

Standardised assessment framework (SAF)

Flourish Deliverable WP3.D7

The FLOURISH project was developed in response to Innovate UK's Connected and Autonomous Vehicles Collaboration Research and Development competition. The three-year project, worth £5.5 million, seeks to develop products and services that maximise the benefits of Connected and Autonomous vehicles for users and transport authorities. By adopting a user-centred approach, FLOURISH aims to achieve a better understanding of consumer demands and expectations, including the implications and challenges of an ageing society.

FLOURISH sets out to identify innovative solutions that address two distinct but related topics within the connected and autonomous vehicle (CAV) market which will help to realise market readiness of CAVs:

- Customer Interaction focusing on the customers' needs and experience when using the technology; and
- Connectivity focusing on effective data analytics and ensuring that the cyber security and wireless connectivity elements of CAVs are safe by design.

The project has the following objectives:

1. Develop an understanding and articulation of user needs and expectations of CAVs to maximise the mobility potential they offer.
2. Develop usable adaptive interfaces, performance certification processes, products and services that enable secure, trustworthy and private technology within CAVs.
3. Capitalise on the large volume of data created by CAVs to develop innovative new tools and products.
4. Leverage existing investment in the Bristol City-Region to expand validation and test capabilities in both urban and interurban networked environments and enhance the commercial opportunities this will deliver.

SAF objectives

- Tests and measures assess –

(For use of an HMI within a CAV):

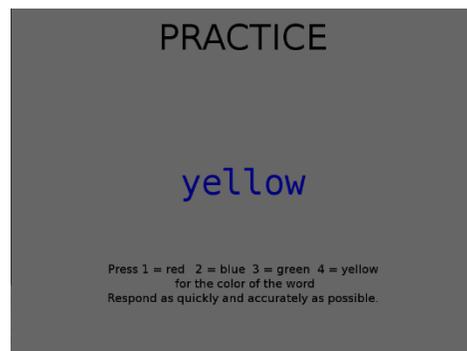
- **Sensory abilities and simple motor abilities** that are required to interact with the HMI and that will enable adaptation or adjustment of the HMI according to the user's needs (vision, hearing);
- **Cognitive abilities** that are required to interact with the HMI (e.g., perception, attention, short-term memory, processing speed, inhibition);
- **Alertness and state that could affect how individuals interact with the HMI** (sleep, sleepiness, alertness, fatigue, mood, emotions);
- **Computer usage** that is likely to affect how individuals interact with the HMI and their interest in adopting CAV technology;
- **Trust measures** (e.g. trust in automation);
- **Cyber security, data sharing and privacy data** as these variables are likely to impact users' trust and acceptance of CAV-related technology
- **Other individual differences** that are likely to affect how individuals interact with the HMI (e.g., personality, risk taking, distractibility);
- **Driving experience.** To be able to differentiate between those that have driven in the past (low, moderate and high mileage drivers), those that have driven in the past and no longer drive, and those that have not driven in the past. Not to assess current driving ability.

Framework development

- SAF took 90 minutes to complete and was completed twice: consists of pen and paper questionnaires (50 min) and computerised cognitive assessment tests (40min).
- Five trials (3 Simulator, 2 real life Pod trials)
- Four iterations of the framework
- 150 data sets from 65+ years old and 35 data sets from 18-35 year olds to provide a baseline/comparison group
- Collected over a 3 years period (25 weeks overall data collection over 5 trials)

Cognitive tasks

- Five different cognitive tasks assessing selective attention, inhibition, working memory, and executive functioning were administered.
- For example: Colour Word Stroop



The Colour Stroop task is a task of selective attention and inhibition. Words presented in colours blue, red, yellow and green, are displayed on the screen. Participants are required to respond to the colour the word is displayed in by selecting the corresponding digit key.

CAV interaction related measures: Physiological data



Tobii eye tracker glasses – gaze direction and duration



Empatica E4 – EDA, Heart Rate and Skin temperature



Non-contact ECG monitoring

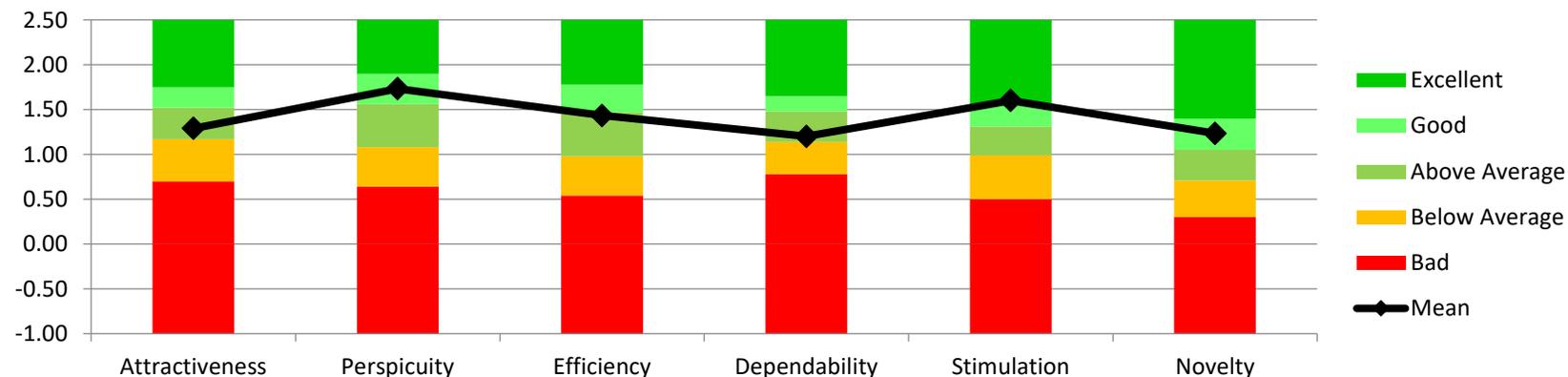
CAV interaction human factors related measures

Two Cognitive measures (Situation awareness and mental workload)

Two Affect measures (Positive and negative affect, and Trust)

Two Usability measures (system Usability and user experience)

Example ratings (black line plotted against reference data):



The SAF will be useful for assessing:

- Individual user variables correlating with particular user needs and behaviour relating to CAV journeys
- Variables predicting user attitudes to the CAV and technology
- Barriers in CAV acceptance in terms of physical, psychological/social and cognitive needs

Publication of the tool is in progress and is planned to be submitted in 2019