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Heavier Mid-Life Smoking May Double Dementia Risk in Later Years

BY KURT SAMSON

A growing body of evidence indicates that cigarette smoking may be associated with a significantly increased risk of developing Alzheimer disease (AD), vascular dementia, and possibly other dementias.

Credit: istockphoto

SMOKING has been associated with dementia in several other population studies.

One new study, published online Oct. 25 in advance of the print *Archives of Internal Medicine*, found that heavy smoking in mid-life may increase the risk of AD and vascular dementia in later life by as much as 100 percent.

The long-term prospective study by a multinational team of researchers is the first comprehensive analysis of the potential influence of heavier mid-life smoking on AD dementia and vascular dementia in later years, according to

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SEPSIS REPORTED TO LEAD TO MORE THAN THREE-FOLD RISK OF COGNITIVE IMPAIRMENT

BY TOM VALEO

Older people who develop sepsis, the most common non-cardiac cause of critical illness, are 3.3 times more likely to acquire moderate to severe cognitive impairment, as well as new physical limitations, according to a study published in the Oct. 27 *Journal of the American Medical* Association (*JAMA*).

The degree of severe cognitive impairment found in the patients studied would lead to an estimated 40 extra hours a week of caretaking — a full time job — the authors estimated.

"Thus, sepsis is often a sentinel event in the lives of older patients, initiating major and enduring cognitive and functional declines with lasting implications for patients' independence, for their loved ones, and for the societal institutions charged with supporting them," the authors say.

These findings lend urgency to the search for ways to prevent and

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Neurons Moved Through Thought in Another Advance for Brain-Computer Interface

BY JAMIE TALAN

Scientists have been able to record from a few neurons in the human brain and teach people to drive up or down the activity of a particular neuron by thinking about a specific familiar person. The feat — thought driving the production of a specific picture on a computer screen — could pave the way for thought-based computer interfaces to help paralyzed patients, experts in computer-brain interface technologies say.

The finding, published in the Oct. 28 *Nature*, also helps explain how a person can selectively summon up one image and shut out all other competing sensory stimuli, said the lead study author Moran Cerf, PhD, currently a post-doctoral scholar at the University of California-Los Angeles (UCLA).

STUDY METHODS

Twelve patients with intractable epilepsy who were implanted

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Courtesy: Dr. Moran Cerf

ILLUSTRATION OF THOUGHTS PROJECTION: Two neurons, one corresponding to the concept of Marilyn Monroe and another corresponding to Michael Jackson, are pitted against each other. The subject is asked to fade in one image on the expense of another.

PERIODICALS

Brain-Computer Interface

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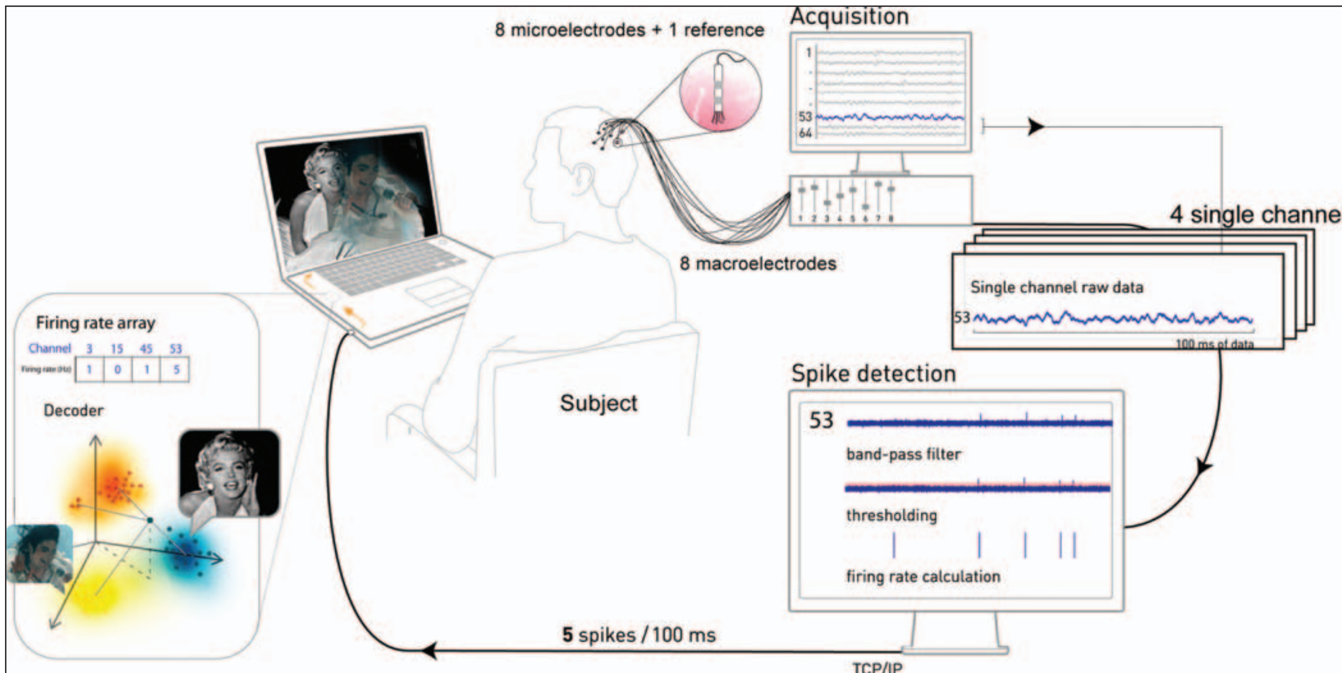
ARTICLE IN BRIEF

In a new study using a novel brain-computer interface technology, investigators recorded and decoded the firing of subjects' neurons in response to visual images and observed that individuals could use thought processes to selectively summon up one image and shut out all other competing sensory stimuli.

with intracranial electrodes in their medial temporal lobe (MTL) to localize the seizure focus for possible surgical resection were asked to play a game in which they looked at a display of images representing familiar individuals, landmarks, objects or animals.

Dr. Cerf created the computer interface that allowed the electrical activity of the neurons to be fed onto the screen so that when a person was thinking about Marilyn Monroe, for example, the activity in that particular neuron would increase and the picture on the screen of the movie actress would become sharper.

Simultaneously, the spiking activity of their neurons in different subregions



Courtesy: Dr. Moran Cerf

ILLUSTRATION OF THE 'CLOSED-LOOP' from the patient viewing the image on the screen, to the acquisition system recording the activity of single neurons in his/her brain, to the system which perform the detection and filtering of spikes from the selected brain regions and the decoder which identifies the thought in the patient's brain and sends the data to the computer for visualization of the patient's thoughts.

and hemispheres was decoded in real time by the investigators.

Once the investigators were able to identify neurons that responded to four famous people, including Marilyn Monroe, Michael Jackson and Josh Brolin, the patients were asked to watch a computer screen and two faces were superimposed onto one another and the person was asked to think about one person.

While the subjects were thinking about an image of their choice, the scientists were collecting the firing rates of the relevant neurons and fed it through a decoder. The more the neuron fired the sharper the image of the picture became. The neuron that was slowing its firing rate was decoded and the image was faded as the other picture was enhanced.

The thinking drove the neural activity, which in turn made the picture come to life and the other picture that they were not thinking about fade away. The participants were able to do this correctly about 70 percent of the time.

When the subjects were asked what they were doing during the thought process, some said they were trying to enhance the image in their minds while others said that they were trying to fade out the second image. When they could not see the feedback of the picture, their performance was dramatically reduced to about a third of correct responses.

Previous studies with depth electrodes that had been done at UCLA had shown that individual cells respond to a particular abstract image and when someone thinks about or recalls that individual that particular cell fires. But this study was novel because it looked at what happens when a person is faced with two competing thoughts.

"By directing your thoughts the picture on the screen changes because the firing of the cell changes," explained study co-author Itzhak Fried, MD, PhD, professor of neurosurgery at UCLA. "It is a simple version of what we face in everyday life. There is so much competing stimuli but we have to focus on one thought at a time."

> 'This is the first paper (to my knowledge) to use neurons in temporal lobe in regions that are typically associated with memory and cognition to deal with mechanisms of attention and visual signals.'

DR. MORAN CERF created the computer interface that allowed the electrical activity of the neurons to be fed onto the screen so that when a person was thinking about Marilyn Monroe, for example, the activity in that particular neuron would increase and the picture on the screen of the movie actress would become sharper.

DR. ITZHAK FRIED: "We use thought to manipulate and change the activity of these cells. We may be able to develop neuroprosthetic devices that would allow people to communicate to the outside world through thought."

The study proves that people can drive the activity of a single cell with thought, he said.

There are many implications of the finding. At this level of the nervous system, a thought can override sensory input. "We use thought to manipulate and change the activity of these cells," explained Dr. Fried. "We may be able to develop neuroprosthetic devices that would allow people to communicate to the outside world through thought."

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Brain-Computer Interface

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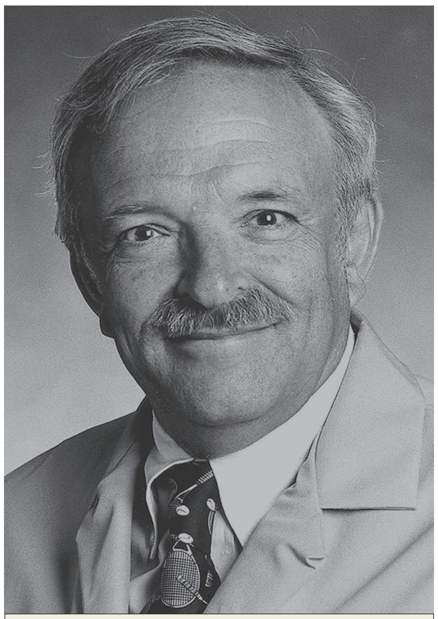
There are brain interface technologies in development that use the activity in the motor cortex to drive a robotic arm. The interfaces that are now being created are based on many electrical signals in the brain, including scalp EEG waves, or EEG recorded from the surface of the cortex.

By contrast, this study was able to drive an image on a computer screen based on the distinct voice of a few single cells. It could be an opening for the next generation of devices that are based "pure thought, imagery or memory," said Dr. Fried.

There are still a lot of basic questions to be answered. For instance, how is sensory information transformed from perception into information that we can later recall and manipulate? How does the real world become a mental representation in our own mind?"

"This is a very unique opportunity to record the firing of individual nerve cells," said Christof Koch, PhD, a professor of biology and engineering at CalTech and one of the lead investigators in the study. "Each neuron really expresses how well, how quickly, how strongly patients can control the neurons with nothing but their thoughts in a conscious manner."



DR. W. ZEV RYMER: "The findings may guide us towards a better understanding of memory and cognitive processes, and of our ability to control these processes voluntarily."

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"How do you not think about the white elephant? The answer is that you partially suppress the response of the neurons thinking about the white elephant," said Dr. Koch.

EXPERTS COMMENT

"This is novel," said W. Zev Rymer, MD, PhD, professor of physical medicine and rehabilitation at Northwestern University Feinberg School of Medicine. "Most of the papers in this field address the ability of different parts of brain to control systems or devices, such as robotic arms or electrically simulated muscles. This control is done through discharge of single units, multi-unit traces, and local field potentials"

"This is the first paper (to my knowledge) to use neurons in temporal lobe in regions that are typically associated with memory and cognition to deal with mechanisms of attention and visual signals," he continued. "The findings may guide us towards a better understanding of memory and cognitive processes, and of our ability to control these processes voluntarily." •

REFERENCE:

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