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Brain-computer link systems on the brink of breakthrough, study finds

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Systems that directly connect silicon circuits with brains are under intensive development all over the world, and are nearing commercial application in many areas, according to a study just placed online.

Neurobiologist Theodore W. Berger of the University of Southern California chaired the eight-member committee which compiled the "International Assessment of Research and Development in Brain-Computer Interfaces," published in October by the World Technology Evaluation Center, Inc., of Baltimore MD

Berger, who holds the David Packard Chair at the USC Viterbi School of Engineering and is Director of the USC Center for Neural Engineering contributed the introduction and two chapters of the report, which encompassed dozens of research institutes in Europe and Asia.

The other committee members (and chapter authors) included John K. Chapin (SUNY Downstate Medical Center); Greg A. Gerhardt (University of Kentucky); Dennis J. McFarland (Wadsworth Center); José C. Principe (University of Florida); Dawn M. Taylor (Case Western Reserve); and Patrick A. Tresco (University of Utah).

The report contains three overall findings on Brain-Computer Interface (BCI) work worldwide:

-- BCI research is extensive and rapidly growing, as is growth in the interfaces between multiple key scientific areas, including biomedical

engineering, neuroscience, computer science, electrical and computer engineering, materials science and nanotechnology, and neurology and neurosurgery.

-- BCI research is rapidly approaching first-generation medical practice—clinical trials of invasive BCI technologies and significant home use of noninvasive, electroencephalography (EEG-based) BCIs. The panel predicts that BCIs soon will markedly influence the medical device industry, and additionally BCI research will rapidly accelerate in non-medical arenas of commerce as well, particularly in the gaming, automotive, and robotics industries.

-- The focus of BCI research throughout the world was decidedly uneven, with invasive BCIs almost exclusively centered in North America, noninvasive BCI systems evolving primarily from European and Asian efforts. BCI research in Asia, and particularly China, is accelerating, with advanced algorithm development for EEG-based systems currently a hallmark of China's BCI program. Future BCI research in China is clearly developing toward invasive BCI systems, so BCI researchers in the US will soon have a strong competitor.

The chapters of the report offer detailed discussion of specific work from around the world, work on Sensor Technology, Biotic-Abiotic Interfaces, BMI/BCI Modeling and Signal Processing, Hardware Implementation, Functional Electrical Stimulation and Rehabilitation Applications of BCIs, Noninvasive Communication Systems, Cognitive and Emotional Neuroprostheses, and BCI issues arising out of research organization-funding, translation-commercialization, and education and training.

With respect to translation and commercialization, the Committee found that BCI research in Europe and Japan was much more tightly tied to industry compared to what is seen in the U.S., with multiple high-level

mechanisms for jointly funding academic and industrial partnerships dedicated to BCIs, and mechanisms for translational research that increased the probability of academic prototypes reaching industrial paths for commercialization.

The report is now downloadable online at the WTEC website, at http://www.wtec.org/bci/BCI-finalreport-10Oct2007-lowres.pdf

Source: University of Southern California

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