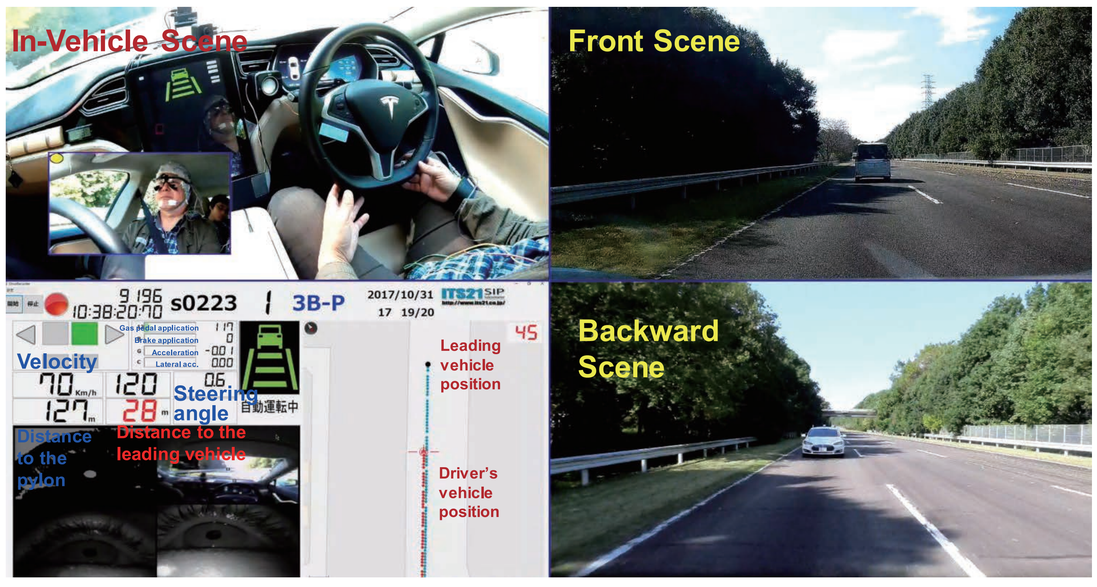
Human Factors

Task B

Assessment of driver states in automated driving and Investigation of driver controllability in transition from automated to manual driving

FY2016: Driving simulator experiment

→**FY2017: Proving ground experiment**



RtI(Request to Intervene)[6sec before reaching to the pylon]

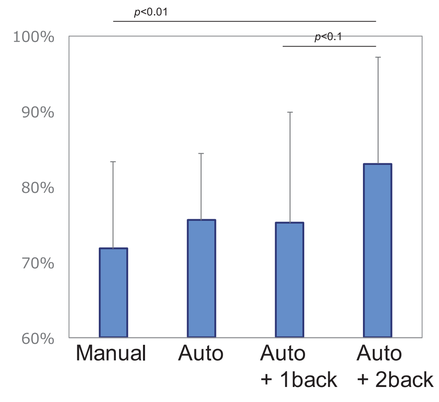
Automated Driving ▽ **Manual Driving**

- Following the lead vehicle
- Cognitive load (N-back task)or Visual-manual load (SuRTtask)
- 4 experimental conditions per one participant (manual, automated, automated with easy non-driving task, automated with difficult non-driving task)
- Measuring driver's visual behaviors

- Avoiding the pylon manually after the lead vehicle changes lane
- Measuring driver's operational behaviors

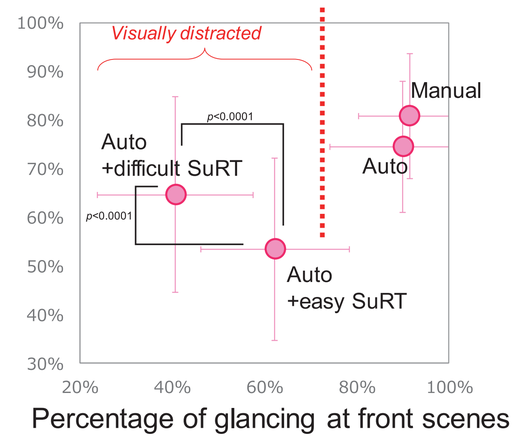
Results of driver's conditions before RtI

Percentage of frequency of saccades (5 to 16 degrees) in all saccades for 1 minute before RtI



Cognitive load

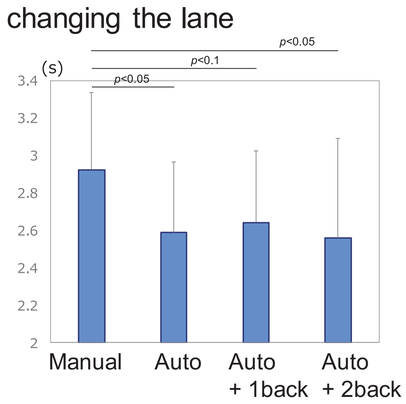
Percentage of frequency of saccades (5 to 16 degrees) in all saccades for 1 minute before RtI



Visual-manual load

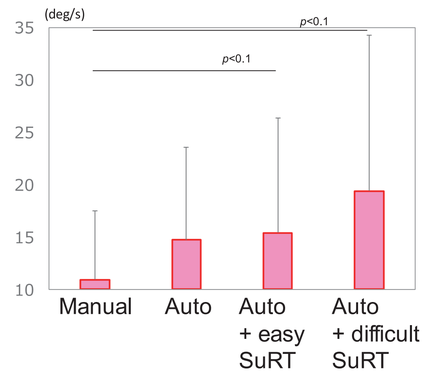
Results of driving behaviors after RtI

Time margin to the pylon when changing the lane



Cognitive load

Steering speed during the maximum steering angle



Visual-manual load

Findings obtained from the proving ground experiment are similar to those in the simulator study

Task C

Experiment on recommendations for on-road communication measures of AV

- Vehicle behavior is the primary communication cue to surrounding pedestrians.
- External HMI can be an additional cue to clarify AV's intention to yield when vehicle behavior is not clear enough.
- Different types of pedestrians responded to the external HMIs differently. The design of external HMI needs to be "Universal".
- Meaning for an external HMI signal needs to be selected carefully to magnify the positive effects.

An experiment in a closed track

Simulated external HMIs

I am going to stop	After you	Automated driving

Text messages were used to eliminate ergonomic design factors of e-HMI.

Did the participants feel the approaching AV yielded to them?

- Results for Efficiency -