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Host: Welcome to “Science Today.” My guest is Daniela Karpov, who is an expert on robots. Welcome.

Robot expert Daniela Karpov: Good to be here.

Host: I’m sure you hear this often: When we talk about robots in the workplace, people worry, “Am I going to lose my job? Will I be replaced by a robot?”

Karpov: Yes, I do hear that often.

Host: Is that a real concern?

Karpov: Actually, there are very few jobs that can be completely replaced by a robot. We estimate that less than 5 percent of jobs can be entirely replaced by a robot or machine.

Host: Really? Only 5 percent?

Karpov: Yes. But in many jobs, there are some parts of the work that could be replaced. We think that about 30 percent of the work in most jobs can be done by machines.

Host: What do you mean?

Karpov: Think of a chef in a restaurant, for example. There are some types of work that a machine could do much more quickly and efficiently. For example, chopping or mixing food. A machine—a robot—can do that very quickly.

Host: Right.

Karpov: But on the other hand, there are other types of work that a machine cannot do. Specifically, work that involves understanding people’s feelings, or work that requires creativity. For example, a chef has to understand what type of food the customers want. And the chef has to create new, interesting dishes that they’ll enjoy. That type of work is still very, very difficult for a robot to do.

Host: So interesting. Though, I’ve eaten at some restaurants where the food tasted like it was made by a robot ...

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Speaker: One place we find robots is in education. Now, I’m not talking about robot-teachers. We don’t have those just yet! But many schools have robotics clubs that build robots to enter in robotics competitions with other schools. There are robotics competitions for students of all ages, from primary school to university. For instance, the Junior First Lego League competition is for students as young as six years old! And each competition focuses on a specific task. For example, some competitions are for robots that can move around on land. Others are for aerial robots—that is, robots that can fly through

the air. Many schools use robotics programs to motivate students. In other words, educators hope that by building robots, students will be excited about studying math and science.

WATCH the lecture page 56

Professor Nancy Lee: E01 Robots—they once seemed like science fiction, but today robots are part of everyday life. So what do we use robots for? To answer this, we’ll look at examples of where robots are used today and the tasks that they’re performing. **E02** But first, I’d like to review a basic definition of “robot.” A robot is a machine, a mechanism that can move automatically, by itself. Some of the first robots in the early 1900s were controlled by radio signals. Since the 1940s, scientists have made robots that can be programmed—that can be controlled by a computer “brain.” **E03** So, robots are programmable: They’re controlled by computers. And all robots must do two things: First, they must obtain information from their environment. That means robots need to have at least one “sense”—in other words, they can see, feel, hear, or even smell or taste things. For example, researchers in Mexico developed “Gasbot” robots to detect gas leaks that humans can’t smell. And researchers in Denmark developed “biosensor” robots that can taste food better than any food critic. **E04** And second, robots must do something with that information—they must perform a task. For example, in an automobile factory, a robot might be programmed to “see” a car part in front of it. And then pick up that part and connect it to another part of the car. A robot in a food processing plant might be programmed to look for dirty surfaces and then clean them. **E05** Increasingly, robots are performing a lot of work that people used to do. Most of that work is what we call “the four Ds”—dull, difficult, dirty, and dangerous. In other words, robots do work that people can’t do, because it’s too dangerous or difficult—or don’t want to do, because it’s dirty or dull. **E06** One very important way that we utilize robots today is in industry, mostly in factories. In fact, almost 90 percent of the robots in use today are in factories. Now, robots are very useful in factories because they can do work that is very dull—very boring—or work that is difficult for humans because of its repetitive nature. That is, they can perform the same task again and again and again—without getting bored or tired. For example, in a chocolate factory, a mechanical arm can pick up chocolates and put them into boxes 20,000 times in one eight-hour workday. Twenty thousand times! It’s impossible for a person to do a task like this as efficiently as a robot. **E07** Robots also perform work that is too dirty or too dangerous for

humans. For example, the police and military use robots with cameras to enter dangerous areas to look for criminals. These robots may go inside a vacant building or along a dark street and take pictures or audio or video, which they send to police waiting in a safe area. Officials also use robots to find and destroy bombs or other weapons. Robots can even help clean up nuclear waste or search for and rescue people from earthquakes, fires, or accidents. **E08** Robots are also utilized in exploration. Robots can explore and get information from places that are dangerous or difficult—often impossible—for people to visit. For example, robots can explore volcanoes where it’s very hot—people obviously can’t go into a volcano! And robots are also very important for exploring other planets, like Mars. The US Space Program often sends small robots, called rovers, to explore other planets. Exploration robots like these take pictures and gather information so that we can learn about these places without actually going there. **E09** Another common use of robots is as medical assistants. For example, robots sometimes perform surgeries that are very difficult, or, again, impossible, for doctors to perform. These surgical robots have a camera that can “see” inside a patient’s body, and mechanical parts that can perform the surgery. A doctor controls the robot from a computer, but the robot does the work! These surgical robots can perform surgeries more easily and more carefully than a human can. **E10** Scientists are also developing robotic body parts for people who have lost their arms, legs, or feet because of sickness or injury. These robotic body parts can be attached to a person’s body and controlled by the person’s mind. For example, a person with a robotic hand can use their mind to tell the hand to move or pick things up. Pretty cool, huh? **E11** Personal robots are also becoming popular. For instance, many people use robots to vacuum their homes. Or buy robotic toys just to play with. Or as pets—a pet robot instead of a cat or a dog. Today, almost 4 million personal robots are used all over the world. And we can expect that number to increase as scientists develop robots that can drive our cars for us, do our housework, or take care of us when we are sick or old. Or just be our friends. **E12** So, you can see there are many ways that robots can benefit humans—at work, and in our everyday lives. But one important question on many people’s minds is: What are the dangers of robots? For example: Will robots take away all of our jobs? And as robots start to learn and think, will they also start to control us? I’ll leave you with that thought. Next time, we’ll talk more about the benefits and dangers of living with robots.

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- 1 But first, I’d like to review a basic definition of “robot.”
- 2 So, robots are programmable: They’re controlled by computers.

- 3 For example, researchers in Mexico developed “Gasbot” robots to detect gas leaks that humans can’t smell.
- 4 In other words, robots do work that people can’t do, because it’s too dangerous or difficult—or don’t want to do, because it’s dirty or dull.
- 5 It’s impossible for a person to do a task like this as efficiently as a robot.
- 6 Robots also perform work that is too dirty or too dangerous for humans
- 7 Robots can explore volcanoes where it’s very hot
- 8 People obviously can’t go into a volcano!
- 9 I’ll leave you with that thought.
- 10 Next time, we’ll talk more about the benefits and dangers of living with robots.

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Kenzie: So, can we review the definition of a robot? Shelley, can you start?

Shelley: Well, there are different kinds of robots, right? Like robots in factories.

Ben: Right. But what makes something a robot? You know? Like, it has to be controlled by a computer. Do we all agree?

Hugh: Yes. And can I add something? Another point from the lecture is that a robot must have at least one “sense”—you know, like it can touch or see or hear.

Ben: Right, like I thought it was really interesting how some robots can even “taste.”

Kenzie: OK. Anything else? Shelley?

Shelley: Hm, I wrote that robots have to do a job, like, pick up a part and connect it to something.

Ben: Right. Perform a task.

Shelley: Dask? What’s that?

Hugh: Task. You know, t-a-s-k. Like a job.

Shelley: Right. Thanks.

Kenzie: Great. Well, that’s our basic definition: a machine that’s controlled by a computer, obtains information, and performs a task. Do you want to move on to medical robots?

Ben: Well, I think using robots for things like surgery is actually a great idea—’cause robots can be a little more careful than human doctors.

Hugh: Yeah, I’m with you. But I hope robots don’t replace humans. Can you imagine?

Shelley: No. I don’t want that.

Kenzie: Hey guys, maybe we can stop for now? This was great, thanks, but I gotta go.

Shelley, Ben, Hugh: OK. Sure.

Kenzie: Talk to you later.

Shelley, Ben, Hugh: OK. Bye. See you. Bye.