Transportation Active Safety Institute
TASI: Our Focus on the Human Machine Interface

An Industry-Academic-Government Consortium to Advance the Use of Active Safety Systems to Reduce Vehicle Crashes and Save Lives

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25 January 2007
Human Machine Interface Fog

- Fatigue or Impairment
- Visual Distraction
- Radar & Vision
- GPS Data Extraction
- Scene Complexity
- Navigation and Scheduling
- Driving Demand-Based Distraction
- HMI Control
- Data fusion and Reasoning
- Situational Risk Assessment
- Alerts and Interventions
- Navigation and Planning
- FCW Threat Assessment
- FCW Deceleration Assist
- Driving Task Awareness
- Sign Recognition
- Lateral Maneuver Prediction
- Lane Departure Warning
- Forward Collision Warning

Alerts and Interventions

Data fusion and Reasoning

Situational Risk Assessment

Navigation and Planning

Driver State Awareness

Navigation and Planning

FCW Threat Assessment

Forward Collision Warning

Lateral Maneuver Prediction

Lane Departure Warning

Driving Task Awareness

Sign Recognition

GPS Data Extraction

Scene Complexity

Radar & Vision

Visual Distraction

Fatigue or Impairment

Navigation and Scheduling

Driver State Awareness

Data fusion and Reasoning

Situational Risk Assessment
Obstacles to introduction and acceptance

- One of the biggest obstacles to introduction and acceptance of Active Safety Systems is absence of a standard HMI protocol.

- Active Safety Systems provide two types of responses:
  - Warnings that require driver intervention
    » Beep, Flash, rumble of seat
  - Autonomous responses triggered by driving situation
    » Apply brakes strategically, adjust steering angle, etc.

- Autonomous actions provide the most consistent responses and simplify design of Active Safety Systems.

- However, some driving situations require a more complex response, obtainable only through human intervention.
Some HMI issues for active safety systems

- How do people react?
  - What is the average and range of abilities?
    » Hearing
    » Vision
    » Coordination
    » Attention span
    » Multi-tasking ability

- Does a trigger yield an appropriate reaction?

- Should the driver have choices of how information is displayed?

- Should the driver have choices regarding alerts?
Questions relating to HMI Design

• Is it possible to warn the driver?

YES: What’s the best way?
  ▪ What is range of human ability?
  ▪ How many warnings is too many?
  ▪ Which warning is best for each scenario?

NO: What can we do to prevent the need for warnings?
  ▪ How much information can the driver process?
  ▪ Which information is most important in a given scenario?
  ▪ How is the information best conveyed?

• What standards are needed?
Standards will eliminate a possible source of driver confusion

- Drivers need consistent alerts and displays.

**Audible Alerts**

**Visual Alerts**

**Haptic Alerts**

- Motorized Seatbelt
- Seat Vibration

- Acceptance / effectiveness also depend on
  - Reaction time
  - Data processing speed
  - Ability to distinguish among signals
  - Ability to respond without panicking
  - etc.
Summary

- Again, one of biggest obstacles to introduction and acceptance of Active Safety Systems is absence of a standard HMI protocol.

- TASi universities will work with industry partners to design experiments to address these issues.

- Target start date is beginning of 2\textsuperscript{nd} quarter.

- Questions?
Contacts

- Interested in specific activities? Please contact:

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Slides describing TASI Activities follow

- Flow charts show larger scope of TASI’s activities.

- Activities in which Human Factors play a key role are highlighted in red.
TASI Activities

- Mine available data;
- Run experiments to obtain missing data
  - Accident data analysis
  - Benefit/effectiveness analysis
  - Cost sensitivity analysis
  - Human Factors/Biomechanics
- Technology Research and Development
  - New sensors
  - Algorithms

Common Protocols & Processes
  - HMI protocol
  - Product performance testing
  - Test Methodology
TASI Activities

- **Common Protocols & Processes**
  - HMI protocol
  - Performance testing
  - Test Methodology

- **Test Methodology**
  - Laboratory/bench-test
  - Hardware-in-loop simulation
  - Closed-course test track
  - Instrumented roadway segment
  - On-road

- **Evaluation/Validation**
  - Protocols
  - HMI
  - Performance

- **Consumer Awareness/Education**