1

preparing your EV3 set

All of the robots in this book can be built with one *LEGO MINDSTORMS EV3* set (LEGO catalog #31313). If you have this set, shown in Figure 1-1, you're good to go. If you have the LEGO MINDSTORMS EV3 Education Core set (#45544), visit *http://ev3.robotsquare.com/* for a list of pieces you'll need to complete the projects in this book.

In this chapter, you'll learn about the EV3 brick and the other elements in the EV3 set. You'll also download and install the software that you need to program your robots.

what's in the box?

The LEGO MINDSTORMS EV3 set comes with a lot of Technic building pieces as well as electronic components, including motors, sensors, the EV3 brick, a remote control, and cables (see Figure 1-2). You'll learn to use each of these components as you read this book. In addition, the inside back cover contains a complete parts list.

EV3 robots use large- or medium-sized *motors* to power their wheels, arms, or other moving parts. They use *sensors* to take input from their surroundings, such as the color of a surface or the approximate distance to an object. *Cables* connect the motors and sensors to the EV3 brick. The *infrared remote control*—or simply, the *remote*—can be used to move and steer a robot remotely.

the EV3 brick

The *EV3 brick*, or simply the EV3, is a small computer that controls a robot's motors and sensors, enabling the robot to move around by itself. For example, you'll soon build a robot that automatically moves away from an object in its path. When a sensor tells the EV3 that an object is nearby, the EV3 triggers the motors to drive the robot away.

Figure 1-1: The LEGO MINDSTORMS EV3 set (#31313) contains all of the elements necessary to build the robots in this book.

Your robot is able to perform these actions due to the use of a *program*—a list of actions that the robot will perform, usually one at a time. You'll create programs on a computer with the LEGO MINDSTORMS EV3 programming software. Once you've finished creating a program, you'll send it to your EV3 brick with the USB cable that comes with the set, and your robot should be ready to do what it's now programmed to do.
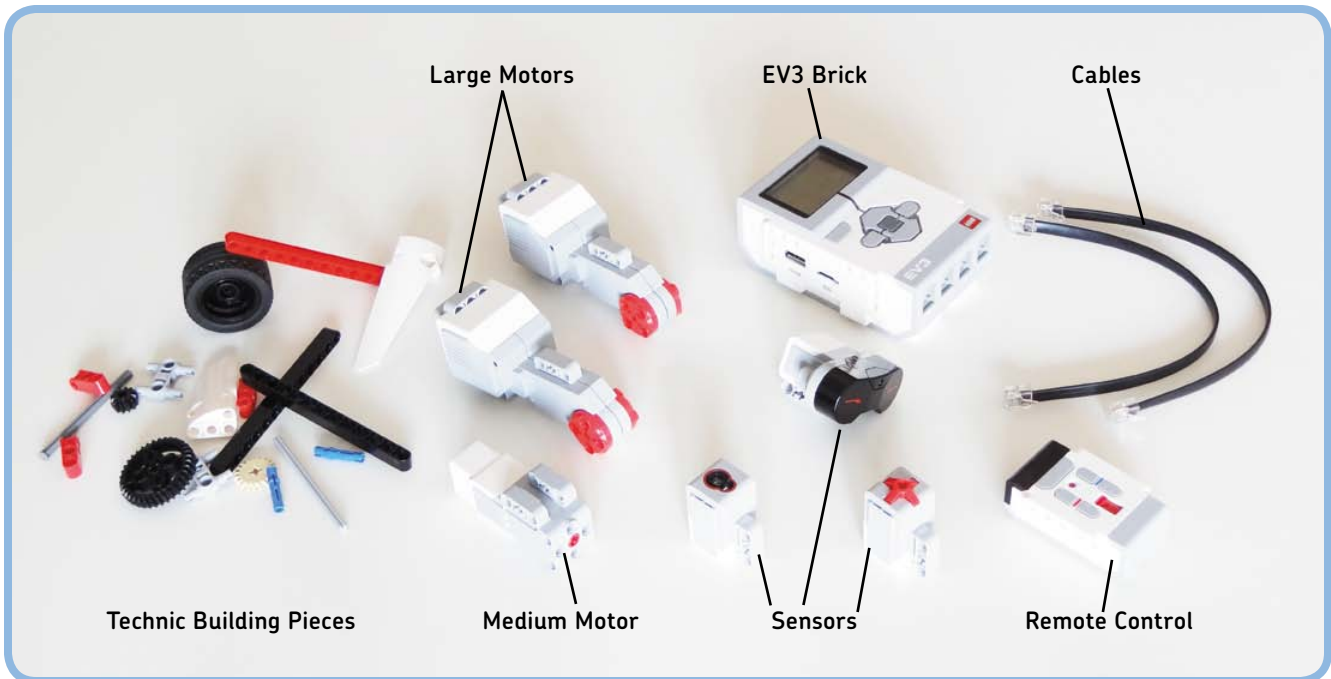
Figure 1-2: The EV3 set contains Technic building pieces, motors, sensors, the EV3 brick, a remote control, and cables.

To power your *EV3*, either insert six AA batteries (as shown in Figure 1-3) or use the LEGO EV3 rechargeable battery (#45501) and charger (#8887). The shape of the rechargeable battery pack makes your EV3 a bit bigger. While the robots in this book will work with this battery, the rechargeable battery won't fit in the TRACK3R robot featured on the LEGO MINDSTORMS EV3 packaging, unless you modify it slightly to make space.

To power the infrared remote control, insert two AAA batteries.

Figure 1-3: You can power the EV3 brick with six AA batteries or with the EV3 rechargeable battery.

sorting Technic elements

To save time when searching for LEGO Technic elements, consider sorting and storing your elements in an organizer like the one shown in Figure 1-4. Doing so will make it easier to build the models in this book and, later on, to design your own robots. You'll be able to see at a glance when a specific element runs out, so you won't have to waste time looking for pieces you don't have.

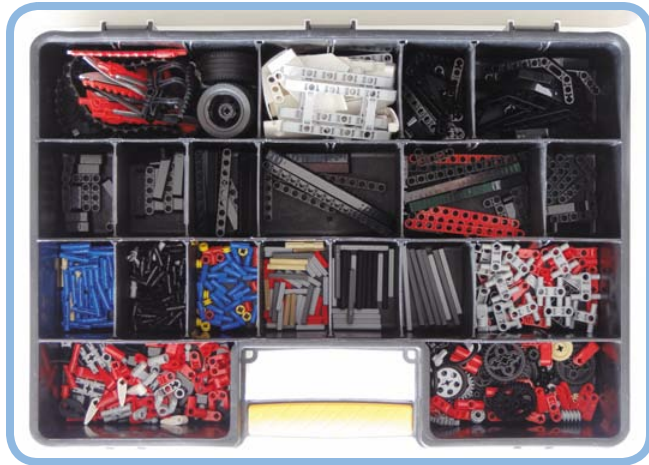When sorting elements, it's best to do so by function. For example, separate beams from gears, axles, and so on. If you don't have enough bins for each type of element, store easily distinguishable items together. For example, store short grey axles with short red axles instead of mixing grey axles of various lengths.

The EV3 set comes with a set of stickers, one for each white "panel" element. Add all the stickers to the panels now, as shown in Figure 1-5; the sticker patterns will help you determine which sort of panel (large or small) to use later in this book.

the mission pad

The EV3 packaging includes a *mission pad* on the inside of the sleeve around the box, as shown in Figure 1-6. You can program your robots to interact with this pad by, for example,

Figure 1-4: Example of an organizer containing the Technic elements in one EV3 set
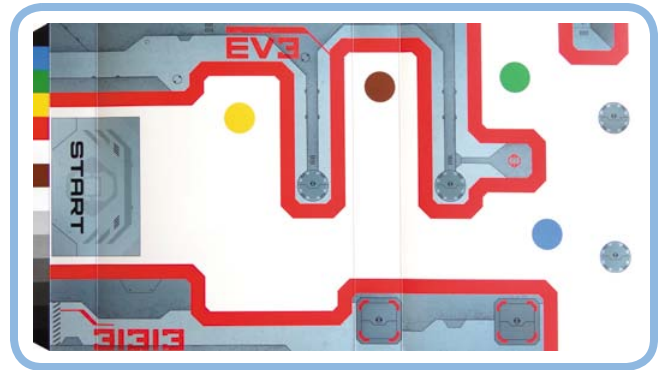

Figure 1-6: The mission pad. You'll find the pad by carefully cutting the sleeve around the EV3 packaging (look for a dashed line and a symbol of a pair of scissors).

Figure 1-5: To add the stickers to the panels neatly, first connect complementary panel elements using two black pins, making it easier to align the stickers, and then remove the pins when you're done.

following the thick red line (see Chapter 7). For the activities in this book, you can go to *http://ev3.robotsquare.com/* to download and print your own track for the robot to follow.

controlling your robot

The EV3 set allows you to control your robot in many different ways, as shown in Figure 1-7. In this book, you'll learn how to write programs that make your robot do certain things automatically using the EV3 programming software, but you'll also learn to control your robots with a remote. You can steer and send commands to your robots with the infrared remote that comes with the set or download apps that let you use a smartphone or tablet as a remote control. These apps will allow you to control the motors and sensors on your robot and even create a customized remote. (See *http://ev3.robotsquare.com/* for an updated list of apps.)

downloading and installing the EV3 programming software

Before you can start writing programs for your robots, you need to download and install the EV3 programming software. An Internet connection is required in order to complete the following steps.

(If the computer you'll use for programming is not connected to the Internet, follow steps 1 and 2 on a computer with Internet access and download the installation file to a USB stick that is at least 1GB in size. Next, copy the file from the stick to your other computer and proceed with step 3.)
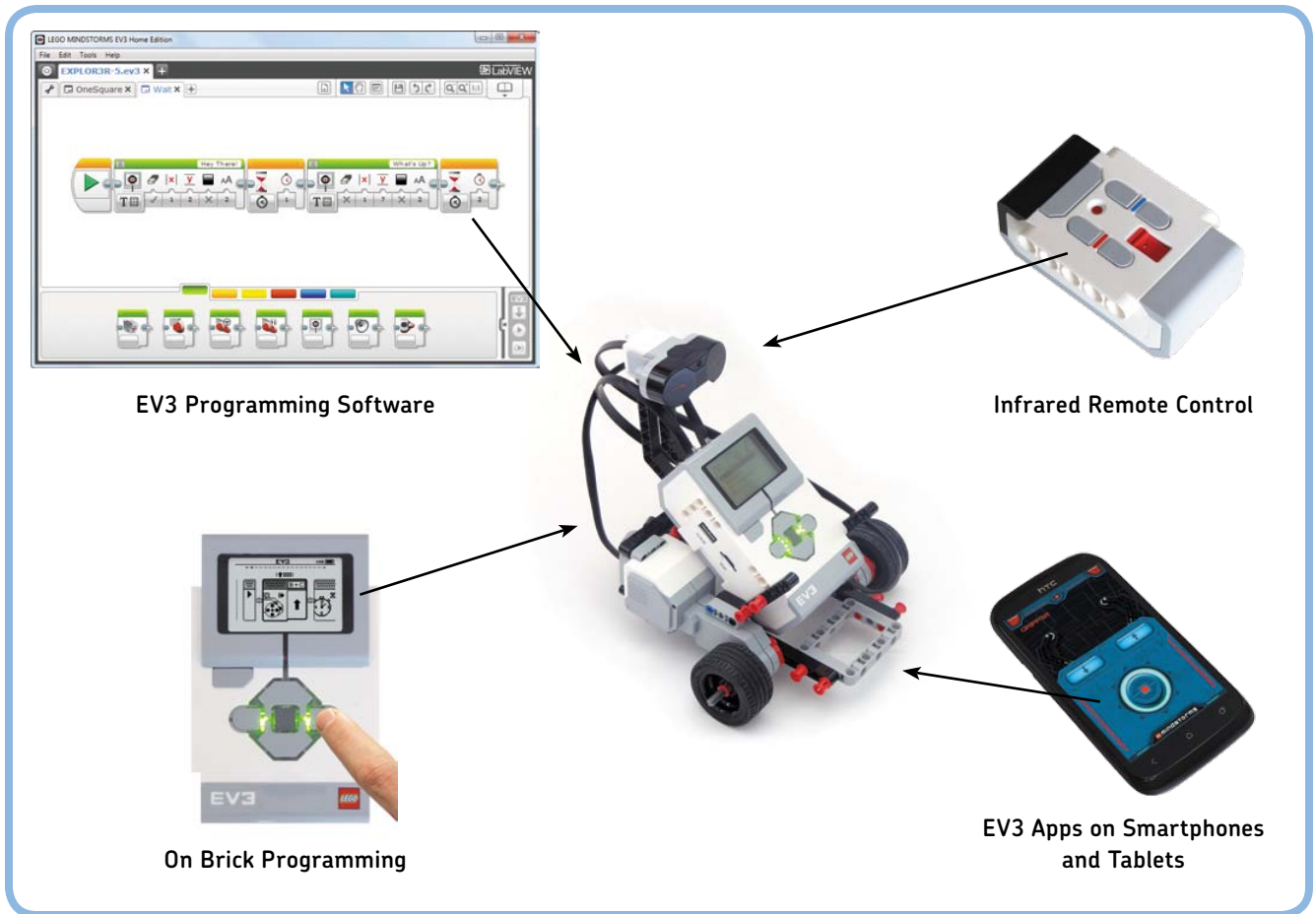

EV3 Programming Software

Infrared Remote Control

On Brick Programming

EV3 Apps on Smartphones and Tablets

Figure 1-7: You can create programs to make your robot move around automatically, or you can control it with a remote.

1. Go to *http://LEGO.com/ MINDSTORMS/*, click **Down-loads**, select **EV3 Software**, and click **Download** (see Figure 1-8).

2. On the next page, select your operating system and preferred language (see Figure 1-9). You can select any language you like, but this book will use the US English version. For Windows XP, Vista, Windows 7, and Windows 8, choose **Win32** and then click the file ending in *.exe*. For Mac OS 10.6 and higher, choose **OSX** and then click the file ending in *.dmg*. A new page should appear with a download button. Click this button and save the file to your computer when asked.

NOTE If your download is taking a long time (the file is about 600MB), you can skip to Chapter 2 and start building! Just return here when the download is complete.

3. On Windows, double-click the file you've just downloaded and install the software according to the instructions shown on the screen (see Figure 1-10).

    On a Mac, double-click the *.dmg* file you've downloaded and then double-click the package that appears. Follow the onscreen instructions to install the software.

4. Once the installation is complete (and you've restarted your computer when prompted), you should find a shortcut labeled *LEGO MINDSTORMS EV3 Home Edition* on your desktop. Double-click it to launch the software (no Internet access is required from now on).

Figure 1-8: The download page on the LEGO MINDSTORMS EV3 website. Here, you can also download additional content, such as a user guide or additional programming blocks.
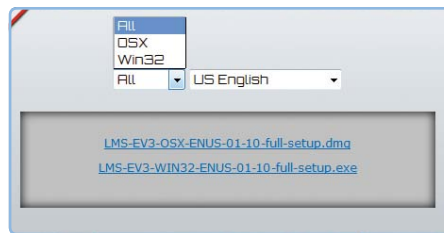

Figure 1-9: Selecting the operating system and language. The 01-10 in the filenames indicates that this is version 1.10. When you download the software, choose the newest version available.
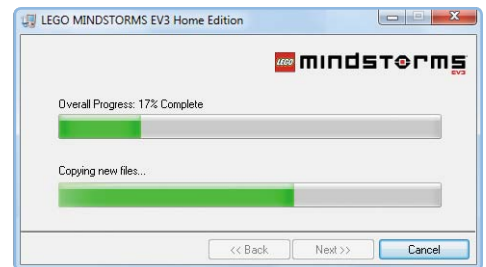

Figure 1-10: Installation in progress. Launch the installer by double-clicking the installation file that you've downloaded.

NOTE To update the software to a newer version, simply download the latest software and install it using the same steps. You do *not* need to uninstall the current version first.

conclusion

Now that you have everything you need to build and program a working robot, it's time to start building one. In Chapter 2, you'll learn more about the EV3 brick, motors, and the remote control as you build your first robot.