Boris Reuderink

Boris Reuderink began his research into brain computer interfaces 18 months ago. He measures brain signals and tries to interpret them. Will you be able to play a computer game by just imagining movements in your brain?

Brain games

'the direct way'

"We're using brain-computer interfaces (BCIs) for computer games. BCIs were initially developed for people who were paralyzed and unable to communicate by other means. Clearly, this is an extremely useful application for interfaces of this kind. Yet a trend is emerging in which healthy people, too, are making use of these interfaces for entirely different purposes. This is our area of specialization, harnessing BCIs for use in computer games: the stuff of science fiction."

"We conduct a great deal of research into hand and arm movements. Your brain has to do a lot of preparatory work before you can actually move your hand. Although you're not aware of the fact, your brain initiates an internal planning process. Luckily for us, the seat of all this activity is located on the surface of the brain, just beneath the crown of your head. This simplifies the task of measuring this type of brain activity. We've now developed a game that works so well that the computer correctly guesses the user's thoughts 60 to 70% of the time."

"It's very simple to tell someone to 'imagine a movement'. For the user, though, it's very difficult, because they're not used to doing that. So we let people practice first by making actual movements, and by using EEG signals we try to recognize what is happening. With a bit of luck, assuming the computer has learnt what to do, it will enable you to accelerate your actions. Indeed, this is one of the technique's most useful aspects, it enables you to respond faster than would be possible if you had to use your hands. We're not quite there yet, but we're working on it."

"A major part of our work is based on signal processing. My own focus is the reliable identification of brain signals. The problem is that many other factors interfere with these signals, which also affects the accuracy of the prediction. The signal generated when you blink your eyes just once, is ten times as strong as the one I'm looking for. I have to find some way or other to suppress such strong signals. The differences I'm looking for are tiny, quite undetectable to the unaided eye. We're employing machine learning to teach the computer in advance what certain results should look like. The computer can then recognize the correct frequencies and react accordingly."

"We can also study other signals. How users perceive things for example. If they get tired, bored or frustrated, that causes subtle changes in the brain signal, to which the computer can, in turn, respond. So far, we've been talking about actions that are generally carried out by the user. By measuring brain signals, you can identify the focus of a user's attention. Just 300 milliseconds after the computer displays a scene extra activity is detectable in the brain signals. This could be cleverly embedded in a computer game. If you can identify what the user focuses on and adapt the computer game correspondingly then the game would be much more fun. It would also lead to a far more natural interaction, as with the characters in the game, who would then be able to react to your emotional state."

'We've now developed a game that works so well that the computer correctly guesses the user's thoughts 60 to 70% of the time.'

"They're already developing special EEG caps for users that can transmit their brain signals to a computer. That's over the top for the average gamer, but for hardcore gamers, being able to react faster is a big advantage. The game truly reacts to what you do, not only to commands. One game we're working on is 'World of Warcraft'. Based on your frame of mind, you can choose between being a human or an animal character. While this new feature doesn't offer any practical advantages as such, it's certainly really cool that you can switch game characters according to on your mood."

"This research yields knowledge about the brain in day-to-day situations. It might also lead to new forms of interaction. In 10 years, you can expect to see the first practical applications, such as lorry drivers being prevented from falling asleep at the wheel, or, say, visual material that can be scanned more rapidly. Other useful future applications might be for fighter pilots. They often have to do many things at the same time. By operating controls with your thoughts, you can get them to respond faster."