

Chaotic Robotics

If you thought robots with brains were tweaky, how about robots without brains? Mark Tilden is building them. The story of robotics over the past four decades is one of complicated machines that don't work - or, anyway, not for long. Canadian roboticist Mark Tilden (currently at Los Alamos National Laboratory in New Mexico) has been trying a different idea: building very simple machines that work continuously, for decades. Tilden creates small, elegant 'bots by scavenging parts from the jetsam of consumer life: dead calculators, motors from defunct camcorders, discarded toys, and reprogrammed digital chips from singing birthday cards. WIRED caught up with Tilden at his Third World Robot Games in Toronto, where, Tilden says, humans act as reproductive agents for robots.

By Fred Hapgood

Have you been involved with robots for long?

Mark Tilden: Since always. I built my first robot doll out of wood scraps at the age of 3 and progressed from there to a Meccano suit of armor for the family cat at the age of 6. I've been building devices ever since.

In the '50s and '60s there was much expectation about robots.

The real history of robotics started in 1939 when a 19-year-old Isaac Asimov invented the idea of the positronic brain. When the computer came along, people assumed robotics was a self-fulfilling prophecy. This made the domestic robot seem just a breath away. After all, it was what everybody understood and wanted from technology: something that they could kick to make life easier.

But that didn't happen.

People thought, and for the most part still think, that robots can't exist unless a brain exists first. But artificial intelligence was not yielding the promised results, so people gave up.

So where were you in all of this?

Like everyone else, I just assumed that making a robot involved creating a mind. In 1982 I tried to build myself a robot butler with a built-in vacuum cleaner. I used a 68000, 4 megs of memory. Completely conventional techniques. Spent months on the damn thing. I just got more and more frustrated. I used the Asimovian Robotic Rules (protect humans, obey humans, then look after yourself), but this made the robot so incredibly paranoid about anything in its environment that the most it could do was move away from you when you got close to it. It was pathetic. I'd come home in the middle of the day and the damn thing would be going clunk-clunk-clunk in the corner, hiding from my cat. Similar stories have occurred in pretty much every college and university around the world, from Japan to Moscow. No matter how big the computer, simple general problems made them fall on their mechanical butts. Things changed for me in October of 1989, when I saw a talk by Rod Brooks of MIT. He basically told me everything I needed to know: Forget the brain, let's just build something with a simple stimulus-response ability. I went home that night thinking about how minimalist you could actually make this

technology. Brooks suggested making a creature without any memory for its brain. But could you make a creature without a brain at all? That's what happened.

So you don't use any computers in your robots?

That's right.

No processing whatsoever?

Not even simulations. A lot of people have trouble with this. Computers have made such an impact that it's hard to think of any technology - let alone robotics - without them. The trouble with processors is that you're never finished. There's always something you can do to improve the software, there's always something you want to add on. One thing about not using computers is that you can finish a robot and move on to the next generation without getting hung up on the limitations of an old design.

So where does the intelligence come from?

From the world. From the machines themselves. Simple machines have three advantages: accessibility, confidence growth, and emergent properties - "accessibility," as the parts and tools are ubiquitous and cheap; "confidence growth," as the builders find that the devices can be built in a very short period of time, sometimes hours; "emergent properties," as these things often exhibit behavior that was not designed or predicted even though the mechanism seems simple. That's one source of intelligence.

Most of your robots seem to use solar power. Where did that idea come from?

From my convictions on robotic eugenics. Robots cannot reproduce themselves easily, nor would we want them to. So if you want a colony of robots to do an acceptable job, you must extend their lifetime to many years. That means solar power. Solar power also implies micropower analog control systems, which implies slow movement, which extends the mechanical operating lifetime by exponents, etc., etc.

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What do your robots do?

First of all they survive. They're survivor automata. I have three guiding principles:

- 1) A robot must protect its existence at all costs;
- 2) A robot must obtain and maintain access to a power source;
- 3) A robot must continually search for better power sources. Otherwise known as: protect thine ass; feed thine ass; look for better real estate.

This makes a wild robot, a feral machine that is already useful for some purposes. Other functions require domesticated robots - wild robots that have been bribed, tricked, or evolved into household roles. But the wild robot has to come first.

What sort of practical consequences do you see for these machines?

They may lead to the brains of artificial intelligence dreams, but I think they will be best put toward patching up the damage between humankind and the environment, replacing the work of damaging chemicals worldwide. That's my goal, anyway. I see them as the components of a programmable ecology. They'll replant forests, hunt cockroaches, monitor poachers, cut your grass, clean your pool, polish your floors - all invisibly, dependably, for years.

No Human Droids?

Why would I want to build a person when I can explore unorthodox alien intelligences from the ground up? To borrow from author David Brin, what I like to think I'm doing is proctoring a silicon species into sentience, but with full control over the specs. Not plant. Not animal. Something else. Why wait for the stars when we can build new minds here? Already, they're more surprising than I'd expected. I'm hoping they'll be stranger than we can imagine.

