The University of Iowa (Lead Institution)
University of Central Florida
University of Massachusetts – Amherst
University of Puerto Rico – Mayagüez
University of Wisconsin - Madison

Connection and Collaboration
Virtual Symposium
hosted by The University of Iowa
IT’s NOT JUST US

October 4, 2017

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SaferSim II

- Automated vehicles technology
- Connected vehicles technology
- Vulnerable road users
- Roadway infrastructure design
- Distributed simulation technology
Part I

Introduction
One life
Three lives

3 pedestrians survive being struck in Oakland crosswalk
The United States

Motor Vehicle Fatalities

- 50,000
- 45,000
- 40,000
- 35,000
- 30,000


14% Increase
The world – 1,250,000

The Bloomberg Global Road Safety Program focuses on 10 countries that account for more than 600,000 road traffic deaths annually.

- **Mexico**: 22,000
- **Brazil**: 35,000
- **Turkey**: 10,000
- **Egypt**: 31,000
- **Kenya**: 12,000
- **India**: 196,000
- **Russia**: 35,000
- **China**: 220,000
- **Vietnam**: 14,000
- **Cambodia**: 1,700
Vulnerable road users

FIGURE 6
Road traffic deaths by type of road user, by WHO region

- Cyclists
- Pedestrians
- Motorized 2-3 wheelers
- Car occupants
- Other

World:
- 21% Cyclists
- 31% Pedestrians
- 23% Motorized 2-3 wheelers
- 22% Car occupants
- 4% Other

Europe:
- 4% Cyclists
- 10% Pedestrians
- 26% Motorized 2-3 wheelers
- 9% Car occupants
- 51% Other

Eastern Mediterranean:
- 14% Cyclists
- 3% Pedestrians
- 3% Motorized 2-3 wheelers
- 27% Car occupants
- 45% Other

South-East Asia:
- 3% Cyclists
- 34% Pedestrians
- 11% Motorized 2-3 wheelers
- 3% Car occupants
- 45% Other

The Americas:
- 21% Cyclists
- 3% Pedestrians
- 22% Motorized 2-3 wheelers
- 35% Car occupants
- 20% Other

Africa:
- 11% Cyclists
- 4% Pedestrians
- 40% Motorized 2-3 wheelers
- 39% Car occupants
- 7% Other

Western Pacific:
- 14% Cyclists
- 22% Pedestrians
- 23% Motorized 2-3 wheelers
- 34% Car occupants
- 7% Other
IT’s NOT JUST US
Part 2

Trust and Reliance
Part 2
Engineering solutions

- Advanced driver assistance systems
  - Lane departure warnings
- Automated vehicles technology
  - Lane keeping assist
  - Lane centering assist
- Connected vehicles technology
  - Head on collision warning systems
- Roadway infrastructure design
  - Jersey barriers
Human behavior: An engineering conundrum

By Mal
Lane departure warning systems

\[ \frac{2}{3} \]
An ideal world
Wind gusts
The results

Figure 3.1. Groups A’s average TTL for each set of drive by reliability level. Note: ** denotes $p<.01$; *** denotes $p<.001$
Figure 2. The relationship among calibration, resolution, and automation capability in defining appropriate trust in automation. Overtrust may lead to misuse and distrust may lead to disuse.
SaferSim: Trust and Reliance
And what about Vietnam
Driving in Vietnam
Vietnam

Smartphone Penetration

Smartphone penetration in urban areas

2013: 20%
2014: 36%
2015: 55%
2016: 72%

* Smartphone ownership in Vietnam is booming, with current penetration at 72% in urban areas and 53% in rural.

Source: Consumer Barometer Question A2. Which operating system do you have on your smartphone? Smartphone users, n=1000 TNS / Google smartphone apps research Vietnam
V2P
Pedestrian simulators

Hank Virtual Environments Lab
Helping others, helping ourselves
Part 3

Distraction
Distraction is deadly
Visual-manual distractions

Diagram showing tasks with associated risk levels:
- Talking/listening on hands-free cell phone
- Reading
- Dialing hand-held cell phone
- Reaching for moving object

Dashed box indicates a task affected by these guidelines:
- Boxes indicate visual-manual tasks
- Ovals indicate auditory-vocal tasks

The most distracting tasks are visual-manual intensive

A Notice by the National Highway Traffic Safety Administration on 09/16/2014
Acceptance criteria

1) Frequency of long glances
   1) For at least 21 of the 24 test participants, no more than 15 percent (rounded up) of the total number of eye glances away from the forward road scene have durations of greater than 2.0 seconds while performing the testable task one time.

2) Mean glance duration
   1) For at least 21 of the 24 test participants, the mean duration of all eye glances away from the forward road scene is less than or equal to 2.0 seconds while performing the testable task one time.

3) Total glance duration away from the forward roadway
   1) For at least 21 of the 24 test participants, the sum of the durations of each individual participant’s eye glances away from the forward road scene is less than or equal to 12.0 seconds while performing the testable task one time.
Lockout criteria
Voice control systems
Cognitive distractions

Mental distractions can last as long as 27 seconds after using voice commands on cars and phones to make a call, send a text or change the music.
What’s the problem?
Evaluation of voice control systems
OSPAN Task

\[ \frac{4}{2} + 1 = 3 \]

serene
OSPAN Task

3 + 12/4 = 7

stressed
Six infotainment systems

- Ford equipped with MyFord Touch,
- Chevrolet equipped with MyLink,
- Chrysler equipped with Uconnect,
- Toyota equipped with Entune,
- Mercedes equipped with COMAND, and
- Hyundai equipped with Blue Link
Findings

Figure 10. Mental Workload Scale for each of the 8 research conditions
But what about crashes?
SaferSim: Cognitive Distraction

- Mind wandering with little disrupting/distracting content vs none reported
- Mind wandering with highly disrupting/distracting content vs none reported
- External distraction (any vs none)
- Negative affect (negative vs positive/neutral)
- Alcohol use (blood alcohol values $\geq 0.50$ g/L vs $< 0.50$ g/L)
- Psychotropic drug use (any in preceding week vs no use)
- Sleep deprivation ($< 6$ hours vs $\geq 6$ hours)

Adjusted OR (95% CI)

- Mind wandering with little disrupting/distracting content vs none reported: 1.06 (0.79 to 1.42)
- Mind wandering with highly disrupting/distracting content vs none reported: 2.12 (1.37 to 3.28)
- External distraction (any vs none): 1.64 (1.18 to 2.27)
- Negative affect (negative vs positive/neutral): 1.43 (1.02 to 2.00)
- Alcohol use (blood alcohol values $\geq 0.50$ g/L vs $< 0.50$ g/L): 1.68 (1.07 to 2.65)
- Psychotropic drug use (any in preceding week vs no use): 1.76 (1.11 to 2.77)
- Sleep deprivation ($< 6$ hours vs $\geq 6$ hours): 1.98 (1.25 to 3.12)
Hazard anticipation, cell phones and voice command systems

1. Pedestrian crossing obscured on right
2. Truck obscuring crosswalk
3. Hidden crosswalk after curve in school zone
4. Car obscuring crosswalk
5. Hidden crosswalk to the left
And what about China?
# Around the world

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<th>Program Name</th>
<th>Label</th>
<th>Countries</th>
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<td>France, Germany, Italy, Spain, Sweden, The Netherlands &amp; United Kingdom (European region as a whole)</td>
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Helping others, helping ourselves

5-Star Safety Ratings
More Stars. Safer Cars.

New Car Assessment Program (NCAP)
Non-regulatory vehicle safety program

www.nhtsa.gov
Part 4

Training and Education
Automated vehicles
MyCarDoesWhat.org is a national campaign to help educate drivers on new vehicle safety technologies designed to help prevent crashes. These technologies range from increasing the stability and control of cars to providing warnings about crash threats to automatically intervening to avoid or reduce the severity of a crash.

The National Safety Council and the University of Iowa are national leaders in transportation safety education and research, respectively.
Deeper learning: Understanding

WHAT IS IT?
Forward collision warning systems warn you of an impending collision by detecting stopped or slowly moved vehicles ahead of your vehicle. Forward collision warning use radar, lasers, or cameras to scan the road ahead while you drive. If there is an impending collision, the system will warn you of the danger using lights, beeps, vibrations of your seat, or a combination of these. Some systems may also tighten your seat belt and pre-charge the brakes, making it easier for you to stop as quickly as possible.

Many vehicles with forward collision warning also quickly become equipped with safety technologies like automatic emergency braking. If your vehicle has automatic emergency braking it will urgently apply the brakes if you fail to do so in time to avoid an impending collision. While automatic emergency braking may not prevent every crash from occurring, the technology may help lessen the severity of a crash.

HOW TO USE IT?
Activation/Deactivation
Most forward collision warning systems are active by default at speeds greater than 10 mph. You can deactivate the system by pressing the forward collision warning system button or by accessing your forward collision warning settings via your vehicle's information screen. Check your owner's manual for details about your specific vehicle.

What you should do
Always maintain a safe following distance from the vehicle in front of you. Your forward collision warning system is intended to warn you when you are getting dangerously close to the vehicle in front. If you receive a warning from your forward collision warning system, or if it begins braking for you, be prepared to brake or steer to safety.

HOW DOES IT WORK?

Speed and distance sensors. Forward collision warning systems use both speed and distance calculations to help keep you safe. The most common type of distance sensor uses radar to detect traffic ahead of you, but some systems use lasers, cameras, or a combination of these. These sensors detect slow or stopped vehicles in your lane and warn you if a collision is likely.

Looking under the hood: Radar-based systems. Let’s look at how radar-based forward collision warning systems work. Some forward collision warning systems send radar waves that reflect off objects in front of your car. Based on the radar reflection, forward collision warning uses your speed and the changing distance to the vehicle ahead to detect if a crash is imminent.

Automatic Emergency Braking. Some forward collision warning systems work together with Automatic Emergency Braking. If your vehicle has automatic emergency braking, the system helps you avoid a crash by urgently applying the brakes when a crash is imminent if you fail to do so in time.
Deeper Learning: Understanding

HOW DOES IT WORK?

Parts of a typical forward collision warning system
Deeper Learning: Challenge

CHALLENGE #2: BICYCLES AND PEDESTRIANS

Some forward collision warning systems are not able to detect some obstacles or even vehicles because of their size or shape. When driving in areas where bicycles, motorcycles, and other small vehicles are common, you should not rely on your forward collision warning system.

What would you do?
Imagine yourself driving the blue car on the city street to the right. Think about the questions below.

1. If the pedestrian in front of you crosses the street, how will your forward collision warning system respond?

2. What should you do?
Driver education

DUMB AND DUMBER: AMERICA’S DRIVER EDUCATION IS FAILING US ALL - REFERENCE MARK

Mark Rechtin Words, Kevin Whipple Illustration - June 20, 2017
Driver education can have an effect, but...
Driver education can have an effect, but…

The percentage of hazards anticipated by the four groups of drivers. (The error bar represents the between-participant 95% confidence interval.)
SaferSim: Training and Education
And what about Robin Hood
Licensure

- Internationally „Hazard Perception“-Tests are used in two European countries and in 5 Australian states:
  
  For this innovative form of testing, differences in design and also in regard of the placement in the Systems of Novice Driver Preparation can be found.
Part 5

The Environment Outside the Car
The environment outside the car
Traffic signals
Roadway geometry
Fog

Figure 3.2 - Heavy fog level example
UCF driving simulator
Results
SaferSim: How many alarms are too many?
Traffic signals
Field evaluations

FIGURE 1 Permissive Flashing Yellow Arrow in Operation in Jackson County, Oregon
SaferSim: The cycle of research
Roadway geometry
Simulators
Toll plaza geometry: Massachusetts
Toll plaza geometry: Puerto Rico
Results: Familiar and unfamiliar drivers
Baseline
Treatment
Results
SaferSim: Unprecedented opportunity
The Big Dig
Simulated world
Logan International Airport
The SaferSim Challenge
Part 6

Conclusion
Four areas of research:

- Trust and Reliance
- Distraction
- Training and Education
- Environment Outside the Car
Next major questions

New technologies

- Resolution and calibration
- Voice command
- Automated vehicles
- Multiple alarms
International perspective
Helping others, helping ourselves