Innovation and Technology

未来を見つめる科学英語

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NAN'UN-DO

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To Teachers and Students

What will skyscrapers look like in the future? How can we travel at 4,000 km/h in a train? What kind of cars will we be driving in 2050? How can we create intelligent robots? Can we make video games that are good for us? If you're interested in any or all of these questions, this is the book for you. Based on authentic texts from the brilliant BBC Future website, *Innovation and Technology* introduces some of the most innovative thinkers of our time, from the engineers working on the next generation of supercomputers to the Harvard graduates making power-generating soccer balls for the developing world.

Each article is supported by exercises designed to develop language, comprehension and thinking skills. A pre-reading discussion activity introduces each topic in an accessible and interesting way and a vocabulary exercise helps to aid comprehension of the article to follow. Once you have read the passage, three kinds of comprehension questions test your understanding fully: a skimming question about the main idea; true/false questions about important details; and scanning questions about specific information. A follow-up exercise helps to review key vocabulary and grammar from the article, and then a final discussion activity encourages critical and creative thinking about the topic.

The variety of activities means that the textbook can be used in more than one kind of course. Reading courses can concentrate on understanding the passages and their language. However, teachers who want to use the book for four-skill courses can do so with only a minimal amount of adaptation. The book comes with a CD recording of all the passages, allowing the comprehension questions to be used as listening exercises. The pre-reading and follow-up discussion activities can also be extended into writing assignments at a sentence or paragraph level. Finally, for those who enjoy bringing the internet into classes, you can easily find videos about the topics covered by the book. These make an ideal warm-up to grab students' attention.

However you decide to use the book, we are sure you will enjoy both the topics and the activities. Have fun!

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Table of Contents

Unit 1

Driving with the Terminator
Augmented Reality for Cars

自動車用の拡張現実機能

Before You Read: Talk about these questions with a partner and write your answers in the spaces.

1. Have you seen the movie *Terminator*? Did you like it?

_____

2. What was special about the Terminator's eyesight?

- ☐ a) He could see 360° all around him.
- ☐ b) He could see extra information like on a computer screen.
- ☐ c) He could shoot laser beams from his eyes.

3. Recently Google developed a new kind of glasses called Google Glass. Which of these can they do?

☐ a) Let you see in the dark ☐ b) Play music ☐ c) Show directions

4. What kind of information might augmented reality for cars show?

_____

_____

Important Vocabulary: Match the word to its meaning.

1. ___ distraction (n.)
2. ___ enhance (v.)
3. ___ minimise (v.)
4. ___ allow (v.)
5. ___ series (n.)
6. ___ monitor (v.)
7. ___ be aware of (v.)
8. ___ transparent (adj.)
9. ___ devise (v.)
10. ___ subject (n.)

a. can be seen through (like glass)
b. somebody who takes part in an experiment or study
c. something that disturbs you or stops you from concentrating
d. know about, realise something
e. improve, increase
f. make possible, permit
g. think of, invent
h. watch, observe
i. a group, a line
j. make as small as possible

CD 2

Augmented Reality for Cars

The dangers of talking on a mobile phone or texting while driving are well known. So adding what, at first glance, looks like extra **distractions** may not seem like the best idea. However, researchers and car firms are looking to give drivers enhanced or augmented reality[1] (AR) that adds extra information ranging from directions to social media feeds to the view through the windscreen. Perhaps the most unexpected part of it is that it is designed to make the roads safer for all of us.

"The biggest way augmented reality can be useful is in supporting safe driving," says Professor Anind Dey, of the Human-Computer Interaction Institute at Carnegie Mellon University. "The ability to **enhance** information around us that might otherwise be hidden to us is very valuable."

AR is usually considered to be a live view of the real world, onto which extra data—usually taken from the Internet—is superimposed[2]. It is similar to the view of the world that Arnold Schwarzenegger's character had in the *Terminator* movies.

The technology is well established elsewhere. For example, there are numerous smartphone apps that allow users to overlay[3] the view from their camera with everything from directions and transport options to restaurant reviews and house prices. Companies like Google are taking it one step further. Recently, the search giant unveiled its Google Glass project, a pair of minimal glasses that overlay a person's vision with things like weather data, location and diary appointments.

Now AR is making its way into cars. It builds on so-called "heads up display" (HUD) technology that is commonly used in fighter planes and began to make its way into expensive cars in the late 1990s. These HUDs are frequently used to project[4] directions or speed onto the windscreen in the driver's line of sight to **minimise** the amount of time the driver takes their eyes off the road. However, augmented reality could **allow** these displays to go much further than that.

Car manufacturers such as BMW, Toyota, Mercedes and GM have introduced various prototypes in recent years. For example, a Mercedes system known as DICE allows drivers to bring up information about places of interest by merely pointing at them, while friends driving past the car show up as an icon on the windscreen, alongside their social network status.

Another system, developed by GM and known as the enhanced vision system, uses a **series** of sensors and cameras mounted inside and outside the vehicle to **monitor** the environment around the car and the driver's eye and head

movements. This information is then used to overlay the view from the windscreen with relevant information about driving conditions—such as the location of the building you are trying to find or dangers that you may not **be aware of**, such as an animal or child at the side of the road. Another mode marks the edges of the road when fog hides them from the driver's view.

The most extreme concept comes from designers at Keio University in Japan, who are working on technology that will make the back seat of the car appear **transparent**, so that when drivers are reversing they can see everything around them.

Innovations like this may be a long way from going into production. But other uses of AR could appear much sooner. For example, the most common use of AR is to display directions that are overlayed on the road in front of you. This kind of innovation would be helpful to any driver. However, Professor Dey and his team believe it could be especially useful for older people, whose sense of spatial awareness[5] may be reduced. This is particularly problematic when they must look down at a navigation system, for example.

"The amount of time spent not looking out of the windshield, and the number of times that occurs on a short drive, can get pretty high," he explains. "Particularly when you are talking about elder drivers, you want to reduce the amount of time they are looking away."

To test this theory, he **devised** a simulator that projects the navigation system across the full width of the windscreen. The driver sees the real world, but with a map superimposed on top.

His trials have revealed potential problems, however. For example, many of the **subjects** who have tried the system out in Professor Dey's simulator have reported that it feels like playing a computer game. This detachment from reality is an issue that the engineers know needs to be dealt with. After all, augmented reality is only useful if the driver is aware of the reality behind it.

Notes

1 augmented reality 拡張現実
2 superimpose 重ね合わせる
3 overlay 重ね合わせる
4 project 映す
5 spatial awareness 空間認識

Understanding the Main Idea: Choose the best summary.

Car companies are working on augmented reality systems for cars.

A) The main purpose is to make driving more interesting by using information from social media and the Internet.

B) Drivers will wear special glasses that project useful information onto the windscreen.

C) They aim to make driving safer by giving useful information and reducing the amount of time drivers look away from the windscreen.

Understanding Details: True or false

1. 【T / F】 Professor Dey believes augmented reality can make driving safer.

2. 【T / F】 So far, augmented reality is only being used in cars.

3. 【T / F】 HUD technology was first used in expensive cars.

4. 【T / F】 The system designed at Keio University will probably be used when you are parking your car.

5. 【T / F】 Augmented reality might be dangerous for older drivers.

Finding Specific Information: Write the answer.

1. With the Mercedes system called DICE, how would a driver get information about interesting places?

_____

2. What could GM's enhanced vision system show you on a foggy day that it would not need to show in normal weather?

_____

3. What problem did many subjects find with Professor Dey's simulator?

_____

Extend Your English: Look at the following two sentences taken from the article and the Japanese translation beneath. In particular, pay attention to the meaning of the words in bold.

1. However, researchers are looking to give drivers augmented reality that adds extra information **ranging from** directions **to** social media feeds to the view through the windscreen.

   しかし、研究者たちは、フロントガラスを通して見える視界に、道案内からソーシャルメディアのフィードにわたるまでの様々な追加の情報を加えた拡張現実（AR）を運転者に提供することを考えている。

2. For example, a Mercedes system **known as** DICE allows drivers to bring up information about places of interest by merely pointing at them.

   例えば、メルセデスの「DICE」として知られるシステムでは、運転者は興味がある場所を指差すだけで、その場所の情報を得ることができる。

Language Review: Fill in the following sentences using the words in the box.

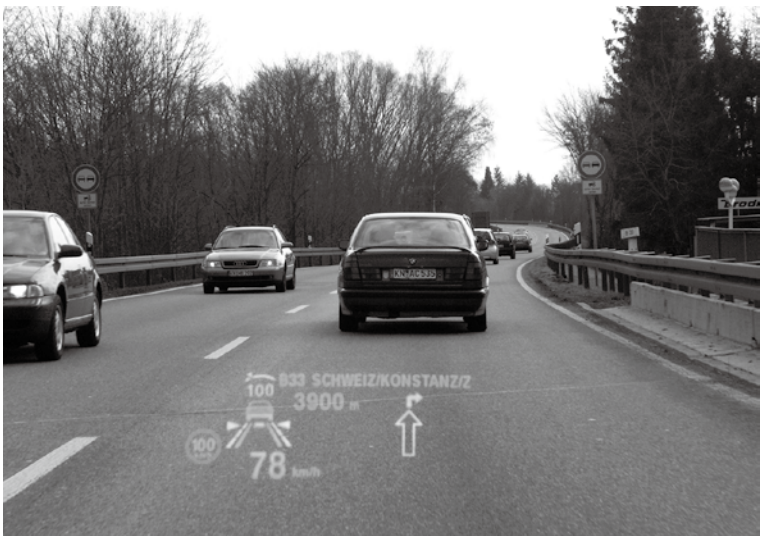
distraction	enhance	minimise	allow
series	monitor	be aware of	transparent
devise	subject		

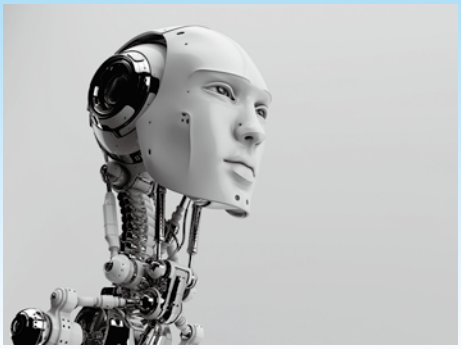
1. We need to find 20 _____s who will participate in the experiment.
2. The police were able to _____ the building by using hidden cameras.
3. The technology can make the seats _____ so that people can see through them.
4. Scientists need to _____ new developments in their field.
5. This new machine will _____ us to reduce our costs.
6. We should _____ a new method to speed up our production process.
7. The scientists carried out a _____ of experiments to prove their theory.
8. Robots are being developed that should _____ the quality of life of elderly people.
9. We want to _____ the amount of electricity consumed by the machine.
10. The noise of the construction work outside was a _____ when I was trying to study.

Think about the Article

The article mentioned various kinds of information that augmented reality will provide for cars, such as directions, warnings about dangers on the road and information about interesting places. Think of more types of information that might be useful when you are driving. Share your ideas with your classmates.

Types of Information





Unit 2

Artificial Human Beings
Intelligent Robots

知的ロボット

Before You Read: Talk about these questions with a partner and write your answers in the spaces.

1. Honda has built a humanoid robot called Asimo. Which of these can it NOT do?
   - ☐ a) Climb stairs
   - ☐ b) Understand human body language
   - ☐ c) Shake hands with and greet someone

2. In the science fiction film *I, Robot*, what was so special about the robot?
   - ☐ a) It was very good at playing chess.
   - ☐ b) It could feel emotions.

3. What kinds of tasks can robots do now?

   _____

   _____

4. What kinds of tasks can't robots do now?

   _____

   _____

Important Vocabulary: Match the word to its meaning.

1. ___	crisis (n.)	**a.**	handle, manage
2. ___	argue (v.)	**b.**	communicate with and react to
3. ___	exhibit (v.)	**c.**	very important
4. ___	distinguish (v.)	**d.**	a very serious or dangerous situation
5. ___	deal with (v.)	**e.**	relatively
6. ___	comparatively (adv.)	**f.**	ability to move
7. ___	perception (n.)	**g.**	tell the difference between
8. ___	mobility (n.)	**h.**	give an opinion
9. ___	interact (v.)	**i.**	show
10. ___	crucial (adj.)	**j.**	understanding, awareness

CD 3

Intelligent Robots

The idea of creating intelligent robots has inspired human imagination for decades. In reality, though, how far have we progressed towards being able to create an intelligent robot?

To understand where we are now, we have to go back about 20 years, to a time when the field of artificial intelligence (AI) was in **crisis**. Rodney Brooks, then a professor of Electrical Engineering and Computer Science at the Massachusetts Institute of Technology, wrote an important paper in 1990, **arguing** that the study of artificial intelligence had reached a dead end[1]. The problem was that the type of research inspired by Alan Turing's famous artificial intelligence test was not going anywhere. The Turing test was a test of a machine's ability to **exhibit** intelligent behaviour which could not be **distinguished** from that of a real human being—for example, being able to hold a "human-like" conversation. The Turing test directed decades of AI efforts towards creating computer systems that "thought" by solving logic puzzles.

These systems could sort and process information at incredible speed, giving them the appearance of intelligence when performing certain tasks (like playing chess). But when it came to "common sense" intelligence—the kind we use when selecting a book from a bookshelf, distinguishing a cat from a dog or a rock, or holding a glass of water without dropping it—a Turing-style AI couldn't cope.

A better alternative for AI was, Brooks said, to forget about building brains that can solve logical problems, and instead to focus on building bodies that can **deal with** and respond to the physical world. In other words, build robots. He called this "situated AI".

There's something about a robot with a body that seems more "intelligent", in a general sense, than any algorithm. IBM's Watson system may be able to beat humans at *Jeopardy!*[2] with its deep knowledge of facts—an impressive simulation of being academically "smart". But Boston Dynamics' Big Dog robot, moving itself up hills and around unfamiliar obstacles, and even maintaining its balance when pushed by its human companion, actually seems to be smart—at least, in the same way a dog or horse is.

"One kind of smart has to do with knowing a lot of facts and being able to reason and solve problems; another kind of smart has to do with understanding how our bodies work and being able to control them," says Marc Raibert, CEO of Boston Dynamics.

However, a truly intelligent robot—with the ability to think and move even at the level of a domestic dog—has yet to be built. Why? It's not because situated AI turned out to be another dead end, but because it came up against a newer, harder problem, known as Moravec's Paradox. "It is **comparatively** easy to make computers exhibit adult level performance on intelligence tests or games like chess, but it is difficult or impossible to give them the skills of a one-year-old human when it comes to **perception** and **mobility**," roboticist Hans Moravec wrote in 1988.

So how can we solve Moravec's Paradox? One approach is to take the assumptions of situated AI to their logical conclusion: if you want to build a robot with human-like intelligence, first build a robot with human-like anatomy. A team of European researchers has done just that: their ECCERobot (Embodied Cognition in a Compliantly Engineered Robot) has a thermoplastic[3] skeleton equipped with actuators and rubber tendons. It has as many degrees of movement as a human torso; it collapses into a heap when its power is turned off, just like an unconscious human would. Most importantly, all of these parts are covered with sensors.

"The patterns of sensory[4] stimulation that we generate from moving our bodies and **interacting** with the environment are the basic building blocks of cognition," says Rolf Pfeifer, a lead researcher on ECCERobot. Sensory perceptions are the raw material for the brain to learn things about the environment and how to make distinctions in the real world.

For now, ECCERobot's humanoid physiology is so difficult to control that it can barely pick up an object, much less exhibit intelligent behaviour. In any case, says Pfeifer, building an intelligent humanoid robot—one that "can smoothly interact with humans and human environments in a natural way"—will require breakthroughs in computing and battery efficiency, not to mention a huge advance in sensory equipment. "A really **crucial** development will be skin," he says. "Skin is extremely important in the development of intelligence because it provides such rich sensory patterns—touch, temperature, pain—all at once."

A robot with skin and human-like anatomy starts to sound less like a robot at all, and more like a synthetic organism. But such a reality is still far away.

Notes

1 dead end 行き詰まり
2 *Jeopardy!* 有名なアメリカのクイズ番組
3 thermoplastic 熱可塑性物質の
4 sensory 感覚の、知覚の