Human Factors Issues in Interactions Between Human and Automated Vehicle

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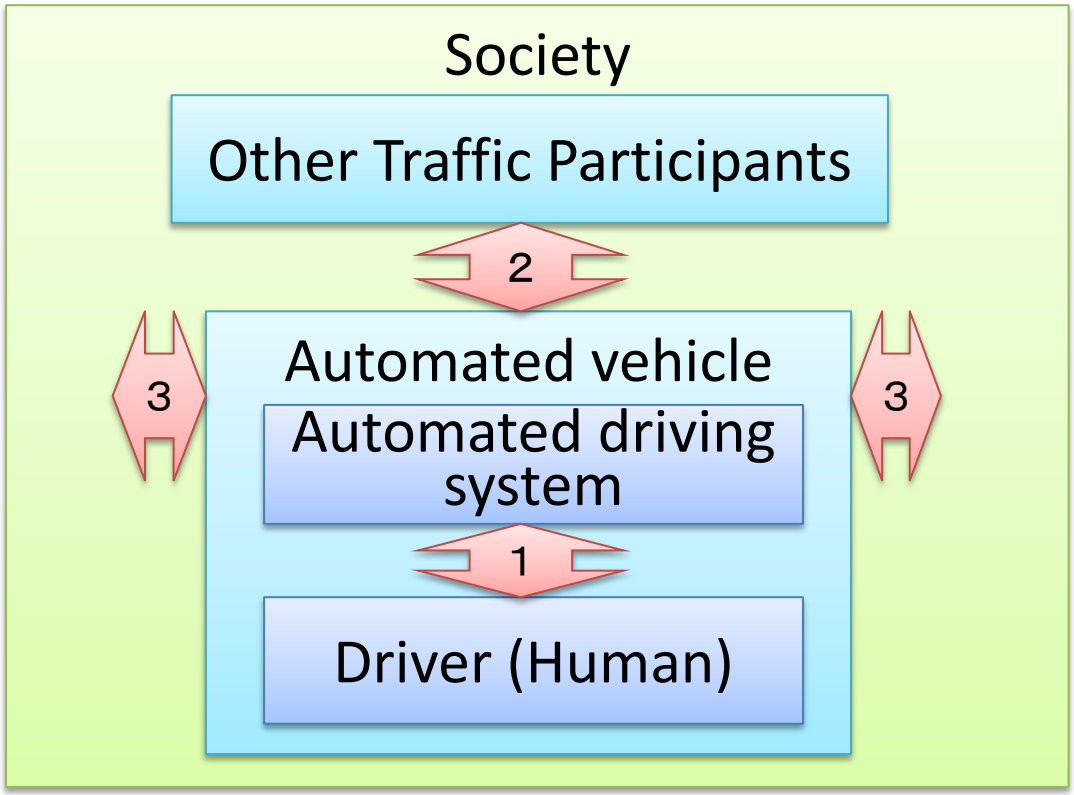
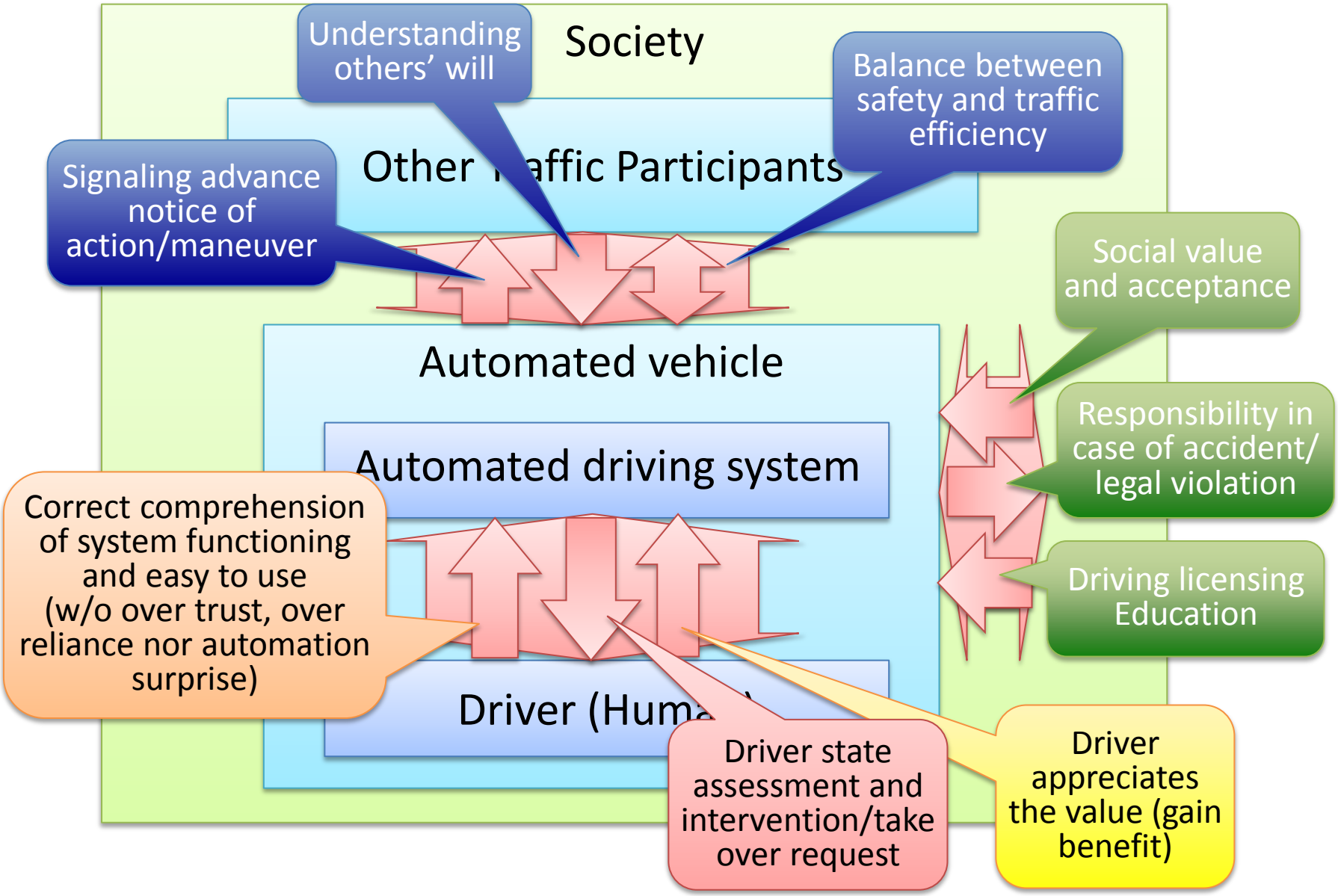
Three interactions for automated vehicle

- automated driving system and driver
- automated vehicle and other traffic participants
- automated vehicle and society

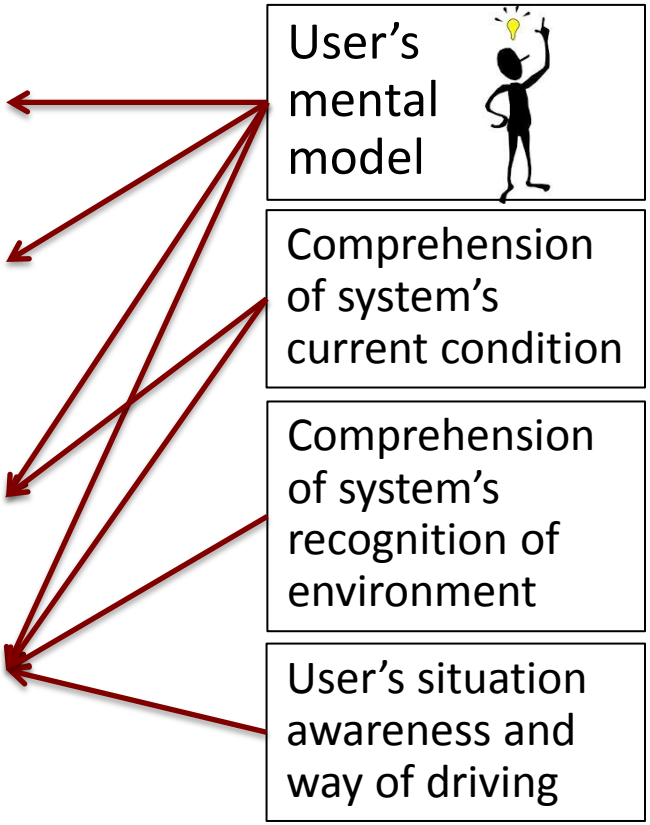


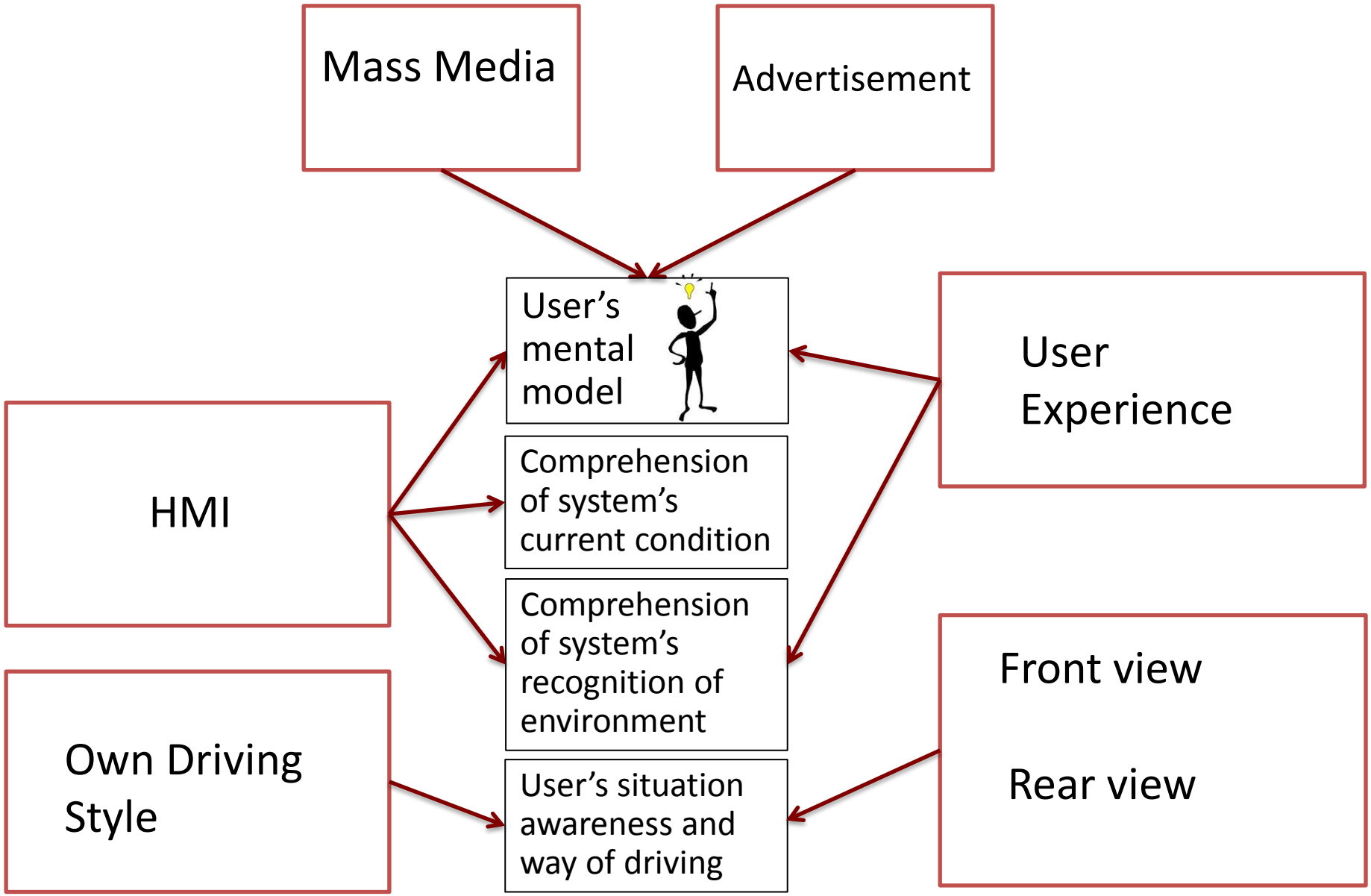
Three interactions for automated vehicle



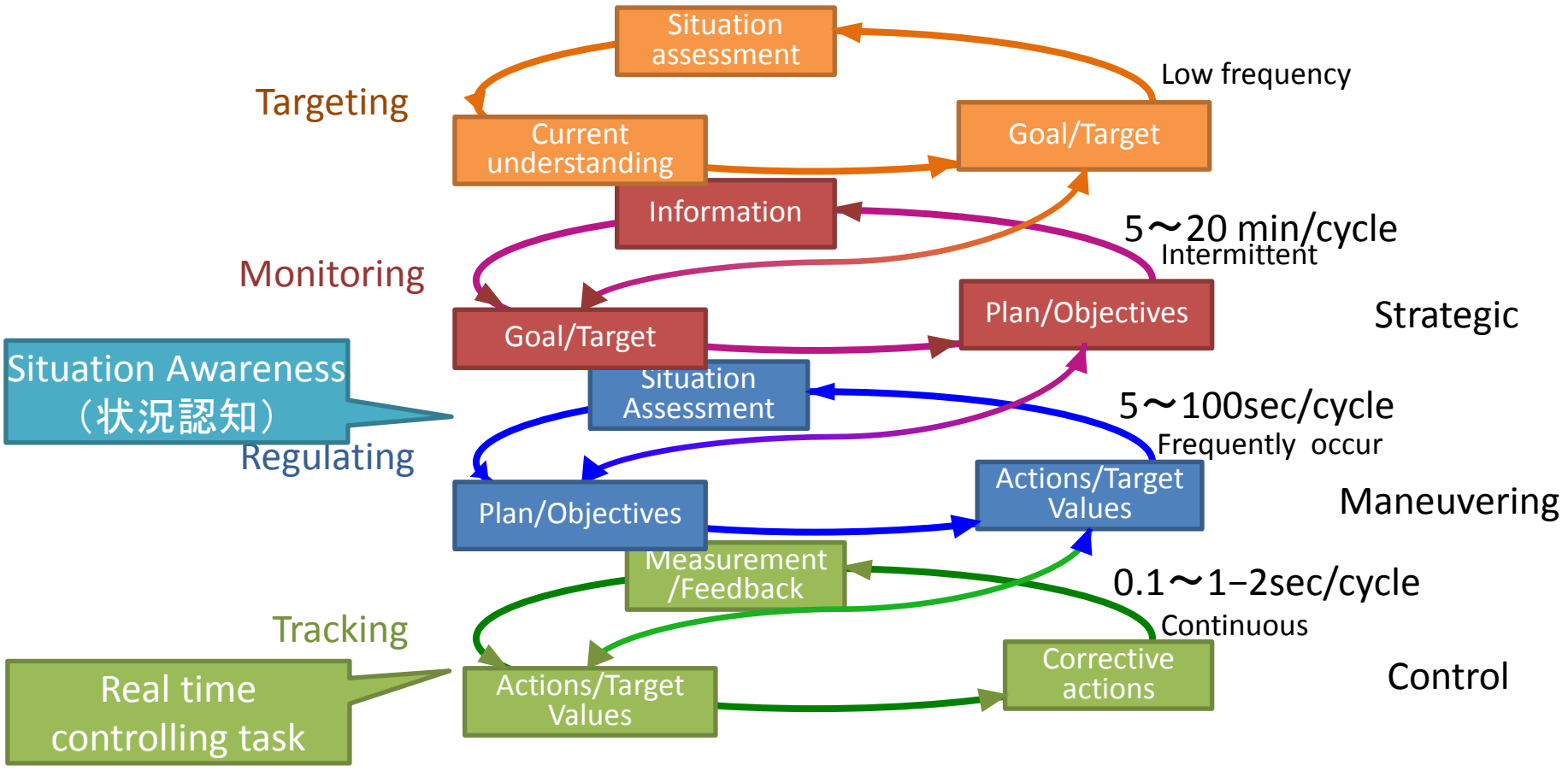
Correct comprehension of system functioning and easy to use (avoid misuse and automation surprise)

- System function:
  - what system can do and how reliable they are
- System status:
  - how system works at this moment
- System operation:
  - how to use and set parameters
- System behavior:
  - comprehensible and comfort in system's behavior




Mass Media
Advertisement
User's mental model
User Experience
HMI
Comprehension of system's current condition
Comprehension of system's recognition of environment
Front view
Rear view
Own Driving Style
User's situation awareness and way of driving

ECOM (Extended Control Model) (Eric Hollnagel)



Level 2

No real time control task while driving

- Lowering arousal level
- Less attention to road environment
- Lower level and less frequent of situation awareness

Sudden requirement to hand over

- Start to perform real time control task for high speed run

Level 3

Manual Driving

No real time control task, nor situation assessment task while vehicle running

- Lowering arousal level/ sleepiness
- Lowering safety awareness: not stay in driver's seat

Move from Driving task by system to manual driving

- Starting situation assessment under high speed running condition
- Initiating proper control action for high speed running condition

System interaction with driver (System initiated HMI) for Level 2 & 3

- Maintain arousal level
  - Monitoring arousal level
    - Face、PERCLOS、Physiological measures？
  - Promote/keep arousal level for level 2 & 3
    - Sensory stimulus、dialogue with system
    - Limitation of duration of system use
  - Awake technology for level 3
- Assist situation awareness
  - HMI for system's recognition of environment
  - Guide to paying attention to road environment
  - Enhancing situation awareness
- Procedure of handover from Auto to Manual
  - Required time to handover, step by step procedure
  - Shared control of system and driver

Related system design

- Reliability of system
- Stability of control

- Requirement to driver
  - Hands on wheel
  - Allow to sleep