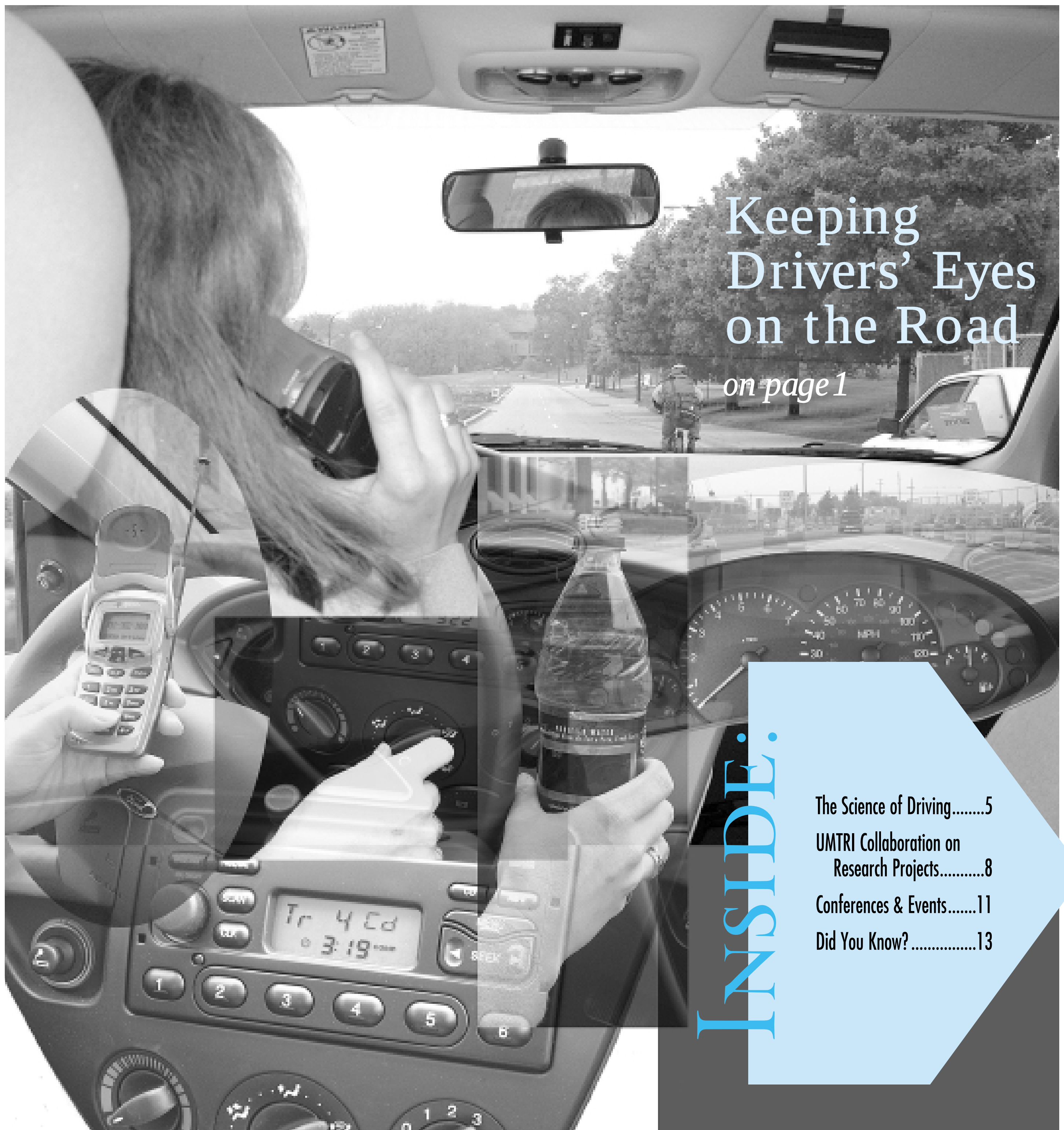
UMTRI
RESEARCH REVIEW

• UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE • January–March 2001 • Volume 32, Number 1 •



Keeping Drivers' Eyes on the Road

on page 1

INSIDE:

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• University Of Michigan Transportation Research Institute • January–March 2001 • Volume 32, Number 1 •

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The UMTRI Research Review is published four times a year by the Research Information and Publications Center of the University of Michigan Transportation Research Institute, 2901 Baxter Road, Ann Arbor, Michigan 48109-2150 (http://www.umtri.umich.edu). The subscription price is $35 a year, payable by all subscribers except those who are staff members of a State of Michigan agency or an organization sponsoring research at the Institute. See the subscription form on the inside back cover. For change of address or deletion, please enclose your address label.

Welcome to the New *UMTRI Research Review*

No doubt you've noticed the new "look and feel" of the *UMTRI Research Review*. We have updated the format to better reflect our mission of delivering a larger variety of information in each issue. We will highlight UMTRI research projects and personnel, as well as general issues in transportation research. We have also added a section on upcoming events that may be of interest to you.

We have also given our website, http://www.umtri.umich.edu, a facelift and made it easier to navigate its resources. Stop by and see what you find.

We hope you enjoy the updates!

UMTRI's home page provides a new look, better navigation tools, and added resources.

ARTICLE PHOTOS AND ILLUSTRATIONS: UMTRI / SHEKINAH ERRINGTON

Keeping Drivers' Eyes on the Road

The best way to drive, as the song says, is to "keep your eyes on the road and your hands upon the wheel." But with all the distractions drivers face—both inside and outside the vehicle—it's easy for the eyes or mind to wander.

Almost half of all drivers have cell phones in their cars and 70 percent of all wireless calls are made from cars. Add to that in-vehicle e-mail, faxing, paging, dashboard navigation systems, Internet access, and voice mail and it's easy to see how drivers' attention can become diverted from the road. Experts estimate that between a quarter and a half of all crashes occur because drivers are paying attention to something other than the road.

Barry Kantowitz, director of UMTRI, says that unless vehicles and the devices in them are engineered to help prevent such accidents, the situation will only get worse. Accordingly, researchers at UMTRI are working to decrease driver distraction in a variety of ways, including understanding in-vehicle telematics, driver attention lapses, and distractions outside the vehicle.

The Many Sides of Driver Distraction

In addition to the myriad of in-vehicle features that can distract drivers, there is also the matter of what is happening outside the vehicle and what is going on inside the driver's head.

Simply put, driver distraction is any shift of attention away from safe driving, says Fritz Streff, associate research scientist with UMTRI's Social and Behavioral Analysis Division. He explains, "Essentially, everything that distracts from driving is a potential hazard. Of course, some tasks have benefits that are acceptable. The question is, and no one really agrees, where to draw the line."

Distraction can be both physical and cognitive, Streff says. "Keeping your eyes on the road is important, but cognitive distraction, when your mind is not on what you are doing, is just as important and dangerous. For example, talking on a cell phone is not only distracting because of the dialing and holding, but also because talking tends to shift your perceptions and you are 'looking without seeing.' Especially in emotionally-laden conversations, drivers are not as conscious of their environment."

Other cognitive distractions include fatigue, aggression, and mental distraction. Also, drivers tend to misjudge the dangers. "People overestimate their ability to do a lot of things at the same time, and they underestimate the probability of rare events like traffic accidents," Kantowitz observes. The problem is that on the road, situations can change from safe to unsafe in the blink of an eye. "Minor lapses of attention at the wrong time can result in tragedy, and major lapses of attention at the right time can be uneventful," Streff says.

Even under the best scenarios, drivers become distracted by things outside the vehicle such as accidents and construction sites. Sometimes solutions are simple, such as using sheet plastic to mask buildings under construction or screening crash sites. However, all solutions require a balance of efficiency, safety, and cost.

Cognitive Distractions

Streff explores issues related to driver distraction, aggression, and fatigue and makes recommendations to the Michigan State Police. The input is integrated into the planning process for developing the Michigan Office of Highway Safety Planning's driver behavior safety program. He also works with the local NHTSA representative to develop a plan with the greatest chance of being legislated, based on the latest crash data, political realities, and financial resources.

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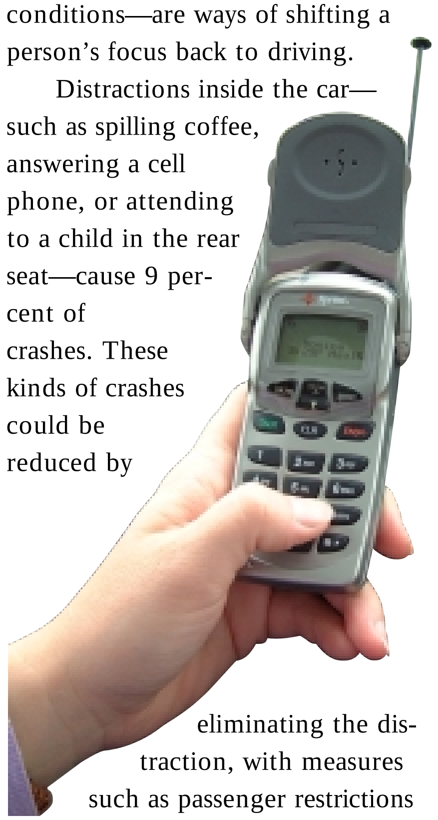
Concentration Lapses and Distraction

Unlike other car components, such as brakes and power steering, telematics involve human thought processes, and that's where the danger lies, Kantowitz maintains. Crashes become more likely when drivers lose attention, focus on the wrong tasks, divide attention between too many things, or otherwise become distracted from driving, Streff found.

About 15 percent of crashes are caused by driver preoccupation. "Your mind is on one task, and it takes a while to change over to another task," Kantowitz says. "So if you're thinking about some contract negotiation, you may notice something out the window, but by the time you switch your attention to it, you've lost a fair amount of the time you need to avoid a potentially dangerous situation." Noticeable external stimuli—daytime running lamps or signs displaying traffic conditions—are ways of shifting a person's focus back to driving.



Distractions inside the car—such as spilling coffee, answering a cell phone, or attending to a child in the rear seat—cause 9 percent of crashes. These kinds of crashes could be reduced by eliminating the distraction, with measures such as passenger restrictions for young drivers and prohibitions on in-vehicle cell phone use; or by controlling the distraction, with measures such as convenient cup holders and hands-free cell phones.

Aggression and Road Rage

Aggressive driving results from frustration and ranges from being annoying (tailgating, flashing headlights, and honking) to dangerous (saving time at the expense of others by running red lights or weaving out of lanes). Road rage is hostile behavior purposefully directed at other drivers. "Aggressive driving distracts attention from the road to playing mental games with another driver. The focus shifts from driving to exercising their will on someone," Streff says.

Drivers between the ages of 18 and 25 have the highest aggressive driving tendency, followed by single drivers, and drivers aged 26 to 29. It's not certain what percent of crashes is related to aggression or road rage, as crash reports don't include information on the intent of the driver.

A way to alleviate aggressive driving would be reducing the number of frustrations drivers encounter, including reduced road congestion through increased road construction, development and use of alternate routes, and better crash response and clean-up. In addition, radio broadcasts or electronic message signs that provide information about upcoming driving conditions may help drivers set their expectancies and lower their frustration.

Fatigue

Both fatigue and alcohol use significantly decrease the amount of attention a person can devote to a task.

"Tired drivers do not have as many attentional resources and their focus shifts from what they ought to be paying attention to, to what they are actually paying attention to," Streff says. Fatigued drivers have trouble focusing and are more easily distracted. Fatigue impairs driving ability through increased reaction time and decreased vigilance, attention, and information processing ability. Driver sleepiness causes about 2 percent of all motor vehicle crashes in the United States. As one might guess, sleep-related crashes are more likely to occur at night or mid-afternoon, times when people have a natural propensity for sleep. They are also more likely to involve a single vehicle running off the roadway, to occur on higher-speed roads, and to result in serious injury.

Only one strategy is really effective to combat fatigue: sleep. Other measures that drivers often use (e.g., rolling down the windows, turning up the radio, or stopping to stretch) are not supported as being truly effective.

In-Vehicle Telematics

Another way to look at distraction is to focus on what goes on inside the vehicle. Vehicles now have myriad telematics features (such as navigation systems, e-mail, paging, and voice mail) that can distract drivers' attention. "Cars are becoming more like airplanes," Kantowitz says. "But airplane pilots are very highly trained and closely regulated and licensed. Once you get your car driver's license—and that's a fairly simple test to pass—you don't have to go back and be retested every couple of years. You don't have to be certified to use any amount of vehicle information."

Therefore, researchers are striving to make telematics as easy and non-distracting to use as possible. Paul Green, a senior research scientist in UMTRI's Human Factors Division and head of UMTRI's Driver Interface Group (http://www.umich.edu/~driving), says, "There are all sorts of distractions to drivers, but the ones engineers can work to control are those of telematics." Green leads a team that studies driver workload, navigation, and driver interfaces to assess what people can and cannot do safely.

People want new telematics products and companies want to deliver them—if possible, before the competition. But some companies are more conscious of safety than others. "OEMs and tier-one suppliers are more aware of the safety statistics—that 42,000 fatalities result from car crashes each year in the United States. On the other hand, dot com companies are more used to working with computers and software, and safety has not needed to be part of their mindset." To drive the point home he says, "How often would they hear, 'A computer came out of nowhere and hit me.'?"

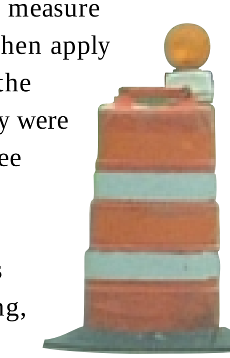
And, of course, in-vehicle telematics are not inherently bad—benefits include summoning help in an accident, scheduling appointments, and getting directions. However, doing certain things at certain times that distract from driving is harmful, and determining and compensating for those moments is the focus of safety telematics. "Someone has to say, here are the functions and here are the limitations, and the car companies have to agree to do it," Kantowitz points out. Otherwise, in response to competition, automakers "will pile on feature after feature and wind up with very complex systems that are not always safe to use." With multiple in-vehicle telematics, drivers have to manage input and output, understand and interpret multiple forms of interaction, and process increased information. These tasks have the potential of adversely affecting driver safety unless they are integrated using human factors principles, or workload managers, to help people deal with multiple telematics. [Editor's Note: Watch the next *UMTRI Research Review* for an article on Green's work with workload managers.]

Roslyn Millman, NHTSA deputy administrator, agrees, "All of those involved in highway safety—whether in government, industry, or the public at large—are responsible for raising and debating the important questions of driver distraction. The highway traffic safety community must expand to include those who design, manufacture, and service the computers, navigation systems, and other devices used on the roads and installed in vehicles."

The 15-Second Rule

Unfortunately, the data to make sound decisions about telematics safety and driver distraction doesn't exist. Green asserts, however, "We can't wait for crash data to act." Green has worked as a consultant for the Society of Automotive Engineers (SAE) Human Factors Committee, Navigation Subcommittee to evaluate existing studies and to create two standards (design requirements) based on the results: a procedure for determining whether a telematic device can be used in a moving vehicle and a procedure to calculate its performance. (The latter includes equations for how to time the steps involved in using navigation systems.)

The committee members wanted to develop a standard that would be incorporated into the design of the system, instead of added on later in the process when changes are time-consuming and costly. They considered various ways of defining the standard, from number of menu items to performance criteria, and the logistics of performing their own tests. They discovered it takes 1.2 to 1.7 times as long to perform a telematics task in a moving vehicle than it does in a static car. For measurement purposes, though, it is easier to measure static task time, and then apply the multiplier. Once the mechanics of the study were decided, the committee had to decide on an acceptable task time.



Tasks that drivers are used to performing, like turning on headlights or windshield wipers, take between three to five seconds. On the other hand, it can take people in a moving vehicle one to two minutes to enter information into visual displays. The committee agreed that three to five seconds was too short and one to two minutes was too long. For guidance on the midpoint, they looked at established practices in Japan, which state that no more than 30 characters (in a mixture of Kanji and Roman) can appear on the display.

Kanji characters are pictorial, so each character represents a word. After calculating the information content of the Roman and Kanji characters (measured in bits), they computed the equivalent number of Roman characters to express a message that was originally a mixed Roman-Kanji message. Next, knowing the number of Roman characters per word and human reading rates (in words per second), the time to read a 30-character message of both Roman and Kanji characters could be estimated. From there, they deduced that it took ±9 seconds to read about 30 Roman characters. Other studies found the same rate to be 9 to 12 seconds. After much deliberation, the committee reached consensus at 15 seconds, and created the 15-second rule (formally known as recommended practice SAE J2364): "Any navigation function that is accessible by the driver while a vehicle is in motion shall have a static total task time of less than 15 seconds."

The committee then conducted the static vehicle tests with drivers between 45 and 65 years old in five practical trials. They measured total task time from when the driver's hand moved to a control (typically, when the hand leaves the steering wheel) to when the goal has been achieved (e.g., guidance from a navigation system is displayed), and included any error time. The final time was the mean of three test trials per subject. The 15-second rule is currently in the process of being approved by the SAE executive board.

The research being performed on driver distraction should pave the way for safer driving, despite the continued increase in distractions. "Plain old, good engineering design is the right thing to do from a technical standpoint," says Kantowitz. For example, future systems could be designed to allow drivers to perform certain functions, such as entering a destination in a navigation system only when the car is parked. Other functions—zooming in on an electronic map, for example—might be permitted when the car is stopped at a traffic light, but not when it's moving. RR

The Science of Driving

By Nancy Ross-Flanigan, UM News & Information Services

I'm cruising down I-94 at 70 miles an hour when a truck in the next lane suddenly cuts in front of me. I draw in my breath, and my foot hovers over the brake pedal.

"It's okay! It's okay!" my passenger says. "The car will do it for you."

And so it does. Without my doing a thing, the Chrysler Concorde I'm driving slows down enough to leave a safe gap between me and the truck ahead.

"Whoa!" I gasp. "That was cool!"

While I'm exulting, my passenger is analyzing. The car's response, the distance between it and the truck, even my hovering foot, all are of interest to Zevi Bareket, a senior engineering research associate with the UMTRI. The car we're in has been outfitted with an experimental "adaptive cruise control" system, and Bareket wrote the computer programs that control the system.

Like regular cruise control, this system maintains a cruising speed that the driver specifies. But it goes a step beyond, into the realm of "intelligent transportation systems," by allowing me to set a minimum distance between my car and the one ahead. If we start to get too close, my car automatically slows down, braking if necessary, to keep the distance I've selected. If the car ahead speeds up or changes lanes, leaving me a long stretch of unobstructed highway, the Concorde automatically speeds up to the cruising speed I've chosen.

Systems like these may make life a lot easier for drivers, but they're also making it a heck of a lot more challenging for engineers. When cars were simpler and stupider, engineers considered how drivers responded to certain types of instrument displays or how easily they could operate the pedals, but paid little attention to the minute details of all the things people do while driving. Now, as cars take over more and more of the tasks that drivers used to do, engineers are realizing they need a deeper understanding of just what those tasks entail.

UM PHOTO SERVICES / BILL WOOD

The author changes a setting that controls the distance between her vehicle and the one ahead.

"We're moving from the study of a vehicle as a big hunk of steel with a driver inside to looking at the dynamic system comprising a driver, his or her vehicle and the nearby highway environment. That is, we're trying to understand how the driver drives," explains Robert Ervin, head of UMTRI's Engineering Research Division. And in doing so, researchers are asking new questions, gathering and analyzing data in novel ways, and arriving at fresh insights. With approaches that borrow from psychology and sociology, as well as traditional engineering disciplines, they're forging what Ervin calls a new "science of driving."

Instead of just looking under the hood, researchers are peeking inside the head of the person behind the wheel. They're asking questions such as, How does a driver decide when and how much to brake? What cues does the driver use before braking—the sight of a car looming up ahead? the feel of the road surface? a glimpse of motion off to the side? What makes a driver decide to change lanes? How much weaving from one side of a lane to the other is typical?

Cruising in the Concorde with Bareket, another question occurs to me: How does a driver react to a partially automated car that takes over some of the work of driving? It takes me a while to get used to the car slowing down and speeding up by itself. But gradually, I begin to trust its judgment. And then I begin to trust it too much. Exiting at a ramp with no car ahead of me, I forget for a moment that the system sees no reason to slow down. It only knows to do that when my car gets too close to one up ahead; it can't read speed limit signs or understand that negotiating a cloverleaf at 70 miles an hour could be disastrous. This time, it's up to me to brake.

Clearly, drivers' notions—and misconceptions—about where the car's job leaves off and theirs begins are things that engineers must understand if they are to design safe and effective driver-assistance systems. The need to collect this whole range of information about how people drive led UMTRI researchers to undertake one of their most ambitious studies.

Over a period of 14 months, an UMTRI team trained 108 randomly selected southeast Michigan drivers to use 10 test cars equipped with both conventional and adaptive cruise control (ACC), then turned them loose to drive the cars as their own for two to five weeks. For the first week, drivers could choose to turn conventional cruise control on or off anytime they wanted. After that, the only choice was driving with or without ACC.

UMTRI researchers outfitted each of the 10 test cars with a data collection system, says Jim Sayer, an assistant research scientist with UMTRI's Human Factors Division. On each trip, onboard computers continuously collected and stored information about the car's speed and the gap between it and the vehicle in front of it. A global positioning satellite system collected data on the car's location, and a video camera mounted behind the rearview mirror recorded a view of the road ahead. A "concern" button on the dashboard was at hand for drivers to push any time they were concerned about or dissatisfied with ACC. The drivers also filled out questionnaires and participated in focus groups after returning their cars.

With 108 drivers spending a total of 3,049 hours on the road and traveling 114,084 miles, the UMTRI study yielded a huge collection of data that have already provided much valuable information. It showed, for example, that drivers fall into several groups, classified by the strategies they use in traffic:

- Hunters—Those aggressive folks who whoosh up behind you and tailgate until you move over. They drive fast and like to lead the pack.
- Ultraconservatives—They are the opposite of hunters. They take it nice and slow, staying far behind the car in front of them.
- Flow Conformists or Gliders—This type travels at about the same speed and following distance as other cars around them.
- Planners—A shrewd bunch, they figure out how to drive fast without getting too close to the car ahead, a strategy that allows them to go for long stretches without touching the cruise control. (Bareket, who has logged more than 5,000 hours in ACC-equipped vehicles, falls into this category. Once, driving one of the cars to a technology show in the Upper Peninsula, he didn't touch the brake or accelerator even once between Ann Arbor and the Mackinac Bridge, a distance of around 300 miles.)

In the study, a given driver usually fell into the same category—hunter, ultraconservative, flow conformist or planner—whether on or off ACC. But the four types used the system differently. Flow Conformists, for instance, used ACC more often and set the system to allow longer distances between their vehicle and the one ahead. Hunters chose the shortest "headway" distance the system would allow but used ACC less frequently overall than did the other groups, possibly because it wouldn't let them tailgate.

Age was a factor, too. "Older people almost never used the 'close' setting, young people rarely used the 'distant' setting, and middle-aged people normally used the middle setting," says Paul Fancher, a senior research scientist with UMTRI's Engineering Research Division who directed the field test.

Like me, many drivers in the UMTRI study had to be reminded not to expect more of the car than it was capable of doing. They tended to use adaptive cruise control "when the world looked benign and there were fewer possibilities," Fancher says. "But they still did the tough stuff the way they always had."

Most drivers said they liked using the system, and an insight into its appeal came from data collected when they weren't using ACC. The researchers discovered that in normal driving, drivers press and release the gas pedal far more frequently than anyone would have guessed, and each use registered as a peak and valley on the UMTRI graph of their behavior.

"In an hour there can be a thousand peaks and valleys," says Fancher, "You can see why this would be fatiguing, even if people aren't aware of it. With ACC they don't have to work as hard."

A bound report nearly an inch thick details the project's initial findings. One UMTRI researcher already is sifting through it to try to learn whether time of day influences a person's driving speed and choice of roads. And Sayer is intrigued with the possibility of exploring relationships between personality type and driving style.

When drivers enrolled in the study, they were given the Myers-Briggs Type Inventory personality test, often used in corporate personnel decisions. It classifies people by such factors as how they express themselves, evaluate other people and act on their feelings, and is correlated with scales of aggression, self-confidence and other traits. As far as Sayer knows, no one has ever done a rigorous study relating driving style to Myers-Briggs, but there are clear reasons to take a look. "You're hearing more and more about things like road rage on the news," he observes. "You can't help but wonder if there might be some relationship there."

Whether the science of driving can help soothe the savage road warrior remains to be seen. But gaining a better understanding of what all of us—hunters, flow conformists, and the rest—do behind the wheel is an avenue worth exploring.

How Adaptive Cruise Control Works

The adaptive cruise control (ACC) system used in the UMTRI study depends on two infrared sensors to detect cars up ahead. Each sensor has an emitter, which sends out a beam of infrared light energy, and a receiver, which captures light reflected back from the vehicle ahead.

The first sensor, called the sweep long-range sensor, uses a narrow infrared beam to detect objects six to 50 yards away. At its widest point, the beam covers no more than the width of one highway lane, so this sensor detects only vehicles directly ahead and doesn't detect cars in other lanes. Even so, it has to deal with some tricky situations, like keeping track of the right target when the car goes around a curve. To deal with that problem, the system has a solid-state gyro that instantaneously transmits curve-radius information to the sweep sensor, which steers its beam accordingly.

Another challenge arises when a car suddenly cuts in front of an ACC-equipped car. Because the sweep sensor's beam is so narrow, it doesn't "see" the other car until it's smack in the middle of the lane. That's where the other sensor, called the cut-in sensor, comes in. It has two wide beams that "look" into adjacent lanes, up to a distance of 30 yards ahead. And because it ignores anything that isn't moving at least 30 percent as fast as the car in which it is mounted, highway signs and parked cars on the side of the road don't confuse it.

Information from the sensors goes to the Vehicle Application Controller (VAC), the system's computing and communication center. The VAC reads the settings the driver has selected and figures out such things as how fast the car should go to maintain the proper distance from cars ahead and when the car should release the throttle or down-shift to slow down. Then it communicates that information to devices that control the engine and the transmission. RR

Note: This article originally appeared in *Michigan Today* and is reprinted with permission.

UM PHOTO SERVICES / BILL WOOD

UMTRI's Robert Ervin hopes to forge a new "science of driving" that integrates information about drivers, vehicles, and highway environments. In one project, trucks are equipped with an experimental rollover stability advisor, designed to help drivers know if they are close to tipping over. The goal is to alert drivers to potential dangerous driving behaviors.

COLLABORATIONS

UMTRI Collaboration on Research Projects

The old adage "Two heads are better than one" certainly holds merit when it comes to interdisciplinary collaboration in research projects. Many researchers at UMTRI are doing just that—working with experts in other departments to get better results and bring a more holistic approach to their work. For example, UMTRI's Biosciences Division is participating in several of these kinds of partnerships.

Larry Schneider, head of UMTRI's Biosciences Division, is working with experts from the UM Health System's Trauma Burn Center and with a renown researcher in obstetrics and gynecology. Similarly, research scientist Matt Reed is working with the UM College of Engineering's new Human Motion Simulation Lab.

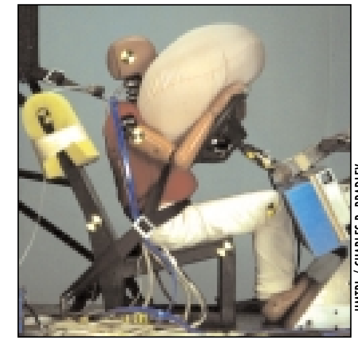
Multi-Disciplinary Investigation of Real-World Crashes

Larry Schneider, head of UMTRI's Biosciences Division, and the UMTRI crash-investigation team are working with the UM Health System's Trauma Burn Center to form the UM Center of the Crash Injury Research Engineering Network (CIREN). CIREN is a relatively new multi-disciplinary crash-investigation program funded jointly by NHTSA and the auto industry. The UM CIREN center is one of nine trauma-based CIREN centers throughout the U.S.

Unlike most crash investigation programs, CIREN crash investigations are initiated by a patient who is admitted to a level-one trauma center as a result of a motor-vehicle crash. Cases are selected for investigation based on preliminary information about the patient's injuries, the type and severity of the crash (from EMS reports), and the vehicle model year. If the crash fits the study criteria and the patient or family member agrees to participate in the study, UMTRI investigators spring into action to find, measure, and photograph the involved vehicles and the crash site. Detailed information, plus digital images of the vehicle exterior and interior, are later examined at monthly case review meetings, along with detailed information, photos, and medical images.

Using the combined input of medical, EMS and rescue personnel, biomechanical engineers, crash investigators, and auto safety experts, an effort is made to determine the sources and mechanisms of injuries to the trauma patient, and to evaluate the performance of the latest safety technologies. "The more details you have about the crash and the resulting injuries, the better chance you have of figuring out what caused the injuries," Schneider says. The CIREN cases are unique in this regard, because they include medical images showing details of internal injuries, and often photographs of external injuries that can be useful in determining exactly what the occupant contacted and how a body part was loaded or deformed.

Stop by the UM CIREN center's newly designed Web site at http://www.umich.edu/~thelab/ciren.html/.


UMTRI / CHARLES R. BRADLEY

Pregnant Occupants and Fetal Loss in Motor-Vehicle Crashes

Biomechanics researchers in the Biosciences Division are also working with Dr. Mark Pearlman, UM professor of surgery, and obstetrics and gynecology, on several projects related to fetal loss in motor-vehicle crashes. The researchers have been investigating motor-vehicle crashes involving pregnant occupants, as well as studying the anthropometry of the pregnant driver and the location of the pregnant abdomen and fetus in relation to the steering wheel and belt restraints. These studies have provided information and data needed to design a new pregnant crash test dummy called Mama-2B (short for Maternal Anthropomorphic Measurement Apparatus—Version 2B). The projects also involved James A. Ashton-Miller of the UM College of Engineering, and Steve Moss and Jennifer Zhou of First Technology Safety Systems, the leading crash dummy manufacturer in the United States. The new pregnant dummy has been designed to assess the likelihood of fetal loss due to separation of the placenta from the uterus (abruptio placenta), which is reportedly the leading cause of trauma-induced fetal death.

(For more details on this project, see *UMTRI Research Review*, Vol. 31, No. 1, January–March 2000.)

Human Motion Modeling

Matt Reed, an assistant research scientist in UMTRI's Biosciences Division, is working with the UM Industrial and Operations Engineering (IOE) department on ergonomic studies relating to vehicle occupants. Dr. Reed is working with the Laboratory for Human Motion Simulation (HUMOSIM), which is part of IOE's Center for Ergonomics.

The HUMOSIM laboratory studies and models human motion to improve the design of vehicles and workplaces. HUMOSIM has recorded over 30,000 whole body motions from operators in vehicles and industrial settings. Statistical models created from these data provide realistic human movement predictions for tasks ranging from driving cars and trucks to manufacturing and assembling complex equipment.

Injuries caused each year as the result of overexertion—strains from lifting, reaching, pushing, and pulling—cost billions of dollars each year in lost wages and medical bills. So designing ergonomically friendly environments, such as vehicle interiors and office space, makes both people and bank balances more comfortable. But such design also requires extensive and accurate human motion data, much of which does not yet exist. "The best way to provide this is to fuse computerized modeling with real human movement data," says Prof. Don Chaffin, director of the HUMOSIM lab. "Providing the designer or engineer with lifelike computer images of various people, and giving them the means to easily depict many different movements, enables early and fast evaluation of new designs to assure their compatibility with intended user groups."

Principal investigators on the project include Dr. Reed; Prof. Chaffin of Industrial and Operations; Prof. Julian Faraway, from the Department of Statistics; and Prof. Bernard Martin of Industrial and Operations Engineering.

The team plans to develop statistical functional regression analyses to use in predicting 34,000 existing motions, and create software versions of the motion models. They will also perform empirical motion

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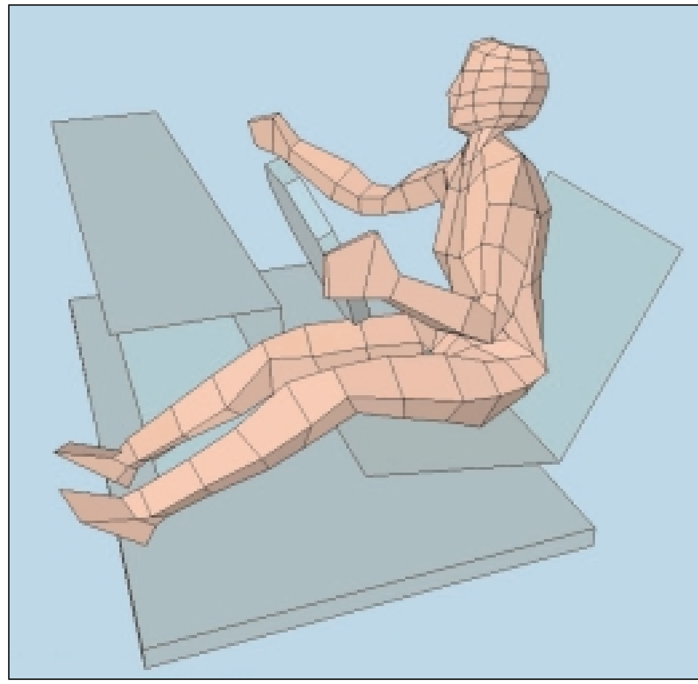
COLLABORATIONS

COLLABORATIONS

studies to investigate:

- Complex grasping of objects required to reach into vehicles for maintenance or assembly
- Leg-foot motions needed to operate mid- to large-pedal trucks
- Reach and motion capabilities of people with spinal cord injuries and chronic lower back pain
- Seated and standing reaches needed to determine the exertion levels that define functional maximum reach capabilities.

Dr. Reed, who is involved in the latter investigation, says, "We will be modeling reach envelopes—that is, how far the average person can reach, or how difficult it is for a population of drivers to reach various controls in a vehicle, such as the radio or navigation system. UMTRI brings expertise in automobile and heavy truck ergonomics to the collaboration with HUMOSIM, which has extensive experience in human motion measurement and modeling." RR



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CONFERENCES & EVENTS

Vehicle Thermal Management Systems Conference and Exhibition
May 14–17, Nashville, TN
http://www.sae.org/calendar/vtm/index.htm

Sixth Annual Michigan Traffic Safety Summit
May 15–16, Grand Rapids, MI
http://www.ohsp.state.mi.us/summit/summit2.htm

Accident Reconstruction TOPTEC: Special Topics
May 22–23, Tempe, AZ
http://www.sae.org/calendar/toptecs2.htm#accident

Fundamentals of Sensor Design for Automotive Air Bag Systems
June 4, Troy, MI
http://www.sae.org/contedu/

17th International Technical Conference on the Enhanced Safety of Vehicles
June 4–7, Amsterdam, Holland
http://www.esv2001.com

ITS2001, Intelligent Transportation Society of America's 11th Annual Meeting and Expo
June 4–7, Miami Beach, FL
http://www.itsa.org/its2001.nsf

2001 Global Powertrain Congress
June 5–7, Detroit, MI
http://www.gpc2001.org

Canadian Multidisciplinary Road Safety Conference XII
June 10–13, London, Ontario, Canada
http://www.cyberus.ca/~carsp/cmrsc.htm

EnV 2001: Global Solutions for Sustainable Mobility
June 10–13, Southfield, MI
http://www.esd.org

Braking Performance of Heavy Commercial Vehicles
June 18–19 or Sept. 10–11, Troy, MI
http://www.sae.org/contedu

EAEC 2001: European Automotive Conference
June 18–20, Bratislava, Slovakia
http://www.saits.sjf.stuba.sk/eaec2001e.htm

Testing Expo 2001
June 19–21, Stuttgart, Germany
http://www.testing-expo.com

National Symposia on Transportation: Innovations in Transportation Education and Workforce Development
June 21–22
U.S. DOT Volpe Center, Cambridge, MA
http://www.volpe.dot.gov/outreach/symposia01/two.html

Work Zone Traffic Control
June 21–22, Chicago, IL
http://www.asce.org

Vehicle Dynamics for Passenger Cars and Light Trucks
June 25–27, Troy, MI
http://www.sae.org/calendar/semdyn.htm#dynamics

Digital Human Modeling for Design and Engineering
June 26–28, Arlington, VA
http://www.sae.org/calendar/dhm/index.htm

2001 Great Lakes International Rural Intelligent Transportation Systems Conference
June 27–28, Kalamazoo, MI
http://www.mdot.state.mi.us/conference/ruralits/

Current Issues in Using Crash Injury Data
June 28, Troy, MI
http://www.sae.org/contedu

Fundamentals of Seat Ride Dynamics
June 28–29, Troy, MI
http://www.sae.org/calendar/sempart.htm#ride

31st International Conference on Environmental Systems (ICES)
July 9–12, Orlando, FL
http://www.sae.org/calendar/ice/index.htm

continued...

Conferences & Events

Advanced Topics in Seat Suspension Design and Human Body Vibration Control
July 17–18, Chicago, IL
http://www.sae.org/contedu/

National Symposia on Transportation: Enabling Technologies and Transportation Innovation
August 7–8
U.S. DOT Volpe Center, Cambridge, MA
http://www.volpe.dot.gov/outreach/symposia01/three.html

Driving Assessment 2001: International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design
August 14–17, Aspen, CO
http://www.driving-symposium.org

International Future Transportation Technology Conference (FTT)
Aug. 20–22, Costa Mesa, CA
http://www.sae.org/calendar/ftt/index.htm

International Conference on Lightning and Static Electricity
Sept. 11–13, Seattle, WA
http://www.sae.org/calendar/ico/index.htm

Traffic Safety on Three Continents: 12th International Conference
Sept. 19–21, Moscow, Russia
http://www.vti.se/

2001: A Transportation Odyssey—Institute of Transportation Engineers' Annual Meeting and Exhibit
Sept. 19–22, Chicago, Illinois
http://www.ite.org/annualmeeting/sixdays.asp

International Fuels and Lubricants Meeting and Exhibition
Sept. 24–27, San Antonio, TX
http://www.sae.org/calendar/ffl/index.htm

Fundamentals of Sensor Design for Automotive Air Bag Systems
Sept. 25, Detroit, MI
http://www.sae.org/contedu/

2001 PAL: Fourth International Symposium on Progress in Automobile Lighting
Sept. 25–26, Darmstadt, Germany
http://fgltweb.lt.e-technik.tu-darmstadt.de/PAL_info.htm

8th World Congress on Intelligent Transport Systems
Sept. 30–Oct. 4, Sydney, Australia
http://www.itsworldcongress.org RR

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Did You Know?

Interesting Facts About Transportation Safety

• In 1895, five years after the first autos are manufactured, the only two cars in Ohio crash into each other. One driver dies, becoming one of the first known motor-vehicle fatalities.

• By 1922, auto fatalities reach 14,859 or almost 22 per 100 million vehicle miles (the rate today is about 1.7).

• In 1924, President Herbert Hoover convenes the first national conference on street and highway safety.

• The U.S. has 46,564 miles of interstate highway, 113,995 miles of other National Highway System roads, and 3,771,456 miles of other roads.

• Nationwide, school bus accidents are most likely to occur on Tuesdays (21.2 percent) and accidents involving other kinds of buses are most likely to occur on Fridays (20.2 percent).

• Angle collisions (38 percent) are the most common type of bus accidents and usually occur at intersections.

• Most households (42 percent) have two vehicles, while 6 percent have no vehicles, 31 percent have one vehicle, and 21 percent have three or more vehicles.

• In 1999, 34,519,136 vehicles entered the U.S. from Canadian borders, and 83,638,656 vehicles entered the U.S. from Mexico.

• The average household spends about 20 percent of its income on transportation expenses. RR

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