Program Description:
“Listening to the Brain” is a short video profile of the work of research scientists at the Wadsworth Center in Albany, NY, who have developed sophisticated computer software to analyze brain signals in real time. Epilepsy patient volunteers are shown participating in brain-computer interface studies where they manipulate a virtual hand and play a computer game using only the power of their brain waves. Furthermore, the brain-computer interface system is shown mapping out what a patient is speaking, or—incredibly—what word a volunteer is merely imagining. The research depends on electrocorticography (ECoG)—an array of electrodes placed directly on the surface of the brain in preparation for epilepsy surgery. As Dr. Anthony Ritaccio explains in the program: “The brain is an electrical organ, and brain cells communicate through electricity.” Dr. Gerwin Schalk adds: “...it’s possible to tap into this ongoing conversation that the brain has, and what we are now able to do is listen into this conversation and start to make sense of it.”

TRANSCRIPT KEY:
Italic text = Transcript text
[ALL CAP TEXT] = [NOTES ABOUT PROGRAM]
Bold = On-screen text

TRANSCRIPT:

[ON-SCREEN DISCLAIMER:]  
All epilepsy patients shown are volunteers participating in brain-computer interface studies.

[ON-SCREEN TITLE:]  
LISTENING to the BRAIN

[ON-SCREEN ID:]  
Anthony Ritaccio, M.D.  
Neurologist, Albany, NY

ECoG is our abbreviation for electrocorticography. Which essentially means listening with an electrode or a recording device directly on the surface of the brain, as an aid in epilepsy surgery. I want to cut your tumor out, but I don't want to cut your language out.
The brain is an electrical organ and brain cells communicate through electricity. Certain very, very high frequencies – they're so weak they can only be recorded when you're really close by and hovering right over the surface of the brain.

And it turns out when neighborhoods of brain cells are engaged in a particular function, they communicate together and resonate or synchronize together in these high frequencies. By recording on the surface of the brain, we can localize function.

Well, brain computer interfacing is possible, has become possible, mainly for two reasons. The first reason is that there is now a much better understanding of brain function in how the brain represents behavior. And the second reason is that we now have much more powerful computers in the algorithms – it's possible to tap into this ongoing conversation that the brain has, and what we are now able to do is listen into this conversation and start to make sense of it.

Alright, so what we’re going to do now is we’re going to show you different words on the screen, OK? And what I want you to do is to imagine repeating
each word as it’s presented.

[Patient:] OK

[Dr. Gerwin Schalk to patient:] Robert, are you ready?

[Patient:] I’m ready.

[Dr. Gerwin Schalk to patient:] Ready, set and begin.

[ON-SCREEN ID:] Gerwin Schalk, Ph.D.
Research Scientist, Wadsworth Center

So the person has to figure out how to produce that language, how to produce those brain signals. And the computer has to figure out how to better listen in to those signals and how to better interpret them – to get a better understanding of what the person wants to say. In many ways it’s not too different from two people speaking two different languages trying to start to communicate.

[ON-SCREEN NOTE:]
patient volunteer in
Language Mapping
brain-computer interface

[patient reading from computer screen:] Do... Doubt...Dance

[ON-SCREEN ID:] Anthony Ritaccio, M.D.
Neurologist, Albany, NY

The definition of a brain-computer interface is the ability to take that frequency and throw it into some complex computer algorithm so that when you think about moving your thumb, you’ll turn on a light...you will spell on a computer screen...you’ll operate your limb and bypass your spinal cord...you’ll operate a robotic arm....is at the core of brain-computer interface.

[ON-SCREEN NOTE:]
patient volunteer in
Brain-Based Device Control
brain-computer interface

[ON-SCREEN ID:]
Gerwin Schalk, Ph.D.
Research Scientist, Wadsworth Center
The thought that it may be possible to control a computer with brain signals alone is very appealing to many people and very—perhaps even frightening—but certainly very interesting to many people.

[Dr. Gerwin Schalk to patient:]
Cory, can you close the hand for me, please? That’s great, thank you.

[ON-SCREEN ID:]
Gerwin Schalk, Ph.D.
Research Scientist, Wadsworth Center

The purpose of this experiment and of this exercise is to demonstrate that it’s actually possible to use brain signals to open and close, in this case a virtual arm, in the future it may be an actual arm.

[Dr. Gerwin Schalk to patient:]
Close it.

[Dr. Gerwin Schalk to patient:]
Cory, do you think if you had lost control over your hand, do you think you could use the system to control a virtual hand or a prosthetic hand?

[Patient, Cory (does not wish full name to be used in program) to Dr. Schalk:]
It’s possible, eventually with lots and lots and lots and lots of practice.

[Dr. Gerwin Schalk directing patient to control virtual hand:]
Open it half way. Open it up.

[ON-SCREEN ID:]
Anthony Ritaccio, M.D.
Neurologist, Albany, NY
ECoG doesn’t work because we’re clever. Electrocorticography doesn’t work because we’re clever. Electrocorticography doesn’t work because we finally have the right amplifier technology and software processing.
Electrocorticography works because that's the way the brain works. Brain cells are on the outside. Brain cells are organized in functional clusters. Functional clusters vibrate together. ECoG works because we're just finally listening at the right place and that's how the brain does it.