[¶35-301] Investment in brain training provides a new path to workplace productivity gains

Henry Mahncke, PhD

Dr Mahncke received his PhD in Neuroscience at UCSF, studying neuroplasticity in the Merzenich Lab, before becoming a consultant at McKinsey & Company and, then, joining the team that launched Posit Science, the maker of BrainHQ computerised brain exercises — shown in recent studies to improve workplace performance.

Email: henry.mahncke@positscience.com

Overview

Stretching back to the dawn of the Industrial Revolution, gains in productivity have been viewed as largely driven by replacing human labor — especially for repetitive tasks — with machines.[1] This view linked the goal of productivity growth to the threat of worker replacement.[2] Yet, automation is not the only driver of growth in productivity. Training and development of workers is also widely viewed as driving productivity.[3]

New studies on the use of brain training in the workplace (discussed below) indicate that a relatively small amount of automated and personalised brain training can drive significant gains in the workplace — suggesting that ongoing investments in maximising brain performance can help workers contribute to gains in productivity.

A new type of cognitive training

Up until the late 20th century, cognitive training was largely driven by the fields of education and psychology. Such training often consisted of strategies — tips and tricks — for remembering information. Traditional cognitive training was often criticised for only improving the abilities of the participants at the tasks trained and not generalising to other activities.[4] However, starting in the 1980s, new theories from the field of neuroscience sparked the introduction of a new type of brain training based on neuroplasticity.

A key pioneer in the development of neuroplasticity-based brain training was Dr Michael Merzenich of the University of California San Francisco (UCSF). He led the team that invented the cochlear implant — a medical device that restores hearing to people with deafness. It was conventional wisdom that a device could never restore the ability of a deaf person to process the rapid input required to understand normal speech — but Dr. Merzenich showed that the brain physically and functionally adapted to the new input from a cochlear implant, and patients quickly could converse.

This breakthrough demonstrated that the adult human brain was *plastic* — capable of substantial chemical, structural and functional change throughout life. Experts previously had believed the brain was only plastic during the developmental epoch of childhood and that the adult brain was hard-wired and destined to wear out over the remaining life course.[5]

Starting in the 1990s, Merzenich focused on using computers to provide new visual and auditory inputs to the brain, in a progressively challenging manner, to harness the brain's plasticity to change the brain to process information faster and more accurately. He theorised that training the brain at an elemental level to be faster and more accurate would result in improved higher brain function, including better memory.[6] Drawing on animal experiments that had first confirmed the existence of adult plasticity, Merzenich and colleagues built computerised exercises that were intensive, repetitive and progressively challenging, with smart algorithms to continuously measure responses and make micro adjustments to drive the brain in positive directions.

The theory that speed and accuracy were key drivers was proven correct in 2007 in the IMPACT Study[7] led by researchers at the Mayo Clinic and USC, which showed that driving gains in brain speed of older adults generalised to gains in memory and attention, and also in measures of everyday function. Within a few years

other studies would show gains in executive function and social cognition, as well as on standard measures of quality of life (eg mood, confidence and health related quality of life) and in real world activities (eg gait, balance, driving, hearing and Instrumental Activities of Daily Living).[8]

These plasticity-based exercises became commercialised as BrainHQ.

From seniors and people with impairments to peak performers

While most studies of the 100+ studies of BrainHQ exercises focused on either healthy older adults or people with cognitive deficits from diseases and disorder, BrainHQ started getting applied by peak performers, quite unexpectedly, in an unusual workplace.

In 2014, professional football quarterback Tom Brady reached out to the makers of BrainHQ to report that the exercises had both helped improve his brain imaging and also had noticeably improved his on-field performance, which led to BrainHQ being increasingly used by elite athletes and teams in the sports workplace.[9]

In his best-selling book The TB12 Method, Brady wrote "It's hard to imagine any movement that isn't helped by processing information more accurately and split-seconds faster — whether I'm scanning the field for a receiver or opening, reading the defense as I pass through the line of scrimmage, seeing defenders rush me, or taking the right step at the right time."[10]

The next workplace that explored using BrainHQ for performance (as well as resilience and recovery from brain injuries) was the US military. In January 2018, the US Department of Defense made BrainHQ available to every soldier, sailor, airman and marine.[11] , [12]

2019 workplace studies

While BrainHQ was beginning to be applied in workplaces, in 2019, three studies showed results in very different types of workplaces.

Power line workers

Power line workers are expected to connect lines without making errors, because such errors can be costly or even fatal. However, such workers are human and do make errors.

In April 2019, independent researchers published a study in *Professional Safety,* the peer-reviewed journal of the American Society of Safety Professionals, that found that training on BrainHQ exercises not only made the workers more attentive and less likely to make errors on a standard assessments, but also significantly reduced actual error rates in power line workers over a four-year follow-up period.

Reviewing incident reports, researchers found those who trained a small amount (12 hours at the beginning of the period) were about nine times less likely to make an error than the untrained control group.

When looking at those with "perfect" safety performance records, the researchers reported 62.5% of the workers who did the training were error-free over the four-year period, as opposed to just 15% in the control.[13]

Police and law enforcement

Members of law enforcement are often called upon to make split-second decisions in life or death situations. Researchers, who ran a study published in *The American Journal of Psychology,* found training with certain BrainHQ exercises significantly reduced the error rate of officers making "shoot versus don't shoot" split-second decisions.

Independent researchers from Randolph-Macon College, Wichita State, and the US Navy conducted a double-blind, live-ammunition, shooting-range study, in which law enforcement officers (average age 38) were randomly assigned either to an intervention training group or a control training group. Officers in both groups were assessed before and after training.

In those assessments, targets popped up across the range (for a duration of one second). One version of the target was a man holding a gun. The other version of the target was the same man holding a cell phone. Officers were told to fire at the man with the gun and withhold fire on the man with the cell phone.

The intervention group was assigned exercises from BrainHQ targeting performance in visual speed, visual acuity and impulse control — cognitive skills called upon by the threat versus non-threat shooting task. The control group was assigned different exercises, targeting visual memory and spatial working memory, which were not expected to help. Officers were asked to train for 10–15 minutes per day, 5 days per week, for 4 weeks.

Only the active training group showed significant improvement in the shooting range task, indicating about a 29% improvement in overall accuracy (shooting and withholding fire as appropriate). When looking at the more common error — failing to withhold fire at the unarmed target — the intervention group showed a 60% improvement.[14]

Tech workers

The study was conducted by researchers at the Platypus Institute, an independent consultancy which tests and curates neuroscience-based products for industry. The researchers presented their findings in July 2019 at the 41st Annual Engineering in Medicine and Biology Conference in Berlin, sponsored by the Institute of Electrical and Electronics Engineers (IEEE).[15]

Tech workers were recruited at Fujitsu Labs America, a commercial think tank. The employee pool was largely comprised of highly-educated top performers in technology and science.

The researchers found relatively small amounts of BrainHQ training drove significant gains in cognitive efficiency, based on standard neuropsychological assessments and EEG-based imaging. In addition, study participants self-reported qualitative gains in workplace performance from the training.

Participants were asked to complete 20 half-hour sessions (a total of 10 hours) of BrainHQ training over the course of six weeks; however, some participants did much more training, and some did less.

For analysis purposes, the researchers split participants into two groups: a group that trained more than average and a group that trained less. The “Long Group” completed between 17 and 45 hours (with an average of 30 hours) and the “Short Group” completed between 1 and 14 hours (with an average of 7 hours). This allowed the researchers to measure the effect of the amount of training on results. Before the training, there was no significant difference between the two groups in the cognitive assessments, nor in EEG recording.

Researchers found an overall improvement in cognitive efficiency — measuring the speed and accuracy of cognitive performance — of about 8% from the training. And, the data indicated that more training was better — with the Short Group improving by 5% and the Long Group by 12%. EEG recording showed the brain increasing in efficient operations in a manner that was parallel to what was seen in the neuropsychological testing.

The researchers indicated that qualitative self-reports from participants further confirmed the findings, sharing a quote from a participant who said, “Since I started brain training, I’ve noticed a change in my focus and memory. I recall more details in my work and can sustain a high level of focus for longer.”

Implications for industry

These recent studies present a new avenue for productivity growth, by training people in the workplace with exercises designed to improve cognitive processing speed and accuracy. That seems intuitive — after all, greater speed and accuracy at work is a good way to define productivity. Even in the age of artificial intelligence and robotics, it still makes sense to keep investing in humans — and now human brains — to improve productivity in the workplace.

Footnotes

1 National Center for Research in Vocational Education and National Institute of Education, Responsiveness of Training Institutions to Changing Labor Market Demands, Ohio State University, 1983; 18.

2 Autor, D. and Salomons, A. Does Productivity Growth Threaten Employment? Paper prepared for the ECB Forum on Central Banking. Jun 2017:1.

3 De Grip, A. and Sauermann, J. The effect of training on productivity: The transfer of on-the-job training from the perspective of economics. Educational Research Review, 2013; 8:28–36.

4 Benjamin Katza, B. et al. How to play 20 questions with nature and lose: Reflections on 100 years of brain-training research. PNAS 115(3):201617102 DOI:10.1073/1617102114.

5 Doidge, N. The Brain That Changes Itself Viking Press 2007; 45–92 ISBN 9781101147115.

6 Mahncke, H. et al. Brain plasticity and functional losses in the aged: scientific bases for a novel intervention. Prog Brain Res. 2016; 157:81–109.

7 Smith, G. et al. (2009) A cognitive training program based on principles of brain plasticity: results from the improvement in memory with plasticity-based adaptive cognitive training (IMPACT) study. J Am Geriatr Soc. 2009. 57(4):594–603.

8 See 100+ Published Research Studies at www.brainhq.com/world-class-science/published-research/ (viewed 23 September 2019).

9 See Tom Brady's (no longer) Secret Weapon: BrainHQ at www.brainhq.com/blog/tom-bradys-no-longer-secret-weapon-brainhq/ (viewed 23 September 2019).

10 Brady, T. The TB12 Method: How to Achieve a Lifetime of Sustained Peak Performance Simon & Schuster 2017; Chapter 9.

11 See CBS Evening News at www.cbsnews.com/news/traumatic-brain-injuries-computerized-program-could-offer-hope-to-veterans-2019-05-16 (viewed 23 September 2019).

12 See Digital Journal at www.digitaljournal.com/life/health/usa-armed-forces-offer-brain-training-to-personnel-interview/article/513163 (viewed 23 September 2019).

13 Walters, J. et al. Improving Attentiveness: Effect of Cognitive Training on Sustained Attention Measures. Professional Safety Journal April 2019; 31–35.

14 Hamilton, J. et al. Can Cognitive Training Improve Shoot/Don't-Shoot Performance? Evidence from Live Fire Exercises. American Journal of Psychology. 2019; 2(2):179–194.

15 Miller, S. et al. An Investigation of Computer-based Brain Training on the Cognitive and EEG Performance of Employees presented at the 41st Annual Engineering in Medicine and Biology Conference July 2019 www.researchgate.net/publication/334654550.

Last reviewed: 30 September 2019