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Audi and MIT Develop First-Ever Index to Quantify Driver Frustration

HERNDON, VA--(Marketwired - Jun 6, 2013) -

- **Driving in chaotic urban traffic can be as nearly as stressful as skydiving, new study finds**
- **Study uses a blend of real-time driver and environmental data, such as road conditions and heart rate, to quantify the factors that lead to driver stress**
- **Findings to inform how current and future technology from Audi can help ease driver frustration on the road**

Driving in chaotic urban traffic can be as nearly as stressful as jumping out of an airplane, according to new findings from an Audi and Massachusetts Institute of Technology (MIT) study. To better understand the impact road frustrations have on motorists today, Audi joined forces with the MIT SENSEable City Laboratory to explore a wide range of measurements aimed at quantifying driver stress on the road today. For Audi, the research helps validate how the latest driver assistance and connectivity technologies found in most Audi models can help ease the stress of daily driving.

The research initiative, Road Frustration Index (RFI), seeks to narrow in on the individual factors that lead to driver frustration, providing Audi with insight toward finding solutions that make driving safer and more enjoyable. This new methodology quantifies and contextualizes driver stress and frustration using skin conductance sensors, facial/body tracking, and environmental recordings. Findings were compared with a variety of other activities -- such as taking a test or engaging in adventure sports -- to make the overall methodology and results more relatable.

"In addition to daily driving conditions, we are measuring stress levels under a variety of daily activities: at home, in the office, while having breakfast or attending a lecture at MIT. We found that certain driving situations can be one of the most stressful activities in our lives," said Kael Greco, project leader, MIT SENSEable City Laboratory.

"The data we received is fascinating. One study showed that getting side swiped by an oncoming car can be almost as stressful as jumping out of a plane," said Filip Brabec, Director of Product Management, Audi of America. "By working with MIT to identify stress points for drivers, Audi is able to anticipate the needs for future mobility. Audi has worked with MIT on other projects as part of a strategy to develop new technology and approaches with leading universities to better understand the conditions that lead to driver stress, and subsequently, to driver enjoyment."

To calibrate the frustration algorithm, MIT designed a series of experiments that measure stress and frustration during real-world driving tasks using physiological sensors and an array of face/body tracking technologies, including: GPS to track the subject's location and speed; cameras to monitor both the subject's facial response and external driving environment; a modified Microsoft Kinect sensor to track the subject's body movements; and skin conductance sensors to monitor the subject's stress responses.

Preliminary trials have taken place in the Boston metropolitan area over a 12-month period. Trials cover a variety of roadway types, ranging from bustling highways to quiet suburban side streets, and variety of road conditions, from stop-and-go traffic patterns to confusing roadway navigation. Observations were validated both by a driver questionnaire administered after the trial and a score determined by observable events from the recorded video.

"Cities, blanketed with networks and digital devices, are developing new forms of intelligence. The same is happening inside our cars, which are increasingly filled with different kinds of connected sensors. From the intersection of these two trends will emerge tomorrow's mobility systems -- starting from the next generation of autonomous vehicles," said Professor Carlo Ratti, director, MIT SENSEable City Laboratory.

The experiment is catalogued on <http://senseable.mit.edu/rfi/>. The website allows for visitors to view the video documentation and explore some interactive maps and stress charts to get a better understanding of how stress and frustration are quantified.

MIT will conclude its research by publishing the RFI methodology and findings in a peer-reviewed journal later this year.

ABOUT AUDI

Audi of America, Inc. and its U.S. dealers offer a full line of German-engineered luxury vehicles. AUDI AG is among the most successful luxury automotive brands globally. Audi was a top-performing luxury brand in Europe during 2012, and broke all-time company sales records in the U.S. Through 2016, AUDI AG will invest about \$17 billion on new products, facilities and technologies.

Visit www.audiusa.com or www.audiusanews.com for more information regarding Audi vehicles and business topics.

ABOUT MIT SENSEABLE CITY LAB

The MIT Senseable City Lab investigates and anticipates changes in the relationship between cities, new technologies and citizens. Situated at the intersection of architecture, urban design, engineering, human-computer interaction and the social sciences, the Lab brings together MIT researchers and external organizations: partner cities offer test cases, industry provide technical expertise and funding, and the lab unites public and private sectors with a shared vision of the future. Since 2004, the Lab has 72 completed projects, 383 scientific publications and been covered over 1,000 times by global media and press outlets, with feature stories appearing in The New York Times, The Economist, NPR, BBC, CNN, Wired, and many more. The work of the Lab has been exhibited globally, including at the Venice Biennale, the MoMA New York, and the Guggenheim Lab Berlin. For more information on the lab's work, visit senseable.mit.edu.