

MIT studies seek to limit the stress of driving

Research could help promote better-designed cars and highways — and less behind-the-wheel tension

By [Hiawatha Bray](#) | GLOBE STAFF JULY 15, 2013



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MIT grad student Kael Greco demonstrated stress monitoring devices on his wrist and hand as he drove in Boston and Cambridge traffic.

Cars make Kael Greco nervous. And he has the computer read-outs to prove it.

A graduate student at the Massachusetts Institute of Technology's program in urban planning, Greco drives only occasionally. But when he does, Greco tricks out a rented Zipcar with an array of digital monitoring devices to measure his state of mind while cruising through the challenging traffic of Greater Boston.

The result: Greco found driving a lot more stressful than taking a tough class or giving a presentation about his research.

Greco and his colleagues at MIT's Senseable City Laboratory are trying to establish the first rigorous scientific standard for measuring the emotional stress of driving. Funded by the German automaker Audi AG, the team hopes its proposed Road Frustration Index could help automotive designers and road engineers craft innovations to ease the tension of driving.

“We collaborated on this idea that was basically developing a score . . . that would tell you how frustrating it is to drive, for a number of cities in the US,” Greco said. “That’s where these driver trials started. We wanted to get people out on the streets, driving around, and just sort of measure this ground truth.”

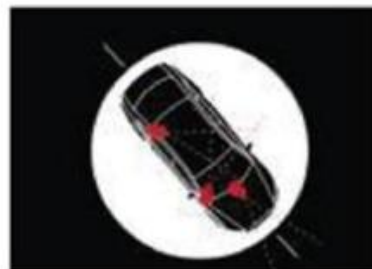
Ray Bingham, a professor at the University of Michigan's Transportation Research Institute, said there has been a lot of research on how drivers deal with distractions, such as cellphone calls. But he knew of no other major effort to measure the stress caused by driving.

Bingham said the MIT research might help scientists understand how angry driving leads to traffic accidents. “I would assume that frustration plays a role in aggressive driving,” Bingham said. “That’s an important factor to look at.”

The test car includes a GPS positioning unit to track its location and to record the driver’s facial expressions and road and weather conditions outside the car. Also on board is a Kinect motion-detection unit designed by Microsoft Corp. for its Xbox video game system; it is used to track the driver’s body movements.



GPS
to keep track of the subject's location and speed



CAMERAS
to monitor both the subject's facial response, and the external driving environment



KINECT
to track the subject's body movements



SKIN CONDUCTOR SENSORS to monitor the subject's stress response

Next come sensors strapped to the palms of the driver's hands. These detect how well his skin conducts electricity. Conductivity changes when we sweat, which people tend to do when they are nervous or frustrated, so it is a good way to measure emotional turmoil.

So far, Greco and four of his colleagues have taken test drives of about 45 minutes each. Greco learned that simply climbing behind the wheel makes him tense up. When he wore the skin sensors during a tough class in economics, they recorded a high level of frustration. But just getting into the car sent his stress level even higher. Then the car got sideswiped by another vehicle, sending Greco to a new pinnacle of nervous tension.

The researchers also realized they needed a base line for the highest possible level of stress. So Carlo Ratti, director of the lab at MIT, persuaded Greco to strap on the sensors and leap from an airplane.

"I really didn't want to do it," Greco said. "We just wanted to know that there was something more stressful, that we'd get a larger skin conductance response from. And we did."

Not surprisingly, Greco's first sky dive pinned the needle on the stress test, far higher than any of his drives in terrestrial Boston had produced.

Tests such as these will help the MIT team design a precise standard for measuring driver stress. Then Greco and his colleagues can begin running more trials, ideally with hundreds of test drivers in cities all over the world. "We have to set up and run these trials on a very big scale," Greco said.

The goal is to create "stress-scapes" of various cities. These would be maps showing the roads that drivers find particularly annoying, and the most unpleasant times of day for traveling those routes. The information could also be used someday to redesign road networks to make commuting less of a nuisance.

Audi and other manufacturers could also use the data to design vehicles with features that could help the driver relax. Russ Rader, spokesman for the Insurance Institute for Highway Safety, said that carmakers are already planning vehicles that



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Sensors show how well a student's skin conducts electricity while driving. Changes in conductivity may signal stress.

can respond to the driver's physical or mental state.

"Cars will not only monitor the road ahead," Rader said, "but also monitor drivers and be able to sense whether they're stressed, distracted, tired, or even whether they've been drinking too much."

Indeed, Greco said, sensors like those in his Zipcar will eventually become standard features. "Imagine when they're just baked in," he said. "You can have some sort of car that's learning from you."

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