A Note for Common Understanding of Driver Assistance in Advanced Systems

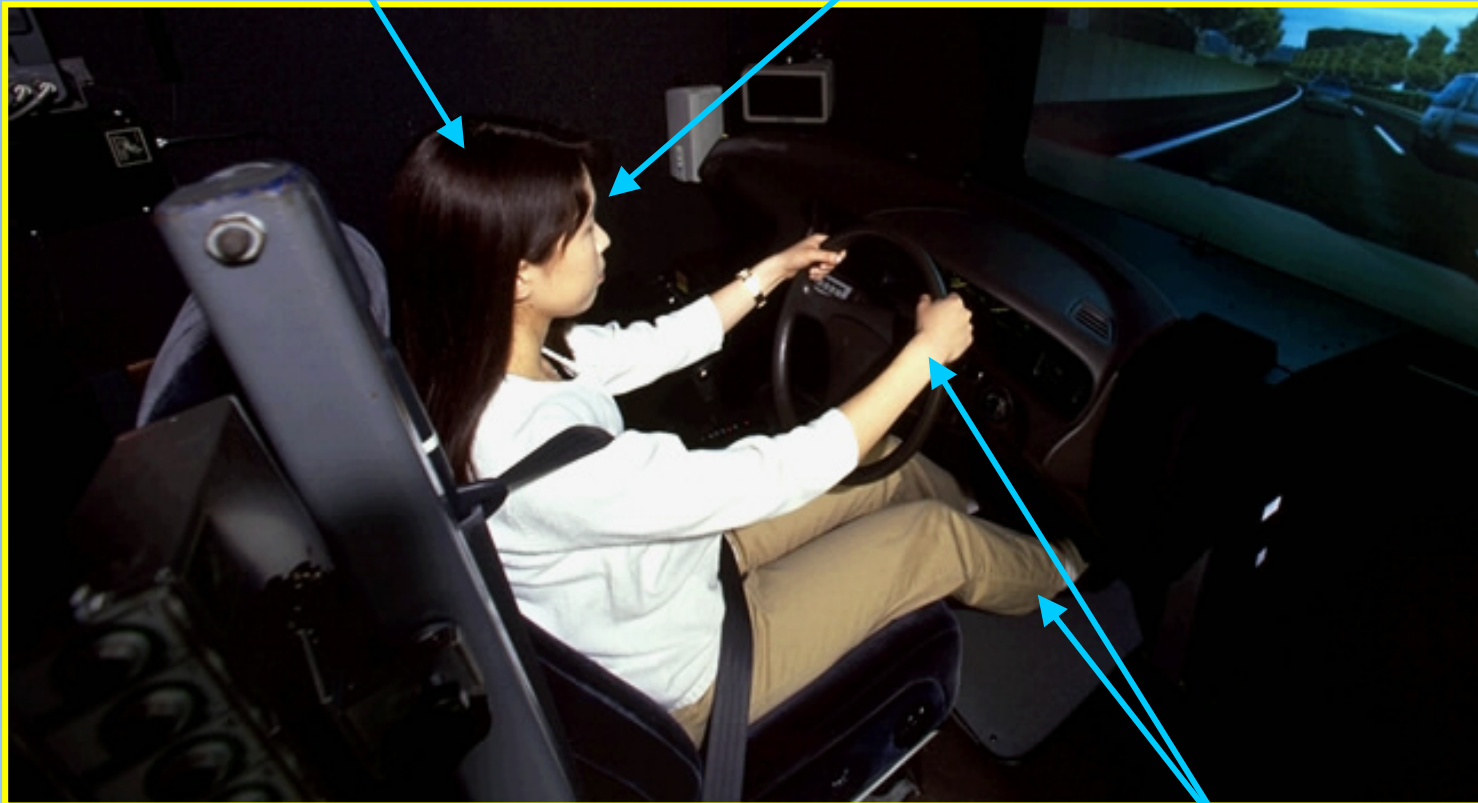**UNECE/WP29/ITS Informal Group**

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Kaneo Hiramatsu

IHRA-ITS WG & JARI

Driver Behavior in Car Driving


Judgment

Recognition

Operation

Causes of Traffic Accidents
How to improve the situation?

Errors of recognition, judgment and operation in car driving may directly cause traffic accidents. Therefore, it becomes important to make up for errors by advanced technologies. Information technology could be an effective tool to be applied for improvement of convenience and reduction of errors as well.

About 70% of accidents with fatalities or serious injuries caused by late recognition

All accidents with fatality or serious injury (61,531 cases)

Operation error
9%

Judgment error
20%

Inattention to road ahead
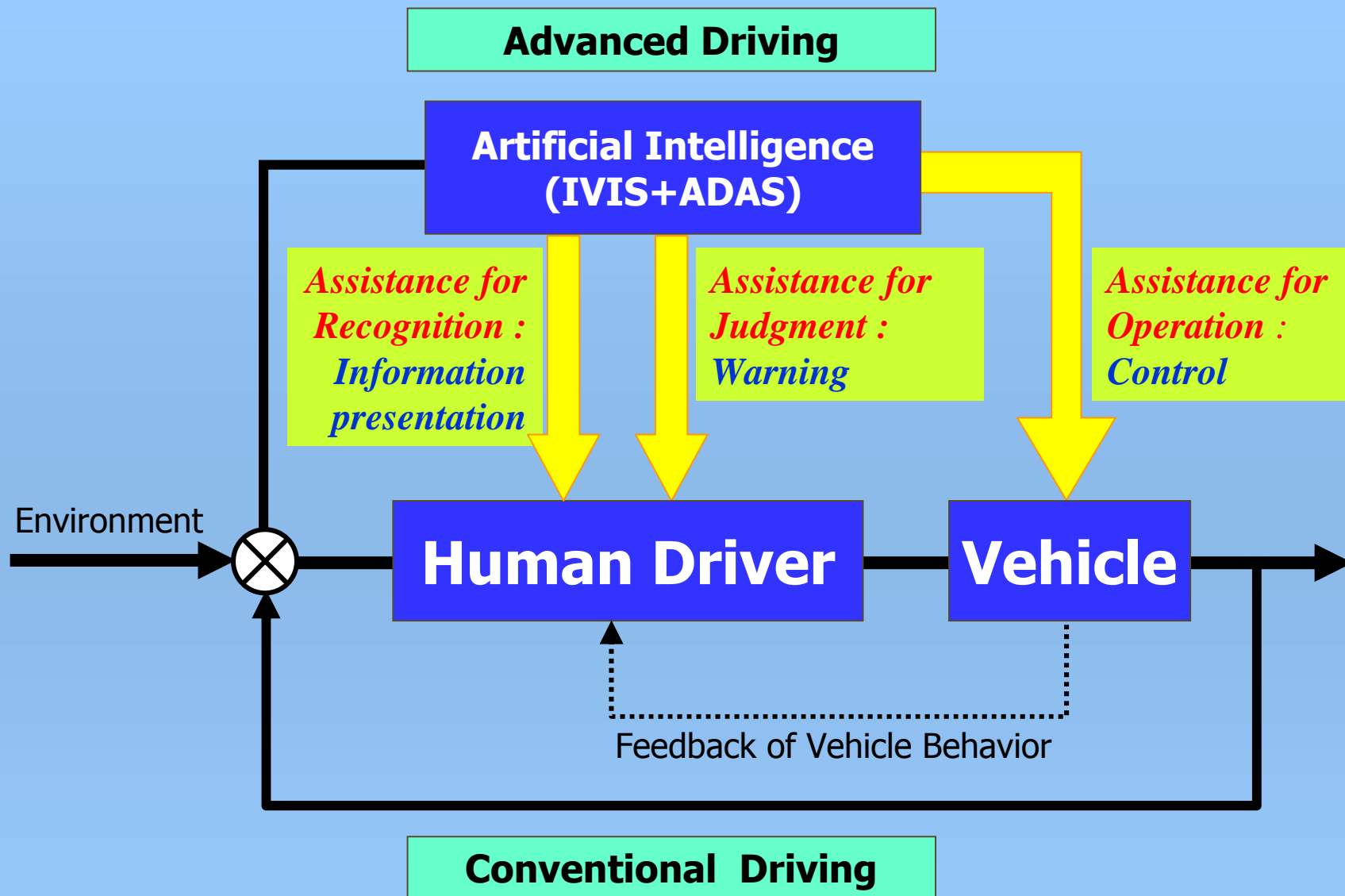28%

71%

Safety not checked
43%
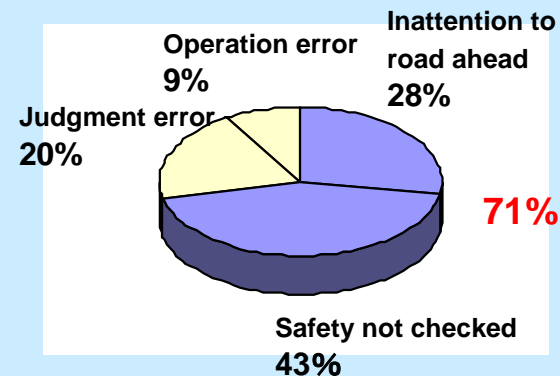
Human factors in accidents caused by ordinary and light automobiles (from 2001 ITARDA data), written by S. Kuzumaki

How to assist a driver using information?

◆ Level 1 : Information presentation
  ➢ for convenience

◆ Level 2 : Warning
  ➢ for risk reduction

◆ Level 3 : Control
  ➢ for convenience and/or
     crash severity reduction

Advanced Driving

Artificial Intelligence (IVIS+ADAS)

Assistance for Recognition : *Information presentation*

Assistance for Judgment : *Warning*

Assistance for Operation : *Control*

Environment

⊗

Human Driver

Vehicle
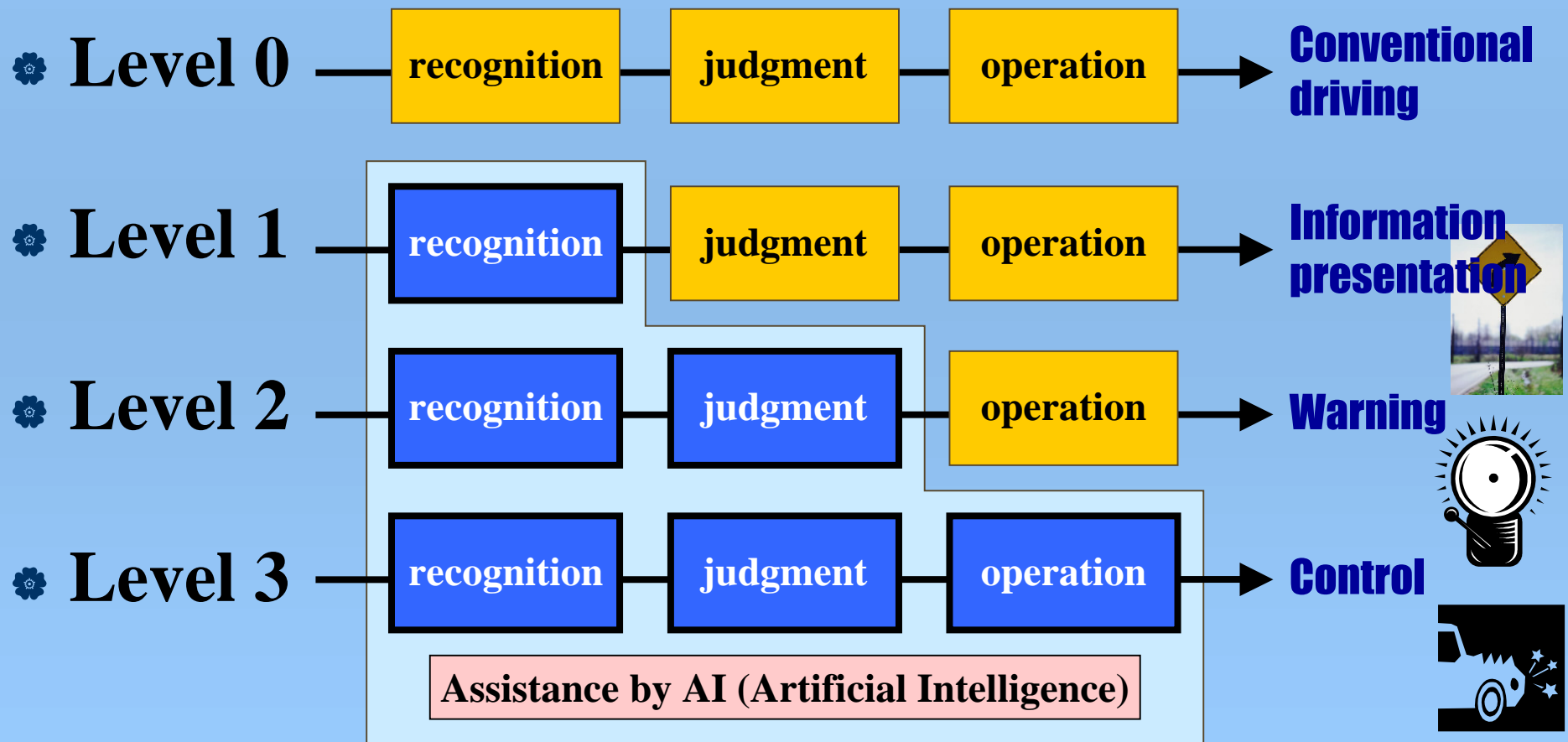
Feedback of Vehicle Behavior

Conventional Driving

Block Diagram of Car Driving

Behavioral Model of a Driver and Level of Driver Assistance

Behavioral Model of a Driver

	recognition	judgment	operation	
Level 0	recognition	judgment	operation	**Conventional driving**
Level 1	recognition	judgment	operation	**Information presentation**
Level 2	recognition	judgment	operation	**Warning**
Level 3	recognition	judgment	operation	**Control**

Assistance by AI (Artificial Intelligence)

Classification of Advanced Systems according to Level of Driver Assistance

level of driver assistance		examples of advanced systems
Level 1	information presentation *(To assist recognition)*	/ Navigation system / Adaptive front-lighting system / Night vision / Information on road curve
Level 2	warning *(To assist judgment)*	/ Forward collision warning / Lane departure warning / Side obstacle warning
Level 3	control:active braking, steering *(To assist operation)*	/ Adaptive cruise control / Collision mitigation braking system / Intelligent speed adaptation / Lane keeping support system

Information Presentation

Excessive information will cause a driver distraction. What is the proper way to use information for a driver?

Driver Distraction

◆ **First class distraction**

 ➢ **Frequency and duration of glances away from the road ⇒ visual distraction (visual workload)**

◆ **Second class distraction**

 ➢ **Cognitive workload caused by attention of thoughts ⇒ cognitive distraction (mental workload)**

◆ **Third class distraction**

 ➢ **Body shifts and manipulation of hands ⇒ execution workload**

Warning

Proper warning will reduce the potential risk of traffic accidents. It shall be afforded in an appropriate manner.

Warning

◆ <u>**Hierarchy**</u>
  - ➢ **Warning/Caution/Advisory ⇒ urgency and criticality**
  - ➢ **Warning ⇒ alert that requires immediate evasive actions**

◆ <u>**Timely presentation**</u>
  - ➢ **Driver response time ⇒ individual difference between drivers (changeable to fit personal capability)**

◆ <u>**Integration**</u>
  - ➢ **Signal allocation, Modality, Timing management, Priority**

Control

Active braking and/or steering could be useful not only to improve convenience but to reduce severity of traffic accidents.

Control

◆ <u>Convenience (load reduction)</u>

➢ **The idea of "driver in the loop" can maintain a driver to be engaged in a task of car driving**

◆ <u>Severity reduction (crash mitigation)</u>

➢ **Active braking, accelerating and/or steering when a driver has no evasive actions**

◆ <u>Degree of autonomous control</u>

➢ **Partial or full control**

Combined control with braking and accelerating will imply distance control.

Next Step : Proposal

Contribution of IHRA/ITS WG for WP29/ITS Informal Group

◆ **Comparison between European Statement of Principles, AAM Guidelines and JAMA Guidelines ⇒ from Europe**

◆ **Remarks of Research Results on Information Presentation (Driver Distraction) ⇒ from North America**

◆ **The Idea of "Driver in the Loop" and Active Braking, Accelerating and/or Steering ⇒ from Japan**