|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Utterance** | **Response** | **Utterance** | **Response** | **Utterance** | **Response** | **Utterance** | **Response** | **Utterance** | **Response** | **Utterance** | **Response** |
| **Q** |  | **F** |  | **B** |  | **X** |  | **B** |  | **M** |  |
| **H** |  | **K** |  | **X** |  | **K** |  | **M** |  | **Q** |  |
| **R** |  | **K** |  | **F** |  | **B** |  | **X** |  | **H** |  |
| **X** |  | **F** |  | **H** |  | **M** |  | **K** |  | **K** |  |
| **M** |  | **Q** |  | **M** |  | **R** |  | **H** |  | **M** |  |
| **B** |  | **M** |  | **F** |  | **H** |  | **R** |  | **B** |  |
| **F** |  | **B** |  | **Q** |  | **K** |  | **Q** |  | **X** |  |
| **K** |  | **R** |  | **K** |  | **R** |  | **F** |  | **Q** |  |
| **R** |  | **X** |  | **X** |  | **M** |  | **X** |  | **R** |  |
| **F** |  | **H** |  | **R** |  | **H** |  | **F** |  | **F** |  |
| **X** |  | **Q** |  | **B** |  | **B** |  | **K** |  |  |  |
| **M** |  | **F** |  | **H** |  | **F** |  | **M** |  |  |  |
| **Q** |  | **B** |  | **M** |  | **X** |  | **H** |  |  |  |
| **K** |  | **H** |  | **X** |  | **Q** |  | **Q** |  |  |  |
| **B** |  | **X** |  | **H** |  | **Q** |  | **B** |  |  |  |
| **H** |  | **R** |  | **F** |  | **F** |  | **R** |  |  |  |
| **K** |  | **K** |  | **R** |  | **K** |  | **R** |  |  |  |
| **H** |  | **M** |  | **Q** |  | **H** |  | **K** |  |  |  |
| **R** |  | **B** |  | **B** |  | **R** |  | **Q** |  |  |  |
| **X** |  | **Q** |  | **K** |  | **X** |  | **H** |  |  |  |
| **B** |  | **X** |  | **F** |  | **M** |  | **F** |  |  |  |
| **M** |  | **K** |  | **B** |  | **B** |  | **X** |  |  |  |
| **Q** |  | **F** |  | **Q** |  | **B** |  | **M** |  |  |  |
| **F** |  | **M** |  | **X** |  | **R** |  | **B** |  |  |  |
| **M** |  | **R** |  | **H** |  | **H** |  | **X** |  |  |  |
| **R** |  | **H** |  | **R** |  | **X** |  | **H** |  |  |  |
| **X** |  | **M** |  | **K** |  | **F** |  | **K** |  |  |  |
| **H** |  | **Q** |  | **M** |  | **M** |  | **B** |  |  |  |
| **Q** |  | **R** |  | **F** |  | **K** |  | **F** |  |  |  |
| **B** |  | **K** |  | **Q** |  | **Q** |  | **R** |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
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| **Q** |  | **F** |  | **B** |  | **X** |  | **B** |  | **M** |  |
| **H** |  | **K** |  | **X** |  | **K** |  | **M** |  | **Q** |  |
| **R** |  | **K** |  | **F** |  | **B** |  | **X** |  | **H** |  |
| **X** |  | **F** |  | **H** |  | **M** |  | **K** |  | **K** |  |
| **M** |  | **Q** |  | **M** |  | **R** |  | **H** |  | **M** |  |
| **B** |  | **M** |  | **F** |  | **H** |  | **R** |  | **B** |  |
| **F** |  | **B** |  | **Q** |  | **K** |  | **Q** |  | **X** |  |
| **K** |  | **R** |  | **K** |  | **R** |  | **F** |  | **Q** |  |
| **R** |  | **X** |  | **X** |  | **M** |  | **X** |  | **R** |  |
| **F** |  | **H** |  | **R** |  | **H** |  | **F** |  | **F** |  |
| **X** |  | **Q** |  | **B** |  | **B** |  | **K** |  |  |  |
| **M** |  | **F** |  | **H** |  | **F** |  | **M** |  |  |  |
| **Q** |  | **B** |  | **M** |  | **X** |  | **H** |  |  |  |
| **K** |  | **H** |  | **X** |  | **Q** |  | **Q** |  |  |  |
| **B** |  | **X** |  | **H** |  | **Q** |  | **B** |  |  |  |
| **H** |  | **R** |  | **F** |  | **F** |  | **R** |  |  |  |
| **K** |  | **K** |  | **R** |  | **K** |  | **R** |  |  |  |
| **H** |  | **M** |  | **Q** |  | **H** |  | **K** |  |  |  |
| **R** |  | **B** |  | **B** |  | **R** |  | **Q** |  |  |  |
| **X** |  | **Q** |  | **K** |  | **X** |  | **H** |  |  |  |
| **B** |  | **X** |  | **F** |  | **M** |  | **F** |  |  |  |
| **M** |  | **K** |  | **B** |  | **B** |  | **X** |  |  |  |
| **Q** |  | **F** |  | **Q** |  | **B** |  | **M** |  |  |  |
| **F** |  | **M** |  | **X** |  | **R** |  | **B** |  |  |  |
| **M** |  | **R** |  | **H** |  | **H** |  | **X** |  |  |  |
| **R** |  | **H** |  | **R** |  | **X** |  | **H** |  |  |  |
| **X** |  | **M** |  | **K** |  | **F** |  | **K** |  |  |  |
| **H** |  | **Q** |  | **M** |  | **M** |  | **B** |  |  |  |
| **Q** |  | **R** |  | **F** |  | **K** |  | **F** |  |  |  |
| **B** |  | **K** |  | **Q** |  | **Q** |  | **R** |  |  |  |

**Experiment Instructions**

First of all, thank you for your interest in this experiment. Please read the instructions carefully.

**Before the experiment**

You are now seated in our Southampton University Driving Simulator (SUDS). This simulator is able to simulate manual, as well as automated driving amongst a variety of scenarios.

Now you will be asked to read and fill out a few questionnaires. These are:

* Participant Information Sheet
  + This will explain what the research is about and what can and will happen before, during and after the experiment
* Consent Form
  + This is to ensure you understand what your participation entails
* ECG Electrode placement
  + This is to inform you of how and where the ECG electrodes will be placed
* General Information
  + This is to get some general information, solely for research purposes
* State Questionnaire
  + This is to assess your current state, solely for research purposes
* Quick Association Check
  + This is to assess your general idea on driving automation

The researcher will monitor your eye- and head movements by means of a head-mounted eye tracker. Some calibrations will have to made, and therefore your cooperation is appreciated. Also some of your biometric measures, such as your heart rate, will be measured. For this, some electrodes have to be placed on you, as explained in the Information Sheet. Furthermore, you will be asked to “think aloud” several times along the ride. This will be rehearsed before the experiment starts, to give you an idea of what is expected from you.

Lastly, during the experiment your utterances will be recorded and saved anonymously, stored and to be used by the research team only.

**During the experiment**

You will take part in a simulated drive in a highly automated platoon. This means you will be part of a group of highly automated vehicles that will drive very close together.

Driving in a highly automated vehicle means that the vehicle automation takes care of both the speed and the steering, so, theoretically, you don’t have to do a thing! But an incident is always possible, so you still have to pay attention. The drive will take place along a highway with mild traffic. This first drive (out of three) will be around 40 minutes.

Your task is to monitor the road and the drive along the ride, and intervene whenever an unexpected critical situation appears. Try to avoid any accidents at all times, and remember to “think aloud” when asked by the researcher.

**After the experiment**

You will be asked to fill out three questionnaires:

* State Questionnaire
  + This is to assess your current state after your drive
* NASA-TLX
  + This is to assess your experiences about your drive
* Quick Association Check
  + This is to assess your general idea on driving automation

Then you will receive the next instructions for your second drive.

Participant Information Sheet

**Study Title**: Long-Term Effects of Highly Automated Platoons

**Researcher**: Daniel D. Heikoop **Ethics number**: **18070**

**Please read this information carefully before deciding to take part in this research. If you are happy to participate you will be asked to sign a consent form.**

**What is the research about?**

This study is part of a larger international research project called HF-AUTO. I am interested in the long-term effects of highly automated driving on driving behaviour. This research is funded by the Marie Curie-Skłodowska Actions.

**Why have I been chosen?**

You have been approached to take part in this study as part of an effort to recruit people who have a driving license, and are at least in adequate physical and mental health.

**What will happen to me if I take part?**

Should you choose to take part, you will be asked to participate in three sessions of driving in the University of Southampton’s Driving Simulator. The three sessions will all involve driving a similar route on a highway within a platoon of highly automated vehicles, each lasting approximately 40 minutes, with one short questionnaire to be filled out before, and two short questionnaires to be filled out after each session, plus you will be asked to create a map using A3 sheets of paper.

In total, the experiment should last around three hours. The questionnaires will ask about the amount of workload you feel you are under for each driving trial and about your feelings and thoughts at the moment. Furthermore your heart rate will be measured during the ride by electrodes placed on the upper chest- and back region, and your eye movements will be measured by means of a remote eye tracker. Both measurements will not hurt in any sense, and discretion is being considered at all times.

**Are there any benefits in my taking part?**

While individual benefit may be limited, your participation will help us to build an understanding of the long-term effects of highly automated driving in platoons on driving behaviour. It is hoped that the results achieved in this research will be used in the development of driving automation in commercially available road vehicles.

**Are there any risks involved?**

Driving in a simulator can cause motion sickness in some people, though not all. Some suggest around 10% of people experience symptoms such as nausea and dizziness. Previous experiments similar to this one resulted in no occasions where that occurred. Should this occur, participation will be stopped.

Beyond the risk of motion sickness, this study does not carry with it any significant risks additional those you would experience in normal, day-to-day life.

**Will my participation be confidential?**

No identifying data will be released to anyone other than the main investigator. Consent forms will be stored securely in a locked cabinet, with the primary investigator having the only key.

**What happens if I change my mind?**

You are completely free to end your participation at any time. You are not obliged in any way to continue with the session, or even begin the session, should you so choose.

**What happens if something goes wrong?**

In the unlikely case of concern or complaint, please contact the Research Governance Office at the University of Southampton).

**Where can I get more information?**

If you would like more information, please feel free to email me, the main investigator, at D.D.Heikoop@soton.ac.uk.

**CONSENT FORM**

**Study title**: Long-Term Effects of Highly Automated Platoons

**Researcher name**: Daniel D. Heikoop

**Study reference**: -

**Ethics reference**: 18070

*Please initial the box(es) if you agree with the statement(s):*

I have read and understood the information sheet and have had the opportunity to ask questions about the study

I agree to take part in this research project and agree for my data to be used for the purpose of this study

I understand my participation is voluntary and I may withdraw at any time without my legal rights being affected

I understand that my participation entails the monitoring of heart rate- and eye measures, and I am happy for it to be so

I understand that my participation entails the monitoring and storing of utterances, and I am happy for it to be so

***Data Protection***

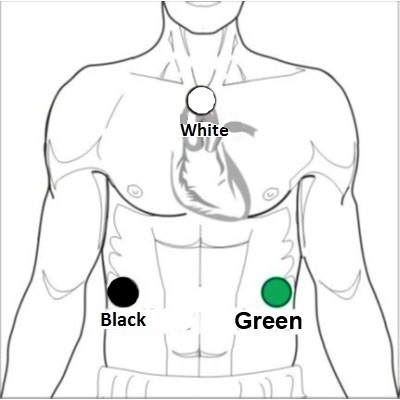
*I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purpose of this study. All files containing any personal data will be made anonymous.*

Name of participant (print name)……………………………………………………

Signature of participant……………………………………………………………..

Date…………………………………………………………………………………

**ECG electrode placement**



The ideal electrode placement for detecting heart rate is a triangular configuration on the chest where the white and green electrodes are parallel with the heart's main axis (see illustration).

**General information**

**\*Note: Any information provided will be handled with the utmost care, and privacy is given priority at all times. None other than the researcher will handle this information, and will be safely secured at all times. The researcher in question is henceforth considered to be responsible, and thereby acknowledges his responsibility.**

Please tick or fill in the boxes appropriate to your situation.

**Age**

|  |  |
| --- | --- |
|  | years |

**Gender**

|  |  |  |  |
| --- | --- | --- | --- |
| O | Male | O | Female |

**Education**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| O | No school completion | O | Primary School | O | Secondary School | O | Vocational School |
| O | Higher Education – MSc/MA | O | Higher Education – BSc/BA | O | Higher Education - PhD | O | Other |

**Profession**

**\_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_**

**Years of driving experience**

|  |  |
| --- | --- |
|  | years |

**Average driving engagement in the last 12 months**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| O | Every day | O | 4-6 days a week | O | 1-3 days a week | O | Once a month |
| O | Less than once a month | O | Never |  |  |  |  |

**Average mileage in the last 12 months**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| O | 0 | O | 1-1,000 | O | 1,001-5,000 | O | 5,001-10,000 |
| O | 10,001-20,000 | O | 20,001-30,000 | O | 30,001-50,000 | O | 50,000+ |

**DSSQ-3 STATE QUESTIONNAIRE**

**PRE-TASK QUESTIONNAIRE**

**Retrievable via G. Matthews**

**DSSQ-3 STATE QUESTIONNAIRE**

**POST-TASK QUESTIONNAIRE**

**Retrievable via G. Matthews**

# NASA Task Load Index

Hart and Staveland’s NASA Task Load Index (TLX) method assesses work load on five 7-point scales. Increments of high, medium and low estimates for each point result in 21 gradations on the scales.

**Instructions:**

Please put a cross (X) **ON THE STALKS**, to indicate the degree of the requested demands you experienced during your recent task. Like so:

|  |  |
| --- | --- |
| Mental Demand | How mentally demanding was the task? |

|  |  |
| --- | --- |
| Very Low | Very High |

|  |  |
| --- | --- |
| Physical Demand | How physically demanding was the task? |

|  |  |  |
| --- | --- | --- |
| Very Low |  | Very High |

|  |  |
| --- | --- |
| Temporal Demand | How hurried or rushed was the pace of the task? |

|  |  |
| --- | --- |
| Very Low | Very High |

|  |  |  |
| --- | --- | --- |
| Performance | How successful were you in accomplishing what you were asked to do? |  |

|  |  |
| --- | --- |
| Perfect | Failure |

|  |  |  |
| --- | --- | --- |
| Effort | How hard did you have to work to accomplish your level of performance? |  |

|  |  |
| --- | --- |
| Very Low | Very High |

|  |  |  |
| --- | --- | --- |
| Frustration | How insecure, discouraged, irritated, stressed, and annoyed were you? |  |

|  |  |
| --- | --- |
| Very Low | Very High |

**Experiment Instructions**

You will now take part in the next simulated drive. This time, your task is to monitor the road and the drive along the ride, and intervene whenever an unexpected critical situation appears.

Please remember to “thinking aloud” when requested, which will be in a similar fashion as the previous session.

Furthermore, you will hear a sequence of utterances of several consonants.

You are *encouraged*, but *not required* to repeat the consonant you heard **2** consonants ago.

For example:

You have heard the sequence “T, L, X, H, R”.

At the point you hear the “R”, you say “X”, as that is the consonant uttered **2** consonants ago.

So, the proper response to this entire sequence would thus be “…, …, T, L, X”.

After the experiment you will be asked to further develop the map and fill out the same two questionnaires again:

* State Questionnaire
* NASA-TLX

**DSSQ-3 STATE QUESTIONNAIRE**

**POST-TASK QUESTIONNAIRE**

**Retrievable via G. Matthews**

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|  |  |
| --- | --- |
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|  |  |  |
| --- | --- | --- |
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|  |  |
| --- | --- |
| Perfect | Failure |

|  |  |  |
| --- | --- | --- |
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|  |  |
| --- | --- |
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|  |  |  |
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| --- | --- | --- |
| Very Low |  | Very High |

|  |  |
| --- | --- |
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|  |  |
| --- | --- |
| Very Low | Very High |

|  |  |  |
| --- | --- | --- |
| Performance | How successful were you in accomplishing what you were asked to do? |  |

|  |  |
| --- | --- |
| Perfect | Failure |

|  |  |  |
| --- | --- | --- |
| Effort | How hard did you have to work to accomplish your level of performance? |  |

|  |  |
| --- | --- |
| Very Low | Very High |

|  |  |  |
| --- | --- | --- |
| Frustration | How insecure, discouraged, irritated, stressed, and annoyed were you? |  |

|  |  |
| --- | --- |
| Very Low | Very High |