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No Drivers, but a Lot of Drive

Tangi Quemener/Agence France-Presse -- Getty Images

"Junior," a Volkswagen Passat modified at Stanford, came in second at the Darpa Urban Challenge for robotic vehicles.

By **JOHN MARKOFF**
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ON Nov. 3, when robot vehicles raced through Darpatown, a simulated suburbia created in an abandoned Air Force Base in Victorville, Calif., each machine appeared to show its own distinct personality.

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The winner was "Boss," a Chevrolet Tahoe modified by a team led by William Whittaker of Carnegie Mellon.

Like human drivers, some machines were aggressive, some were cautious, some cleverly bent rules that normally apply to traffic, and some zigged and zagged their way through the course like New York taxi drivers.

Not surprisingly, perhaps, robot personality quirks can mirror the individual styles of their human designers. And in this third annual race, sponsored by the Pentagon and now called the Darpa Urban Challenge, the leading machines also reflected a very human rivalry between two leading computer science and

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engineering schools.

From the West Coast, the Stanford Racing Team was led by Sebastian Thrun and Michael Montemerlo. Mr. Thrun heads the Stanford Artificial Intelligence Laboratory, and Mr. Montemerlo is a senior researcher at the lab. Before coming to Stanford, both scientists were robotics researchers at Carnegie Mellon University, where they worked with William L. Whittaker, a legendary roboticist known as Red. Mr. Thrun and Mr. Whittaker were Mr. Montemerlo's thesis advisers.

General Motors
William Whittaker led the team from Carnegie Mellon.

From the East, Mr. Whittaker was one of the first people to propose vehicle races as a way to advance robotics. He has designed robots for tasks like clearing mines and exploring Mars.

The personal history of the competitors is all the more striking because Mr. Thrun and Mr. Montemerlo in 2005 led the team that designed "Stanley," a robotic Volkswagen Touareg. That year, in the second annual competition (then called the Darpa Grand Challenge), Stanley narrowly beat Mr. Whittaker's robotic "Red Team" Hummer over a 132-mile desert course to capture a $1 million prize.

Last Saturday, Mr. Whittaker returned the favor, this time leading a team that designed "Boss," a robotic Chevy Tahoe S.U.V., which captured $2 million for its victory. Finishing second, and receiving $1 million, was "Junior," a VW Passat from Stanford.

Both sides played down the competitive nature of the contest, but contrasting styles were clearly visible both in their machines and in their reactions to the results of the race.

"Boss was more jerky," said Gary Bradski, a machine vision expert who has worked with the Stanford team. "It accelerated fast and it turned fast."

By contrast, he contended, "Junior was more Zen; it took the minimal actions needed to achieve its goals."

The designers themselves do little to dispel these stereotypes.

"I had a great day," Mr. Thrun said. "It was my first robot traffic jam," referring to an incident during the race when a stalled robot held up Junior for more than 10 minutes.

Mr. Whittaker, interviewed in the pit area just after the race, seemed eager to move on to the next competition. "We were really throttled back" because of speed limits, he said, and he suggested that if Darpa decided to sponsor a new challenge, robotic Formula One race cars might be a neat idea.

The purpose of the Darpa races has been to help build robot vehicles for the United States military by the middle of the next decade. Progress, however, has been so dramatic that the impact is likely to be felt soon and far more broadly, in the commercial automotive world and elsewhere.

Donald A. Norman, a psychologist and an industrial designer, argues in "The Design of Future Things," his recently published book, that a new organism is emerging that he calls a "person+machine."

"Machines have neither motives nor emotions," he wrote recently in an e-mail message. "Still, machines, appliances and even services have personality traits, if only because they were designed to be conscientious or not, friendly or curt, smooth or abrupt, condescending or understanding, recalcitrant or forgiving."

Autonomous machines of the future, he said, will increasingly have emotions for the
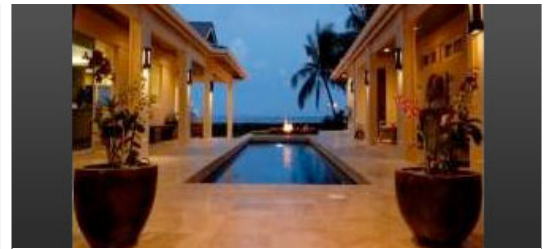
same reason that people have them: to protect themselves as well as to make choices among competing demands for their attention as well as a mechanism for social cooperation.

Though the Darpa autonomous vehicles were clearly not "thinking" machines, there was evidence that the line between human and machine consciousness might have just become a bit less clear.

"In a sense, it is a little conscious," said Mr. Bradski of the Stanford team that charted Junior's course with sophisticated planning software. "In its primitive robotic world, its consciousness is very restricted and the only entities in the world are obstacles and other cars. In its little world, in some sense it has a proto-personality."

Machine personality could be seen in the fact that the best of the robots had path-finding capabilities that allowed them to do humanlike things. For example, some robots violated race rules to get around unexpected obstacles in clever ways, like running up on a curb, if needed.

THIS style of machine personality reflects a rapid step forward to a new age of intelligent machines. Increasingly, researchers are working on products that aid human decision-making. In addition to robotic vehicles, we might see a smart G.P.S. "companion" that offers travel advice, or an expert system for consumers that helps with financial planning. Perhaps we will even see social networking machines that offer advice to Web surfers on how to navigate the Internet.

In the short term, the researchers said that work done in preparation for the Darpa races would lead to new safety systems to help cars avoid collisions.

But there was a distinctly sci-fi flavor to the event as the 11 robots threaded their way through a course dotted with abandoned buildings, while more than 30 humans, wearing crash helmets and driving conventional cars, provided a backdrop of traffic for the machines to interact with.

For many computer scientists, the this year's race was grounds for optimism. Vaughan Pratt, a Stanford professor emeritus in computer science who was one of the designers of Stanley and an officially recognized kibbitzer in the creation of Junior, said the six-hour race through faux suburbia was an important watershed.

"Now I can see a time when I can dial a taxi and it will show up and take me where I want to go," Mr. Pratt said, "and I won't have to tip it."

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