Donald olding hebb: biography and theories

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In Chester, Nova Scotia on July 22, 1904 Donald Olding Hebb was born. Both of his parents were medical doctors (Brown & Milner, 2003). Donald's mother home schooled him till the age of 8 because she was heavily influenced by the ideas of Maria Montessori, an Italian physician who believed that education of the senses should come before development of the intellect (University of Alberta Canada, 2008). At the age of 10 Donald's academic performance was so spectacular it left his teachers amazed and as a result he was promoted to grade 7(University of Alberta Canada, 2008) . Home schooling has been said to influence Donald's attitude towards authority and policy (University of Alberta Canada, 2008). In his high school years he avoided all adult pressure and held a low estimate of the value of academic achievement and as a result failed the 11th grade (University of Alberta Canada, 2008). Donald managed to graduate and enrolled at Dalhousie University where he received his B. A. in 1925 (University of Alberta Canada, 2008). Donald carried distain for structured schooling and had a worse than mediocre record at Dalhousie (University of Alberta Canada, 2008).

In 1925 he began teaching at an elementary school at his old schoolhouse in Nova Scotia for a year (University of Alberta Canada, 2008). Donald then began working as a laborer and read Sigmund Freud (Brown & Milner, 2003). After reading Freud in 1928 Hebb thought that there was area for opportunity in the field of Psychology and sought to go back to school and enrolled at McGill University (University of Alberta Canada, 2008). Donald became bedridden for a year with a tubercular hip and during this time he wrote his M. A. thesis (Brown & Milner, 2003). Donald tried to show in his master's thesis that skeletal reflexes are a product of cellular learning (Brown & Milner, 2003). He later said his thesis was nonsense (Brown & Milner, 2003). In 1934 Donald made the decision to study physiological psychology, and worked with Lashley in Chicago for three academic terms (Brown & Milner, 2003). In 1935 he moved to Harvard with Lashley(Brown & Milner, 2003). While at Harvard the idea of neural networking began to take shape in Donald's mind(Brown & Milner, 2003). He later used the ideas of neural networking for his PhD thesis which he submitted in 1936(Brown & Milner, 2003). These ideas led him to pivotal ideas that made him famous with the creation of a new branch of psychology (Brown & Milner, 2003). Dr. Hebb would later conduct research on the brains of humans regarding intelligence and research on primates (Brown & Milner, 2003).

Hebb's research lead him to write the book *The Organization of Behavior* (University of Alberta Canada, 2008). His book introduced his theory of neural networking (Brown & Milner, 2003). In his book Hebb suggests' that two neurons firing together will strengthen the connection and make it easier for the two neurons to illicit a response from the third. In sum " The neurons that fire together, wire together"(Brown & Milner, 2003). The implications of his findings and theory forever changed physiology and psychology.

Hebb's theory has crossed over from psychology to computer science and engineering (Brown & Milner, 2003). Dr. Donald Hebb received acclaim for his theory and findings and was nominated for the Nobel Peace Prize and served on many boards such as the CPA, APA, NRC (Brown & Milner, 2003). Hebb died on August 20, 1985 from what was thought to be a routine surgery on his hip (Olsen & Hergenhahn, 2013).

Five key findings Hebb discovered transformed the field of learning psychology. The five findings include; cell assembly, phase sequence, arousal theory, short and long term memory, and the Hebb rule. Hebb’s theories and research are now applied in engineering, robotics, and computer science as well as neurophysiology, neuroscience and psychology (Klien, 1999).

The beginning to Hebb’s discoveries began in 1929 when Han’s Berger’s announced that the brain exhibits continuous electrical activity((Brown, & Milner, 2003). With this information Hebb sought explanations as to how learning and physiology interact with one other (Brown, & Milner, 2003). Hebb found that at the time, explanations as to how learning was developed were by simplistic equations such as the S-R relationship in organisms which to him was too simplistic (Brown, & Milner, 2003). He believed that the inborn activity of the path must be taken account for (Brown, & Milner, 2003). Hebb thought that psychologist could no longer pretend that the biology of the organism was irrelevant (Brown, & Milner, 2003). Behavior as Hebb saw was affected by variables such as attention and psychological theory which could no longer be ignored (Brown, & Milner, 2003). Hebb believed that the learning was related to neural activity and current data of the time could not explain the phenomena. Hebb concluded that Classical Behaviorism could not account for electro-encephalic data which clearly demonstrated the inadequacy of the physiological data on which Classical Behaviorism was based on (Brown, & Milner, 2003). As a result Hebb developed neural theory with the current neurophysiological data (Brown, & Milner, 2003).

One of the key findings of Hebb was the cell assembly. Understanding how environmental objects we experience impact the brain led Hebb to the discovery of the cell assembly. The cell assembly is a pattern of neural activity that is caused when an environmental object or event is experienced (Olsen & Hergenhahn, 2013). Furthermore when the cell assembly is well developed, the person is able to think of the entire event following the stimulation of the assembly, even if the object itself or the event is physically absent (Olsen & Hergenhahn, 2013). When a cell assembly fires we experience the event or thought the assembly represents (Olsen & Hergenhahn, 2013). Thought or ideas according to Hebb, is the cell assemblies neurological basis (Olsen & Hergenhahn, 2013).

The next influential finding of Hebb was the phase sequence. The phase sequence is a sequence of temporarily related cell assemblies. A phase sequence occurs when cell assemblies consistently follow one another in time form(Olsen & Hergenhahn, 2013). Once a phase sequence is developed a temporarily integrated series of assembly activities amount to one current stream of thought (Olsen & Hergenhahn, 2013). When a single cell assembly or combination of assemblies in a phase sequence is fired, the entire phase sequence tends to fire (Olsen & Hergenhahn, 2013). As a result of the phase sequence firing, one experiences a stream of thought which is a series of ideas arranged in a type of logical order (Olsen & Hergenhahn, 2013).

Another important finding of Hebb was his development of arousal theory which explained reinforcement. Hebb discovered that there are times in which too much noise or commotion may allow one to not think clearly while at other times, one may need to shake themselves awake to keep up with optimal performance (Olsen & Hergenhahn, 2013). Hebb discovered that these reactions suggests that there is a level of stimulation in which must not be too high or low to produce optimal cognitive functioning (Olsen & Hergenhahn, 2013). This relationship led to Hebb's development of arousal theory (Olsen & Hergenhahn, 2013). Arousal theory according to Hebb is the contention in which brain wave activity ranges from very fast to very slow with a rate in between that allows for the optimal performance of certain tasks. (Olsen & Hergenhahn, 2013).

Hebb contributed towards developing the differentiation between long term and short term memory . Hebb completely developed the distinction between different kinds of memory and theorized on the underlying physiological mechanisms (Olsen & Hergenhahn, 2013). Hebb believed in two forms of memory which consists of long term and short term memory (Olsen & Hergenhahn, 2013). Short term memory according to Hebb, lasts less than a minute and is related with the reverberating of neural activity created by an environmental event (Olsen & Hergenhahn, 2013). However if an experience is repeated enough it is stored as long term memory (Olsen & Hergenhahn, 2013). The process in which short term memory is converted into long term memory is defined as consolidation (Olsen & Hergenhahn, 2013).

Another major contribution of Hebb lays in a learning rule. The Hebb rule is a learning rule used in computer simulation which refers to Hebb's idea that when two cells are active together, the connection between them is strengthened (Olsen & Hergenhahn, 2013), The Hebb rule is a mathematical statement which tries to capture Hebb's contention that the connection between two cells that are active simultaneously will be strengthened or made more efficient (Olsen & Hergenhahn, 2013).

The similarities of Hebb and Pavlov's theories is that Hebb's ideas concerning formation of associations between areas that are contiguously active are not that much different from Pavlov's (Olsen & Hergenhahn, 2013). Comparatively, Hebb like Pavlov was not the first researcher to use his ideas about brain function to theorize about higher cognitive processes (Olsen & Hergenhahn, 2013). Furthermore, it could be said the Hebb may have changed the level of analysis from larger areas of the brain to smaller numbers of neurons but maintained the basic principles of Pavlov (Olsen & Hergenhahn, 2013).

The differences between Hebb and Pavlov's theory is that Hebb along with Lashley discovered that Pavlovian theory had restrictions specifically in the belief that the brain was a complex switchboard. (Olsen & Hergenhahn, 2013). For instance, the switchboard view of the brain assumed that sensory events stimulate specific areas of the brain and learning causes a change in neural circuitry so that sensory events come to stimulate areas other than those they originally stimulated (Olsen & Hergenhahn, 2013). Conversely Hebb and Lashley discovered through their research on rats that the location of destroyed portions of the brain was not as important as the amount of destruction (Olsen & Hergenhahn, 2013). Lashley further proved through the principle of mass action that the disruption of learning and retention goes up when the amount of cortical destruction goes up regardless of the location of the destruction (Olsen & Hergenhahn, 2013). Furthermore, when the cortex functions as a whole during learning, and suppose one part of the cortex is destroyed then the other parts of the cortex take over the destroyed portion's function (Olsen & Hergenhahn, 2013). Hebb and Lashley's discoveries show that the brain did not act like a simple switchboard.

Hebb impacted the field of learning through his discoveries on the effects of environment and neural development and arousal theory (Olsen & Hergenhahn, 2013). Hebb believed there were two kinds of learning (Olsen & Hergenhahn, 2013). First is the gradual buildup of cell assemblies and phase sequences during infancy and early childhood (Olsen & Hergenhahn, 2013). Both cell assemblies and phase sequences in early childhood develop in early learning in which the objects and events in the environment have neurological representations (Olsen & Hergenhahn, 2013). As a result of this neural development, children can think of an object or event, series of objects and events, when it is not physically present (Olsen & Hergenhahn, 2013). According to Hebb the second kind of learning, occurs when cell assemblies and phase sequences are developed in early life, then subsequent learning involves their rearrangement (Olsen & Hergenhahn, 2013). One way of putting it, once the building blocks have been established (first kind of learning) they can then be rearranged in numerous configurations (Olsen & Hergenhahn, 2013). Another contribution to the field of learning was Hebb's arousal theory. Arousal theory shows that for any given student or task efficient learning occurs when there is an optimal level of arousal (Olsen & Hergenhahn, 2013). Together environment and neural development along with arousal theory have contributed towards the field of education.

References

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