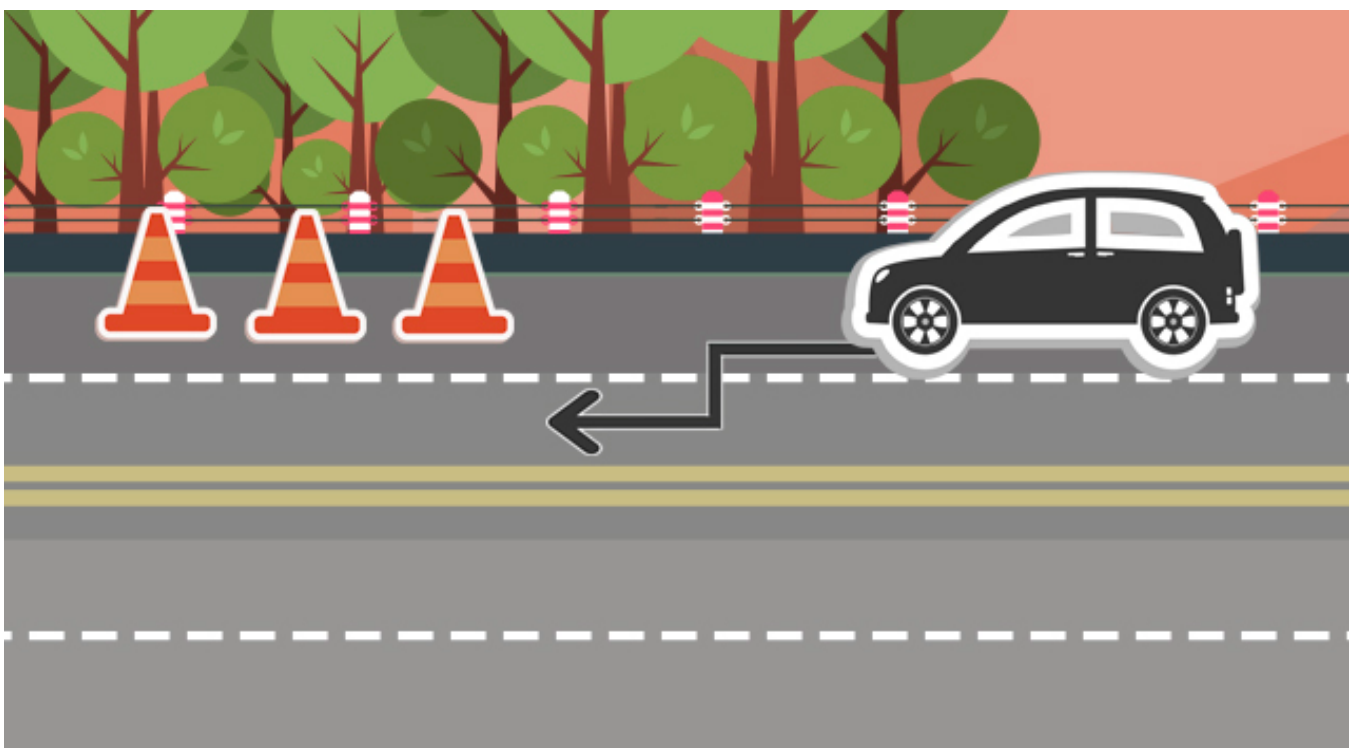
- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

Vibrations are a good way to get my attention back to the road.

- ☐ Disagree strongly
- ☐ Disagree a little
- ☐ Neither agree nor disagree
- ☐ Agree a little
- ☐ Agree strongly
- ☐ I prefer not to respond

Scenario 1: construction works

You are driving on the highway in the automated mode and face construction works ahead of you. The automation cannot control the car while passing the construction works.



What take-over request would you like to receive in this scenario?

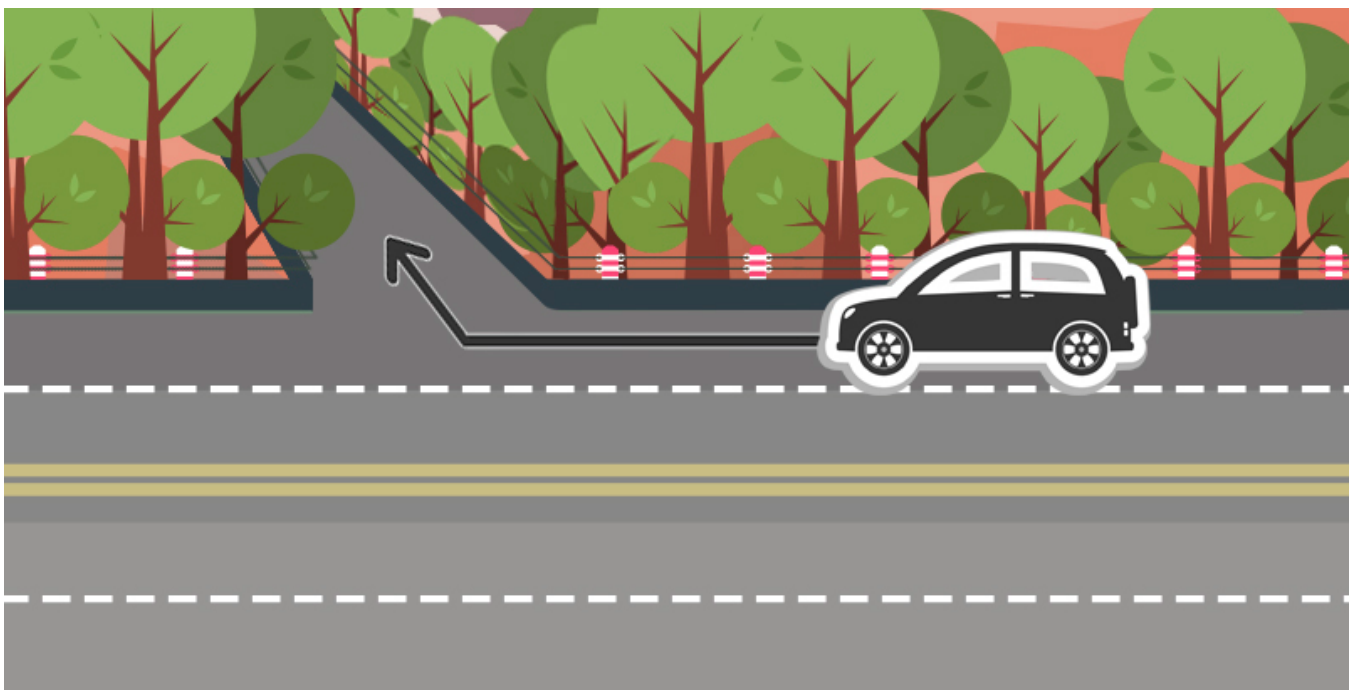
- ☐ Sound message
- ☐ Vibrations
- ☐ Visual message
- ☐ Sound message and vibrations (in any order)
- ☐ Sound message and visual message (in any order)
- ☐ Visual message and vibrations (in any order)
- ☐ Sound message, visual message, and vibrations (in any order)
- ☐ I prefer not to respond

The car has passed the construction works and is ready to go to the automated mode again. How do you want to be informed?

- ☐ Sound message
- ☐ Vibrations
- ☐ Visual message
- ☐ Sound message and vibrations (in any order)
- ☐ Sound message and visual message (in any order)
- ☐ Visual message and vibrations (in any order)
- ☐ Sound message, visual message, and vibrations (in any order)
- ☐ I prefer not to respond

Scenario 2: exiting the highway

You are driving on the highway in the automated mode and you need to exit the highway.



What take-over request would you like to receive in this scenario?

- ☐ Sound message
- ☐ Vibrations
- ☐ Visual message
- ☐ Sound message and vibrations (in any order)

- ☐ Sound message and visual message (in any order)
- ☐ Visual message and vibrations (in any order)
- ☐ Sound message, visual message, and vibrations (in any order)
- ☐ I prefer not to respond

Scenario 3: changing lanes

You are driving on the highway in the automated mode and you need to change lanes for overtaking a slowly moving bus in front of you.



What take-over request would you like to receive in this scenario?

- ☐ Sound message
- ☐ Vibrations
- ☐ Visual message
- ☐ Sound message and vibrations (in any order)
- ☐ Sound message and visual message (in any order)
- ☐ Visual message and vibrations (in any order)
- ☐ Sound message, visual message, and vibrations (in any order)
- ☐ I prefer not to respond

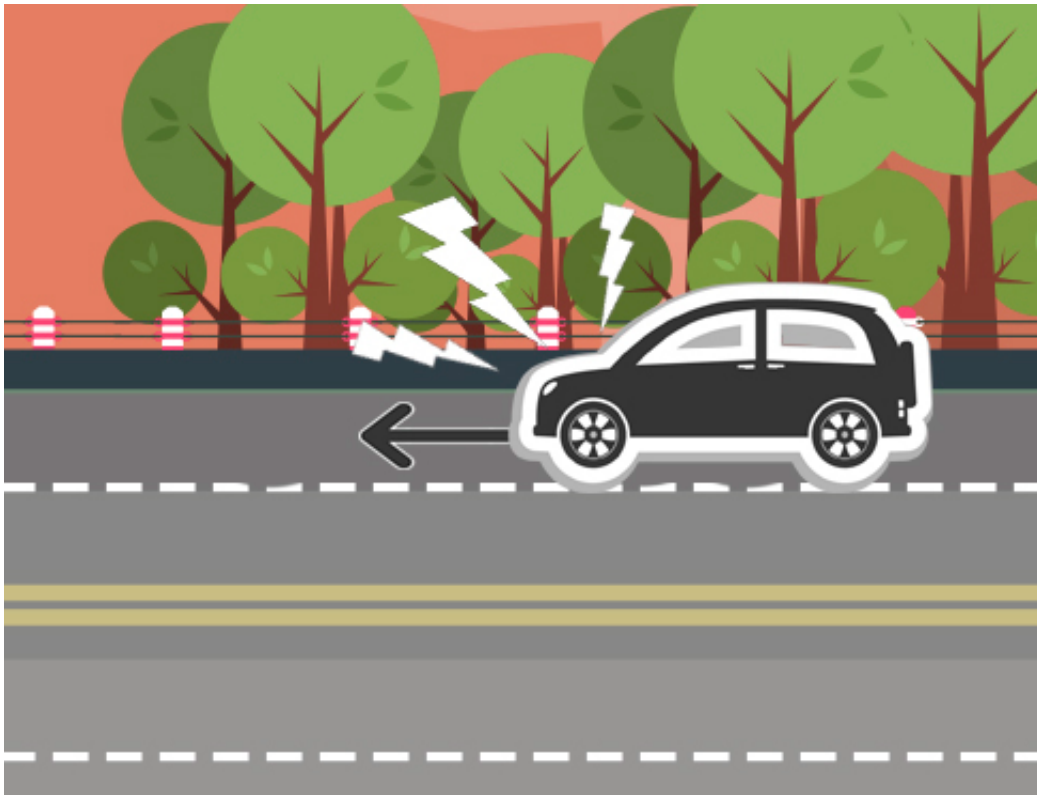
The car has overtaken the bus and is ready to go to the automated mode again. How do you want to be informed?

- ☐ Sound message
- ☐ Vibrations
- ☐ Visual message

- ☐ Sound message and vibrations (in any order)
- ☐ Sound message and visual message (in any order)
- ☐ Visual message and vibrations (in any order)
- ☐ Sound message, visual message, and vibrations (in any order)
- ☐ I prefer not to respond

Scenario 4: automation failure

You are driving on a highway in the automated mode. The automation has a failure and does not work properly. You have little time to take over control.

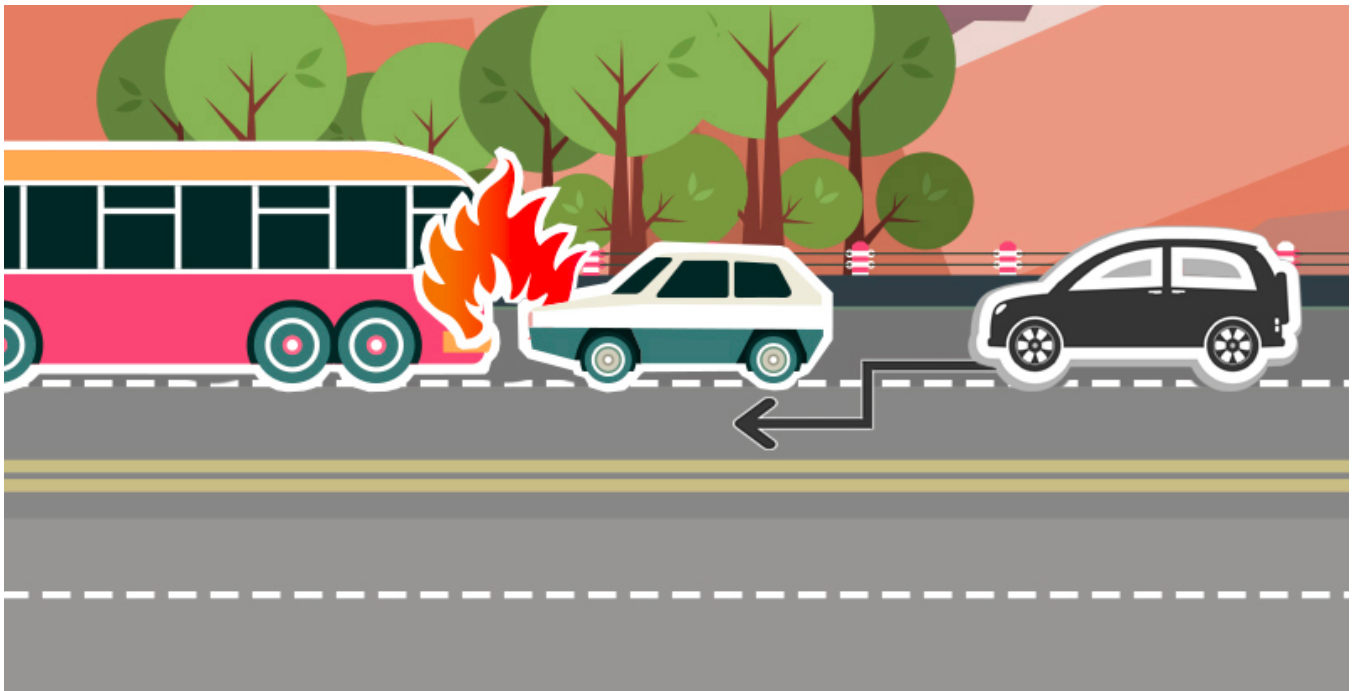


What take-over request would you like to receive in this scenario?

- ☐ Sound message
- ☐ Vibrations
- ☐ Visual message
- ☐ Sound message and vibrations (in any order)
- ☐ Sound message and visual message (in any order)
- ☐ Visual message and vibrations (in any order)
- ☐ Sound message, visual message, and vibrations (in any order)
- ☐ I prefer not to respond

Scenario 5: traffic accident

You are driving on the highway in the automated mode and you see a traffic accident happening in front of you. You have little time to take over control.



What take-over request would you like to receive in this scenario?

- ☐ Sound message
- ☐ Vibrations
- ☐ Visual message
- ☐ Sound message and vibrations (in any order)
- ☐ Sound message and visual message (in any order)
- ☐ Visual message and vibrations (in any order)
- ☐ Sound message, visual message, and vibrations (in any order)
- ☐ I prefer not to respond

The car has passed the accident and is ready to go to the automated mode again. How do you want to be informed?

- ☐ Sound message
- ☐ Vibrations
- ☐ Visual message
- ☐ Sound message and vibrations (in any order)
- ☐ Sound message and visual message (in any order)
- ☐ Visual message and vibrations (in any order)
- ☐ Sound message, visual message, and vibrations (in any order)
- ☐ I prefer not to respond

Miscellaneous questions

In which year do you think that most cars will be able to drive fully automatically in your country of residence?

Please provide any suggestions that could help engineers to build safe and enjoyable automated cars.

Test Validators