



A COLLABORATIVE ONLINE EVENT

PUSHING THE BOUNDARIES OF ACHIEVEMENT

A SERIES ON THE LATEST EVOLUTION OF APPLIED NEUROSCIENCE

Thank you for joining us today, along with our
International Partners.



Your Panelists

Alex Kitzes Ph.D.

Clinical Psychologist & Co-Founder of Stronger Brains Inc, USA

Cheryl Chia

Physiotherapist & Founder of Singapore-based BrainFit

Dave Stanley

Director of Learning Ecosystems at LearnFast Australia

Your Presenter - Ed Hamlin, PhD

Ed is the founder and clinical director of the Center for the Advancement of Human Potential.

He obtained his doctoral degree in clinical psychology from the University of North Carolina and taught at UNC and Duke University before moving to Asheville.

He is certified in EEG biofeedback by the Biofeedback Certification International Alliance and a member of the American Psychological Association and the Association of Applied Psychophysiology and Biofeedback.

The Basics of Electroencephalogram (EEG), Neurofeedback Practice & Science

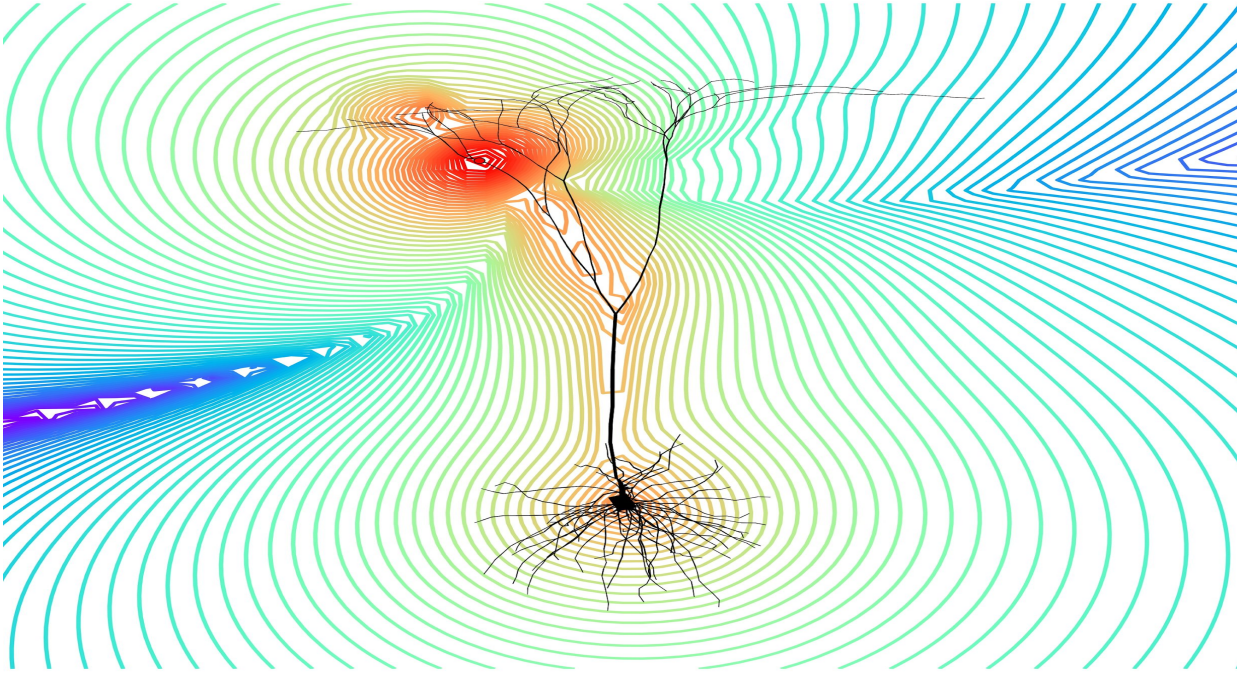
Ed Hamlin, PhD
January 28, 2021





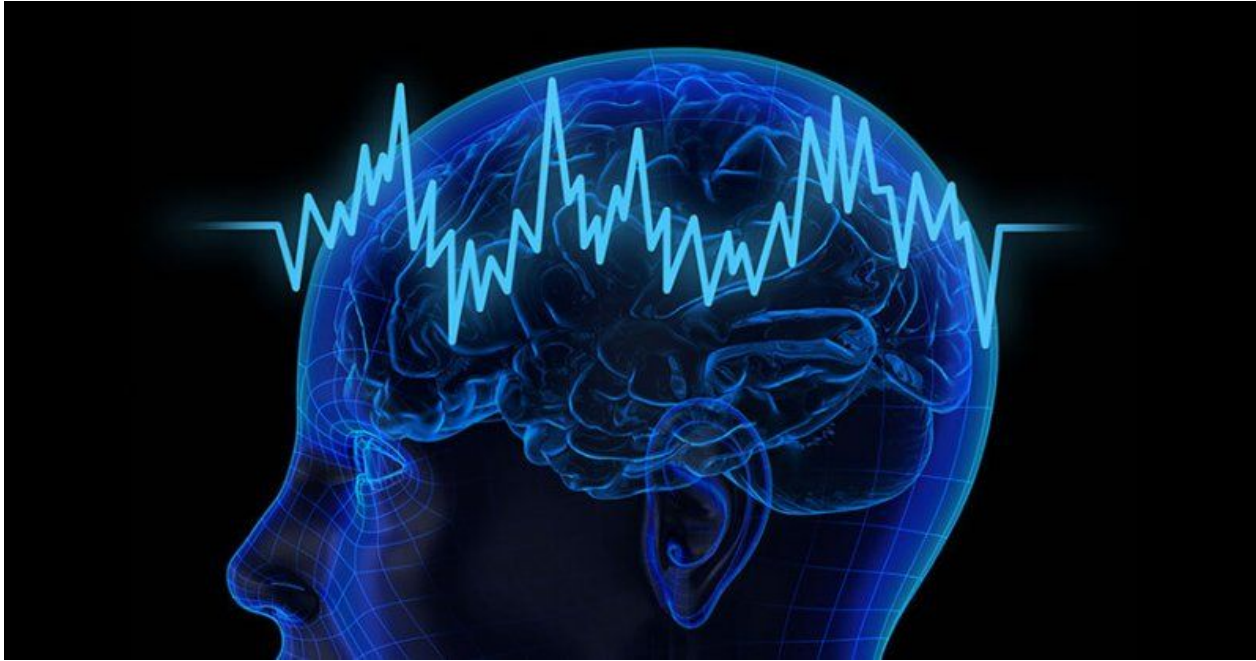
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The Electrochemical Brain

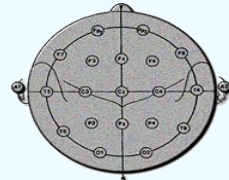


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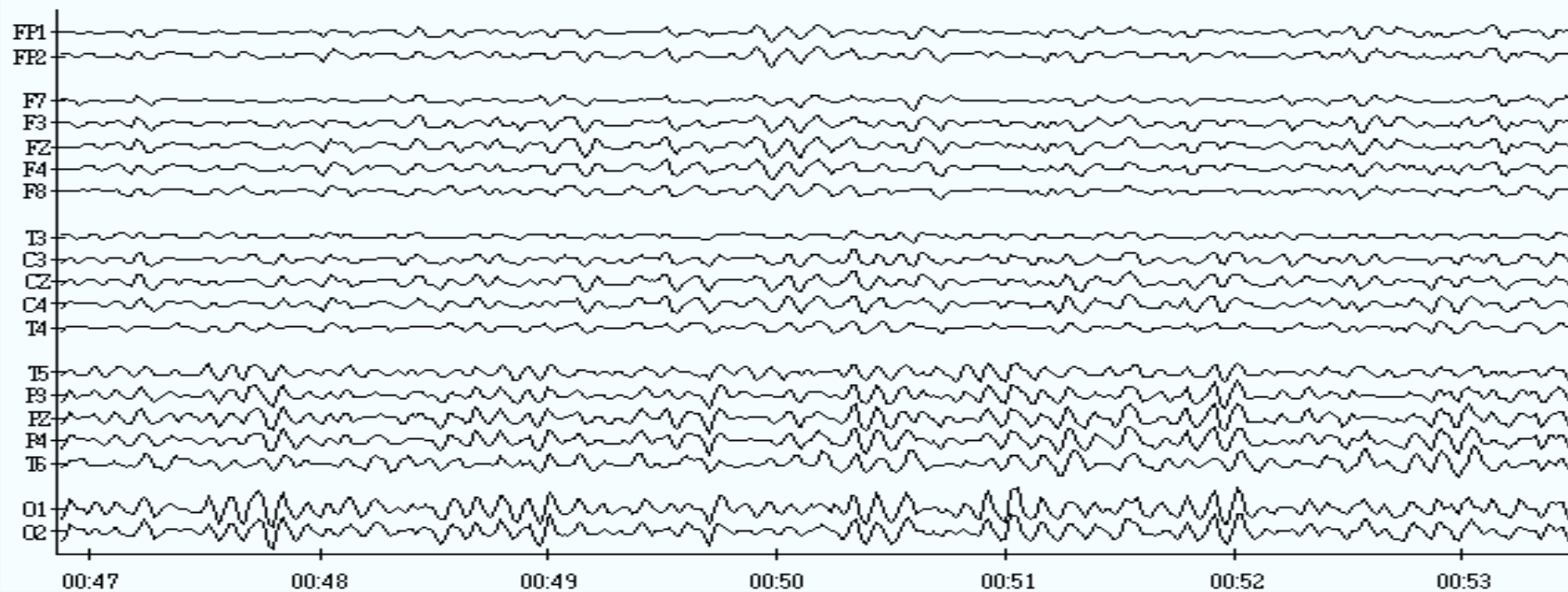
Electrical Output



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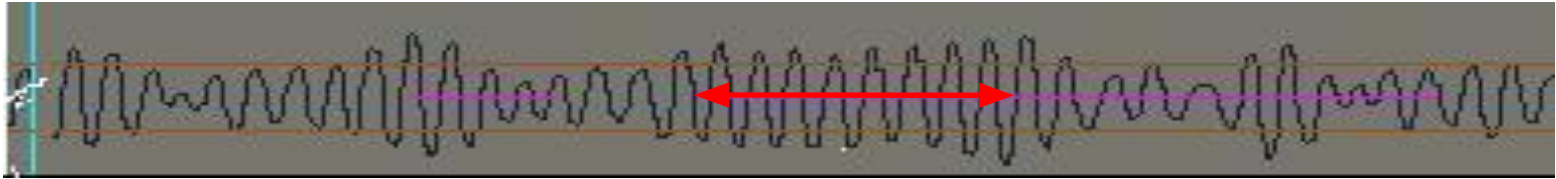
Sample EEG during eyes closed.



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Frequency

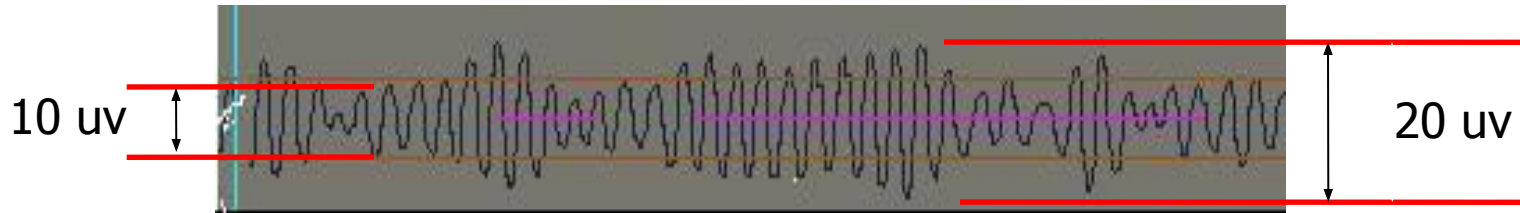
Frequency is the unit of measure for how many times a wave occurs in a second of time. Each start point to end point is referred to as a cycle per second.



8 cycles/sec.
or 8 Hz

Amplitude

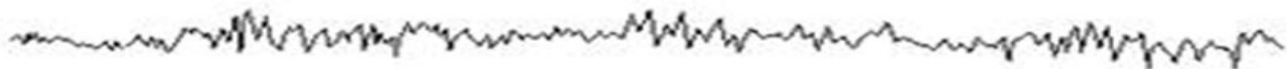
Amplitude is the unit of measure that describes the power of a wave from the highest peak to the lowest peak.



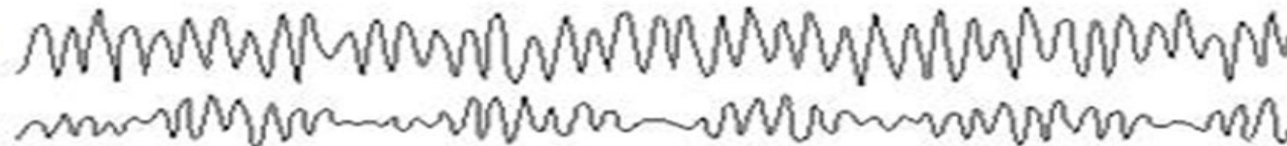
uv = microvolts

Brain Waves: EEG Tracings

Beta (β)
13-30 Hz



Alpha (α)
8-13 Hz



Theta (θ)
4-8 Hz



Delta (δ)
0.5-4 Hz



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A=T3-T4Sc= 50 $\mu\text{V/cm}$

Artl

Thr= 60.00 μV Avg= 17.2 μV

arti% 0

B=

Sc= 50 $\mu\text{V/cm}$

Artl

Thr= 60.00 μV Avg= 0.7 μV

arti% 0

2 4-7Sc= 10 $\mu\text{V/cm}$

Inhb

Thr= 20.00 μV Avg= 9.2 μV

inhib% 0

3 12.00-15.00Sc= 10 $\mu\text{V/cm}$

Ampl

Rwrd

Thr= 20.00 μV Avg= 6.3 μV

rwrdd% 0

4 22-3610 μV Sc= 10 $\mu\text{V/cm}$

Inhb

Thr= 20.00 μV Avg= 6.8 μV

inhib% 0

**Pause**

SingleA

+PB +ASTg Eopn
-Nuse

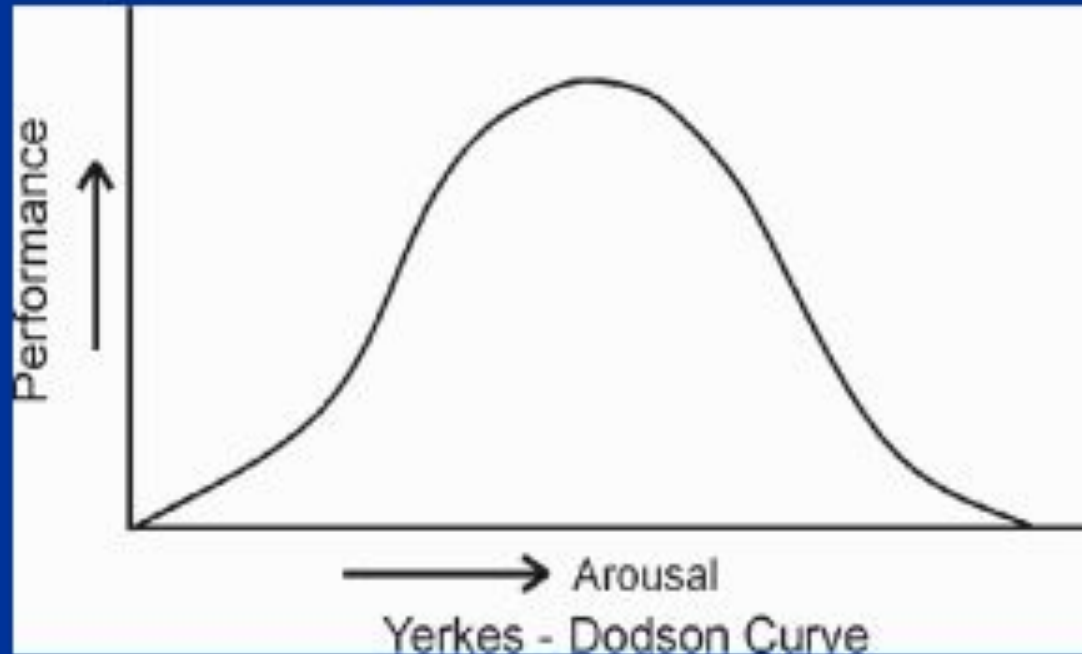
19:20:00

5.88

Setup: C3-A1,,15.00-18.00







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Arousal-performance curve



The RATE of BRAINWAVE FIRING is related to our state of arousal.

cps = cycles per second, or Hertz

DELTA Less than 4 cps	THETA 4-8 cps	ALPHA 8-12 cps	SMR 12-15 cps	BETA 15-18 cps	HIGH BETA more than 19 cps
Sleep	Drowsy	Relaxed Focus	Relaxed Thought	Active Thinking	Excited
					

Depression,
ADD, and
seizure activity
in this range.

We train the brain to move into
this range to modify symptoms of
depression, ADD, and improve
seizure activity.



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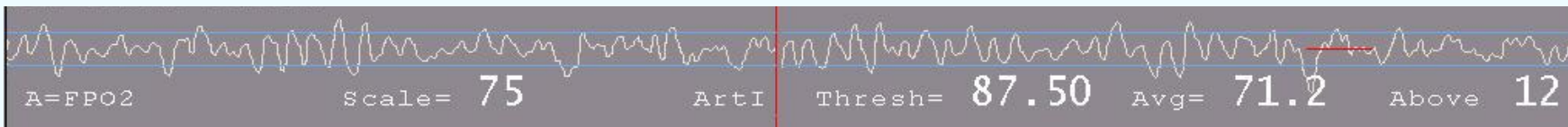
Small activated EEG is more normal - Larger waves in the EEG tend to show excessively slow or fast activity - **Goal: Reduce this activity**

Normal EEG

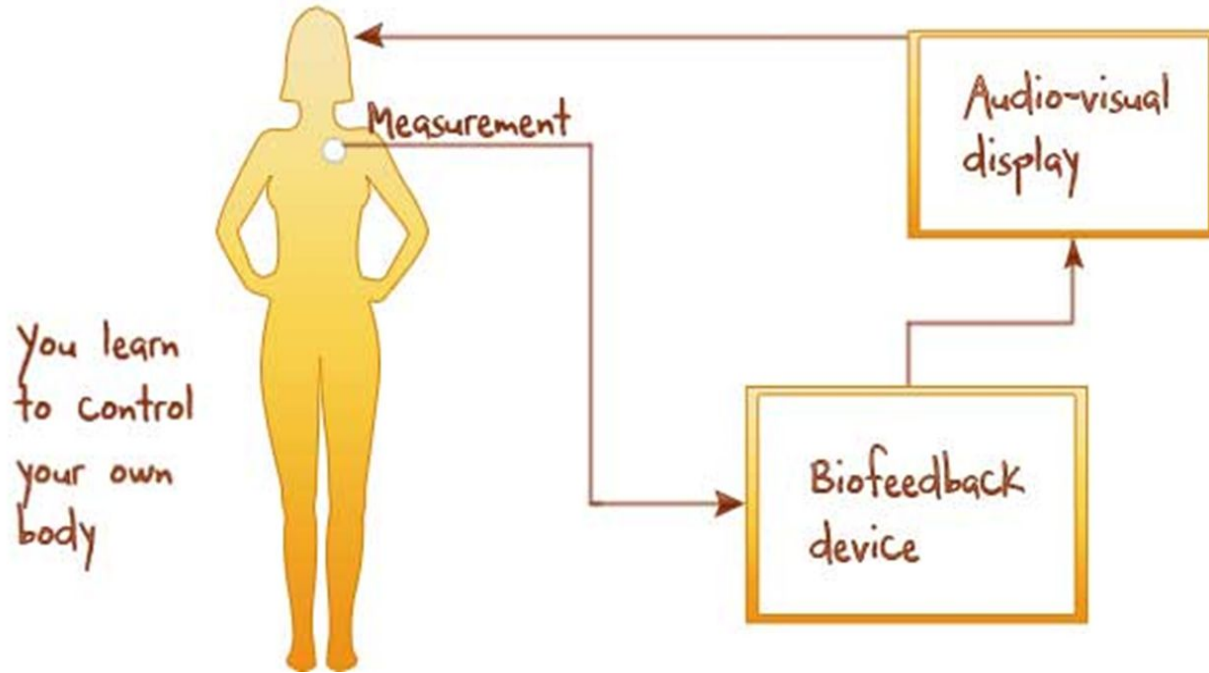
Your brain is more “in tune” - more alert, more awake, focused, calm, efficient



Excessive slow or fast EEG causes you to have to work harder to do active tasks. The brain is less efficient making it harder to do cognitive tasks or to regulate emotions and/or behavior.



Biofeedback Process



Neurofeedback uses real-time EEG signals as data to help people train their brains to function better

- First employed in the late 1960s
- An early clinical application was for treatment of epilepsy
- Quickly discovered to also be effective for children diagnosed with ADHD to help improve focus, reduce impulse control, and enhance executive functioning

According to proponents, the demonstrated benefits are twofold:

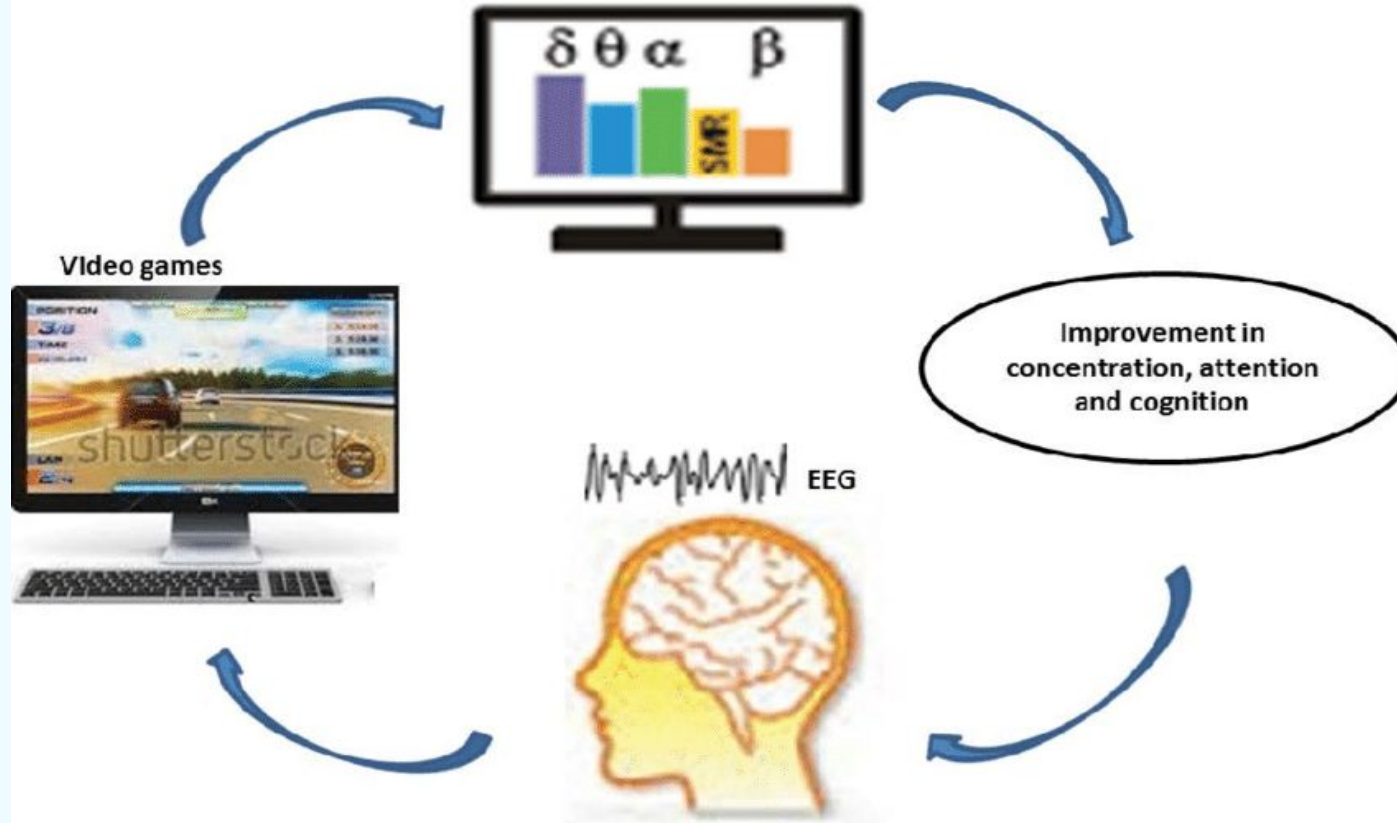
- Brainwave alterations are measurable and appear to endure well beyond the training's end.
- Brainwave improvements can lead to behavior improvements—most notably, sustained focus, diminished impulsivity, and reduced distractibility beyond the training environment.

EEG Biofeedback/Neurofeedback



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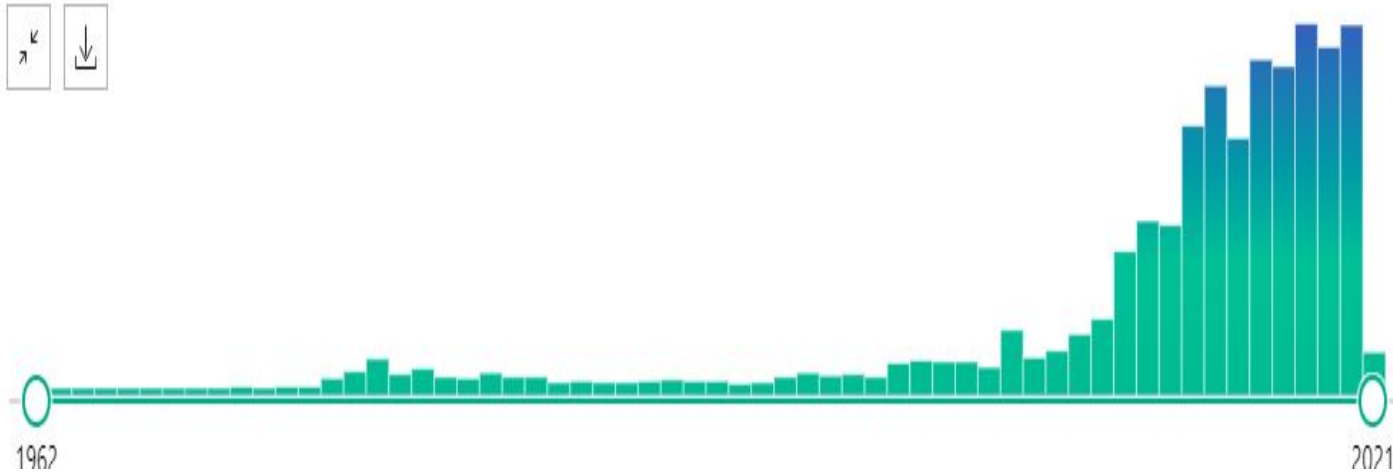
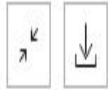
Different brain waves training



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Studies on Neurofeedback

In January, 2021, National Library of Medicine lists almost 2,400 studies of neurofeedback/EEG biofeedback. Over 750 of these studies are regarding ADHD. (Google Scholar lists 37,700 with 12,500 regarding ADHD.)

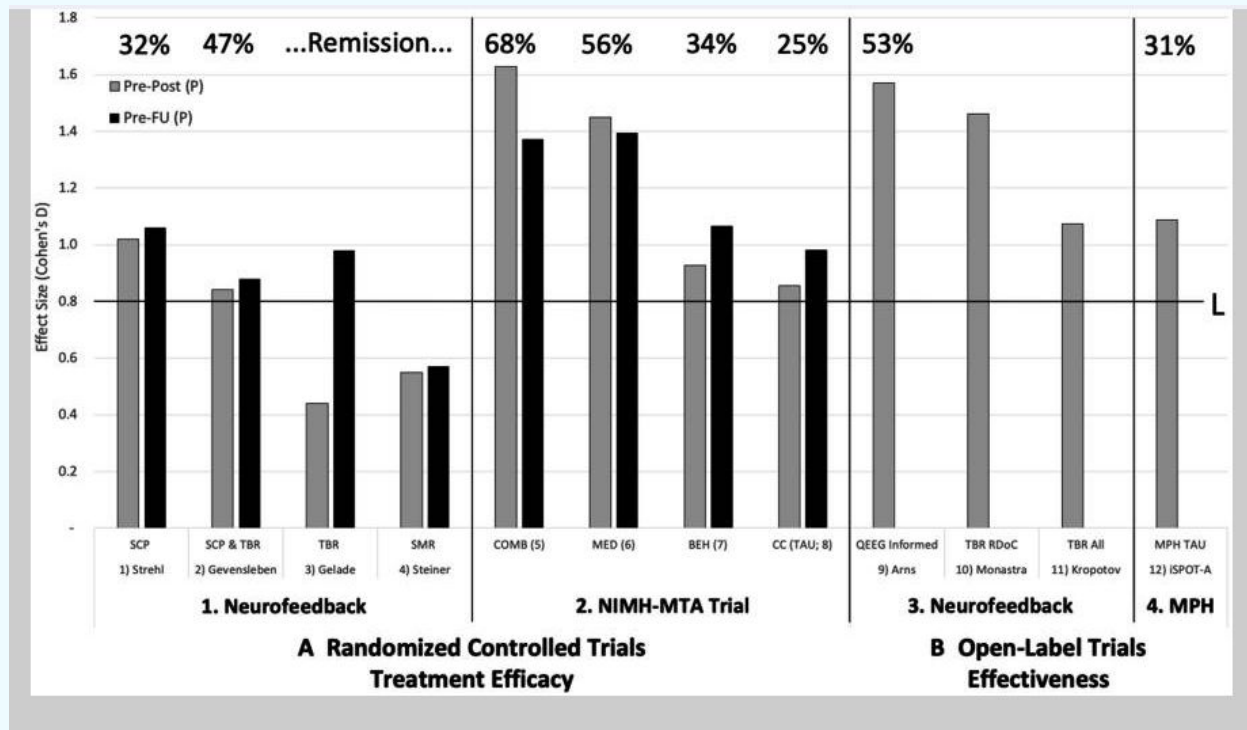


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Neurofeedback Efficacy Studies for ADHD

- Monastra, et al., (2002) - Continued benefits following cessation of treatment for neurofeedback but not for medication.
- Levesque, et al., (2006) - fMRI changes during an attention task following neurofeedback training.
- Gevensleben, et al., (2009) - Improved outcomes for neurofeedback training compared to computerized attention training with sustained benefits for 6 months post-training.

Arns, M., et al., 2020. Neurofeedback and attention-deficit/hyperactivity disorder in children: Rating the evidence and proposed guidelines. *Applied Psychophysiology and Biofeedback*, 45(2), 39-48.



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Conclusion of Meta-Analysis

- Standard neurofeedback protocols in the treatment of ADHD can be concluded to be a well established treatment with medium to large effect sizes and 32-47% remission rates and sustained effects as assessed after 6-12 months.

Arousal, Attention & Neurofeedback



Limitations of Neurofeedback

- Not always locally available
- Not all approaches to neurofeedback have been shown to be effective
- Training generally conducted in an office setting
- Cost of services can be prohibitive as NFT often not covered by insurance
- Transfer from clinical setting to real-world activities does not always occur

Future of Neurofeedback Training

Hamlin, E. (2018) Growing the evidence base for neurofeedback in clinical practice. In J. J. Magnavita (Ed), **Using Technology in Mental Health Practice**. Washington, DC: American Psychological Association

- Neurofeedback's future lies in low cost, low burden approaches and equipment (personal use devices, i.e., Muse, Neurosky, BrainLink)
- Permitting greater frequency of training outside of clinical settings
- Real world training and attention monitoring applications

Thank you for your attention

Your secrets are
safe with me,
I zoned out about
30 minutes ago



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Panel Discussion & Questions


Elite Performance Solutions provides our software and services through our partners:



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Thank you again for joining us!

Join us again next week (February 3 or 4) for,

Neuroscience: The Importance of Understanding the Brain

with Mike Merzenich Ph.D.



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