

# TRAINING GROUND



POKESTUDIO (ILLUSTRATION)

MINECRAFT (ALL PHOTOS)

## How the world of *Minecraft* is helping researchers create smarter computers

AS YOU READ, THINK ABOUT which functions of the human mind machines might have the hardest time replicating.

**EVERY MONTH, 91 MILLION** people around the world sit down at computers and video game consoles to play *Minecraft*. There's no pre-defined goal to the game or levels to beat. Its popularity lies in the fact that players can create almost anything imaginable using blocks of materials, like brick, wood, steel, glass, and wool. They can construct an Eiffel Tower, a space shuttle, or even an entire city. Players navigate their characters through *Minecraft*'s virtual 3-D world as they build. Along the way, they encounter a variety of objects, creatures, and other players—one of which might soon be an *artificial intelligence*, or AI.

An AI is a computer system capable of performing tasks normally associated with the human mind, like understanding language, making decisions, and solving problems. Even if you haven't met an AI in *Minecraft* yet, you may have interacted with one elsewhere, perhaps without realizing it. Self-driving cars rely on intelligent software to navigate without a driver's

input. Smart thermostats use AI to detect when people are home or away and adjust temperatures to keep residents comfortable while saving energy. Electronic AI assistants like Siri and Alexa respond to voice commands to find information, play music, or make calls.

Computer programmers have created AIs so advanced they

can sometimes do things as well as—or better than—people. For example, AIs have painted pictures indistinguishable from those of human artists. They've defeated champion chess players and bested human contestants on a game show

(see *Key Moments: The Rise of Artificial Intelligence*, p. 19).

"But while an AI might be able to do one task really well, it can't transfer its knowledge or skills to another task," says Priyam

Parashar, a graduate researcher in computer science at the University of California, San Diego.

A key goal for many AI creators today is to give their programs the ability to perform well in different situations and apply existing knowledge to new experiences, the way people do. "Working toward intelligences that can be trained in one area and transfer their knowledge to other domains is a hot topic," says Parashar. That's where video

### A CHAT WITH A BOT

A researcher working on developing Facebook's AI assistant in *Minecraft* had the following chat with the bot in the game:

**Researcher:** Hi

**AI assistant:** Hi

**Researcher:** Can you make a circle there? [The assistant starts building a circle out of blocks.]

**Researcher:** What are you doing?

**AI assistant:** I am building. [The AI adds blocks to the circle.]

**AI assistant:** I finished building this.

**Researcher:** That looks good.

**AI assistant:** Thank you!



**GAMING PHENOMENON:**  
*Minecraft* has sold more than 175 million copies since its launch in 2009.

games, like *Minecraft*, come in. They provide a setting where an AI can practice this human skill.

#### A PLACE TO PRACTICE

The ideal of an adaptable, multitalented learning system is known as *general artificial intelligence*. Programmers hope AIs can achieve this type of intelligence by facing challenges, making mistakes, and learning from them. People do this in everyday life all the time—we encounter problems and figure out solutions. But AIs are computer programs. They can't experience and react to things



**MINECRAFT**  
IS THE  
BEST-  
SELLING  
VIDEO  
GAME OF  
ALL TIME.

WONDERLANDSTOCK/ALAMY STOCK PHOTO (TOP); MINECRAFT (PIG); SHUTTERSTOCK.COM (BACKGROUND)

MINECRAFT (DUCK); PETER MORGAN/REUTERS (CHESS); BEN HIDER/GETTY IMAGES (JEOPARDY!); GOOGLE VIA GETTY IMAGES (GO)

in the real world like humans do. That is, unless they're given a physical robotic body. But no one wants a bunch of intelligent robots let loose on the world before the kinks have been worked out. That's where *Minecraft* comes in. It provides a perfect artificial environment where AIs can safely try out novel things. And if the programs make bad decisions or run amok, they won't cause any real damage.

Since *Minecraft* is an *open-world game*, players can go

wherever and do whatever they please. And AIs, playing as characters in the game, can do the same. They get the chance to move through a 3-D world and see, touch, and manipulate objects. That gives scientists like Parashar the opportunity to test AIs they're developing in different scenarios. For instance, she and her colleagues recently used the game to see how an AI would respond to an unexpected obstacle. They taught the AI to retrieve a block from an adjacent room in one of the world's virtual buildings. The scientists provided the AI with an incentive to complete the task using *reinforcement learning*. "This approach is similar to training a dog by giving it a treat when it does what you want," says Parashar. The AI received a reward of points whenever it succeeded.

Next, a researcher closed off the passage between the rooms with a glass block wall—a problem the AI had never encountered before. "The AI agent knows

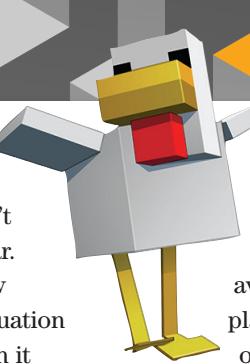
it was able to solve the task when the wall wasn't there," says Parashar. "So it considers how to make the new situation more like ones when it was able to get the block." Eventually, the AI determined that it could break the glass and achieve its goal.

#### HUMAN HELPERS?

*Minecraft* also has a chat feature that allows players to communicate with one another. Researchers at Facebook are using this function to let an AI assistant they've developed for *Minecraft* practice talking with people. The developers want human players to be able to ask the assistant for help with building or other activities in the game (see *A Chat With a Bot*, p. 17). The AI is labeled as a bot, so players know they're not interacting with a real person.

The scientists' goal is to improve the AI's understanding of instructions given in *natural language*, meaning regular everyday speech. Normally, commands for a computer must be provided in a special programming language, or *code*. "Understanding natural language is a big challenge for AIs," says Kavya Srinet, an AI engineer at Facebook and one of the lead researchers on the *Minecraft* assistant project. "But it's an important part of being able to collaborate with humans. We also want the assistant to be fun to play with. We hope that if it makes silly mistakes while learning, it's still amusing and engaging for players."

For now, Facebook's AI *Minecraft* assistant is being



developed only for research purposes. But eventually, Srinet would love to see a similar program made widely available to any *Minecraft* player who wanted to try it out. In the future, a similarly trained helper AI might even be able to apply what it learned in a virtual world to real life. A robot

with general artificial intelligence could someday assist people with tasks that go far beyond just stacking blocks. ☀

—Jennifer Barone

**DEFINING PROBLEMS:** Describe one goal that AI researchers are currently working toward and one challenge they face in achieving it.

#### KEY MOMENTS

### THE RISE OF ARTIFICIAL INTELLIGENCE



**1997**  
DeepBlue, a computer developed by IBM, defeats chess champion Garry Kasparov in a six-game match.



**2011**  
IBM's Watson computer system competes on the trivia TV show *Jeopardy!* and beats two of the game's top players.



**2019**  
A champion of the strategy game Go retires, citing the rise of AI after being beaten by Google's AlphaGo system three years earlier.