



Shape-shifting robot forms from magnetic swarm

12:41 29 January 2008 by [Tom Simonite](#)
For similar stories, visit the [Robots](#) Topic Guide



Adobe Flash Player is no longer supported

Video: [See some prototypes of robot swarms created by researchers at Carnegie Mellon University](#)

Swarms of robots that use electromagnetic forces to cling together and assume different shapes are being developed by US researchers.

The grand goal is to create swarms of microscopic robots [capable of morphing into virtually any form](#) by clinging together.

[Seth Goldstein](#), who leads the research project at Carnegie Mellon University, Pittsburgh, in the US, admits this is still a distant prospect.

However, his team is using simulations to develop control strategies for futuristic shape-shifting, or "claytronic", robots, which they are testing on small groups of more primitive, pocket-sized machines.

These prototype robots use electromagnetic forces to manoeuvre themselves, communicate, and even share power.

No moving parts

One set of claytronic prototypes were cylindrical, wheeled robots with a ring of electromagnets around their edge, which they used to grab hold of one another. By switching these electromagnets on and off, the so-called "claytronic atoms" or "catoms" could securely attach and roll around each other (see video, top right).

The robot's wheels were not powered, so they had to rely entirely on their magnets to manoeuvre themselves around. "These were the first mobile robots without any moving parts," says Goldstein. They also used their electromagnets to share power, to communicate, and for simple sensing.

Since using magnetic forces are less efficient at smaller scales, the team has now begun experimenting with electric forces instead.



PRINT



SEND



SHARE



ADVERTISEMENT

More

Latest news

Satnav device gets the shopping done fast

11:00 21 December 2008

A handheld device that maps out routes around shopping malls could take the drudgery out of buying Christmas presents

Invention: Vertical-takeoff micro aircraft

18:05 19 December 2008

Tiny planes with swivelling propeller engines are easier to manoeuvre and can fly faster, says a new patent application

Snowflake maker to improve weather forecasts



18:00 19 December 2008

An ice cloud chamber that allows physicists to study the delicate processes that govern snowflake formation could also help predict

when snow is likely to fall

Flexible bridge bounces back after quake test

16:02 19 December 2008

A bridge with supports that spring back into place after a devastating earthquake could remain usable afterwards – boosting aid efforts and local economies

[see all related stories](#)

Most read

Most commented

Intelligent soldiers most likely to die in battle

US investigation into gravity weapons 'nonsense'

The scientific guide to gift wrapping

'Evil water' linked to mysterious drownings

This week's issue

Subscribe



20 December 2008

ADVERTISEMENT



Partners

We are partnered with
Approved Index. Visit

The latest prototypes are box-shaped robots dubbed "cubes" that have six plastic arms with star-shaped appendages at the end of each.

These stars have several flat aluminium electrodes and dock together, face on, using static electricity. Electrodes on different stars are given opposing charges, which causes the stars to attract each other. Once connected, no power is needed to hold the stars together.

Micro-scale robots

Tests have shown that it is possible to send messages and power to other cubes over the same links. "Our hope is to assemble around 100 cubes to experiment with ideas," Goldstein says.

Rob Reid at the [US Air Force Research Lab](#) is collaborating with the Carnegie Mellon team to develop even smaller prototype robots. Reid and colleagues can fold flat silicon shapes into 3D forms as little as a few hundred microns diameter.

"We will drive those using electric forces too, by patterning circuits and devices into the silicon design," Goldstein says. He predicts that by the summer of 2008 they will have prototypes capable of rolling themselves around this way.

Modularity is a popular theme with robotics researchers around the world. Other designs include [Swarm-bots](#) 🐜, [Superbot](#) 🐜, and [M-TRAN](#) 🐜.

Complex connections

"The physical mechanism for docking different pieces is really tough to do," says [Alan Winfield](#), who works on artificially intelligent swarms at the [Bristol Robotics Laboratory](#) in the UK. "Most use mechanical latches with hooks." Although these physical connections are complex, they do not need power, Winfield points out, unlike magnetic connections.

Using electromagnetic forces may make more sense at smaller sizes, he adds. "My guess is that electrostatic connectors will come into their own on the micro scale where less power is needed to have a large effect," he says.

But software, not hardware, may be the biggest challenge facing researchers working on swarms of robots, he says: "Right now we just don't know how to design a system that produces complex overall behaviours from a group of simple agents."

Ultimately, Goldstein believes his claytronic robots may one day achieve this, and much more: "I'll be done when we produce something that can pass a [Turing test](#) for appearance," he says. "You won't know if you're shaking hands with me or a claytronics copy of me."

Robots - *Learn more about the robotics revolution in our continually updated [special report](#).*

If you would like to **reuse any content** from New Scientist, either in print or online, please [contact the syndication](#) department first for permission. New Scientist does not own rights to photos, but there are a [variety of licensing options](#) available for use of articles and graphics we own the copyright to.

› [How to make cheap wine taste like a fine vintage](#)

the site to get free quotes from [website designers](#) and a range of web, IT and marketing services in the UK.

Have your say

Comment title

Your name

Email

Comment

[cancel](#)

[submit](#)



I've Delt With These Before
Tue Jan 29 15:22:24 GMT 2008 by **Daniel Jackson**

If anything goes wrong. Only Jack O'Neill can save us from these "replicators".

[» reply](#) [» report this comment](#)



Not The Only One.
Tue Jan 29 15:32:04 GMT 2008 by **C Knowles**

I'm glad I wasn't the only one thinking "replicators" when I read this...

[» reply](#) [» report this comment](#)



Terminator
Tue Jan 29 15:47:15 GMT 2008 by **Stuart Bouglas**

Sounds like the bad guy from terminator 2...

[» reply](#) [» report this comment](#)

All comments should respect the [New Scientist House Rules](#). If you think a particular comment breaks these rules then please use the "Report" link in that comment to report it to us.

If you are having a technical problem posting a comment, please [contact technical support](#).

About us

[New Scientist](#)
[Advertise](#)
[Syndication](#)
[Who's who](#)
[RBI Jobs](#)

User Help

[Contact Us](#)
[FAQ / Help](#)
[Disclaimer](#)
[Ts & Cs](#)
[Cookies](#)
[Privacy Policy](#)

Subscriptions

[Subscribe](#)
[Renew](#)
[Gift subscription](#)
[My account](#)
[Back issues](#)
[Customer Service](#)

Links

[Site Map](#)
[Browse all articles](#)
[Magazine archive](#)
[NewScientistJobs](#)
[The LastWord](#)
[E-Newsletter](#)
[RSS Feeds](#)