# Opinion: Why Robot Cars Are Important

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Some would argue that for the forseeable future robo-cars will be primarily limited to use in the military. But according to Pete Markiewicz, a number of business and societal factors argue against that limited viewpoint.

**By Dr. Pete Markiewicz**

In the wake of the 2004 Defense Advanced Research Projects Agency (DARPA) Grand Challenge (1), some people are considering the future of robotic cars within the larger robotics movement. Are car-bots a diversion, or a major new branch of mobile autonomous robots?

More than one recent article quotes experts who say that robo-cars will see limited use outside the military functions envisioned by DARPA. But such a position misses the true potential of robotic cars. In fact, car-bots are the hottest idea to come down the turnpike in recent years. Robot cars will have widespread application long before they function as a driverless Fed Ex courier or designated driver. In fact, robot-cars are likely to become major players in entertainment, and will offer a positive image helping to erase the "robot Frankenstein" attitude common in today's popular culture.

As a mobile robot, a car offers several unique advantages new to the industry. Car-bots bring in a new business model, allow grassroots participation and maximize entertainment value. Skeptical? Here are some of the reasons:

**Corporate Branding**
Robo-cars present a new model for funding robotics via corporate sponsorship. To date, most advanced robots has been developed using money from university grants or military contracts. Both lead to a robot that is unlikely to be used by the public. In contrast, virtually all of the robots in the Grand Challenge received corporate sponsorship, using the model developed for auto racing nearly a century ago. This sponsorship model is directly fueled by public interest.

<While many sponsors in the DARPA 2004 competition came from the tech and automotive industries, others sponsor types were involved including Melõ (bottled water), Earthlink (Internet Access), Zombie (game development), Boyd Gaming (casinos) and Santa Anita Park (horse racing). Even robotics racing competitions themselves are becoming privatized and commercial. For example, while DARPA is a government agency, the new International Robotic Racing Federation (IRRF) (3) is not, and the robots which will compete in the IRRF's September 2004 Open Challenge race will be there via corporate sponsorship.

Forward thinking companies have now realized that robotic cars offer a branding opportunity in a novel arena with broad public interest, as well as one comprised of the much valued technically astute early adopters. For their part, fledgling robotic companies working one-on-one with top marketing talent as sponsorships are put into place will come to understand the true value of marketing\branding in the success of a company, as well as develop their own brand identity. With corporate sponsorship, robo-designers will have a free hand to develop their technology for public consumption. All that corporate sponsors typically want is a car covered with their logos. Unlike government or university sponsorship, corporate sponsorship typically does not come with strings attached.

Robot cars would offer very novel banding oppertunities. For example, what radio station does a robot-car tune into while driving? Imagine a robot car 'cranking up the volume' and using a beat-heavy CD track for echolocation.

**COTs Technology**
Robo-cars can use off-the shelf computers, engendering broad, grassroots market participation. All mobile robots are limited by the size and energy required to power their computers. Hobby robots use slow microprocessors in part to allow them to run with batteries. In contrast, Carnegie Mellon University's (CMU) entrant into the DARPA Grand Challenge, Sandstorm, had somewhere north of ten computers (several with power-sucking Itanium processors) and multiple redundant hard disk arrays. Sandstorm is probably the biggest energy hog ever built, but it can run without refueling much longer than other mobile robots. Why the difference? Cars, unlike smaller mobile robot bodies, has lots of potential power. Gasoline has a much higher energy density than batteries or fuel cells. There's enough spare power for small teams to use racks of cheap, mass-produced, desktop computers.

One of the reasons for the "grassroots" feel of the DARPA Grand Challenge was that startup companies competed head-on with the majors. This would have been impossible if exotic, customized components were needed to keep power requirements down.

**Low Cost Robot Bodies**
Car-robots use cheap, reliable, high-performance robot bodies. Only high-end researchers can afford to build advanced mobile robotics bodies. In contrast, cars are relatively cheap and reliable. Even if you wreck one car, you can buy another that is exactly the same - they're mass-produced, unlike current mobile robotic bodies. Newer cars have microprocessor controls and dozens of MEMs sensors (4) potentially addressable by a car-bot's computer. What could be more natural than to add more of these same cheap sensors to cars to enhance their robotic performance?

Cars are also capable of rapid movement over rough, real-world terrain, settings which are the complete opposite of the delicate environments required by humanoid robots. Cars can take a lot of physical punishment without breaking down, and have a century of technology behind their high reliability. Cars shrug off dust, rain, and high winds which would destroy other mobile robots, and have cabs for protecting delicate electronics.

Cars also can provide air pressure/vacuum directly from their engines, allowing for the use of extremely strong pneumatic muscles like those produced by the Shadow Robot Company (5). This may allow for more naturalistic movement/stabilization than is possible using electric motors.

**Social Robots**
Robotic racing offers an environment ideal for developing "social" robots. Consider the game-like qualities of auto racing – both cooperation and competition are required to prevent crashes. This makes robotic racing a good environment for developing "social" robots. Sports competitions like Robocup6 provide similar opportunities, but (at present) soccer-playing robots can make mistakes without damaging each other. In contrast, a robotic car moving at high speed could be destroyed by making the wrong moves or misinterpreting the behavior of other cars. Social robotics will be essential, not just useful, for future driverless races.

The 2004 DARPA challenge provided the first example of car-bot social interaction. In the preliminary course, DARPA required that each contestant be able to navigate around a stopped car. During the actual race, one car (Digital Auto Drive's DAD) passed another (Caltech's "Bob").

Most biologists believe that social systems in animals require "individualization". In other words, social animals need individual personalities to function in the group. Social robotic cars will benefit from having their own personalities, which will also contribute to their entertainment value (6).

**Overcoming Fears**
The novelty of car-robots will defuse "Terminator" fears of robots run amock. In the US there is a deep, ingrained fear of humanoid robots, firmly planted there by decades of evil movie robots. Fortunately, Hollywood never had the imagination to think up a blockbuster "mad car-bot" movie ("Christine" and "Maximum Overdrive" notwithstanding). Consider how the U.S. media would react to a competition featuring humanoid robots. In all probability there would be a volley of Franken-bot articles, complete with scary cuts from classic SF films.

The robot cars in the DARPA challenge did not attract this kind of negative publicity. Robotic-cars may have a unique opportunity to catalyze a newly positive perception of robots with the public. It is likely that the public will respond to autonomous robot-cars the way they respond to racehorses, and nobody expects racehorses to take over the world.

**Robo-Entertainment**
Car-robots are natural entertainers. People have a long tradition of treating their cars as something special, and the huge cult of auto worship scarcely needs mentioning. Millions of people flock to see car-based entertainment - monster trucks, tricked-out dragsters, low-riders bouncing on their air shocks. What happens when that flame-painted Chevy can drive itself? The "social" potential of car-robots will eventually establish crowd-pleasing and ticket-selling synthetic personalities that would amaze MIT's baby-faced Kismet (7).

Many animals compete with aggressive displays which show off their health, strength and fitness. It will be natural to give car-bots a similar competitive attitude using biologically-inspired robotics. Imagine future driverless cars revving their engines, blowing fire out their exhaust, honking their own horns and "waving" to the crowd. A car-bot with 'tude will extend the spectacle of current auto shows in a fun and profitable way. As an example of cars with personality, check out Isaac Asimov's classic story "Sally" (8).

Humanoid robots from Japan can dance and play trumpets, so why not cars? Combine pneumatic muscles and air-shocks and you have a robot body that can really shake its tail feathers. Why not a sexy convertible shimmying before the big race? How about gyroscopic robot eyes rocking out to the hard (and easily identified computationally) beat of classic Southern rock? Remember that we've got computational power to burn in a car, compared to other mobile robots. Recent research designed to give robots a feel for the "beat" of music and dancing (9) would apply here.

In the 2004 Grand Challenge there were hints of this trend. The behavior of CMU's Sandstorm at the end of its 7 mile ride caused one team member to say that "it died angry." In contrast, the Terramax robot-truck was overly timid, backing away from bushes it thought were dangerous. Fast-forward a decade and imagine individual robot cars described in Hulk Hogan terms. These synthetic entertainment "personalities" will probably be simpler to develop than those needed for human-robot interaction in service environments. A robot with a pro-wrestler attitude might not be a pretty thought for some professionals, but it will sure make money.

**Conclusion**
Robot cars are here to stay, and offer potential for entertainment and consumer-oriented technology allowing grassroots participation. My guess is that the next DARPA Grand Challenge will have many more contestants, and will produce a winner in the public, if not the literal sense. See you at the robot races!

**References**
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5) Shadow Robot Company (http://www.shadow.org.uk)

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7) Kismet (http://www.ai.mit.edu/projects/humanoid-robotics-group/kismet/kismet.html)

8) "Sally" (1953) by Isaac Asimov (http://homepage.mac.com/jhjenkins/Asimov/Stories/Story231.html)

9) MIT student dances with robots (http://web.mit.edu/newsoffice/nr/2004/dancerobot.html)

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