A Primer for ATP's Cross-Divisional Brainstorm: Are Neuroassessments the Next Disruptive Innovation in the Testing Industry?

Prepared by Assessment, Education, and Research Experts
Manny Straehle, Ph.D., GISF, Founder and President
Emily Kim, Research Associate
manny@aerexperts.com and emily@aerexperts.com

In this primer, we will briefly define neuroassessments, basic neurological functions related to areas of the brain, and current and future applications of neuroassessments to the testing industry. We hope this primer will provide you with a basic understanding to help you address the question we raise in the title of our presentation: Are Neuroassessments the Next Disruptive Innovation in the Testing Industry?

Do We Believe That Neuroassessments Are The Next Disruptive Innovation?

Yes. We believe neuroassessments will eventually replace the cost-effectiveness of a multiple-choice exam as the availability increases and cost decreases to measure brain activity, structures, and processes. There are several reasons why we believe this, which we will discuss below. At this moment, we would like you to consider that a $400 device that reads your brain waves and "plugs into" your smart phone can be purchased online. This relatively affordable brain device may have implications for the assessment community across the five ATP divisions, such as differentiating between high and low job performers and incorporating proper emotional and cognitive functioning. If this kind of tool existed today, just imagine the technological advances in the next few years that will improve their portability, affordability, accessibility, and applications[1].

What Are Neuroassessments?

Our current assessments tend to consist of variations of true/false, multiple-choice, and performance assessments. A neuroassessment measures functions and structures of the brain such as brain images, eye movements, brain waves, hormonal activity, and also

[1] https://peerj.com/articles/38/?utm_source=blog&utm_medium=web&utm_term=videooculography&utm_content=Article38&utm_campaign=MostCitedBlog

includes intelligence tests and behavioral tests of neurological function such as the Halstead-Retain Test Battery. Research has shown that these brain functions and structures directly affect our behaviors, emotions, and other functions and performances. To illustrate, we will use a classic example that is taught in every neuropsychology course – the case of Phineas Gage[2] (see figure above). Phineas was working with explosives when a 43 inch tamping iron shot through his skull and into his brain. Consequently, he suffered a brain injury resulting in a loss of emotional regulation despite maintaining job competence. However, he was unable to be emotionally and socially competent to return to his former job.

What Do Various Areas Of The Brain Control?

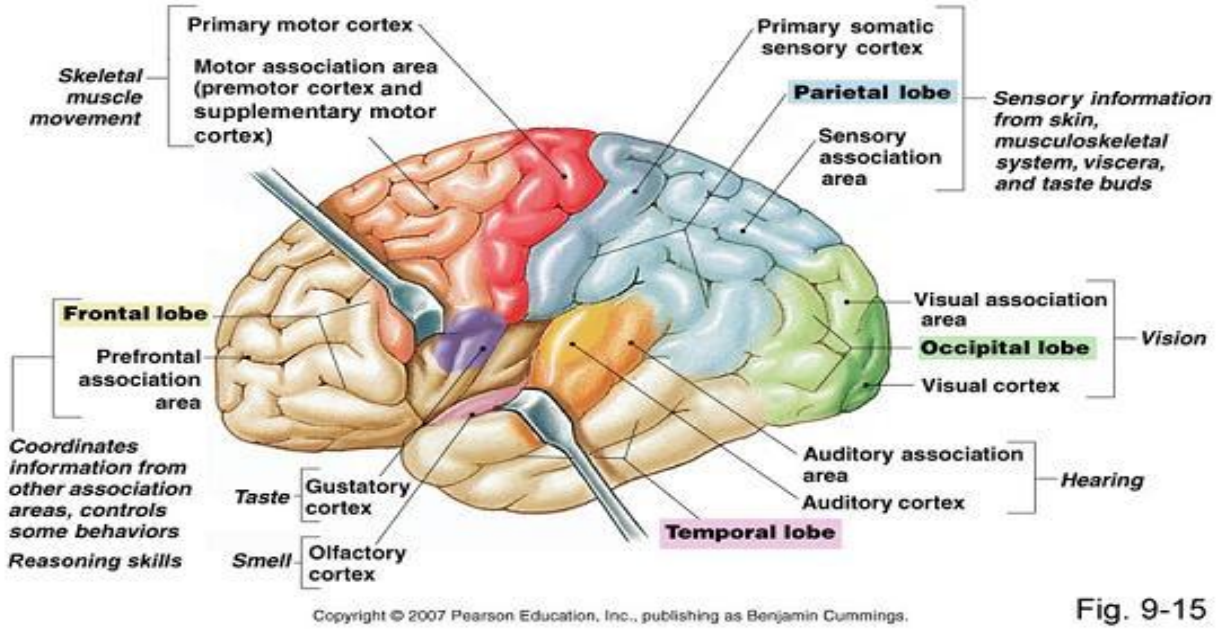


Fig. 9-15

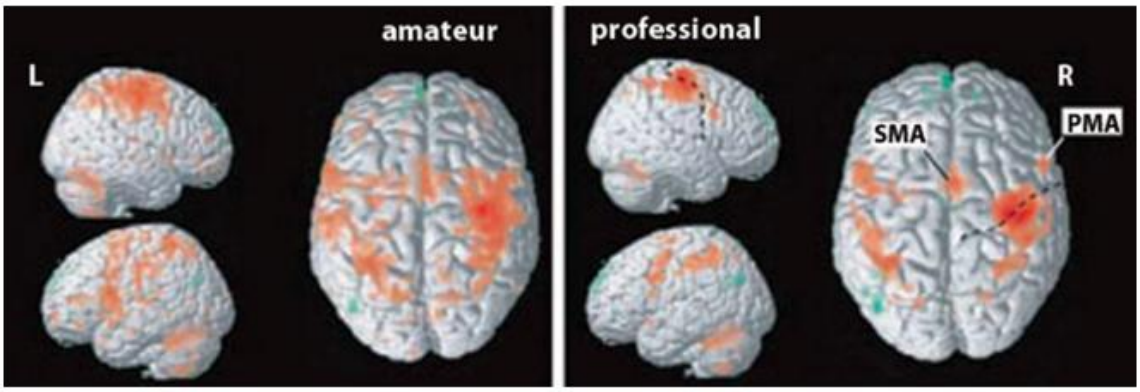
What Are Some Current Applications?

There are many historical citations of neuroassessments, but the modern day neuroassessments began with Broca and expressive language by observing stroke patients. Broca, and later Wernicke, identified issues affecting cognitive processing of language. They identified specific brain functions that were related to cognitive ability. Neuroassessments such as Wechsler's intelligence test, Halstead-Reitan's Test Battery, and others can effectively be used to assess expressive and receptive language (comprehension) to determine if a stroke patient is qualified to return to their job. There are many applications in clinical, employment and some educational settings, however, there is an absence of these neuroassessment applications in certification and licensure. One study may have significant implications for the certification and licensure community to consider. A recent study examined the differences in brain structure and functionality

[2] http://www.smithsonianmag.com/history/phineas-gage-neurosciences-most-famous-patient-11390067/?no-ist

between competent and experienced London cab drivers, compared to less competent and experienced London cab drivers. They found that London cab drivers with more experience and competency had different brain structures and functions than less experienced and competent cab drivers.[3] Another study examining professional versus non-professional violin players showed more focus and efficiencies of brain activity among professional violin players.[4]

The professional violinist's brain on the right shows more focused activity compared to the amateur violionist's brain on the left:



The more we practice the more efficient our brain becomes.

Finally, several studies used EEG results to determine selection criteria based on the likelihood that pilots would have seizures[5] and athletes[6] could participate in contact sports.

What Are Some Future Applications?

We believe that the future of assessments will increasingly rely on measuring brain activity, functions, and structures. We believe that brain imaging, eye tracking, and brain activity measures will show competent individuals more accurately, quickly, and easily than any other assessments, including multiple-choice examinations. Perhaps in 25 years when a candidate takes a test, they will have to walk into a testing center to measure their brain function, activity and structure, rather than take an exam. In the near future, test publishers may detect cheating by using eye tracking, imaging, and/or hormonal levels instead of observations, video recording, and forensic analysis of their scores. Imagine, you

[3] http://www.scientificamerican.com/article/london-taxi-memory/
[4] Other similar studies, particular those involving proficiency with motor functions are musical drumming (Petrini et al., 2011) and driving (Bernardi et al., 2013). Chess players and language experts also show less brain activation among experts (http://www.ifvll.ethz.ch/people/sterne/grabner_neubauer_stern_2006.pdf and http://www.ncbi.nlm.nih.gov/pubmed/22125542)
[5] http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20100033486.pdf
[6] http://www.neurologyreviews.com/the-publication/past-issue-sngle-view/neurologists-at-ringside-is-eeg-an-effective-screening-test-for-boxers/f510cedc1f6f519c2bda202a99cb23b4.html

can ask a series of questions while scanning a brain to detect whether a candidate has cheated. Perhaps in less than 50 years, a brilliant engineer will invent a wireless brain protocol that will allows us to upload and download information between our brain and other devices (Amazingly, wireless protocols that communicated with the brain were discussed at an IEEE conference in 2009[7]). While some of this sounds like a script for a sci-fi movie, these products may become a reality in our lifetime, and competency will be configuring software modules to be uploaded accurately and properly.

[7] http://www.technologyreview.com/news/534206/a-brain-computer-interface-that-works-wirelessly/