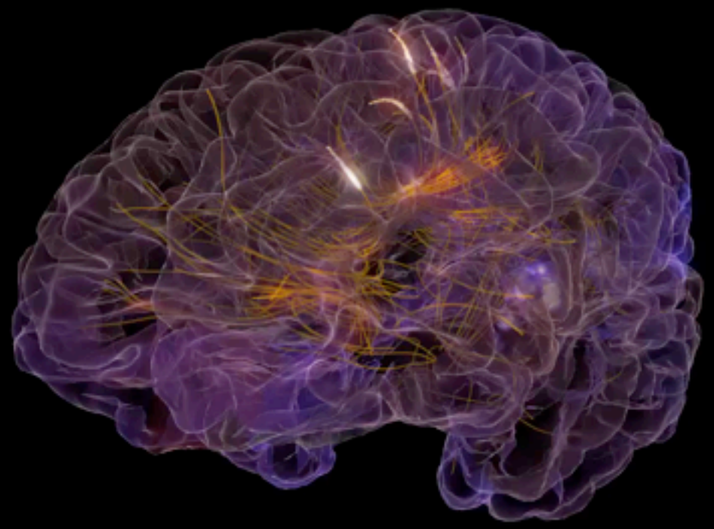
Video Games as Cognitive Enhancers



Adam Gazzaley, MD PhD

Professor - Neurology, Physiology and Psychiatry
Director - Neuroscience Imaging Center
University of California, San Francisco

CoFounder - Akili Interactive Labs
Several Pending Patents using video game technology

Challenge

Develop effective approaches to enhance cognition in both healthy and impaired individuals

Current Approach

60 year old with mild cognitive impairment

- Poor characterization
- Poor targeting
- Non-personalized
- Unimodal
- Open Loop

This is just n good enough

Create a New Approach

targeted

personalized

multimodal

closed-loop

Cognitive Enhancement

Physical exercise

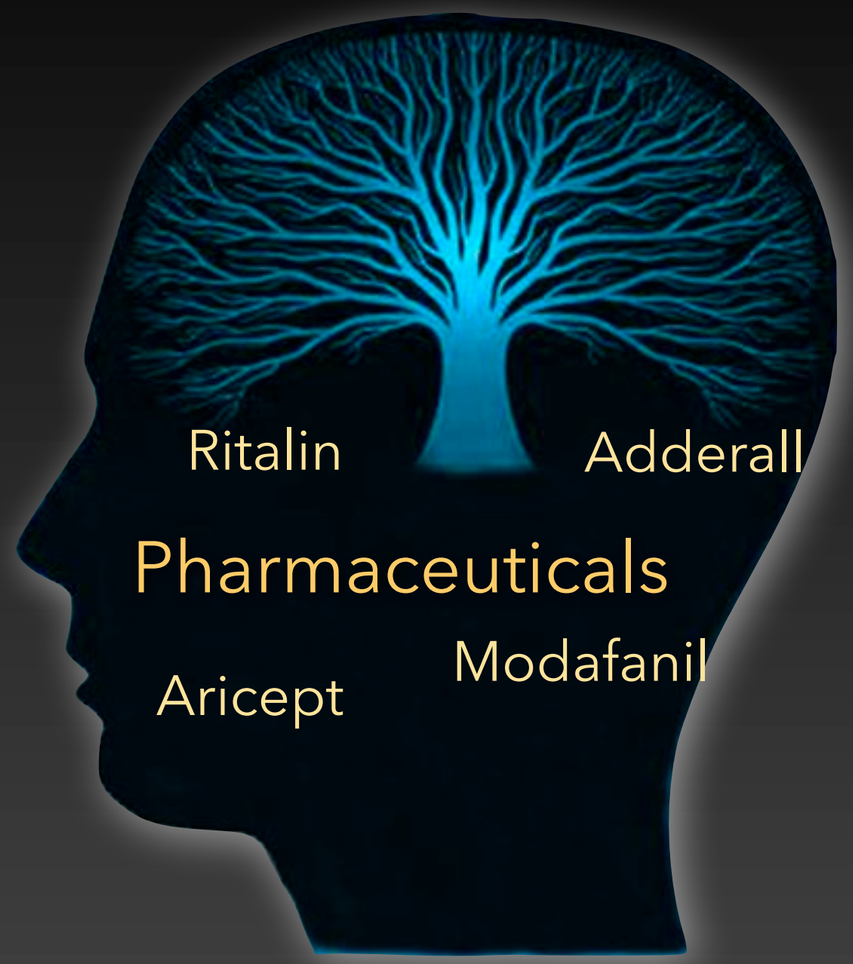
Traditional Education

Nutrition

Meditation

Neurofeedback

Cognitive Training



Transcranial magnetic stimulation (TMS)

Enriched Environments

Transcranial electrical stimulation (tES)

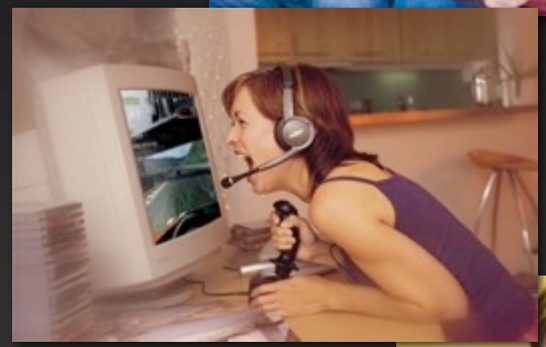
Video games

Direct Brain-Computer Interface

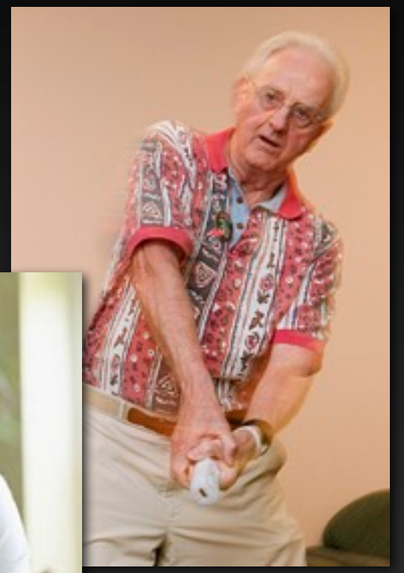
Video Games

are ubiquitous...









Can Video Games Have a Positive Impact?

"Video games are just another manifestation of human mania, our endearing quality of going relentlessly after absolutely pointless goals."

– John Skow, Time Magazine, 1982

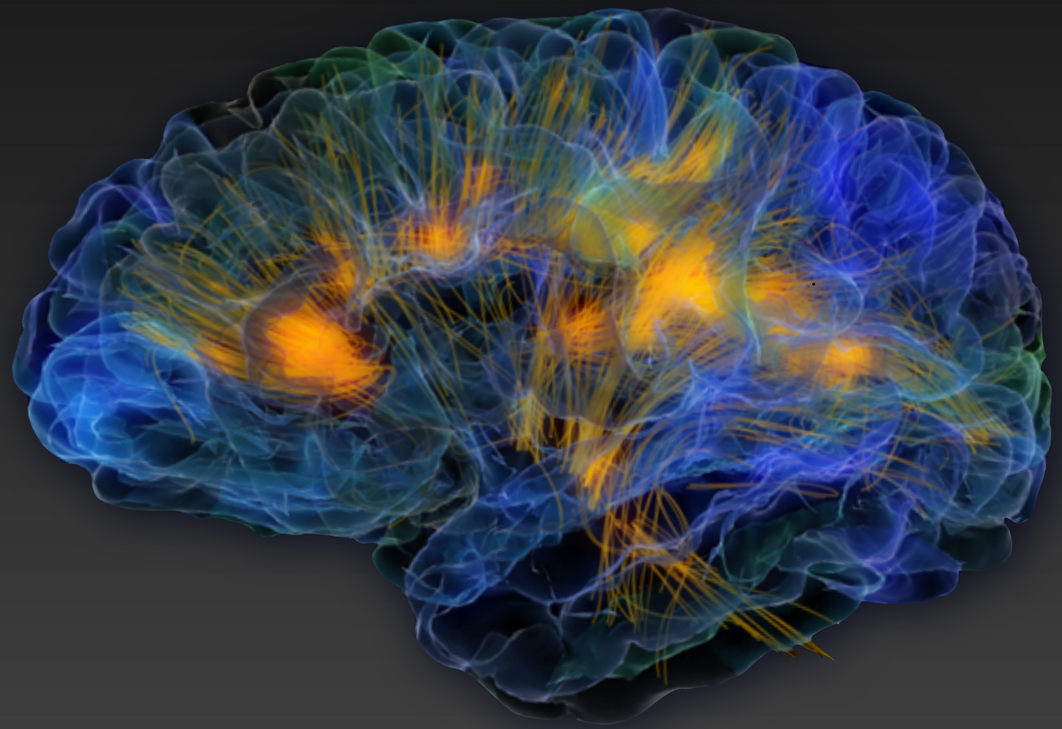
Can Video Games Have a Positive Impact?

Advertising
Health
Productivity
Education
Persuasion

Treatment Adherence
Exercise
Cognition
Knowledge
Attitudes/ Motivation

Brain Plasticity

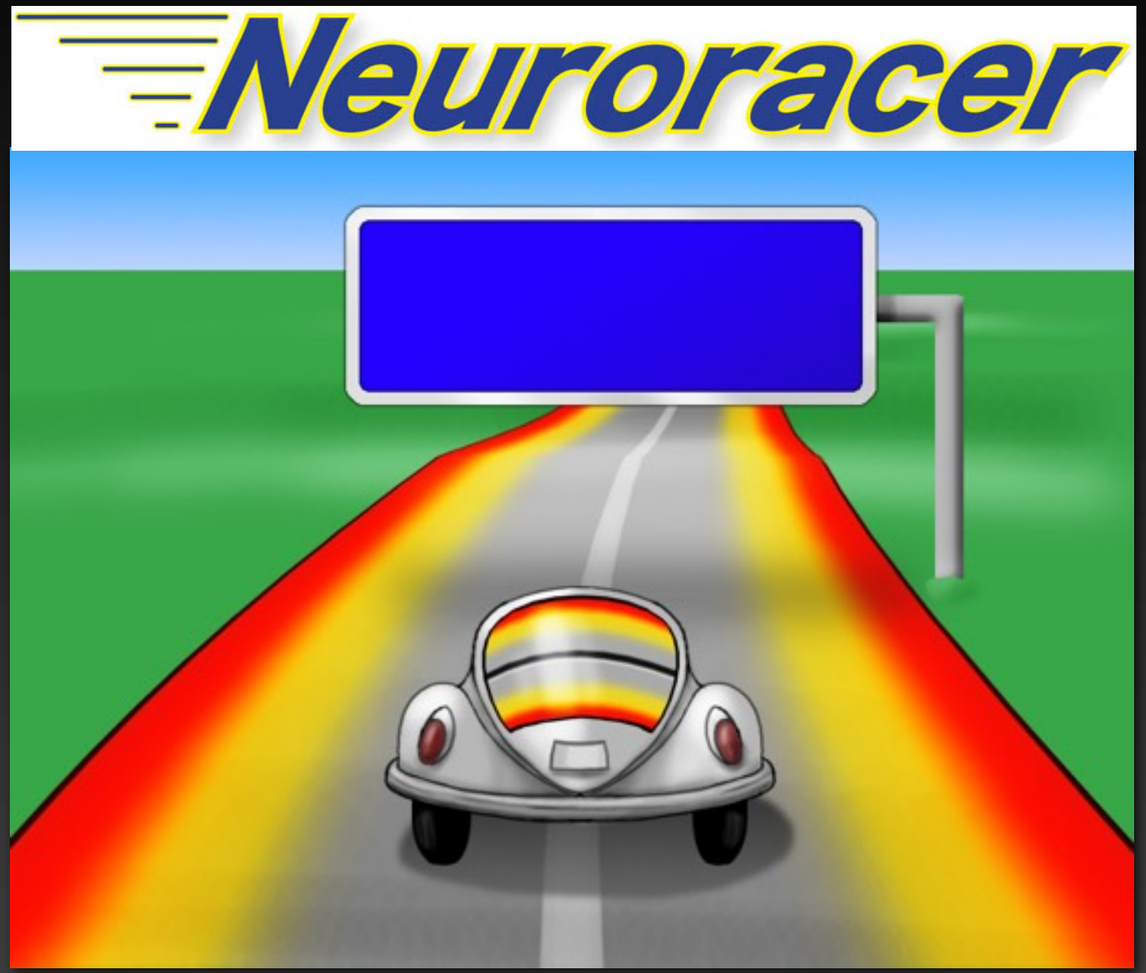
The brain’s ability to modify its function, structure & chemistry in response to new experiences



Video Game Training

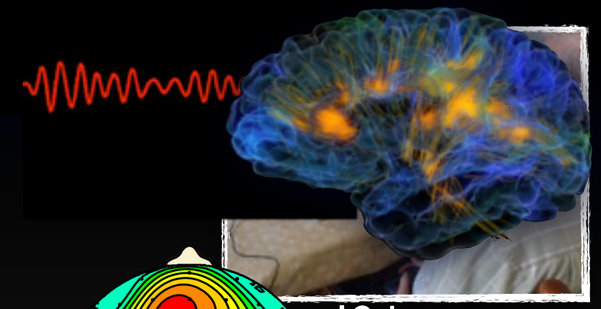
Can we develop a custom-designed video game to enhance cognition in older adults?

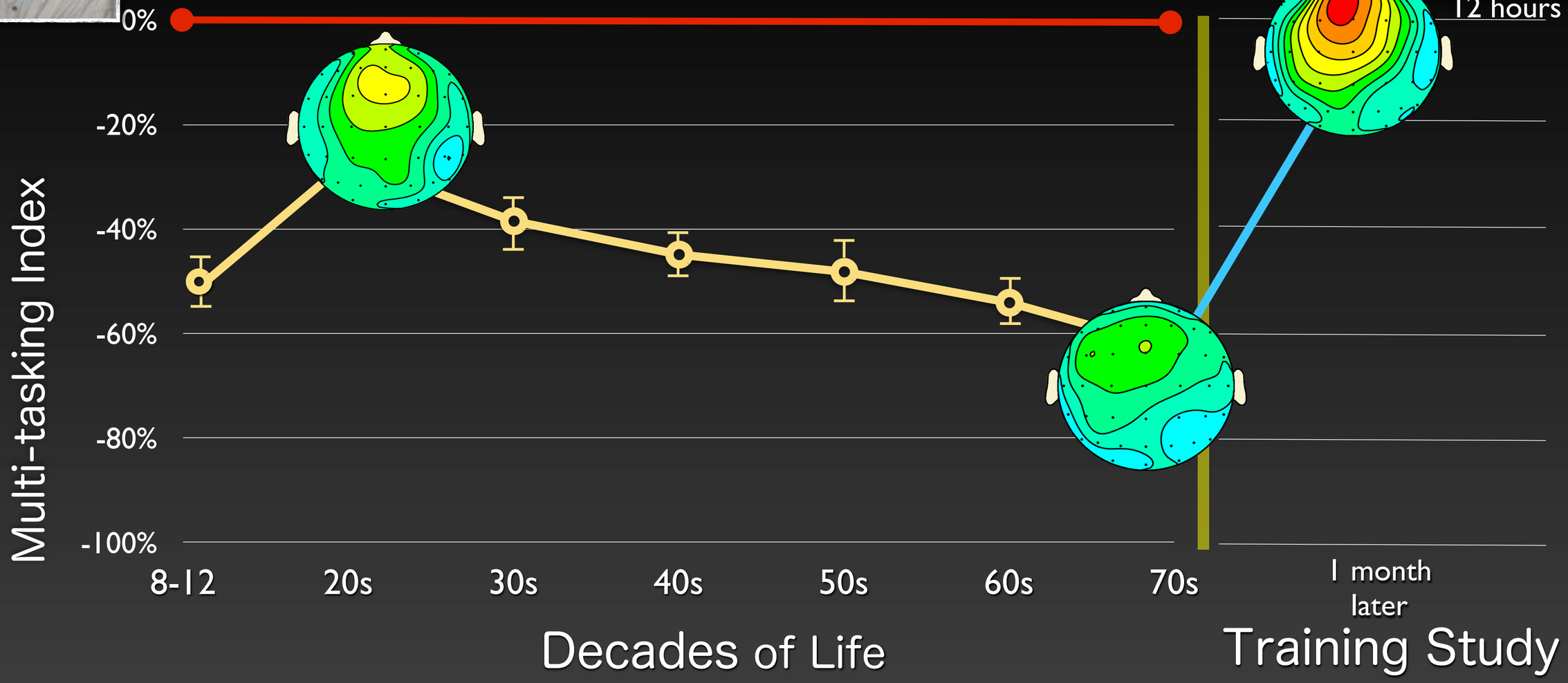
Video Game Training



Funded by Robert Wood Johnson Foundation

Multi-tasking Performance





Anguera et al. Nature 2013

Transfer of Benefits

12 hours

Working Memory

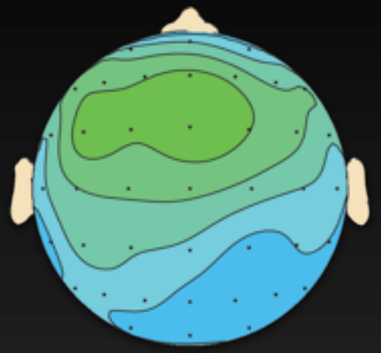
&

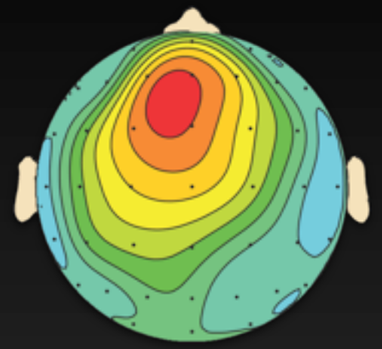
Attention Span

A Neural Bridge

Pre & Post

12 hours





Pre -Training

Post -Training

Transfer of Benefits

Attention Span

Sustained Benefits

Multitasking on Game

Anguera et al. Nature 2013

★ Adaptive training of interference processing drives enhancements of cognitive control in older adults.

★ Task improvements are associated with changes in engagement of prefrontal cortex networks.

Move to the Real World

Akili Interactive Labs
Co-founder and Chief Science Advisor

Patent-pending: “Enhancing Cognition in the Presence of Distraction and/or Interruption”

Evaluate as Diagnostics & Therapeutics

★ Attention Deficit Disorder (ADD)
- Scott Kollins, Duke University / Andrew Cutler, FLCRC
  - [Shire Pharmaceuticals]

★ Depression
- Patricia Arean, UCSF
  - [NIH]

★ Traumatic Brain Injury (TBI)
- Kristine Yaffe, UCSF

★ Alzheimer's Disease
- [Pfizer]

★ Autism
- Elysa Marco, UCSF
  - [Wallace Foundation / James Gates Family Foundation]

Thanks for your attention

Many thanks

Faculty

- Ted Zanto
- Judy Pa
- Jyoti Mishra
- Peter Wais
- Joaquin Anguera

Fellows

- David Ziegler
- Morgan Hough
- WanYu Hsu
- Yixuan Ku
- Martine Schouwenburg

Associates

- Cammie Rolle
- Jacki Janowich
- Roger Anguera
- Rajat Jain

Students

- Omar Alhashimi
- Alan Legitt
- Benjamin Dorn

Game Development

- Matt Omernick
- Dmitri Ellingson
- Eric Johnson
- Noah Fahlstein
- Ty Clark
- Matt Whitman
- Mike Gonzales
- Mickey Hart

GlassBrain

- Tim Mullen
- Christian Kothe
- Oleg Konigs
- John Fesenko

Hardware

- Apple
- NVIDIA
- Oculus VR
- Myers Sound

- to Gazzlab alumni, collaborators, research and industry partners ...

Financial Support

- National Institute on Aging
- National Institute of Mental Health
- American Federation of Aging Research
- Robert Wood Johnson Foundation
- Zynga.org Foundation
- Center 17 Foundation
- UCSF CTSI
- Posit Science
- Pfizer / Eisai
- Tim Ferriss
- Tully and Elise Friedman
- Sara and Evan Williams Foundation
- Ellison Medical Foundation
- James Gates Family Foundation
- Sandler Foundation
- Rose Family Foundation
- Feldman Family Foundation
- Grammy Foundation
- Biggelsworth Foundation