

A Wizard and A Pioneer:
William Grey Walter and his Tortoises

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William Grey Walter
(1910-1977) was one of
those young wizards.





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Born	February 19, 1910 Kansas City, Missouri
Died	May 6, 1977 (aged 67)
Citizenship	United Kingdom
Nationality	United States
Fields	Robotics , neurophysiology
Known for	Brain Wave , Delta wave , Alpha wave , Autonomous robot



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Neurophysiology and Brain Waves

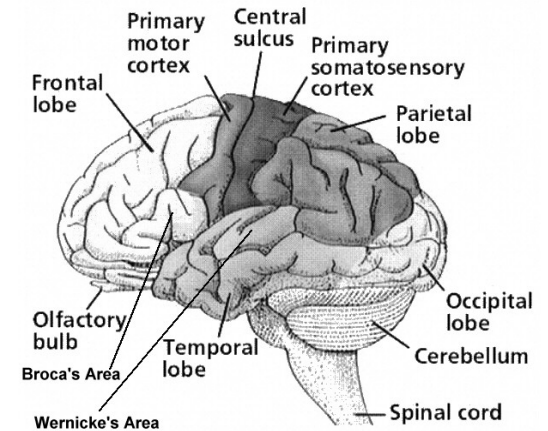
Dr. William Grey Walter contributed great improvement to the technologies of brain waves (EEG: electroencephalography).

Identify the source of the alpha rhythm

Hans Berger in 1929 discovered alpha wave, inferred it came from the frontal lobes

William Grey Walter found the source in the occipital lobe.

Invented use of delta wave to locate brain tumors



This typical instrument displays the brain wave traces with an ink-writing pen on moving papers is conceived by Dr. Walter.

Neurophysiology and Brain Waves

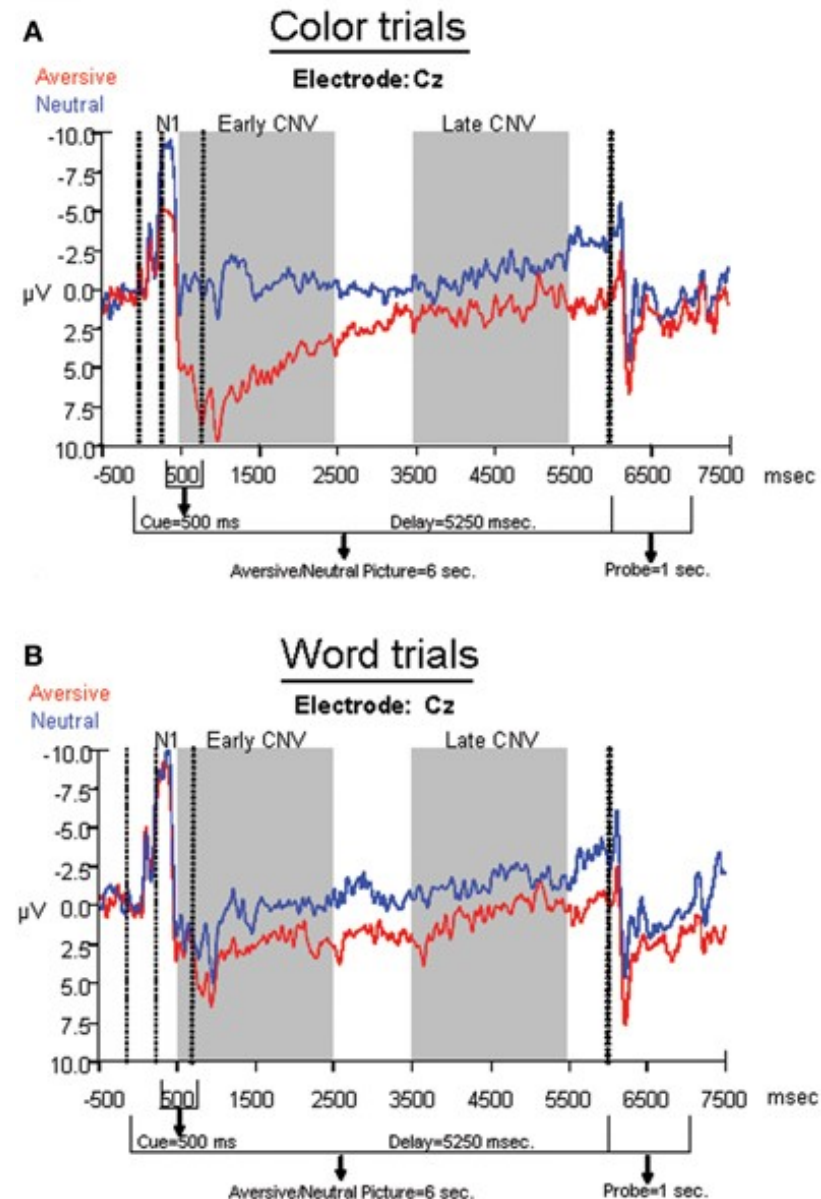
Discovered contingent negative variation (CNV)

This is a very slow change in electrical potential at and around the vertex of the head

It was seen only after a warning signal had been given to a human subject, who would then plan a possible movement in anticipation of a second signal

Observer can predict a subject will make a response half to one second ahead, before the subject is aware of an intention to act

Intentional actions are initiated before awareness of such actions emerges



Neurophysiology and Brain Waves

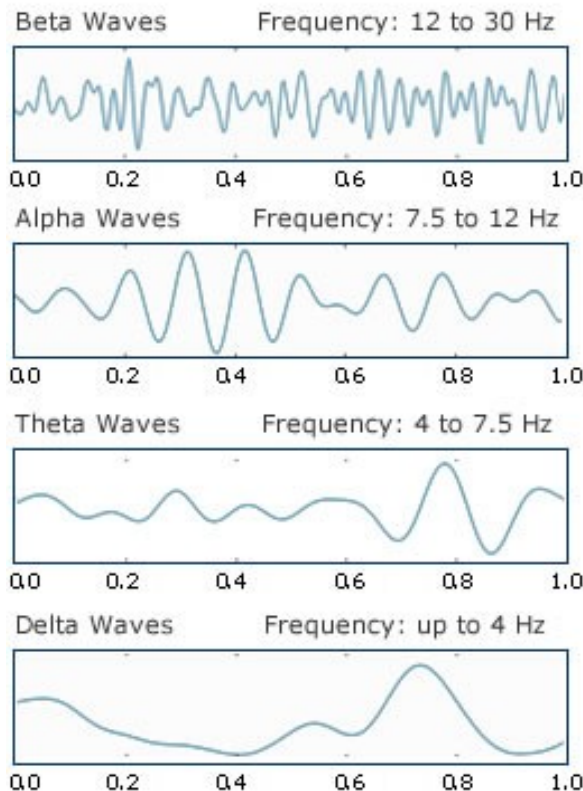
Hypothesis about Alpha Wave activities

The alpha represented 'scanning' by the brain in search of local centers of activity when none was present

It stopped when a 'target' was found in the cortex

This hypothesis was and still is controversial, but it is still not disproven

EEG Brain Frequency Chart



depth of mind



Conscious Mind

Normal waking state of consciousness. Alertness, concentration, focus, cognition and the five physical senses.

Gateway to the Subconscious Mind

Deep relaxation and light meditation usually with eyes closed. Relaxation, visualization, creativity & super learning.

Subconscious Mind

Usually light sleep, including REM dream state. Deep meditation, intuition, memory and vivid visual imagery.

Unconscious or Supra-Conscious Mind

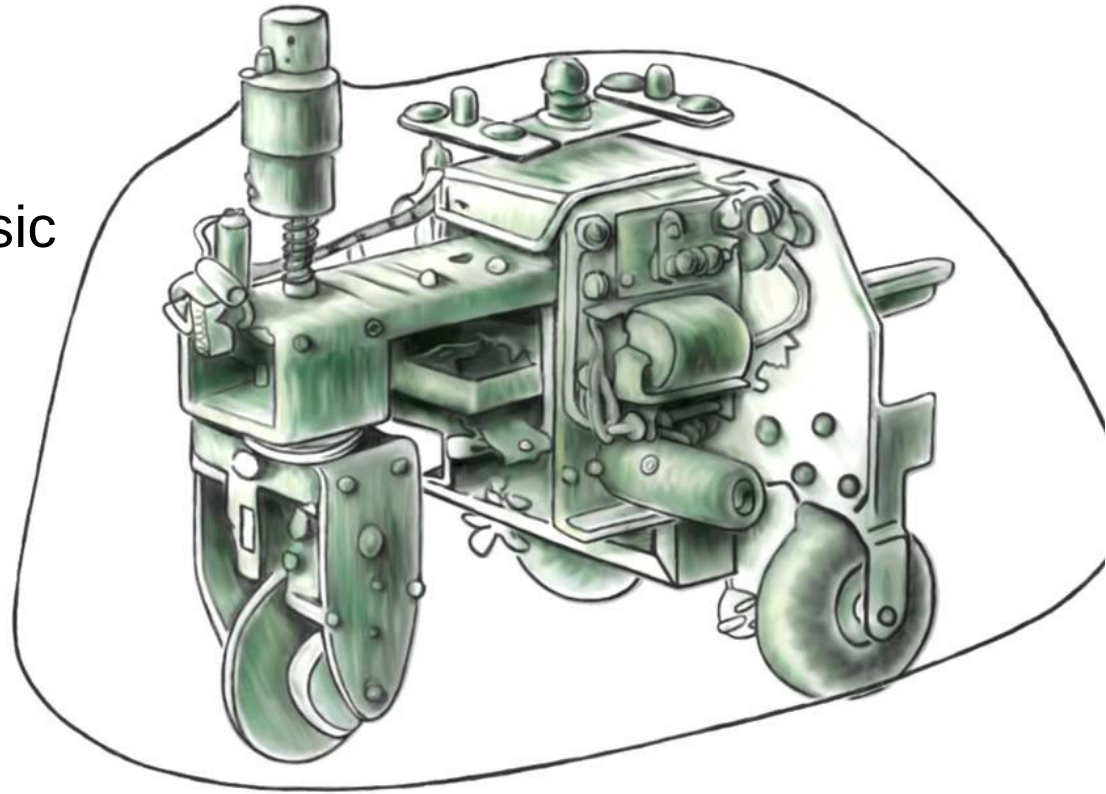
Usually deep sleep, dreamless state. Transcendental meditation. Automatic self-healing, immune system function.

Cybernetics and Robot Tortoise

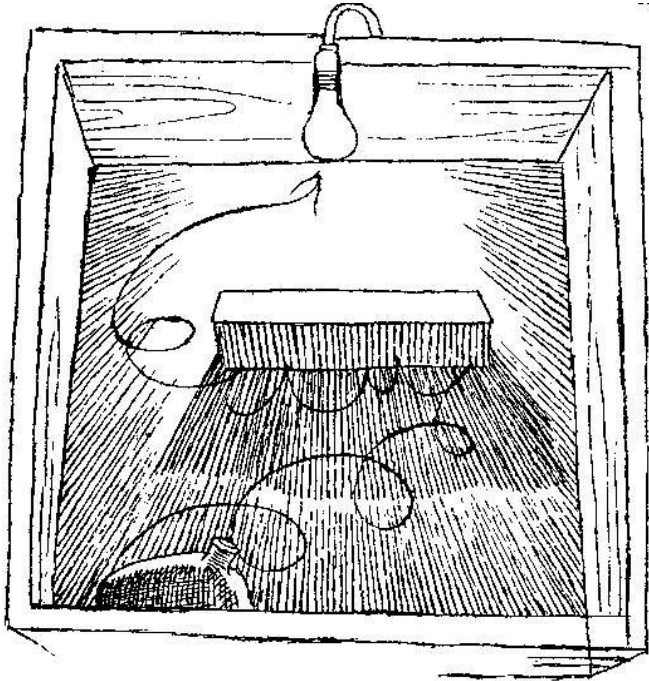
Brains are simpler than many of us have supposed

In 1951, Dr. William Grey Walter displayed his 'tortoises' at the Festival of Britain.

His electric toy simulated two basic characteristics of animal behavior: goal-seeking and scanning



Cybernetics and Robot Tortoise

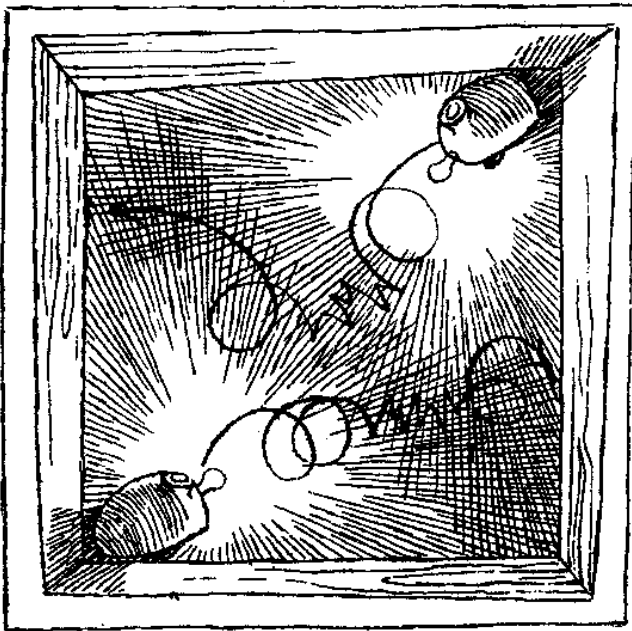


His tortoise was continually on the prowl in search of its goal : moderate illumination

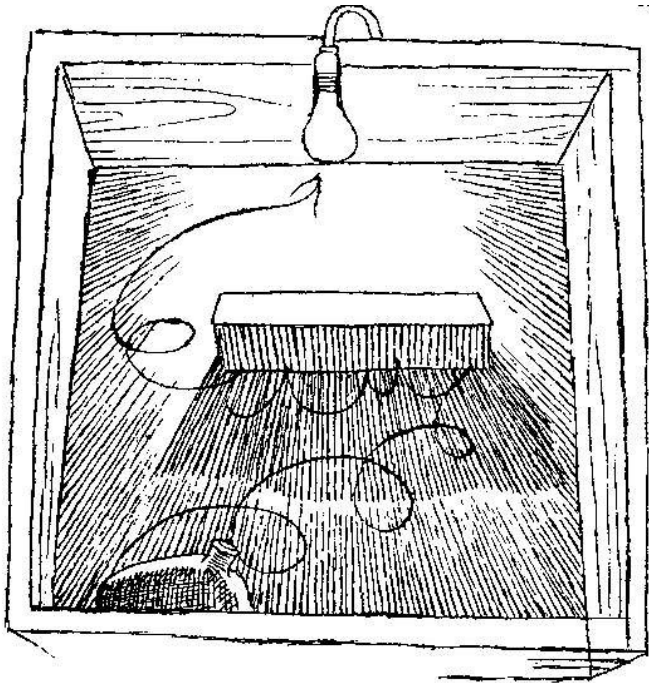
It has a photocell connected to the drive and steering motors

Its hutch was brightly lit, when its batteries were fully charged, it moved out. As its batteries ran down it came back toward the light in its hutch

If it encountered another of its own kind, attracted by the other light, a stately dance ensued of bumping and backing

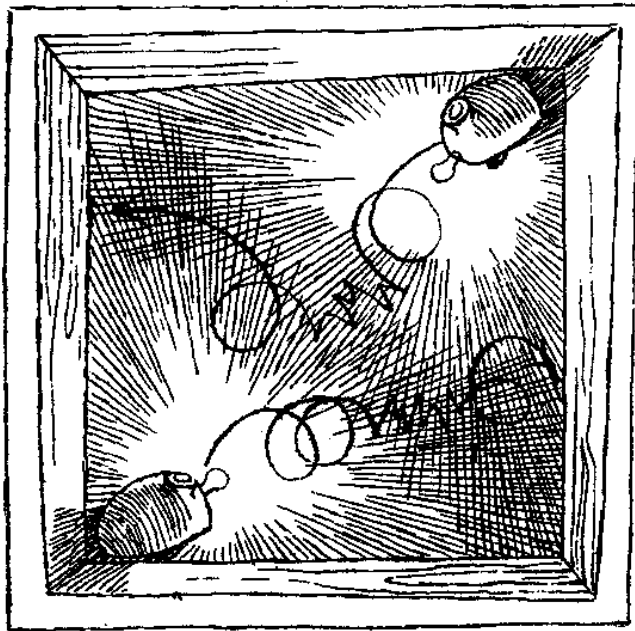


Cybernetics and Robot Tortoise



It has a contact switch that indicated that the turtle's "shell" had bumped into something

If the tortoise hit an obstacle or encountered an incline, it would stop, back up, turn, and eventually move around it or avoid it altogether



This sense of touch gave the tortoises information about the direction and the means to explore objects in its environment by touch

Cybernetics and Robot Tortoise

This is a **video** of his autonomous, adaptive robots

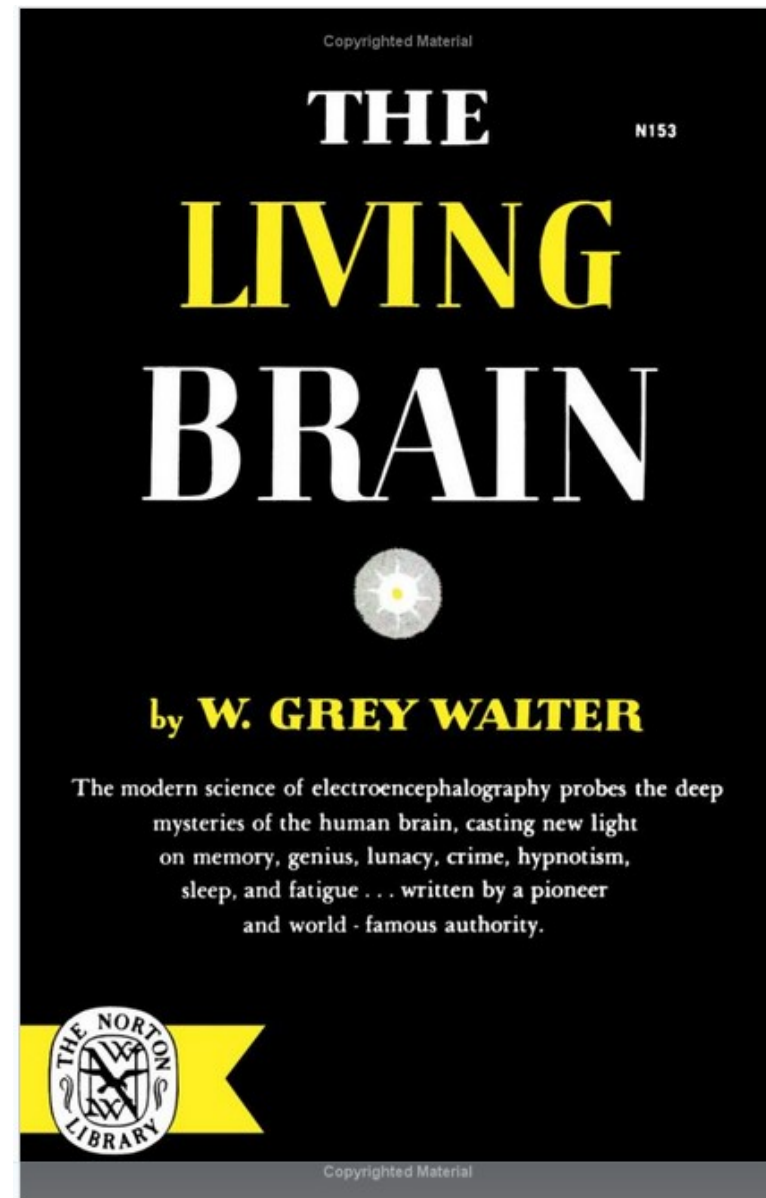
He wanted to prove that a small number of brain cells could give rise to very complex behaviors.

Some of his papers and books are

“An Imitation of Life”, 1950

“A Machine that Learns”, 1951

“The Living Brain”, 1963



Cybernetics and Robot Tortoise

They were the first free-ranging, autonomous robots capable of exploring their limited worlds

They had a capacity to conceive desired future states within their brain

They had the degrees of freedom needed to create and adapt their actions in pursuit of those goals in the unpredictable circumstances.

These flexible brain functions that enable simple systems to function in infinitely complex environments are not achieved by rule-driven symbol manipulation

References:

- [1] CJ. W.Grey Walter: Biographical Essay. Encyclopedia of Cognitive Science(2003) 4: 537-539. Walter J Freeman
- [2] http://en.wikipedia.org/wiki/William_Grey_Walter
- [3] <http://www.extremenxt.com/walter.htm>