Brain control

Lesson code: LKLE-LNCB-CI3Q-A

ADVANCED

1 Warm-up

Do you think it's possible to control somebody else's body with your mind?

2 Vocabulary development

Match the following words with their correct definitions.

1. a disorder	a. A person who plays fair, accepts both victory and defeat, and stays nice
2. DIY	b. an illness
3. a spinal cord	c. relating to work (such as fixing or building something) that you do yourself instead of hiring someone to do it
4. free will	d. the set of nerves inside the spine that connect the brain to other nerves in the body
5. a good sport	e. when you do something because you want to, not because someone forces you to

3 Watching and listening

Read the statements below. Decide if they are true (T) or false (F). Then watch the video and check your answers.

1. Neuroscience isn't taught at schools because the equipment is very expensive.
2. Less than 10 percent of the world will have a neurological disorder.
3. There are cures for some serious neurological disorders.
4. It's possible to move somebody else's hand with your brain.

4 Phrasal verbs

In the transcript, there are six underlined phrasal verbs. Complete each definition with the infinitive form of one of the phrasal verbs.

1. _____ : to push or stretch something forwards or away from you, especially a part of your body
2. _____ : to fold something several times to make it shorter
3. _____ : to receive an electronic signal on a radio or similar piece of equipment
4. _____ : to develop in a particular way
5. _____ : to connect a piece of equipment to a computer
6. _____ : to cause something to appear

Now make a sentence for each phrasal verb.

5 Grammar - Continuous infinitive

Look at the following sentences from the talk.

a. And so it seems that what we should be doing is reaching back earlier in the education process.
b. In the future, they may be thinking about possibly becoming a brain scientist.
c. We're going to be able to listen to exactly what your brain is going to be doing.

The continuous infinitive is used to express a continuing action after a verb or auxiliary which must be followed by the infinitive. The continuous infinitive is formed with 'to be + -ing'. As with the present infinitive, there are situations where the word 'to' is omitted, for example after modal verbs.

If we want to express an action that was in progress before preceding verb, we use the perfect continuous infinitive ('to have been + -ing'):

a. I'm glad to have been living in Barcelona for the last ten years.
b. He must have been waiting for ages.
c. Soon, he'll have been running for four hours.
d. The organisers were thought to have been preparing for days.

6 Practice

Complete the sentences with a continuous or perfect continuous infinitive.

1. Where was he last night? He should _____ (sleep) in bed.
2. You want to go out in this weather? You must _____ . (joke)
3. I don't think Conor was serious when he said he was going to retire young. He must _____ .
4. Look at the dog! She seems _____ (dream) about something.
5. I can't remember where I was this time last year. I might _____ (jog) in the park. But I can't be sure.
6. The manager isn't in his office right now. He could _____ (have) lunch with a client.
7. I'd really like _____ (swim) in the sea right now.
8. I wouldn't want _____ (travel) in the Middle East right now. It's very dangerous.
9. He pretended _____ (work) hard, but nobody believed him.

In pairs, ask and answer the questions below.

a. What would you really like to be doing right now?

b. What wouldn't you like to be doing right now?

c. What were you doing yesterday at 10am? Would you like to have been doing something else instead? If so, what?

3 Watching and listening

1 The brain is an amazing and complex organ. And while many people are fascinated by the brain, they can't really tell you that much about the properties about how the brain works because we don't teach neuroscience in schools.

2 (00:25) And one of the reasons why is that the equipment is so complex and so expensive that it's really only done at major universities and large institutions. And so in order to be able to access the brain, you really need to dedicate your life and spend six and a half years as a graduate student just to become a neuroscientist to get access to these tools.

3 (00:44) And that's a shame because one out of five of us, that's 20 percent of the entire world, will have a neurological disorder. And there are zero cures for these diseases. And so it seems that what we should be doing is reaching back earlier in the education process and teaching students about neuroscience so that in the future, they may be thinking about possibly becoming a brain scientist.

4 (1:07) When I was a graduate student, my lab mate Tim Marzullo and myself, decided that what if we took this complex equipment that we have for studying the brain and made it simple enough and affordable enough that anyone that you know, an amateur or a high school student, could learn and actually participate in the discovery of neuroscience.

5 01:24 And so we did just that. A few years ago, we started a company called Backyard Brains and we make DIY neuroscience equipment and I brought some here tonight, and I want to do some demonstrations. You guys want to see some?

6 (01:37) So I need a volunteer. So right before -- what is your name? (Applause) Sam Kelly: Sam. Greg Gage: All right, Sam, I'm going to record from your brain. Have you had this before? SK: No. GG: I need you to stick out your arm for science, roll up your sleeve a bit, So what I'm going to do, I'm putting electrodes on your arm, and you're probably wondering, I just said I'm going to record from your brain, what am I doing with your arm?

7 (2:01) Well, you have about 80 billion neurons inside your brain right now. They're sending electrical messages back and forth, and chemical messages. But some of your neurons right here in your motor cortex are going to send messages down when you move your arm like this. They're going to go down across your corpus callosum, down onto your spinal cord to your lower motor neuron out to your muscles here, and that electrical discharge is going to be picked up by these electrodes right here and we're going to be able to listen to exactly what your brain is going to be doing. So I'm going to turn this on for a second.

8 (2:30) Have you ever heard what your brain sounds like? SK: No. GG: Let's try it out. So go ahead and squeeze your hand. (Rumbling) So what you're listening to, so this is your motor units happening right here. Let's take a look at it as well. So I'm going to stand over here, and I'm going to open up our app here. So now I want you to squeeze. (Rumbling).

9 (2:53) So right here, these are the motor units that are happening from her spinal cord out to her muscle right here, and as she's doing it, you're seeing the electrical activity that's happening here. You can even click here and try to see one of them. So keep doing it really hard. So now we've paused on one motor action potential that's happening right now inside of your brain.

10 (3:12) Do you guys want to see some more? (Applause) That's interesting, but let's get it better. I need one more volunteer. What is your name, sir? Miguel Goncalves: Miguel. GG: Miguel, all right. You're going to stand right here. So when you're moving your arm like this, your brain is sending a signal down to your muscles right here. I want you to move your arm as well. So your brain is going to send a signal down to your muscles. And so it turns out that there is a nerve that's right here that runs up here that innervates these three fingers, and it's close enough to the skin that we might be able to stimulate that so that what we can do is copy your brain signals going out to your hand and inject it into your hand, so that your hand will move when your brain tells your hand to move. So in a sense, she will take away your free will and you will no longer have any control over this hand. You with me?

11 (4:04) So I just need to hook you up. (Laughter) So I'm going to find your ulnar nerve, which is probably right around here. You don't know what you're signing up for when you come up. So now I'm going to move away and we're going to plug it into our human-to-human interface over here.

12 (4:23) Okay, so Sam, I want you to squeeze your hand again. Do it again. Perfect. So now I'm going to hook you up over here so that you get the -- It's going to feel a little bit weird at first, this is going to feel like a -- (Laughter) You know, when you lose your free will, and someone else becomes your agent, it does feel a bit strange.

13 (4:43) Now I want you to relax your hand. Sam, you're with me? So you're going to squeeze. I'm not going to turn it on yet, so go ahead and give it a squeeze.

14 (4:51) So now, are you ready, Miguel? MG: Ready as I'll ever be. GG: I've turned it on, so go ahead and turn your hand. Do you feel that a little bit? MG: Nope. GG: Okay, do it again? MG: A little bit. GG: A little bit? (Laughter) So relax. So hit it again. (Laughter) Oh, perfect, perfect. So relax, do it again.

15 (5:11) All right, so right now, your brain is controlling your arm and it's also controlling his arm, so go ahead and just do it one more time. All right, so it's perfect.

16 (5:22) So now, what would happen if I took over my control of your hand? And so, just relax your hand. What happens? Ah, nothing. Why not? Because the brain has to do it. So you do it again. All right, that's perfect.

17 (5:38) Thank you guys for being such a good sport. This is what's happening all across the world -- electrophysiology! We're going to bring on the neuro-revolution.

1 Warm-up

Encourage a short warm-up discussion.

2 Vocabulary development

Students can work individually and check in pairs.

1. b
2. c
3. d
4. e
5. a

3 Watching and listening

1. T 2. T 3. F 4. F

4 Phrasal verbs

Students can work individually and check in pairs. Set a time limit.

1. stick out
2. roll up
3. pick up
4. turn out
5. hook (sth) up
6. bring (sth) on

6 Practice

1. have been sleeping
2. be joking
3. have been joking
4. to be dreaming
5. have been jogging
6. be having
7. to be swimming
8. to be travelling
9. to have been working