

The Washington Post

Brain Wave of The Future

What If You Could Move Objects With Your Mind? Well, That Time Has Come.

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Thursday, April 23, 2009

You slip the wireless headset on. It looks like something a telemarketer would wear, except the earpieces are actually sensors, and what looks like a microphone is a brain wave detector. You place its tip against your forehead, above your left eyebrow.

A few feet away is a ping-pong ball in a clear tube called the Force Trainer. The idea is to use your thoughts alone, as recognized by the wand on your forehead, to lift the ball. Your brain's electrical activity is translated into a signal understood by a little computer that controls a fan that blows the ball up the tube. Levitates it. As if by magic. It's mind over matter.

All you have to do is concentrate. On anything, it doesn't matter. The harder you concentrate, the higher the ball goes. A musician says he played a song in his head and focused on a particular chord change. A former high school tennis star focused on his 120-mph serve. One woman brought the image of a candle flame to mind. The ball rose.

Concentrate. Concentrate.

A sound erupts -- first a groan, then a *woooo*, *WOOOO* -- like a Halloween ghost.

The ball spins, slowly at first, then faster.

Concentrate, concentrate.

And then the ball rises inside the tube. Up it lifts, two inches, four inches -- a foot!

You giggle and your concentration is broken; the ghostly sound fades and the ball drops back into its nest with a gurgle.

You have just controlled a physical object with your mind.

Competing mind-over-matter toys from Mattel and Uncle Milton Industries are coming this fall to a store near you. They are the first "brain-computer interfaces" to enter the consumer mainstream.

Toys, but so much more. They embody a dream of the ages: controlling the world with your thoughts. Telekinesis. The stuff of the gods.

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Any sufficiently advanced technology is indistinguishable from magic.

-- Arthur C. Clarke

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The question everyone has about these gizmos is whether they are parlor tricks like Magic 8 Balls or Ouija boards. Even Geoff Walker, a senior vice president at Mattel, acknowledges that users "spend the first 20 minutes stunned that it actually works."

Evidence in favor of them being for real is that some people are worse than others at controlling them -- certainly not a marketing feature.

Lawyers and other multitaskers, for example, tend to have a terrible time focusing their brain waves, says Johnny Liu of NeuroSky, the creator of the mind-over-matter headset. But there are those to whom controlling the device comes effortlessly and instantly, as if single-mindedness is the person's natural default position. Copy editors and IT jockeys on whom we tested this, you know who you are.

What happens when millions of youngsters in a notoriously ADHD generation start getting programmed by these new toys? What happens when they start being rewarded for very long periods of intense concentration? Nobody in the toy industry seems to know.

But it sure looks like parents are about to find out.

The Monkey's Mind

Now let's get serious with these toys, with the idea of telekinesis. A lot of scientists are. Nine years ago, they created the world's first telekinetic monkey. That would be Belle, a cute little owl monkey in the lab of Miguel Nicolelis at Duke University. She was the first to actually control tangible objects, long distance, with her thoughts.

How do you make a monkey telekinetic?

First you get her way into a computer game. She knows that if a light suddenly shines on her screen and she moves her joystick left or right to hit it, she gets a drop of juice.

Then the researchers drill a hole in her head. They take a device the size of a baby aspirin, out of which come many superfine wires, and lower it into Belle's motor cortex -- the portion of the brain that plans muscle movement. The object is to line up each wire with an individual neuron to detect its firing.

Then comes the big moment in telekinesis.

When Belle resumes her game, the scientists put the signal from her brain on the Internet and pipe it 600 miles north to a robotic arm at MIT. Sure enough, it starts dancing like a ballerina in exactly the same fashion as Belle's arm, "choreographed by the electrical impulses sparking in Belle's mind," her researchers report.

"Amid the loud celebration that erupted in Durham, N.C., and Cambridge, we could not help thinking that this was only the beginning of a promising journey," Nicolelis wrote in *Scientific American*.

Indeed, work is advancing rapidly. Four profoundly paralyzed humans equipped with a "BrainGate" implant created by the biotech firm Cyberkinetics have demonstrated their ability, with just their thoughts, to check and send e-mail; turn televisions, lights and appliances on and off; and control a

wheelchair. Monkeys equipped with brain-controlled artificial arms have learned how to guide food to their mouths. A monkey in Nicolelis's lab recently controlled a humanoid robot in Japan.

But the most spectacular work has centered on neural control of mechanical arms, hands and legs. The goal of a program funded by the Defense Advanced Research Projects Agency is to soon produce intelligent artificial limbs controlled by your nervous system that will allow you to pitch a fastball, thread a needle or play a piano as well as you did before your loss.

"You have to dream big," says Col. Geoffrey Ling, a neurologist and program manager. "If you don't dream that you're going to the moon, you won't go to the moon."

'Replace Ball With Kitten'

It's not unusual for new technologies to first enter popular consciousness as toys.

In the 1st century, Heron of Alexandria invented the aeolipile: a metal ball with curved nozzles sticking out of it, perched on stilts. With water in it, and flame beneath it, the resultant steam would make it spin, whiz, whiz, whiz. Such fun. Nobody understood they were looking at a steam engine. Hence, the Industrial Revolution didn't start for another 1700 years.

In 1267 Roger Bacon wrote about "a child's toy of sound and fire and explosion made in various parts of the world with powder of saltpeter, sulfur and charcoal of hazelwood." That description of firecrackers is one of the earliest European references to gunpowder.

Toys make sense as early adoptions of a new technology. Parents will pay to make their children smile.

The generation raised on telekinetic X-Men, from Professor Xavier to Jean Grey to Magneto, already is buzzing all over the Web about the advance videos of these mind-over-matter toys, as they think of further possibilities.

In a Gizmodo chat, "inseptiv" writes, "I'm all for modding the crap out of this to use my brain waves to trigger custom things around the house. 'Let me concentrate . . . and the coffee will be ready in 5 minutes.' "

"Silly scientists," writes "im2fools." "For this to be commercially succesful, you have to tie it into a tv remote, and market it to couch potatoes. 'Push' a button? Like I have that kind of energy!"

On Engadget, "absinthe party" suggests: "Replace ball with kitten."

"i wonder what would happen if you watch porn with this on?" asks "godwhacker" on Gizmodo.

"I want one!" says "Mike." "Not really, nothing says, 'Lives with his mom,' more than acting like you have, 'the force.' "

But it is "Skyfloating" on Abovetopsecret who takes the long view.

"Those were the beginnings' . . . they will say in a few hundred years."

The First Generation

As a mind-reading location, your forehead has only one significant advantage.

"It's a horrible place to get signals. But that's the only place most people do not have hair," says Stanley Yang, chief executive of NeuroSky. "Hair is not conductive."

NeuroSky is in the forefront of turning brain-computer interfaces into cheap, ubiquitous consumer items. It's selling brain-reading hardware and software headsets to all comers -- including Christmas competitors like Mattel's \$80 Mindflex and Uncle Milton's \$130 Force Trainer, both of which involve levitating a ping-pong-like ball. NeuroSky has its sights set on providing brain-wave sensors for the automotive, health-care and education industries.

The prospect for mind controlling matter dates to 1875, when Richard Caton discovered that you could peer into the workings of the brain by detecting its electrical impulses. In 1929 came the first electroencephalograph -- the EEG machine -- that became the staple of science-fiction movies. All those wires and sticky pads festooning bare skulls.

But hospital EEG machines are expensive, enormous and not good at fine control; plus you have to smear conductive goop on your head -- not a great selling point. Thus, NeuroSky's adaptation is no small thing. They get a single dry sensor to read your bare forehead, no goop, no holes drilled through the skull. They get the device to focus on the correct signals from that extremely noisy brain area, filtering out everything else -- that's their big trick. "It's like being at a crowded party, and picking out one quiet conversation," says Liu. Then they make it small, light and cheap, and deliver it to market.

"The sensors you are seeing today are first generation," says Yang. "You have to wear it. The second generation can sense your brain waves and other bio-signals from a distance. Like sensors in your car seats that can go through clothes without touching you. Embed the sensor in the seat belt. In the steering wheel. Or embed a sensor in the headrest."

Yang wants the car to know if you are falling asleep. Or drunk. Or wishing the air conditioning would go on, or the music would play more softly. He is talking with the Japanese telephone company NTT DoCoMo about cellphones. Its brain lab has looked at over 300 mind-over-matter products, he says.

Where we go from there is limited only by imagination: brain-controlled television couch-potato remote controls, brain-controlled video games, brain-controlled race cars, brain-controlled spouses. No, dream on, the last is not on the horizon.

The next announcement NeuroSky expects from a business partner is one that it won't talk about much. But the company expects it later this year.

It will be able to fly.

Around the room.

Controlled by your brain.

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Yoda: Luminous beings are we . . . [*Yoda pinches Luke's shoulder*] . . . not this crude matter. You must feel the Force around you. [*Gesturing*] Here, between you . . . me . . . the tree . . . the rock . . . everywhere! Yes, even between the land and the ship.

Luke: [*Discouraged*] You want the impossible.

[Quietly Yoda turns toward the sunken X-wing fighter. With his eyes closed and his head bowed he raises his arm and points at the ship. Soon the fighter rises above the water and moves forward as Artoo beeps in terror and scoots away. The entire X-wing moves majestically, surely, toward the shore. Yoda, perched on a tree root, guides the fighter carefully down toward the beach. Luke stares in astonishment as the fighter settles gently onto the shore. He walks toward Yoda.]

Luke: I don't . . . I don't believe it.

Yoda: That is why you fail.

-- **"The Empire Strikes Back" * * ***

So where does this leave us right now?

Steve Koenig, director of industry analysis at the Consumer Electronics Association, has little doubt about the high-end, professional possibilities of the mind-over-matter market. He sees the opportunities for military robot wrangling, say, or mastering space or undersea exploration, or allowing the profoundly ill or disabled to control their surroundings.

He is, however, a skeptic about how eagerly we will embrace the toys. "Anybody having to wear anything is challenged in a lot of ways. That's why you don't see everybody you know having a little Bluetooth earpiece in their ear."

As for the TV remote control, Koenig says: "If, to control things, you have to concentrate, at what point is it much easier to just grab the knob and turn the volume down?"

Reyne Rice, the toy trends specialist for the Toy Industry Association, is more optimistic:

"What's been happening in the last couple of years is a real interest in mental gymnastics, mind games and logic solving. Not only for kids but adults" including boomers interested in staving off Alzheimer's. To Rice, mind-over-matter technology is "the next logical step."

She sees great potential for games. Imagine a "CSI"-like law-and-order game that could use a lie detector. Or multi-player games. "Whoever has the strongest mind control can take over the thing on the screen," she says. She also wonders what happens when user-generated content kicks in. When players start creating their own applications to be controlled by mind-over-matter headsets.

Mattel is aiming Mindflex at 8-to-12-year-olds, both girls and boys, although "it seems like a product that can inspire a 'wow' from 8 to 82," says Walker, the senior vice president. Uncle Milton is aiming the Force Trainer, which has a "Star Wars" theme, at those adults who still can't get too much Luke Skywalker in their lives, and then at boys 6 to 11.

But the industry considers \$80 or \$130 pricey for a little kid's toy -- especially in this year's economy. Rice sees the market as being "older kids, college students and adults" who are willing to pay much more.

And indeed, talk to spring-break college kids, suggesting these first-generation ping-pong ball games might be a tad primitive, and you get major push-back. "You've been doing this stuff for too long," says one. "This is going to be the biggest thing to hit colleges since the Frisbee."