Cognitive Prosthetics

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Abstract

This paper seeks to explore the technological approach to cognitive prosthetics. This therapeutic concept is derived from the better known prosthetics for missing limbs (Cole, 2013). With cognitive prosthetics, however, the missing memory and learning ability is being assisted with a prosthetic device. This paper intends to outline how helpful these devices are. Additionally, it will address the hope for future research and study that will eventually assist in the ongoing battle against cognitive disease and injury. The primary areas of cognition that makes use of prosthetics are memory and learning. Cognitive prosthetics seeks to make its impact on the improvement of learning and memory for those who have suffered a loss of function in these realms. Additionally, cognitive prosthetics may assist in the efficiency of learning and memory functions in healthy individuals as well.

Keywords: cognition, prosthetics, Alzheimer's disease, dimentia

Cognitive Prosthetics

The healthcare and technology fields have long been merged together. From the addition of X-rays to functional magnetic resonance imaging (fMRI), technology has played an impressive role in the diagnostic aspect of medicine (Seven Counties Services, Inc., 2012). With the advent of prosthesis, the quality of life of many patients who had suffered the loss of a limb improved greatly. As technology continues to improve, so does the quality of life for those with access to it. Having lagged behind, however, is the technological assistance to those who suffer from various mental illnesses such as Alzheimer's disease and traumatic brain injuries. Technology may, however, be on the right path with the concept of cognitive prosthetics (Wild, 2012).

Many uses for smart devices are part of our daily lives. Our smart phones and tablets are able to remind us of upcoming events, store contact information, give us direct access to the Internet virtually anywhere we are, lets us play games, listen to music, send text messages to our friends and of course make phone calls. These devices are becoming more impressive and powerful with the addition of applications (apps). Scientists are now working on using the smart devices, along with other technologies, to implement the successful use of cognitive prosthetics (Joordens & Teaching Company, 2011).

While the technology exists and efforts are being made to implement the technology toward the solution, has everything been done to this point that is possible? The answer appears to be no. There are gaps in the research and application of technology. The gaps primarily lie in the employment of the technology. Converging the diagnostic tools of neuroimaging techniques such as fMRI and the cognitive theories of learning to form a cohesive teaching model and memory recall strategy appear possible. This strategy can be assisted by utilizing a device that allows for the employment of this cohesive model has the possibility of making significant progress in the field of research on memory and learning and improving the quality of life for those who suffer from learning and memory deficiencies.

Discussion

Foundational theories of human learning are typically categorized in four different ways: behaviorism, cognitive, humanistic and social (Bransford, 2014). Each of these theories have made sizeable contributions to psychology. The behaviorist theory focuses primarily on the observable behavior of the subject. Cognitive theory posits that learning is dependent purely on mental or neurological processes (Reisberg, 2013). Humanistic theory states an individual's emotions play a large role in the acquisition of knowledge. The social learning theory favors the impact of our interactions with each other and our associated groups are the best form of learning.

As it pertains to cognitive prosthetics, the foundational theory most relevant is of course that of the cognitive theory. The Gestalt learning theory is one of the main theories of cognitive learning. The Gestalt theory name stems from the three German theorists who supported the theory, Wertheimmer, Kohler and Koffka. Gestalt theory is a holistic approach that advocated the view that learning occurs as a result of understanding of a conceptual idea as a whole versus the simple and mechanistic response to external stimuli. Modern neuroimaging techniques may or may not support this view entirely. However, the Gestalt theory appears to be an important contribution in that it focuses on the internal response to external stimuli, and the behavioral result of that response.

Memory occurs through a process of activity throughout various regions of the brain such as the hippocampus, amygdala, frontal cortex and many others (Anderson, Hwany & Mulliken, 2010). Through the use of technology, enhancing these memory and learning systems is possible. (Joordens et al, 2011). For an individual with memory loss, or difficulty forming new memories the modern smart devices may be programmed to contain important information for the individual. In situations such as Alzheimer's disease, the patient may forget where they are, who they are and other relevant information such as where they live and phone numbers for caregivers. In this situation, the patient, upon having an episode of memory loss, will be able to refer to the smart device for the information they need to get help.

A gap in the use of this type of technology, however, exists in that these devices are not currently being used widespread, but also that the devices are not sufficient for those patients with advanced stages of Alzheimer's. Along with Alzheimer's, research in the area of age-related memory loss is a topic of much psychological discussion (Crook & Adderly, 1998). Additionally, this use of cognitive prosthetics can be further used in educational settings. The potent combination of technology and teaching methods is strongly in play. There can be significant improvement, however. With the continued advance of neuroimaging techniques such as fMRI, it is possible to observe brain functionality in students in order to determine if a particular area of the brains associated with memory and learning is not functioning as it should. An opportunity for improvement potentially exists for the technology of cognitive prosthetics to be combined with neuroimaging.

Neuroimaging techniques for high risk students may be useful in determining the short-comings of the student's cognitive processes by identifying the under-functioning area of the brain and matching it to the difficulties associated with learning (Nugent et al, 2008). Once this match has been made, the use of cognitive prosthetic devices designed to assist in learning and memory deficiencies can be employed by the educator to assist the student in learning.

Conclusions and Future Study

Learning, directly related to memory, occurs through the exposure to experiences and the encoding of the experiences as significant (Ridley, 2012). The continued advancement in the area of cognitive prosthetics is a potentially important contemporary endeavor. Improving current teaching and recall techniques as a result of the advances in neuroimaging and the use of cognitive understanding by educators and care givers may be able to improve the learning and memory rates of those with insufficient capacity to learn and retain memories at a healthy rate.

In reviewing the existing research on the subject, my interpretation is that it appears the goal of utilizing neuroimaging, improved teaching techniques and cognitive prosthetics is clearly viable. The research is moving in this direction and the potential for the research to positively impact those with learning and memory disorders is encourage. On some levels, this is already being implemented (Matthews, Kim, Brumberg & Clements, 2010)). The continued use of cognitive prosthetics combined with the continued advance in technology promises to assist in the scientific advancement in the fields of learning and memory (Cole, 2013).

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