Amazon Is Quietly Building the Robots of Sci-Fi—Piece by Practical Piece

By **Thomas Hornigold** - Oct 29, 2017

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Science fiction is the siren song of hard science. How many innocent young students have been lured into complex, abstract science, technology, engineering, or mathematics because of a reckless and irresponsible exposure to Arthur C. Clarke at a tender age? Yet Arthur C. Clarke has a very famous quote: "Any sufficiently advanced technology is indistinguishable from magic."

It's the prospect of making that… ahem… magic leap that entices so many people into STEM in the first place. A magic leap that would change the world. How about, for example, having humanoid robots? They could match us in dexterity and speed, perceive the world around them as we do, and be programmed to do, well, more or less anything we can do.

Such a technology would change the world forever.

But how will it arrive? While true sci-fi robots won't get here right away—the pieces are coming together, and the company best developing them at the moment is Amazon. Where others have struggled to succeed, Amazon has been quietly progressing. Notably, Amazon has more than just a dream, it has the most practical of reasons driving it into robotics.

This practicality matters. Technological development rarely proceeds by magic; it's a process filled with twists, turns, dead-ends, and financial constraints. New technologies often have to answer questions like "What is this good for, are you being realistic?" A good strategy, then, can be to build something more limited than your initial ambition, but useful for a niche market. That way, you can produce a prototype, have a reasonable business plan, and turn a profit within a decade. You might call these "stepping stone" applications that allow for new technologies to be developed in an economically viable way.

You need something you can sell to someone, soon: that's how you get investment in your idea. It's this model that iRobot, developers of the Roomba, used: migrating from military prototypes to robotic vacuum cleaners to become the "boring, successful robot company." Compare this to Willow Garage, a genius factory if ever there was one: they clearly had ambitions towards a general-purpose, multi-functional robot. They built an impressive device—PR2—and programmed the operating system, ROS, that is still the industry and academic standard to this day.

But since they were unable to sell their robot for much less than $250,000, it was

never likely to be a profitable business. This is why Willow Garage is no more, and many workers at the company went into telepresence robotics. Telepresence is essentially videoconferencing with a fancy robot attached to move the camera around. It uses some of the same software (for example, navigation and mapping) without requiring you to solve difficult problems of full autonomy for the robot, or manipulating its environment. It's certainly one of the stepping-stone areas that various companies are investigating.

Another approach is to go to the people with very high research budgets: the military.

This was the Boston Dynamics approach, and their incredible achievements in bipedal locomotion saw them getting snapped up by Google. There was a great deal of excitement and speculation about Google's "nightmare factory" whenever a new slick video of a futuristic militarized robot surfaced. But Google broadly backed away from Replicant, their robotics program, and Boston Dynamics was sold. This was partly due to PR concerns over the Terminator-esque designs, but partly because they didn't see the robotics division turning a profit. They hadn't found their stepping stones.

This is where Amazon comes in. Why Amazon? First off, they just announced that their profits are up by 30 percent, and yet the company is well-known for their constantly-moving Day One philosophy where a great deal of the profits are reinvested back into the business. But lots of companies have ambition.

One thing Amazon has that few other corporations have, as well as big financial resources, is viable stepping stones for developing the technologies needed for this sort of robotics to become a reality. They already employ 100,000 robots: these are of the "pragmatic, boring, useful" kind that we've profiled, which move around the shelves in warehouses. These robots are allowing Amazon to develop localization and mapping software for robots that can autonomously navigate in the simple warehouse environment.

But their ambitions don't end there. The Amazon Robotics Challenge is a multi-million dollar competition, open to university teams, to produce a robot that can pick and package items in warehouses. The problem of grasping and manipulating a range of objects is not a solved one in robotics, so this work is still done by humans—yet it's absolutely fundamental for any sci-fi dream robot.

Google, for example, attempted to solve this problem by hooking up 14 robot hands to machine learning algorithms and having them grasp thousands of objects. Although results were promising, the 10 to 20 percent failure rate for grasps is too high for warehouse use. This is a perfect stepping stone for Amazon; should they crack the problem, they will likely save millions in logistics.

Another area where humanoid robotics—especially bipedal locomotion, or walking, has been seriously suggested—is in the last mile delivery problem. Amazon has shown willingness to be creative in this department with their notorious drone delivery service. In other words, it's all very well to have your self-driving car or van deliver packages to people's doors, but who puts the package on the doorstep? It's difficult for wheeled robots to navigate the full range of built environments that exist. That's why bipedal robots like CASSIE, developed by Oregon State, may one day be used to deliver parcels.

Again: no one more than Amazon stands to profit from cracking this technology. The line from robotics research to profit is very clear.

So, perhaps one day Amazon will have robots that can move around and manipulate their environments. But they're also working on intelligence that will guide those

The Alexa Prize, another multi-million-dollar competition, is attempting to make Alexa more social.

To develop a conversational AI, at least using the current methods of machine learning, you need data on tens of millions of conversations. You need to understand how people will try to interact with the AI. Amazon has access to this in Alexa, and they're using it. As owners of the leading voice-activated personal assistant, they have an ecosystem of developers creating apps for Alexa. It will be integrated with the smart home and the Internet of Things. It is a very marketable product, a stepping stone for robot intelligence.

What's more, the company can benefit from its huge sales infrastructure. For Amazon, having an AI in your home is ideal, because it can persuade you to buy more products through its website. Unlike companies like Google, Amazon has an easy way to make a direct profit from IoT devices, which could fuel funding.

For a humanoid robot to be truly useful, though, it will need vision and intelligence. It will have to understand and interpret its environment, and react accordingly. The way humans learn about our environment is by getting out and seeing it. This is something that, for example, an Alexa coupled to smart glasses would be very capable of doing. There are rumors that Alexa's AI will soon be used in security cameras, which is an ideal stepping stone task to train an AI to process images from its environment, truly perceiving the world and any threats it might contain.

It's a slight exaggeration to say that Amazon is in the process of building a secret robot army. The gulf between our sci-fi vision of robots that can intelligently serve us, rather than mindlessly assemble cars, is still vast. But in quietly assembling many of the technologies needed for intelligent, multi-purpose robotics—and with the unique stepping stones they have along the way—Amazon might just be poised to leap that gulf. As if by magic.

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