

## *Non-Invasive Brain Stimulation*

# Non-Medical and Investigational Uses

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## Disclosures / COI

Nil

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Industry: Nexstim

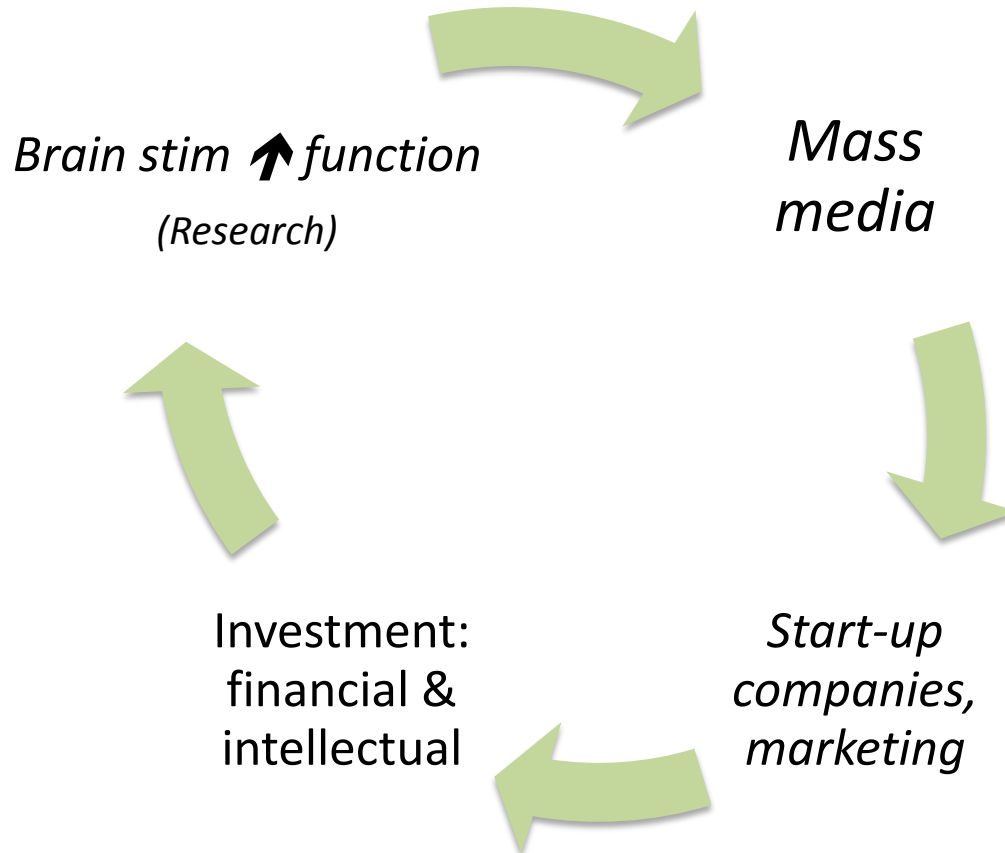
## Categorical

Transcranial *magnetic* and *electrical* stimulation can effectively activate the living human brain

## Murky

How this can be leveraged for adaptive & durable neuromodulation

# *Evolution of NIBS societal cognizance*



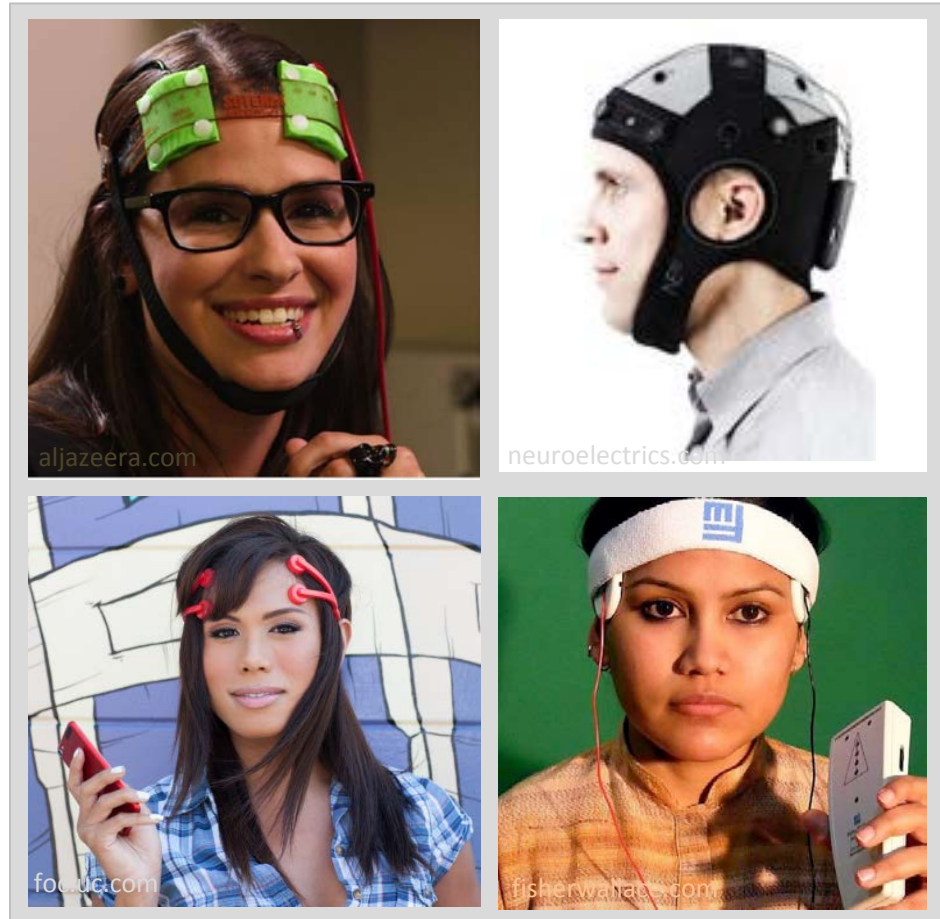
# NIBS methods snapshot

## TMS



Very brief, high-intensity magnetic pulses  
(each < 0.005sec duration)

## TES



Constant very low-intensity electric current  
(10-30 mins duration)

Principal reason for escalating NIBS use

*putative benefit of enhancing human brain function & performance*

Broad Categories of Use

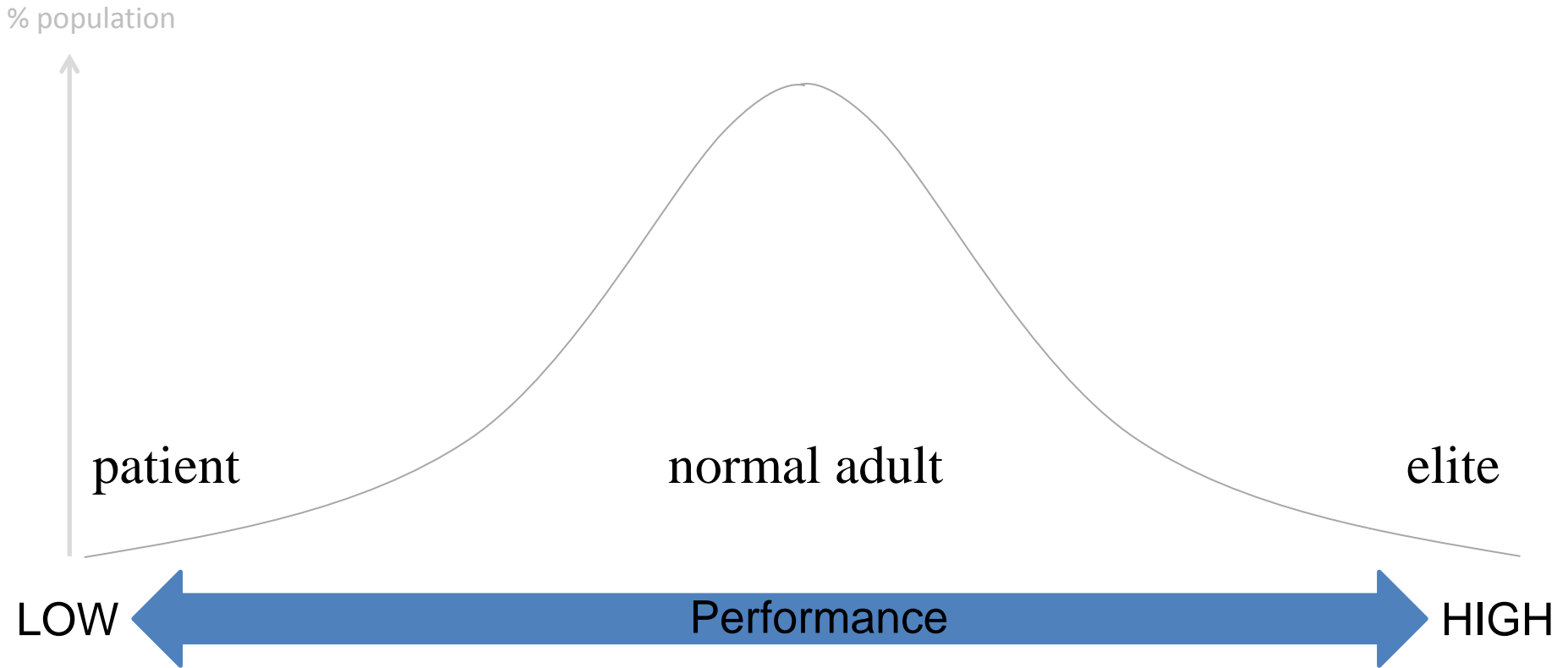
*Military Performance*

*Recreation & e-sports (gaming)*

*Athletic & Sports*

*School / Occupational*

# Performance enhancement across the ability spectrum



# What is features of human performance to enhance?

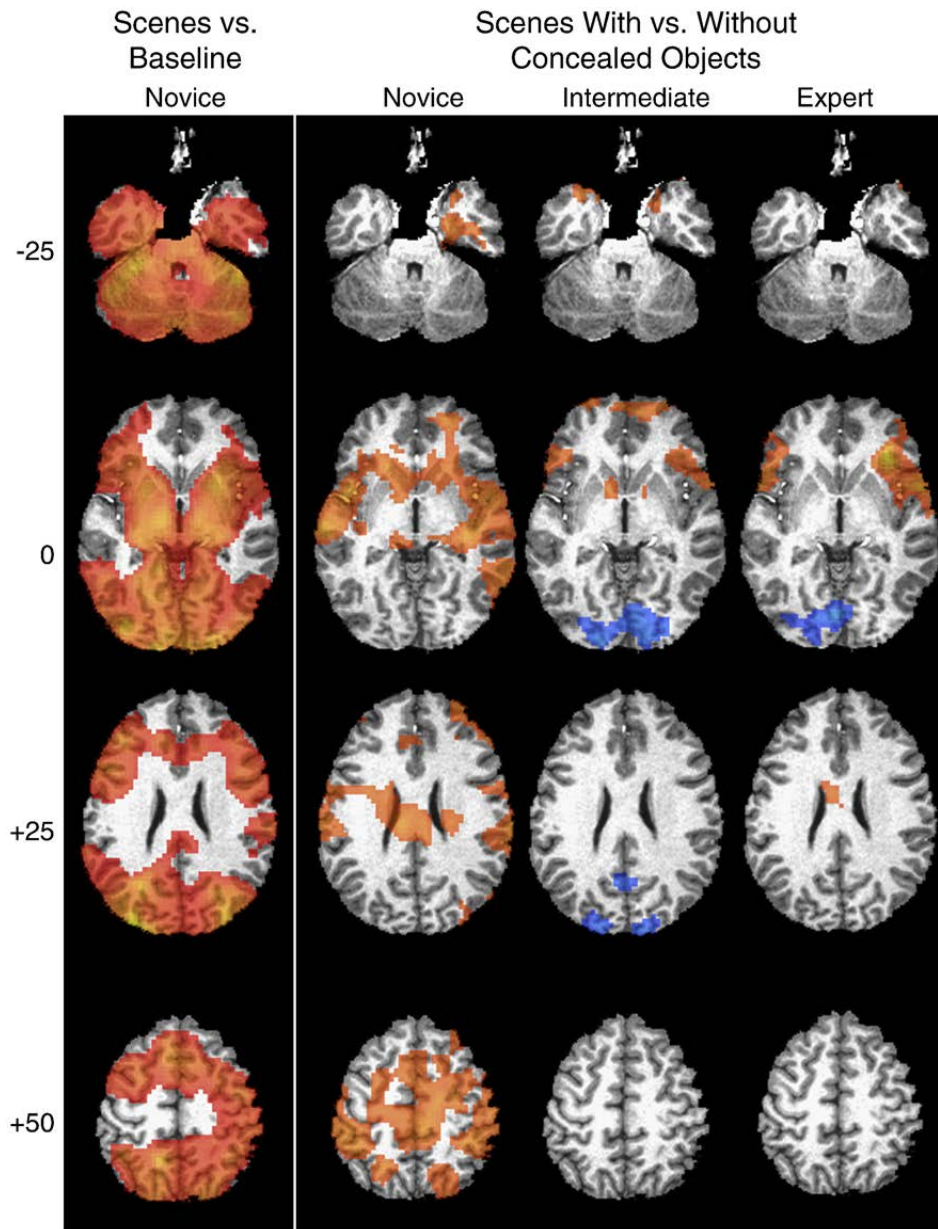




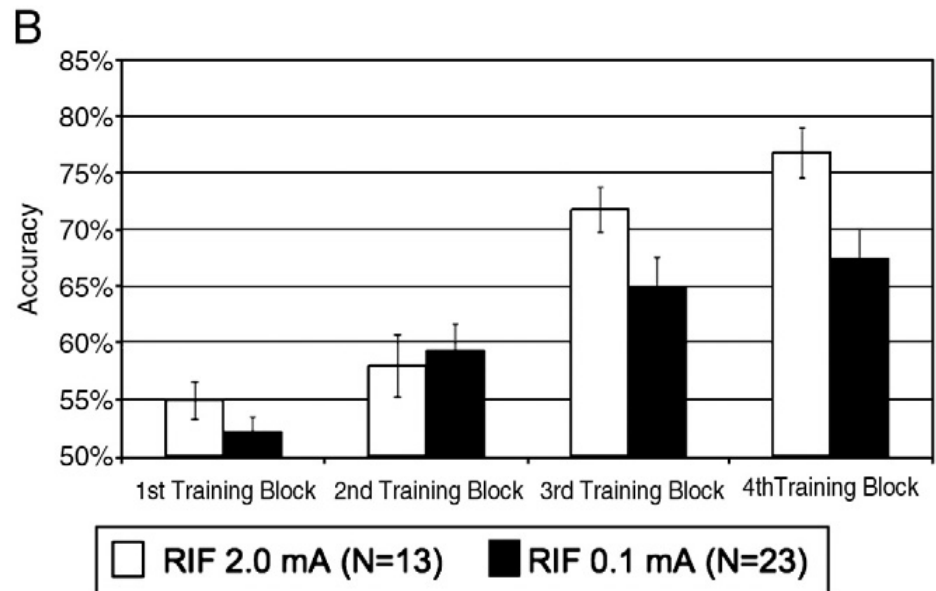
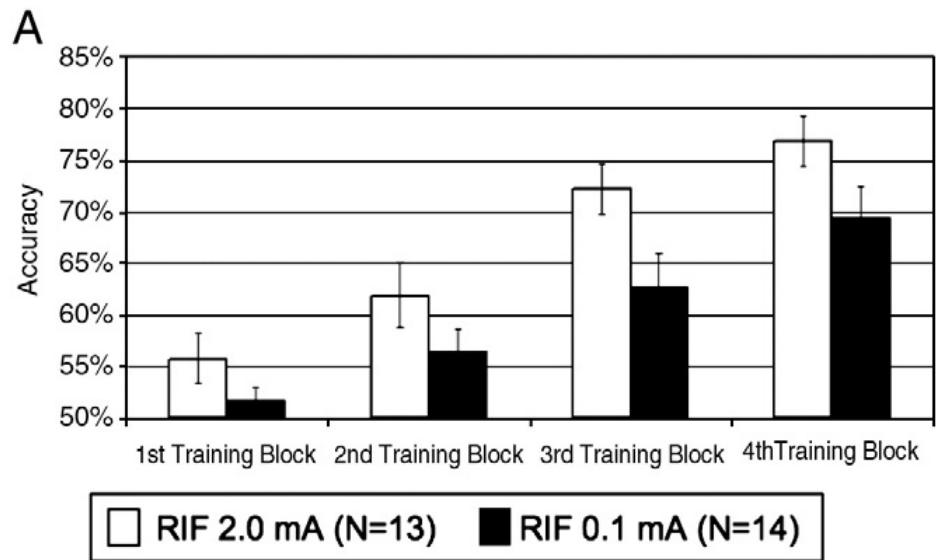
## Perception & learning: Military threats and VR



Clark et al, 2013

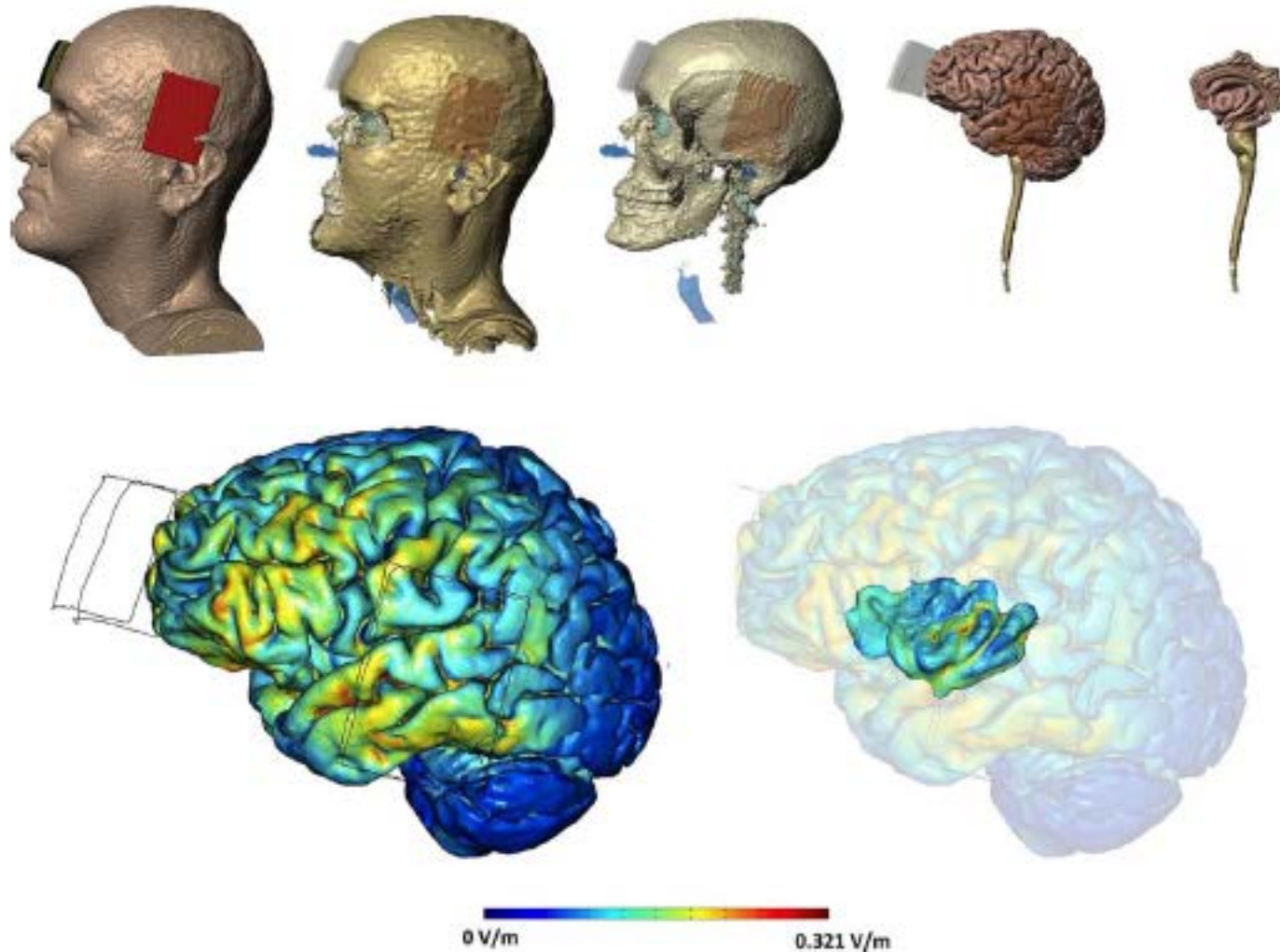


Clark et al, 2013



Clark et al, 2013

# Perception & fatigue: Temporal cortex tDCS and maximal elite cycling performance



Okano et al, 2013

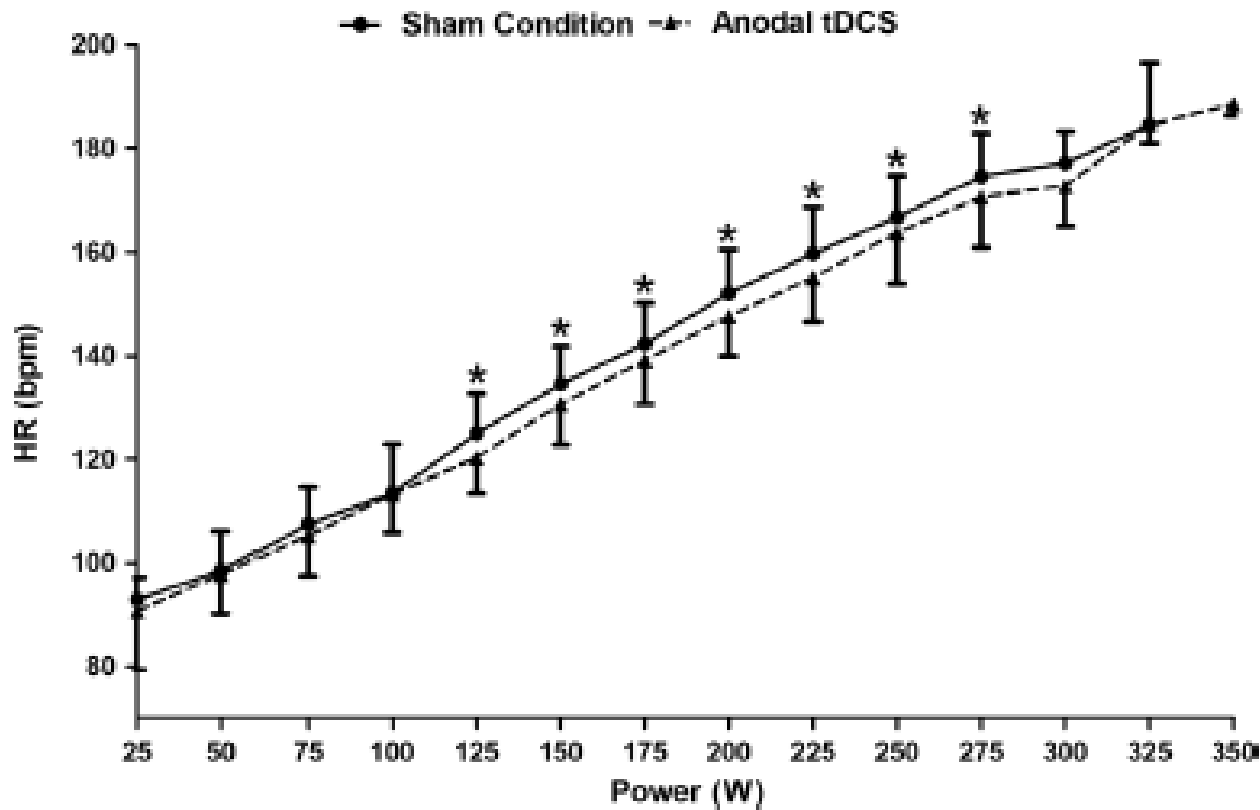
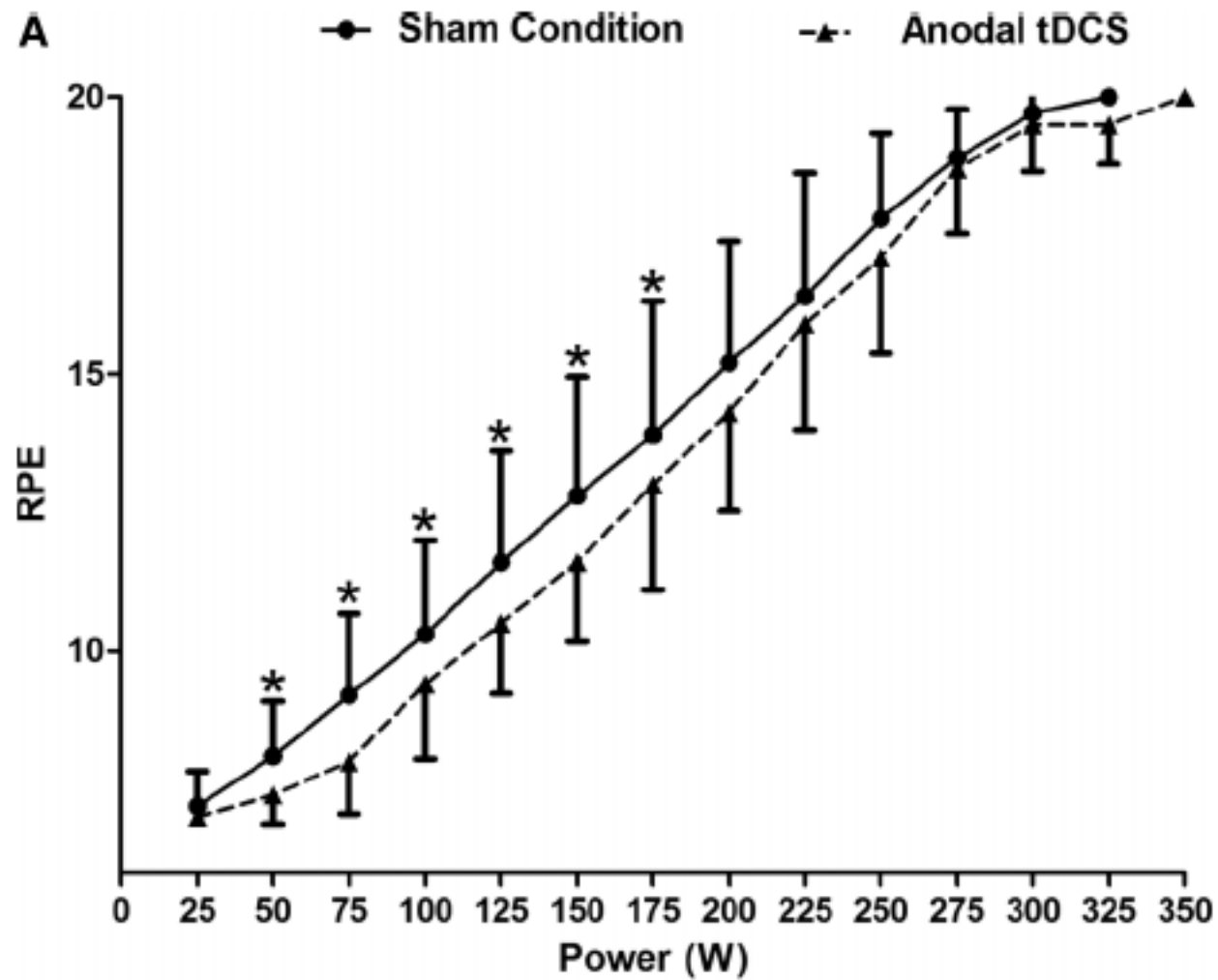


Figure 2 Heart rates at the different power outputs during the maximal incremental cycling test with either anodal or sham transcranial direct current stimulation. \* $p < 0.05$ .

Okano et al, 2013



Okano et al, 2013

## Outlook and recommendations

1. Define NIBS ✓
2. Describe scope of use:  
*Who is using it, where are they using it, how are they using it?*
3. Quality control:  
*User: training required or detailed instructions, remote monitoring/internet logging*  
*Device: safety requirements, servicing*
4. Which facet of NIBS use in the healthy population should IOM recommend to further investigate?