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## Baxter the Unconventional Robot

Baxter the robot (Photo 1) would probably look out of place on the factory floor of an automated manufacturing facility. If you haven't had the opportunity to watch a group of industrial robots building something, you can see them on YouTube. At [www.youtube.com/watch?v=82w\\_r2D1Ooo](http://www.youtube.com/watch?v=82w_r2D1Ooo), you will see an industrial robot environment that looks like an outtake from the movie *Terminator*. The robots in the video are building Toyota hybrid vehicles. When these robots are at work, the physical environment of the shop floor is not people friendly.

Baxter is a new type of robot that has been designed to work in a people-centric environment. With its toy-like features and bright plastic parts, this robot doesn't, at first glance, appear to be a game changer to the current manufacturing scene. But the developers of Baxter expect it to play a significant role in small manufacturing companies.

To see Baxter's potential, you need to know a little about the man behind the machine. Rodney Brooks created Rethink Robotics to turn his new dream of a people-friendly robot into a reality. Before this endeavor, he founded iRobot to turn his earlier dreams into consumer robotic autonomous cleaning machines, military Warrior Bots, and rescue robots.

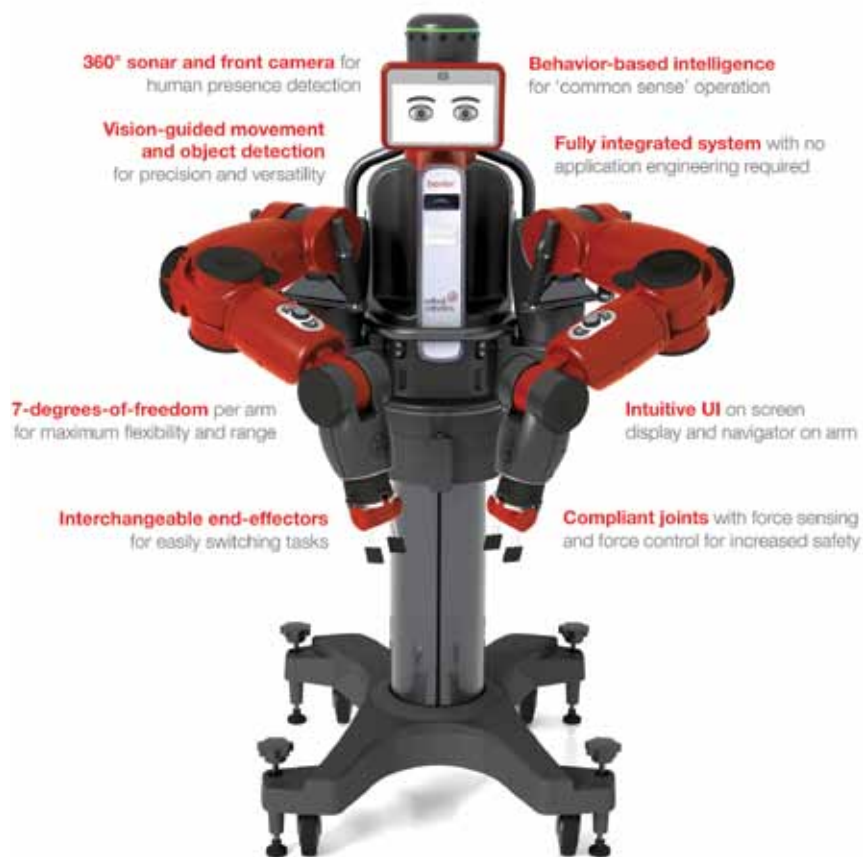
Brooks is the former director of the MIT (Massachusetts Institute of Technology) Artificial Intelligence Laboratory and the world's go-to guy for artificial intelligence, computer vision, robotics, and research into the development of artificial life forms.

Baxter is an unconventional robot. A small firm can purchase a Baxter for \$22,000. Once it is

plugged into an electrical wall outlet, it is ready to go to work and earn its keep. Out of its shipping container, it will be ready to multi-task and adapt to different working conditions. At 165 pounds, Baxter

manipulate its arms and grippers into position to pick up and move objects. (See Photo 2.) Baxter actually has the same flexibility that a real person has from their hips up. Finally—and perhaps what makes it most different from other robots—Baxter can be taught what to do by a person who knows nothing about computer programming.

Before a robot can perform a task, it needs to be programmed. Baxter the unconventional robot writes its own programming code. When a person takes hold of Bax-



**Photo 1—Baxter the robot is about the same size and weight as an average man. It is designed to work next to people in a small-manufacturing setting.**

is also light enough to be physically lifted if its future work station is too tight for it to be rolled in.

Baxter has been designed to instantly stop if its body parts come into contact with an object in its path, so it won't hurt human workers if they accidentally move into its working zone. Baxter's two arms can perform different operations at the same time. It can use its robotic sight to physically bend and

ter's wrist, the robot turns its screen toward him or her and puts on a serious-looking face. This shows its instructor that it is ready to write its own program.

The teaching process requires the instructor to move Baxter's arms and grippers through each physical movement. All programming communication is completed using the two buttons and one turn knob on Baxter's arms. They en-

Photos: Rethink Robotics

**Photo 2—Baxter’s outer shell is made of plastic. It uses its robotic vision to physically coordinate the movement of its arms and grippers so objects that it picks up and moves don’t have to be at an exact location at an exact moment in time.**



at [www.youtube.com/watch?feature=endscreen&v=xojASY5VSIY&NR=1](http://www.youtube.com/watch?feature=endscreen&v=xojASY5VSIY&NR=1).

**Recalling the Facts**

1. What new hardware and software would Baxter need to function as a waiter?
2. If Baxter’s evolution follows the same path as computers, what new capabilities do you think future Baxter-type robots will have in the year 2020 and the year 2050? ©

able its instructor to engage screen menus and Baxter’s vision, and to specify the starting point and ending points of each operation. (See Photo 3.)

What makes Baxter truly intriguing is the fact that it will allow its software to be upgraded once it leaves its place of birth, the Rethink Robotics manufacturing facility. When Baxter is not performing tasks, it goes into a diagnostic mode to see if it is functioning properly and also to download software updates and/or new software.

The creators of this robot also intend to produce new physical robotic parts that will further enhance Baxter’s ability to move and perform new tasks. Over time, Baxter might develop artificial intelligence and take on major roles in areas of technology that are far afield of manufacturing.

A Rethink Robotics store is in the planning stages. It will provide an opportunity for outsiders to develop apps for Baxter to run. Soon robotists from around the world will be able to enhance what Baxter can do. Just as you can download apps for your smartphone, Baxter will be able to download apps that increase its functionality. The Rethink Robotics goal is to eventually allow anyone with programming skill to write apps that will enhance Baxter’s capabilities.

You can see how Baxter works

*Alan Pierce, Ed.D., CSIT, is a technology education consultant. Visit [www.technologytoday.us](http://www.technologytoday.us) for past columns and teacher resources.*



**Photo 3—To program Baxter, an instructor grasps its wrist then moves Baxter’s arms and grippers through each movement. Programming is completed using two buttons and one turn knob on Baxter’s arms.**

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