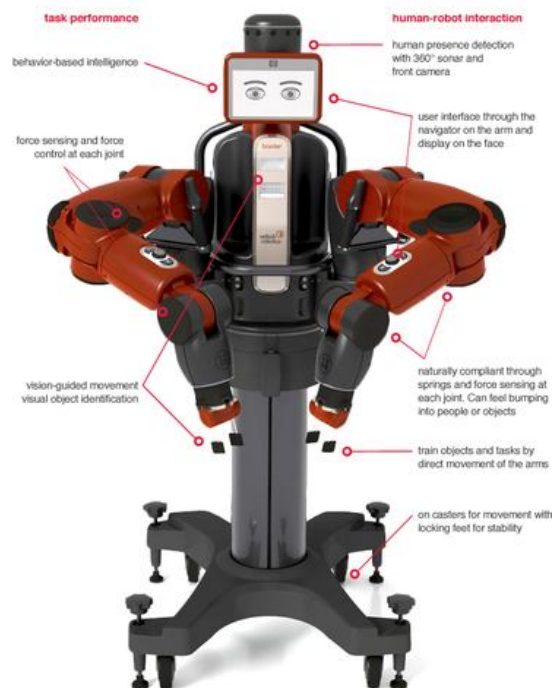


EDITORIAL

Co-working robots like Baxter promise a future for home robotics

By Paul Miller (<http://www.theverge.com/users/futurepaul>) on September 21, 2012 03:30 pm ✉ Email (<mailto:paul@theverge.com>)



My favorite new vocabulary word for the year is "co-working," when applied to robots. In June I spoke with Dr. Oskar Von Stryk from the University of Darmstadt (<http://www.theverge.com/2012/9/7/3287515/robocup-2012-robots-soccer-broken-necks-baby-steps>), who explained the category to me. Little did we know, Rethink Robotics was just months away from introducing "Baxter," (<http://www.theverge.com/2012/9/18/3351164/baxter-production-line-robot>) a machine which epitomizes the co-working robot — and which will likely rule the category for the foreseeable future.

A co-working robot is an industrial robot designed for smaller businesses, and less rigorous tasks. Instead of welding car doors, co-working robots do simple manipulation of objects — like picking them up, and then putting them somewhere else. Imagine multiple buckets of specific Lego pieces, which need to be picked and placed into a single kit of diverse Lego pieces, or a mailer which needs four different pieces of paper inside of it. As someone who has spent thousands of minimum wage hours doing simple sorting tasks (specifically the latter example, and also potato sorting), trying to keep my mind from wandering, I'm glad the robots are finally taking over. Baxter won't get bored, and will turn humans into "operators" instead of simple cogs on an assembly line.

Co-working robots are also need to be easy to program, by definition. An industrial robot might spend an entire year (for instance, a model year of a car) doing the same task repeatedly, which makes bespoke programming worthwhile. In a small business, with smaller runs of products, and more generalized duties for employees, a robot might need to do a different thing each day. Baxter should be up to speed on a new chore in under 30 minutes.

BAXTER WON'T GET BORED

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Safety is a "new" concern for robots. Industrial robots work inside a fence, but a co-working robot might work side-by-side with a human. Baxter is flush with sensors to identify potential human obstacles and interference. But safety isn't just limited to human-robot interaction. Von Stryk pointed out to me that there are many simple tasks that take humans a long time, due to workplace safety best-practices. For instance, working with a drill press, a human has to turn the machine entirely off every time he puts an object inside it, then turn the machine back on to press it, then switch the power off to remove, etc. — otherwise a lapse of attention could risk a limb. A co-working robot, while valuable, is not irreplaceable, which makes edgier use of heavy machinery possible without endangering any human hand.

Most important to this category's allure, to my mind at least, is price. Rethink Robotics is offering Baxter for \$22,000, which is a serious bargain for a two-armed robot of its capabilities. What's even more exciting is Baxter's modular wrist, which will allow its simple manipulators to be upgraded to hands in the future, apparently by either Rethink or a third party.

A SERIOUS BARGAIN FOR A TWO-ARMED ROBOT OF ITS CAPABILITIES

What's truly wild is that \$22,000 isn't the basement of these co-working prices. I've heard a \$10,000 target figure floated, which makes sense for a robot with a bit less than half of Baxter's capabilities: one arm, shorter reach, simpler tasks.

Rethink has the advantage of a head start in the market, and the apparent technical ability to ship a robot with never-before-seen capabilities — "teachability" for a robot is a huge accomplishment in the field. But there are a large number of co-working startups on the horizon, which could make this an exciting, wildly competitive industry in just a few years.

Rethink began as Heartland Robotics, which has some serious financial backing, and was rumored to be bringing a co-working bot to the Chicago's [Automate \(http://automate2013.com/the_show\)](http://automate2013.com/the_show) show in January; that's the bot that ultimately came to market as Baxter. Other companies with co-working robots in the works include Redwood Robotics, and Dr. Von Stryk's own [BioRob \(http://www.biorob.de\)](http://www.biorob.de) — Stryk's involvement is in making an articulated, safe, cheap hand for one of these robots, allowing it to take on more human-like tasks.

The Wall Street Journal reports (<http://online.wsj.com/article/SB10000872396390443720204578004441732584574.html>) that Yaskawa Electric, Universal Robots, Fanuc, and ABB are all working on robots similar to Baxter as well, or at least smaller, "nimble" versions of their industrial models. I also have to believe iRobot, the defacto leader in military and home robotics, can't be ignoring the co-working space.

But Baxter and his forthcoming friends have meaning beyond just menial manufacturing and collation jobs for smaller businesses. Every quality of these new robots is a leap in the state-of-the-art, and every aspect that these robots will compete against each other on will push that state-of-the-art further. What's thrilling is that required innovation shows a clear path toward robots in the home.

Industrial robots have trended toward rigid joints, increased precision, increased speed, increased power, and increased specialization. Meanwhile, a robot that's safe, easily taught, and cheap, is the exact kind of robot that will eventually be useful in the home.

The robotics industry has been waiting for its "Homebrew Computer Club" moment, the robo-equivalent to when hobbyists could start building the computers they wanted, instead of just tinkering with corporate mainframes after hours.

In 2003, Pete Markiewicz, my favorite robo-futurist, argued that the homebrew moment for robotics, the equivalent of the integrated circuit that sparked the PC revolution — a commercially viable

THE ROBOTICS INDUSTRY HAS BEEN



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product, that can be repurposed by hobbyists in less-commercial pursuits — would be a "reliable, environmentally sensitive" robotic body. Well, that moment has arrived: Baxter is the robot body we've been waiting for, a robot that's safe for humans, and yet capable enough to do serious work. Rethink could be the Apple of robotics — in [The New York Times](http://www.nytimes.com/2012/09/18/science/a-robot-with-a-delicate-touch.html?pagewanted=all) (<http://www.nytimes.com/2012/09/18/science/a-robot-with-a-delicate-touch.html?pagewanted=all>), Tony Fadell is quoted saying that Baxter could be the "Macintosh moment for the robot world" — but an "Intel moment" or "Texas Instruments moment" would be just as thrilling, in my opinion.

Baxter is also built on top of the Willow Garage-developed [ROS](http://www.ros.org/wiki/) (<http://www.ros.org/wiki/>). It's an important moment for the Linux-based operating system, which is already hugely popular with hobbyists and researchers. Baxter represents the big commercial debut for ROS, and shows a path for ROS to become the "Android" of robots — an operating system with heavy corporate backing and development (Willow Garage is Google), but with the flexibility for manufacturers (Rethink is Samsung) of an open source, modifiable code base. Maybe 10 years from now we'll be complaining about Samsung or HTC's heavy ROS skinning. "BotSense," "BotWiz".

I was told that Willow Garage only got a last-minute heads up about Baxter from Rethink — a sign of how competitive and secretive this space has already become, but also a sign of how much freedom and maturity Willow Garage has built into ROS.

For now, the usage of ROS means Baxter is prime for tinkering. In fact, Willow Garage's standard platform for ROS development, the PR-2, offers similar mechanical dexterity to Baxter for roughly 10 times the price.

THE FEEDBACK LOOP IS DELIGHTFUL

better hobbyist hardware possible by shipping mechanical hands and arms at volume. And the feedback loop is delightful: the countless researchers building robotic hands right now in universities finally have a market for spinoff companies and a pressure to turn their ideas into products.

As the past decades of over-promise and start-stop in the robotics industry have proven, there is no sure thing in personal robotics. Even Rethink's Baxter could fall flat — it's promising a lot, and a \$22,000 under-deliverer won't bode well for the whole co-worker category.

Still, it's not much of a leap to imagine a robot that can identify, pick up, sort, and place objects in a factory being ready, in a few years, to do the same thing with your child's toys and your husband's laundry.

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[phoneface](#) says:

Paul

Posted on Sep 21, 2012 | 3:33 PM EDT (#116608351) via Android app

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[Chris Ziegler's](#) reply:

I dream of a brave future where comments on posts, even the very first ones, are relevant, intelligent, and add to the conversation.

That future is not today.

Posted on Sep 21, 2012 | 3:36 PM EDT (#116609081)

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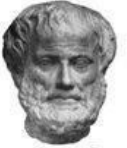
[Arkitekt's](#) reply:

It couldn't be any other way... by definition...

Posted on Sep 21, 2012 | 3:42 PM EDT (#116610219)

Reply (#)

[roy.sherfan's](#) reply:



Aristotle:
"What does it mean to be a good person?"



Descartes:
"What does it mean to be?"



Nietzsche:
"What does it mean?"



Bertrand Russell:
"What does 'it' mean?"



C.S. Lewis:
"What does it?"



Lil Jon:
"What?"

Posted on Sep 24, 2012 | 2:19 AM EDT (#117313625)

Reply (#)

[asperous's](#) reply:

?

Posted on Sep 24, 2012 | 3:03 AM EDT (#117315099)

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[vibrunazo's](#) reply:

Is there any way we can sort comments by rating here on this website? That would solve it, no?

Posted on Sep 24, 2012 | 6:50 AM EDT (#117318689)

Reply (#)

[jota 's](#) reply:

Paul

Posted on Sep 23, 2012 | 6:02 PM EDT (#117208105)

Reply (#)

[benrees21](#) says:

I was just about to add 'Pawl'. Thanks for this, good read. Bit pricey though lol.

Posted on Sep 21, 2012 | 3:38 PM EDT (#116609409) via Android app

Reply (#)

[Arkitekt](#) says:

22k for home hobbyism.

LOL

And no, this company won't be the "next Apple".

Posted on Sep 21, 2012 | 3:42 PM EDT (#116610159)

Reply (#)

[Arkitekt's](#) reply:

"Still, it's not much of a leap to imagine a robot that can identify, pick up, sort, and place objects in a factory being ready, in a few years, to do the same thing with your child's toys and your husband's laundry."

Well... let's all press the snooze button and wake up twenty years in the future when this actually happens....

Posted on Sep 21, 2012 | 3:44 PM EDT (#116610613)

[Reply \(#\)](#)

[Dthawks27](#) says:

Is this by chance, a pleasure bot? Has it been programmed to satisfy.... the urges of humans?

Posted on Sep 21, 2012 | 3:47 PM EDT (#116611035)

[Reply \(#\)](#)

[captain obvious's](#) reply:

Call me a innuendo Nazi, but I think you mean:
satisfy.... the urges.... of humans

Posted on Sep 21, 2012 | 4:51 PM EDT (#116622389)

[Reply \(#\)](#)

[dargast's](#) reply:

Are you trying to put all those hard-working hookers out of work?

That's unpatriotic.

Posted on Sep 22, 2012 | 7:30 PM EDT (#116863337)

[Reply \(#\)](#)

[nsolarz](#) says:

Just a correction: Heartland Robotics changed its name to Rethink Robotics, so the rumored upcoming Heartland robot is Baxter

Posted on Sep 21, 2012 | 3:52 PM EDT (#116612021)

[Reply \(#\)](#)

[eadnams](#) says:

For 22,000, that replaces a menial workers yearly salary... Not hard to "sell" that idea.

Posted on Sep 21, 2012 | 4:53 PM EDT (#116622659)

[Reply \(#\)](#)

[jhambi's](#) reply:

Yeah. I had seen a short blurb on this before, but it had not mentioned the price. 22k is really cheap if that thing is half as capable as they claim it to be. If it is reliable, this thing would pay for itself (over a minimum wage worker) fast.

Posted on Sep 23, 2012 | 4:05 PM EDT (#117142487)

[Reply \(#\)](#)

[andrew.cribb1](#) says:

It's Happening! Somebody, Quickly! Call Will Smith!!!!!!!!!!!!!!

Posted on Sep 21, 2012 | 8:43 PM EDT (#116658379)

[Reply \(#\)](#)

[iCello](#) says:

This is totally awesome.

Posted on Sep 22, 2012 | 11:54 AM EDT (#116735277)

[Reply \(#\)](#)

[lecti](#) says:

\$22k for two armed industrial robot sounds too cheap to be true. Am I missing something here?

Posted on Sep 22, 2012 | 6:55 PM EDT (#116853143) via iPhone app

[Reply \(#\)](#)

[wrr's](#) reply:

well at glace seem baxter is slower and less capable than big bother counterpart

Posted on Sep 23, 2012 | 2:36 PM EDT (#117083153)

[Reply \(#\)](#)

[c2u](#) says:

1:22 in the video is an amazing picture. The look on the robots face, the look of disdain at its supervisor.

Posted on Sep 22, 2012 | 10:00 PM EDT (#116919189)

[Reply \(#\)](#)

[Francisco.G's](#) reply:

"It has a soul".

Posted on Sep 23, 2012 | 7:59 PM EDT (#117247709)

Reply (#)

[DarkOwl](#) says:

Can I go outside, Gerty?

Posted on Sep 23, 2012 | 8:28 AM EDT (#116998191)

Reply (#)

[Fakejoshuatopolsky](#) says:

Great to see Paul doing something other then offline.....well of course I ordered him too.

Posted on Sep 23, 2012 | 9:05 AM EDT (#116999975)

Reply (#)

[lecti](#) says:

22k is pretty damn close to being within reach of private owners. If it can do something that is genuinely useful (save or make money), I'd buy it.

Posted on Sep 23, 2012 | 9:44 AM EDT (#117002913) via iPhone app

Reply (#)

[Sumit8](#) says:

i stopped reading at "Apple of Robotics"...

Posted on Sep 23, 2012 | 11:30 AM EDT (#117014895)

Reply (#)

[bliss88](#) says:

Baxter's movements seem very imprecise, juddery and slow.
Not sure why you would want a 'mechanical dork' on a production line.

Posted on Sep 23, 2012 | 11:41 AM EDT (#117016173)

Reply (#)

[Killing Time](#) says:

where can i get this awesome soundtrack?

Posted on Sep 23, 2012 | 11:49 AM EDT (#117017393)

Reply (#)

[benkim](#) says:

This is the next next revolution. The next one will be battery and power technology. Why don't you guys talk about battery and portable power technology? This is where innovation needs to happen. No home grown robots that need to be plugged in.

Posted on Sep 23, 2012 | 12:23 PM EDT (#117022129) via iPhone app

Reply (#)

[catonkatonk](#) says:

Can we get an expose on Paul's potato farming claims? I don't buy it.

Posted on Sep 23, 2012 | 2:56 PM EDT (#117094591)

Reply (#)

[desa0510](#) says:

oh my god we are doom

Posted on Sep 23, 2012 | 3:00 PM EDT (#117096637)

Reply (#)

[kimeichtry](#) says:

Tge co working concept is really cool, i would love to see some more in depth demos of how tge robot is actually taught. As someone wo has programmed industrial robots, I'm not entirely convinced it would be as simple as they make it sound. I would love to be proven wrong though. Funny story, i bought the domain [www.RethinkRobotics.com \(http://www.RethinkRobotics.com\)](http://www.RethinkRobotics.com) a few years back to use with a few engineering friends of mine as our company name for a small robotic arm kit startup. It never really went anywhere and about six months ago these guys approached me wanting to buy my domain. I got \$1500 for it which was a nice bit of unexpected income. I checked their site a couple weeks back and saw what they were up to. Pretty cool stuff, probably could have held out for quite a bit more money. Oh well, in the other hand they might have just bought [www.rethink-robotics \(http://www.rethink-robotics\)](http://www.rethink-robotics) instead. Anyway, im excited to see what the do in the future and excited to hear they are using Ros. Its a great platform and will only get better with high end contributors / users like them.

Posted on Sep 23, 2012 | 3:15 PM EDT (#117105843) via Android app

Reply (#)

[Francisco.G's](#) reply:

Since they're the "apple" of robotics, I kinda feel you will be regretting selling it for 1500\$ in a decade or two... just saying!

Posted on Sep 23, 2012 | 8:01 PM EDT (#117248089)

Reply (#)

[kjmeichtry's](#) reply:

Haha, ya. I should have asked for 1 share in the company. Can you imagine what one share in apple at its founding would be worth today? FacePalm haha

Posted on Sep 23, 2012 | 10:31 PM EDT (#117284741) via Android app

Reply (#)

[bliss88's](#) reply:

\$693.00

Posted on Sep 24, 2012 | 10:22 AM EDT (#117332151)

Reply (#)

[mcleodglen](#) says:

Reminds me of Roooooomba!

Posted on Sep 23, 2012 | 5:09 PM EDT (#117184469)

Reply (#)

[savin.wangtal](#) says:

Marked to be read later.

Personally, I think technologies like this are..too expensive to be worth it. It's also a little bit too complex for what it needs to do.

I want robots around my house to do chores, not creative stuff. And I have a plan..(will take a long while to build, but oh, it is coming y'all) I'm going for RFID tags EVERYWHERE. Screw visual recognition—that takes good CPUs, and a huge(ish) battery pack. I'm going to have them tags built into dime-size plastic piece, and place them along the floors, the walls, and into important objects around the house. The robots can then identify where it is, and objects it need to interact with that way. Then instead of crazy AI algorithm, I'm going for a "program through movement" approach. Use a few sensors, have the robots memorize the actions that I do to it, action figure style. After that, all it has to do is repeat that movement for that particular task.

Easy, user friendly, programmable. Sure, it won't be able to accomplish harder tasks—but that's what humans are for.

Posted on Sep 23, 2012 | 8:35 PM EDT (#117256367)

Reply (#)

[jonmilani](#) says:

Posted on Sep 23, 2012 | 11:45 PM EDT (#117299423)

Reply (#)

[darryl.vanhorne.18](#) says:

Its time..

<http://i2.listal.com/image/146804/936full-runaway-poster.jpg> (<http://i2.listal.com/image/146804/936full-runaway-poster.jpg>)

Posted on Sep 24, 2012 | 9:04 AM EDT (#117323851)

Reply (#)

[darryl.vanhorne.18](#) says:

Its Time



Posted on Sep 24, 2012 | 9:05 AM EDT (#117323897)

Reply (#)

[willwillywilson](#) says:

You see, killbots have a preset kill limit. Knowing their weakness, I sent wave after wave of my own men at them until they reached their limit and shut down.



Posted on Sep 24, 2012 | 9:42 AM EDT (#117327095)

Reply (#)