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New Robot Can Sense Damage, Compensate

Posted by [CowboyNeal](#) on Friday November 17, @03:12AM
from the omni-consumer-products dept.

AVIDJockey writes "*Researchers at Cornell University in Ithaca, N.Y., built a [four-legged robot that can sense damage to its body](#) and figure out how to adjust and keep going. They report the development in Friday's issue of the journal Science. The article states that the robot can, 'generate a conception of itself and then adapt to damage.' This reaffirms advice that states that when the robot uprising finally comes, you should always aim your rocket launcher at the head (or brain nexus)."*



- **Cornell has a history of unique robots**

(Score:5, Interesting)

by [Salvance \(1014001\)](#) * on Friday November 17, @03:17AM ([#16881254](#))
(<http://www.saynotocrack.com/> | Last Journal: [Saturday November 25, @02:09AM](#))

As a Cornell alumni myself, I am obligated to say "wow, very cool" ... although at first I thought this might be the first incarnation of [the omnidroid from The Incredibles](#) [fiddlersgreen.net].

Cornell has had mixed success in building leading edge robots. Some of their more incredible robots are front and center (such as the work they contributed on the Mars Rovers), while others are barely useful (such as their early dominance in minituarized robotic soccer). One of the school's oddest robots, which might have helped inspire the compensatory robot in this article, was this [rather bizarre chair that could reassemble itself](#) [youtube.com] if it happened to fall apart. I don't think I'll be buying any of them for the dinner table!

[[Reply to This](#)]

- o [Re: Cornell has a history of unique robots](#) by gramji (Score:1) Friday November 17, @06:17AM

- o

Another example @ MIT, 12 years ago.

(Score:5, Interesting)

by [JonTurner \(178845\)](#) on Friday November 17, @10:27AM (#16884322)

Props to Cornell for their impressive work! (and yeah, that chair is just amazing to watch. If only IKEA would license that technology... but I digress.)

I'd like to point out a similar bit of work from about 12 years ago. Different approach, but similar goals: Cynthia Breazeal (Ferrell) (hope I'm spelling that right) did some incredibly impressive work as a Grad student @ MIT in the 90s. The most germain is her paper titled [Failure Recognition and Fault Tolerance of an Autonomous Robot](#) [mit.edu]

This is a MUST READ paper for anyone interested in building robots which operating in real-time in the unpredictable real world. (Real World. Noun. The place where \$#!t happens, stuff breaks, sensors get noisy input, etc. and the robot has to "cope" anyway.)

In this paper she describes a methodology for developing a six-legged, insect-like robot, Hannibal [[pictures and links](#) [mit.edu]], which can adapt to both minor and gross subsystem failures and continue, as much as practical, to fulfill its mission. IMO, the best part is the section talking about adaptive gaits where the robot can change seamlessly from high-speed to high-stability walking patterns, as required, and should one (or more) of the legs becomes inoperable, the robot learns to make due without it prior programming thanks to the subsumption architecture Rod Brooks invented and she and other notable members of the Mobile Robot Labs perfected.

Her work these days is mostly centered around human-computer/robot interactions exploring emotive systems and feedback to bridge the gap.

Yeah, I'm a fanboy.

[[Reply to This](#) | [Parent](#)]

- o [Motronic engine management](#) by SuperBanana (Score:3) Friday November 17, @11:34AM
 - [Re:Motronic engine management](#) by nasch (Score:1) Friday November 17, @07:03PM
- o [Re: Cornell has a history of unique robots](#) by Salvance (Score:1) Friday November 17, @12:03PM
- o [4 replies](#) beneath your current threshold.

• **Redundant post...**

(Score:5, Interesting)

by [RyanFenton \(230700\)](#) on Friday November 17, @03:30AM ([#16881298](#))

This reaffirms advice that states that when the robot uprising finally comes, you should always aim your rocket launcher at the head (or brain nexus)."

That's why any robot worth any title of 'overlord' needs to design itself to use redundant parts, preferably modular and rapidly configurable.

The StarGate creators had a good (if redundant in itself) idea with their 'replicator' race as the main bad guy for a while - only problem is such an enemy quickly forces the need for a, well, deus ex machina as its power grows.

Earlier, the show Lexx had a bad guy using a series of robotic arms that acted in a similar manner, which got so powerful as to entirely destroy one of the two 'universes' that the show took place in. It was impressive, because of the lack of a deus ex machina to fix the, um, daemos ex machina problem. I'm sure countless shows and novels have taken a similar idea before that too.

The future of this idea? Perhaps a Resident Evil game using cyborgs with a shared AI rather than zombies, complete with altering movement for damage? Hey, if everyone can steal ideas from the Thief series, more companies should steal some ideas from System Shock series too!

Ah redundancy - it's everywhere! Likely the mod for this post too.

Ryan Fenton

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- [No redundant mod from me...](#) by skids (Score:2) Friday November 17, @07:09AM
- [Re:Singularitian robot wars](#) by vertinox (Score:2) Friday November 17, @10:14AM
 - [What humans could do to stop you.](#) by JonTurner (Score:2) Friday November 17, @11:23AM
 - **[1 reply](#) beneath your current threshold.**
 - [Re:Singularitian robot wars](#) by wiremind (Score:1) Friday November 17, @02:28PM
- [Re:Redundant post...](#) by Drooling Iguana (Score:2) Friday November 17, @05:49PM
- **[1 reply](#) beneath your current threshold.**

• **call me when it can find sarah connor**

(Score:4, Funny)

by [macadamia harold \(947445\)](#) on Friday November 17, @03:40AM ([#16881330](#))

(<http://www.google.com/>)

Researchers at Cornell University in Ithaca, N.Y., built a four-legged robot that can sense damage to its body and figure out how to adjust and keep going.

Yeah, but was the robot made of intelligent, liquid metal?

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• **Good Month for robots**

(Score:5, Funny)

by [stoneycoder \(1020591\)](#) on Friday November 17, @03:41AM ([#16881338](#))

We've got human eating robots that love the bacony taste of their prey, robots with freakin machine

guns attached to their heads, and now this. I for one... , blah blah.

Im to lazy to post the robotic links, its not like you dont know what im talking about if you're in this discussion at 3am rushing to check if someone already posted the "i for one" on the robot article. Really though, its cool to see robotics doing some crazy things.

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- [Re:Good Month for robots](#) by \$RANDOMLUSER (Score:2) Friday November 17, @06:52AM
 - [Re:Good Month for robots](#) by WilliamSChips (Score:2) Friday November 17, @07:45PM

• **In other news...**

(Score:5, Funny)

by [tttonyyy \(726776\)](#) on Friday November 17, @03:42AM ([#16881340](#))

(<http://www.cooldark.com/> | Last Journal: [Monday April 26, @05:31PM](#))

Small Boy Pulls Four Legs off Robot. Robot says, "It's only a fleshwound, I've had worse!" and rolls about a bit.

[[Reply to This](#)]

- [Re:In other news...](#) by SlashGeO (Score:1) Friday November 17, @04:11AM

◦

Re:In other news...

(Score:5, Funny)

by [gbobeck \(926553\)](#) on Friday November 17, @04:28AM ([#16881498](#))

(<http://www.etl.luc.edu/> | Last Journal: [Monday August 28, @09:28PM](#))

I can only imagine the error.log entries for that robot...

12:01:38 ERROR: Front Right Leg Not Found ('Tis but a scratch)

12:03:14 ERROR: Rear Left Leg Not Found ('Tis but a scratch)

12:04:49 ERROR: Front Left Leg Not Found ('Tis but a scratch)

12:07:26 ERROR: Rear Right Leg Not Found ('Tis but a scratch)

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• **But can it handle stairs?**

(Score:2)

by [Channard \(693317\)](#) on Friday November 17, @03:54AM ([#16881370](#))

(<http://www.godhatesfrags.com/>)

Or is it as effective on those as ED 209?

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• **think more creatively**

(Score:1)

by [beta-guy \(715984\)](#) on Friday November 17, @03:55AM ([#16881378](#))

"This reaffirms advice that states that when the robot uprising finally comes, you should always aim

your rocket launcher at the head (or brain nexus)." what makes you think that the "brain" would be in the head there is little to no protection there plus that's where everyone will think of hitting it... no I say hide the brain near the butt, it's at the back so this will do 2 things 1. anyone in front of the robot will not hit it and 2. anyone behind it will leave it alone unless he's a perfect shot... also put some extra armour plating back there... I'd also recommend an additional backup pair of "eyes" near the wheels behind some transparent aluminum :D

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- [Re:think more creatively](#) by bronney (Score:1) Friday November 17, @05:01AM
- [Re:think more creatively](#) by netscan (Score:1) Friday November 17, @12:23PM
 - [Re:think more creatively](#) by beta-guy (Score:1) Sunday November 19, @10:59AM
- **1 reply** beneath your current threshold.

• Is that a big deal ?

(Score:2, Insightful)

by [himanshuarora \(881139\)](#) on Friday November 17, @03:59AM ([#16881404](#))

Given that robot can be made to sense anything..it can sense the damage of it's own with the best possible mechanism. Try damaging the processor(s) of that robot and see what will it do ?

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- [Re:Is that a big deal ?](#) by Itsacon (Score:1) Friday November 17, @04:46AM
- [Re:Is that a big deal ?](#) by s2jcpete (Score:1) Friday November 17, @06:03AM
- [Brain and Pain](#) by SpeedyGonz (Score:1) Friday November 17, @09:08AM
- [Re:Is that a big deal ?](#) by ShorePiper82 (Score:1) Friday November 17, @11:10AM

• Replicators

(Score:1)

by [ms1234 \(211056\)](#) on Friday November 17, @04:03AM ([#16881410](#))

If you watch the movies from the university website of the robot in motion it brings you a creepy feeling of watching an SG replicator coming to life.

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• Compensate

(Score:5, Funny)

by [Bastard of Subhumani \(827601\)](#) on Friday November 17, @04:20AM ([#16881456](#))

(Last Journal: [Monday November 20, @05:00PM](#))

When I saw the word "compensate", my first thought was that it could automatically decide who to sue for damaging it. This could be based on a fuzzy logic system for calculating angles & velocities of potentially colliding objects and/or a pocket depth sensor.

In which case, I for one welcome our new robot lawyer overlords. YMMV. VWP. Other conditions may apply.

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- [Re:Compensate](#) by Zordak (Score:2) Friday November 17, @09:55AM

My BEAM robot has been doing that for years..

(Score:3, Interesting)

by [QuantumG \(50515\)](#) <qg@biodome.org> on Friday November 17, @04:30AM ([#16881504](#))
(<http://rtfm.insomnia.org/~qg/> | Last Journal: [Wednesday November 16, @07:11AM](#))

Mark Tilden, the man behind the Robosapien and the [BEAM](#) [wikipedia.org] robotics philosophy has been making robots that can compensate for damaged limbs and keep on functioning for, like, decades now. Oh, and did I mention that he does with with \$12 worth of parts.

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- **DARPA did it**

(Score:2)

by [MadUndergrad \(950779\)](#) <the_cheat_1000@yahoo.com> on Friday November 17, @04:36AM ([#16881534](#))

They've got planes now that will compensate for say, a damaged rudder in about 30 seconds to the point that you can hardly tell it was damaged. While this is certainly nifty, it's by no means the first time it's been done. Personally, I'd like to see a robot that screams in pain when it's damaged.

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-

- **Re:DARPA did it**

(Score:4, Interesting)

by [ttonyyyy \(726776\)](#) on Friday November 17, @05:12AM ([#16881694](#))
(<http://www.cooldark.com/> | Last Journal: [Monday April 26, @05:31PM](#))

That'd be the worst USB powered Christmas gadget ever - a mini-robot that screams in pain from the moment it gets plugged in.

I think you've found a gap (albeit a small one) in the market there. :)

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- [Re:DARPA did it](#) by jon_joy_1999 (Score:2) Friday November 17, @05:56AM
- [1 reply beneath your current threshold.](#)

- **The head!?**

(Score:5, Funny)

by [Sippan \(932861\)](#) <sippan@macnytt.com> on Friday November 17, @05:07AM ([#16881670](#))
(<http://www.sippan.se/>)

I have *never* killed a robot by aiming at the brain. That's *zombies*, you ignorant clod.

Robots are defeated by aiming at the bright, red (sometimes yellow) light that is hidden by thick armor which is unpenetrable by any weapon in the world, but which opens for long amounts of time every once in a while so you can fire at it.

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- [Re:The head!?](#) by ttonyyyy (Score:2) Friday November 17, @05:52AM
 - [Re:The head!?](#) by Artifikat (Score:3) Friday November 17, @10:29AM
 - [Re:The head!?](#) by ttonyyyy (Score:3) Friday November 17, @10:54AM
- [Re:The head!?](#) by Jtheletter (Score:2) Friday November 17, @10:07AM
 - [Re:The head!?](#) by Sippan (Score:1) Friday November 17, @10:49AM

- [Re:The head!?](#) by Jtheletter (Score:2) Friday November 17, @01:26PM
- [Re:The head!?](#) by john83 (Score:1) Friday November 17, @11:07AM

• **Big deal**

(Score:2)

by [Spacejock \(727523\)](#) on Friday November 17, @05:14AM ([#16881708](#))

(<http://www.spacejock.com.au/>)

[My robot](#) [spacejock.com.au] could do this a year ago.

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• **Self repairing robot**

(Score:1)

by [Centurix \(249778\)](#) <[mrjolly@optusnetau](mailto:mrjolly@optusnet...au) minus distro> on Friday November 17, @05:23AM

([#16881740](#))

(<http://chris.brimson-read.com.au/>)

It would be great if it could recognise the damage and then find something nearby which it could attach to 'fix' itself. Like a leg goes missing, so it finds a twig and attaches it to itself to keep going. Or if it starts raining and it needs shelter, it finds some kind of sheet or portable cover and attaches itself.

[[Reply to This](#)]

• **Shaun of the Dead reference**

(Score:2)

by [spellraiser \(764337\)](#) on Friday November 17, @06:04AM ([#16881852](#))

(Last Journal: [Wednesday January 12, @10:10AM](#))

This reaffirms advice that states that when the robot uprising finally comes, you should always aim your rocket launcher at the head (or brain nexus).

'In extreme circumstances, the assailants can be stopped by removing the head or destroying the brain. I will repeat that: By removing the head or destroying the brain.'

[[Reply to This](#)]

- [Shaun of the Dead reference?](#) by Proud like a god (Score:2) Friday November 17, @07:10AM

• **Crush, Kill, Destroy**

(Score:2)

by [krell \(896769\)](#) on Friday November 17, @07:02AM ([#16882072](#))

(Last Journal: [Monday October 02, @08:42AM](#))

"Sense, Damage, Compensate!" just doesn't have the same ring to it. Give me a robot that intones "Crush! Kill! Destroy!" anyday.

[[Reply to This](#)]

- [Re:Crush, Kill, Destroy](#) by g253 (Score:1) Friday November 17, @07:14AM

• **Nothing new (no disassemble, stephanie)**

(Score:1)

by [chickenrob \(696532\)](#) on Friday November 17, @07:25AM ([#16882220](#))

(<http://fbcmneapolis.org/>)

This is nothing new, in fact, I know of a robot in the 80's that, when dis-assembled in the back of a truck, could rebuild itself from spare parts with only it's eyelids!

Stephanie Speck: You're a machine from that dumb war lab - I am so stupid!

Number 5: Stupid - foolish, gullible, doltish, dumbell.

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- **Rolling your own self-repairer**

(Score:2)

by [chroma \(33185\)](#) <chroma@mindspring.com [g.c' in gap]> on Friday November 17, @07:37AM

([#16882296](#))

(<http://www.bigbluesaw.com/>)

Anyone interested in creating their own self-repairing robot in a virtual world might want to check the [Yobotics Simulation Construction Set](#) [yobotics.com].

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- **People, you are not getting it**

(Score:3, Insightful)

by [mapkinase \(958129\)](#) on Friday November 17, @07:52AM ([#16882416](#))

(Last Journal: [Wednesday November 22, @12:31PM](#))

After reading +3 comments, I realized that people are not getting it enough:

For those who have access to university libraries or work for academy, in short, have access to Science here is [the movie](#) [sciencemag.org]

This is scary, colleagues.

Does anybody realize, that in the beginning robot only knows that he can move the legs in various directions? Period. That is it, nothing more. The Thing is given the goal: "Must. Move. Forward". In the movie, The Thing, this tetrapod starfish, is laying on the surface, then it gets up and starts crawling. And this crawling itself strikes you with the horrific resemblance to the crawling of real animals, which, I repeat, was not coded. NOT CODED.

Each leg has two joints. I call them "shoulder" and "elbow". After one leg is amputated at the "elbow", The Thing is able to perform the same scary move as before.

Watch the movie, it is worth it, believe me.

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- [Re:People, you are not getting it](#) by mapkinase (Score:2) Friday November 17, @08:05AM

- [I reply beneath your current threshold.](#)

- **Aim for the head and...**

(Score:1)

by [Ruvim \(889012\)](#) on Friday November 17, @08:24AM ([#16882680](#))

robot warriors will adjust and move brain to the ass!

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- [Cranial Rectal Inversion, or "Brain, meet ass"](#) by JonTurner (Score:2) Friday November 17, @11:29AM
 - [Re:Cranial Rectal Inversion, or "Brain, meet ass"](#) by Ruvim (Score:1) Friday November 17, @11:41AM

• **I sense injuries ..**

(Score:2)

by [Entropy \(6967\)](#) on Friday November 17, @08:27AM ([#16882698](#))

the data could be called pain. [/ahhnoId]

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• **Just one frontier left.**

(Score:4, Funny)

by [Rob T Firefly \(844560\)](#) on Friday November 17, @09:04AM ([#16883066](#))

(<http://robvincent.net/> | Last Journal: [Monday November 06, @10:39AM](#))

I'm still waiting for robots that can [criticise b-movies](#). [mst3k.com]

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• **That was about TIME**

(Score:1)

by [Corwn of Amber \(802933\)](#) <[corwinofamber@sky\[.be\]](mailto:corwinofamber@sky[.be]) [[net' in gap](#)]> on Friday November 17, @09:06AM ([#16883104](#))

someone decided to just try and do exactly that.

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• **WoW!**

(Score:1)

by [ZonkerWilliam \(953437\)](#) * on Friday November 17, @09:12AM ([#16883176](#))

(Last Journal: [Monday October 02, @11:42AM](#))

A robot that has a "concept of itself"! I mean in the AI field this a precursor to 'self-awareness'

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- [Re:WoW!](#) by bloobamator (Score:1) Friday November 17, @11:00AM
 - **[1 reply](#) beneath your current threshold.**

• **another article**

(Score:1)

by [brunascle \(994197\)](#) on Friday November 17, @09:21AM ([#16883274](#))

<plug>Technology Review has [another article](#) [technologyreview.com].</plug>

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Obligatory

(Score:2)

by [wootest \(694923\)](#) on Friday November 17, @01:33PM ([#16887802](#))

As far as destroying the part that can readapt when something is destroyed goes:

Something, somewhere, had gone terribly wrong, but none of the supervising programs could tell what it was. At every level, vital instructions were missing, and the instructions about what to do in the event of discovering that vital instructions were missing, were also missing. [...] Further investigation quickly established what it was that had happened. A meteorite had knocked a large hole in the ship. The ship had not previously detected this because the meteorite had neatly knocked out that part of the ship's processing equipment which was supposed to detect if the ship had been hit by a meteorite.

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Better paradigm wins, always.

(Score:1)

by [Maljin Jolt \(746064\)](#) on Friday November 17, @01:49PM ([#16888044](#))

(Last Journal: [Friday November 10, @12:00AM](#))

This reaffirms advice that states that when the robot uprising finally comes, you should always aim your rocket launcher at the head (or brain nexus).

Until they start to put a spare brain in every leg.

[[Reply to This](#)]



Well, I for one...

(Score:1)

by [TaleSpinner \(96034\)](#) on Friday November 17, @02:33PM ([#16888728](#))

...welcome our new electronic overlords, mostly because *I don't see how they could possibly govern this planet any worse than homo sap. has.*

[[Reply to This](#)]



Taking bets...

(Score:1)

by [Dretep \(903366\)](#) on Friday November 17, @05:02PM ([#16890836](#))

How long until the Rise of the Machines and Judgement Day??

[[Reply to This](#)]

- [Re:Taking bets...](#) by Dark_MadMax666 (Score:1) Friday November 17, @05:22PM



Brain Nexus

(Score:1)

by [Dabido \(802599\)](#) on Saturday November 18, @06:39AM ([#16895152](#))

'This reaffirms advice that states that when the robot uprising finally comes, you should always aim your rocket launcher at the head (or brain nexus).'

Which is why I had my brain nexus transplanted to my arse. Someone blows my head off, I'll just keep on plowing along ...

[[Reply to This](#)]

- **Re:Well...**

(Score:4, Funny)

by Anonymous Coward on Friday November 17, @03:44AM ([#16881354](#))

No, no, no... you don't understand, you should had written: "I, for one, welcome our new pain-feeling robot overlords."

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- [1 reply](#) beneath your current threshold.

- **Re:Well...**

(Score:2)

by [SnowZero \(92219\)](#) on Friday November 17, @06:27AM ([#16881912](#))

(<http://www.cs.cmu.edu/>)

IN SOVIET RUSSIA, HTML tags you!

e. e. cummings likes lowercase to avoid the lame(ness) filter.

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- **Re:This is nothing new**

(Score:2)

by [JonTurner \(178845\)](#) on Friday November 17, @11:40AM ([#16885642](#))

>>The F-117 pilot never knew anything was wrong because the flight computer had been compensating for the missing piece of equipment.

What a showoff. The conventional approach for "missing equipment" is driving an SUV.

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- [10 replies](#) beneath your current threshold.

If they can make penicillin out of moldy bread, they can sure make something out of you. -- Muhammad Ali

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