

# Neurological and Cognitive Effects of Stage Combat Training 2561

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# DISCLOSURES

Brandon Brockshus, PhD, and Elizabeth Stegemöller, PhD, faculty for this educational event, have no relevant financial relationships with ineligible companies to disclose.

Elizabeth Stegemöller, PhD, faculty for this educational event, has no non-financial conflicts of interest relevant to this activity.

Brandon Brockshus, PhD, faculty for this educational event, has disclosed the following non-financial conflict of interest - he is a member of the Society of American Fight Directors and has worked as a freelance fight choreographer.

*All of the relevant financial relationships listed for these individuals have been mitigated.*

# LEARNING OBJECTIVES

At the conclusion of this activity, the participant will be able to:

1. Define stage combat
2. Describe underlying processes which support the practice of stage combat
3. Advocate implementation of stage combat as an intervention in their practice

# OBTAINING CME/CEU CREDIT

Credit is only given to attendees after:

- Successful completion of the entire course/session.
- Completion of the course quizzes and evaluations and final conference evaluation.

After completing all required tasks, a certificate is downloadable from the task page on the website/conference app.

The evaluation system will close 30 days after the end of the event.



# Gratitude

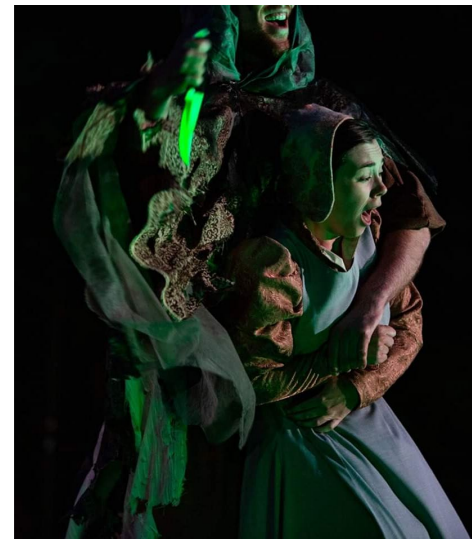
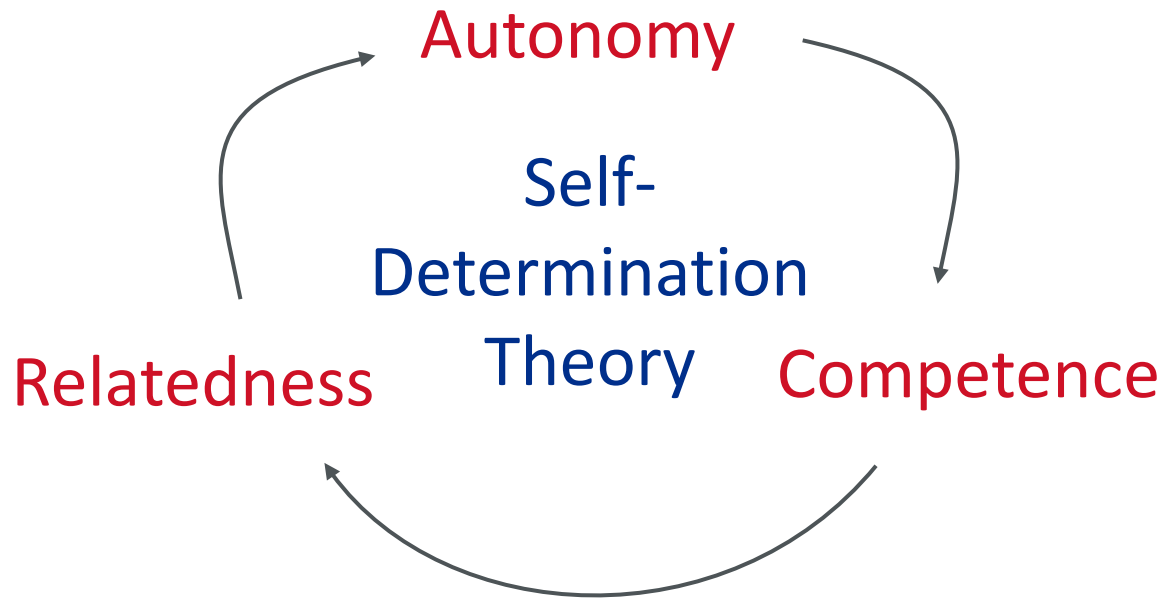


**HUMAN  
PERFORMANCE  
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# Why study stage combat?

- Intrinsic joy of masterful movement
- Community of people with shared goals
- Imagination and creativity



Define

Skills

Psych

Neuro

Apply

# OUTLINE



1. Stage Combat defined
2. Motor Learning and Functional Skills for Stage Combat
3. Psychological Processes which support Stage Combat
4. Neuromotor Processes which support Stage Combat
5. Implications for health, theatre, and education



Define

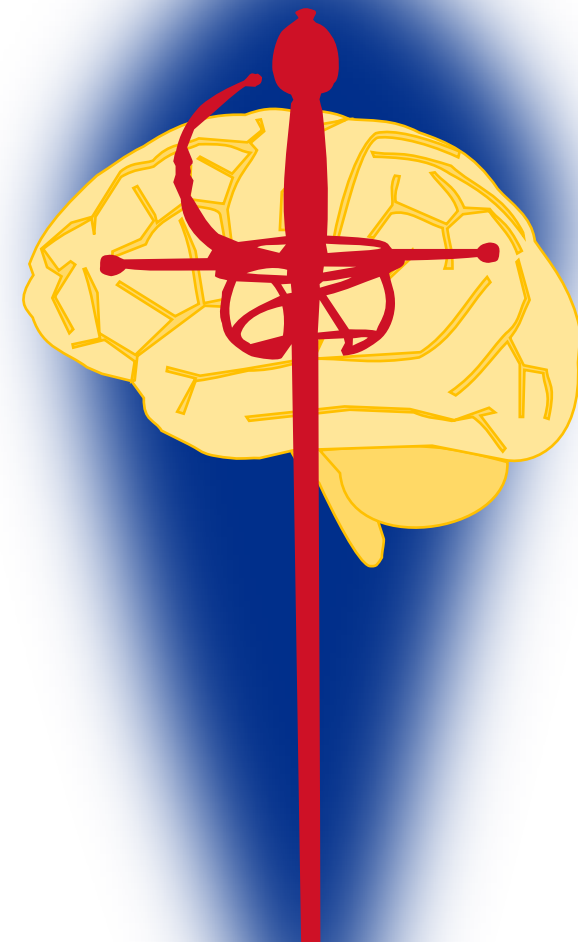
Skills

Psych

Neuro

Apply

# Stage Combat defined



Define

Skills

Psych

Neuro

Apply

# Stage Combat is both Acting and an Aesthetic Martial Art

**Stage combat:** an aesthetic martial art undertaken for the purposes of violent storytelling

## 2 conflicting goals

- Effectively simulate violence for an audience
- Keep the actors unharmed

## 8 weapon disciplines

Unarmed	Knife
Staff	Single Sword
Longsword	Sword & Shield
Rapier & Dagger	Smallsword

## Compulsory Skill Techniques



Define

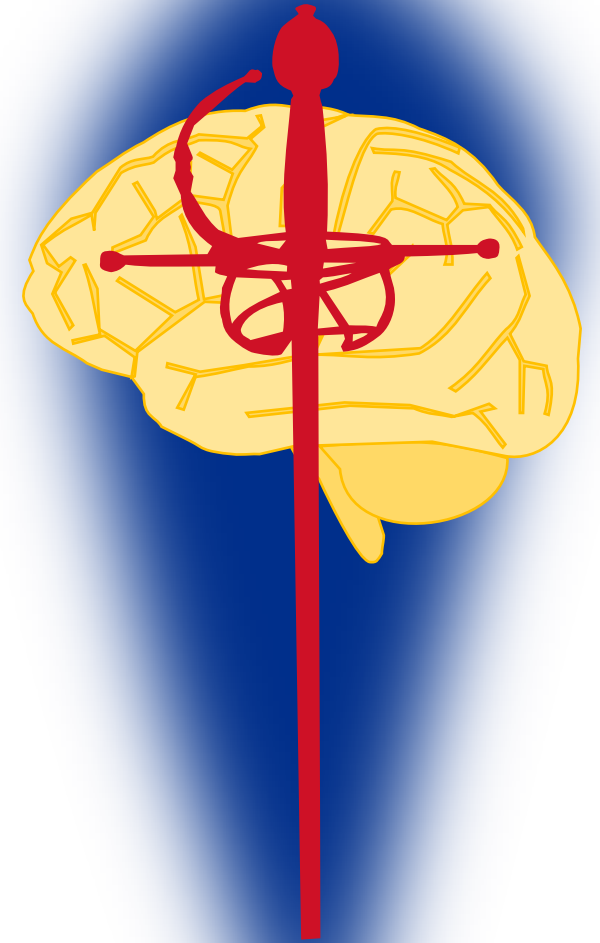
Skills

Psych

Neuro

Apply

# Motor Learning and Functional Skills for Stage Combat



Define

Skills

Psych

Neuro

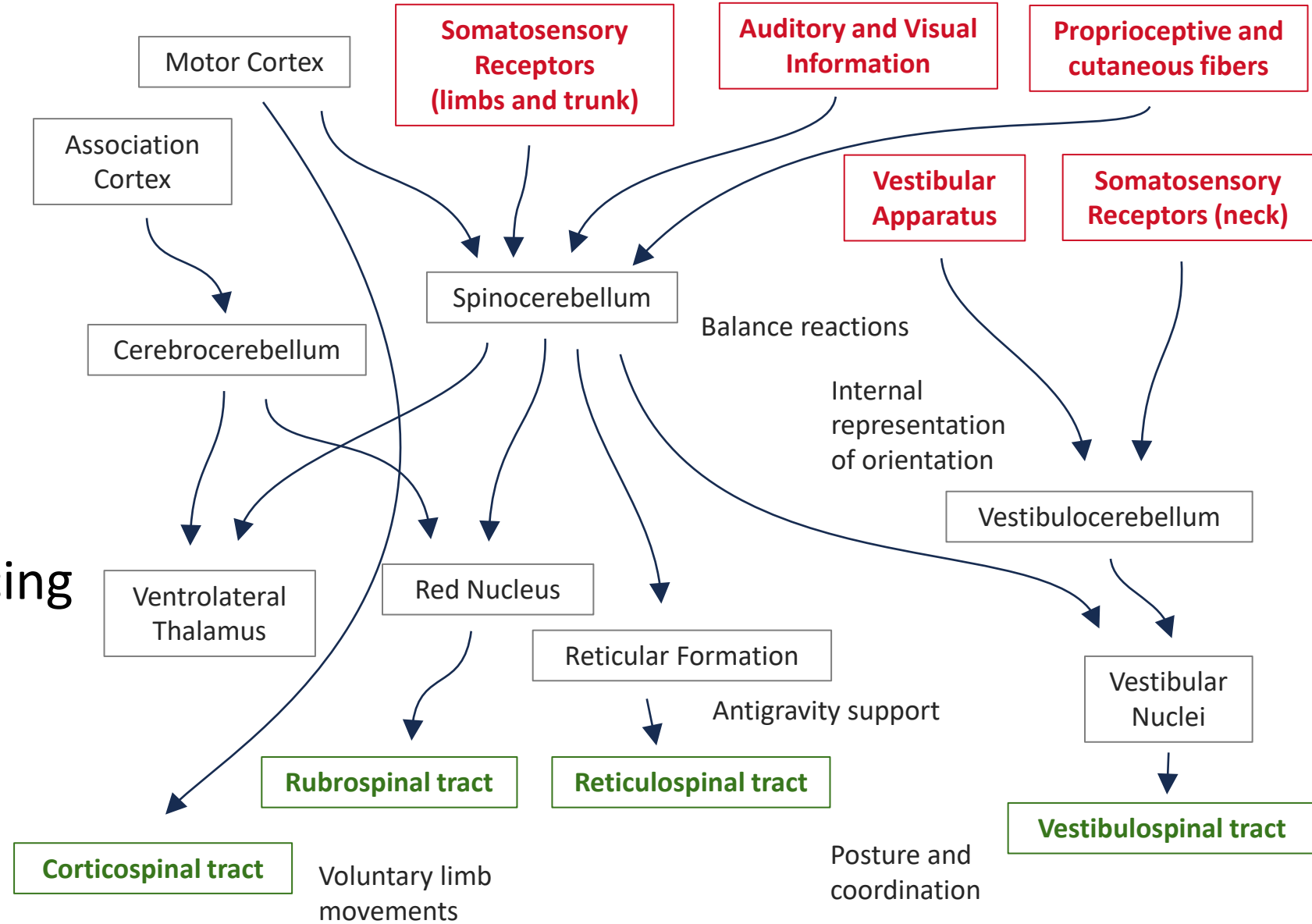
Apply

# Stage Combat is built on Functional Skills

- Posture
- Locomotion
- Prehension
- Target Interception
  - Tool Use
- Movement Sequencing
- Spinal cord circuits are sufficient for maintaining antigravity support but not balance
- Brain stem and cerebellum integrate sensory signals for posture
- Basal Ganglia for quickly adjusting postural set
- Spinocerebellum for postural response adaptation based on experience
- Automatic postural adjustments are not simple reflexes but are highly organized, flexible, and adaptive patterns of muscle activation. Anticipatory postural adjustments accompany our voluntary movements to maintain balance and orientation.

- Define
- Skills
- Psych
- Neuro
- Apply

- Posture
- Locomotion
- Prehension
- Target Interception
  - Tool Use
- Movement Sequencing



Define

Skills

Psych

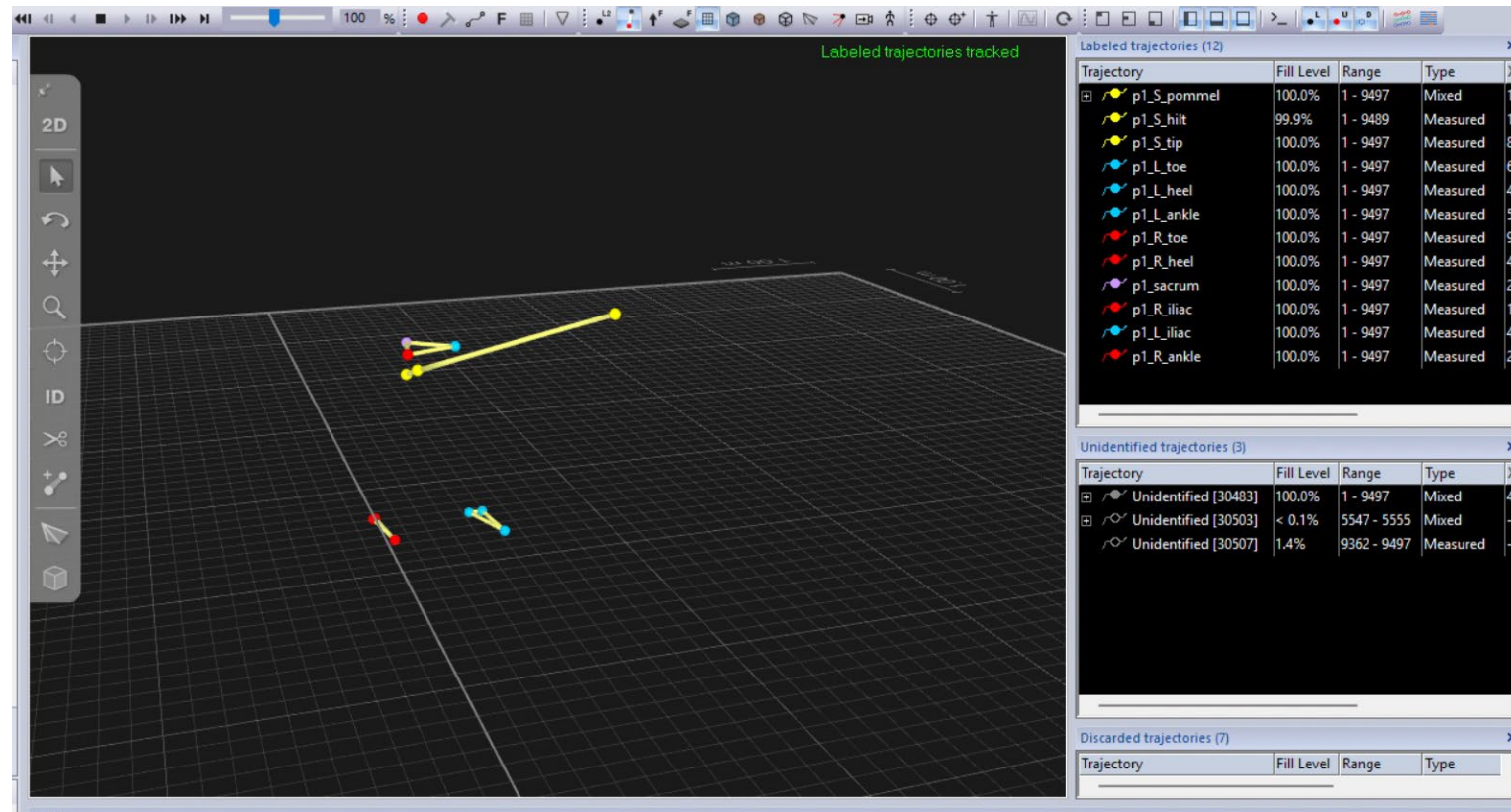
Neuro

Apply

# Stage Combat is built on Functional Skills

- Posture
- **Locomotion**
- Prehension
- Target Interception
  - Tool Use
- Movement Sequencing

## Central Pattern Generators



- Define
- Skills
- Psych
- Neuro
- Apply

# Stage Combat is built on Functional Skills

- Posture
- Locomotion
- **Prehension**
- Target Interception
  - Tool Use
- Movement Sequencing

## Transport – Grasp – Object Manipulation

### Preparatory Phase

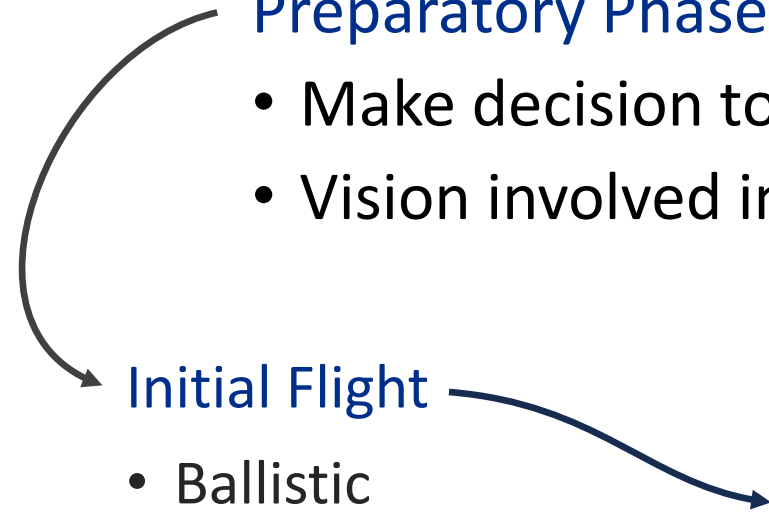
- Make decision to move
- Vision involved in assessment

### Initial Flight

- Ballistic
- Vision is minimal

### Termination Phase

- Error Correction
- Vision is highly involved



Define

Skills

Psych

Neuro

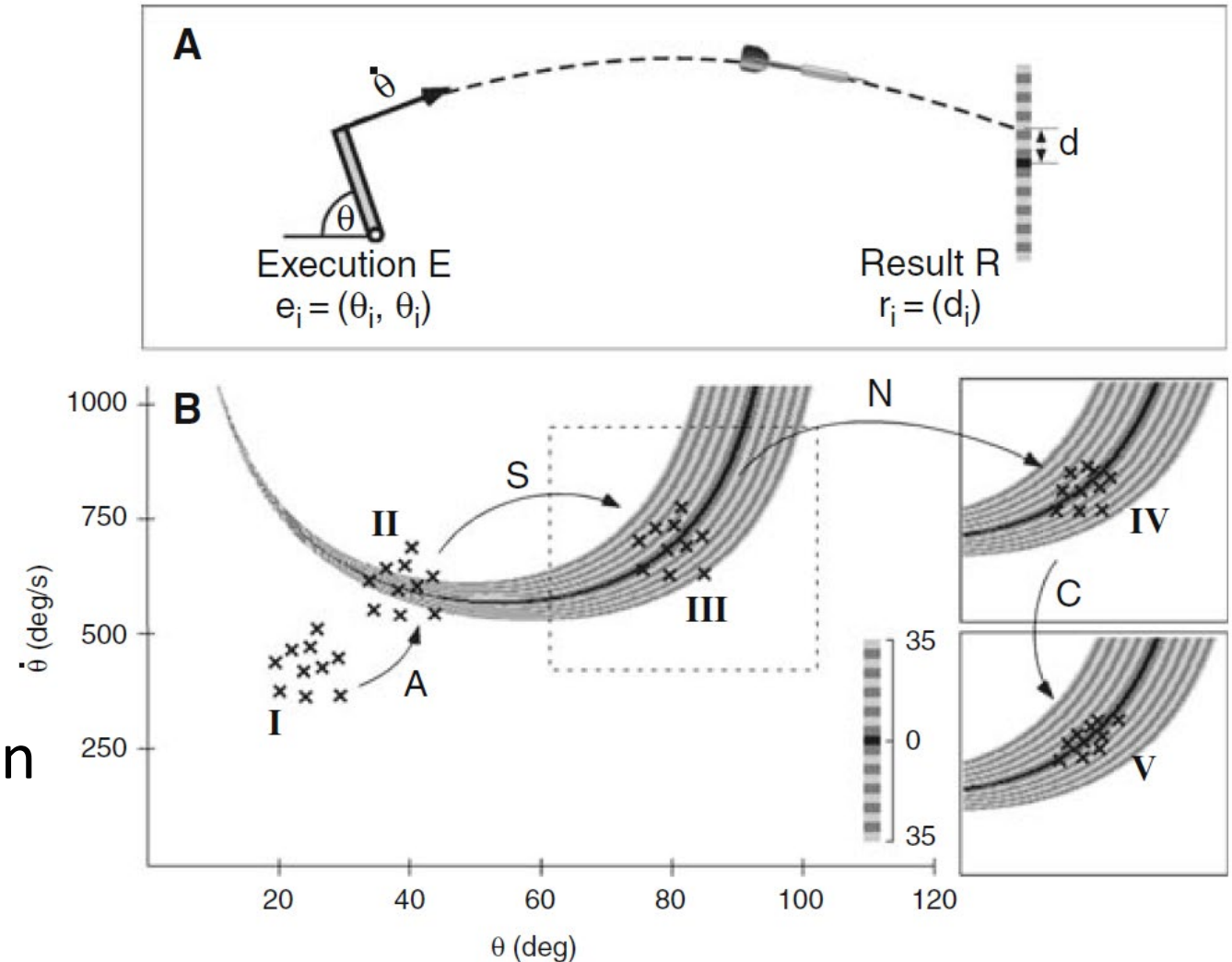
Apply

# Stage Combat is built on Functional Skills

- Posture
- Locomotion
- Prehension
- **Target Interception**
  - Tool Use
- Movement Sequencing

## Solution Manifold

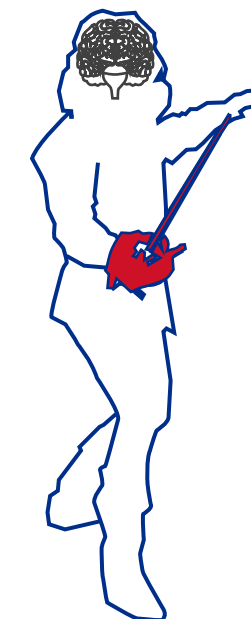
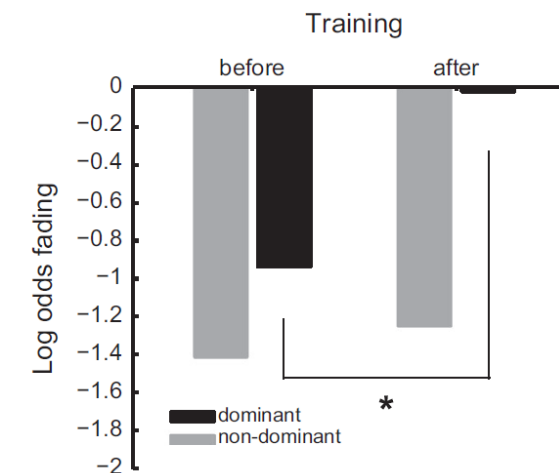
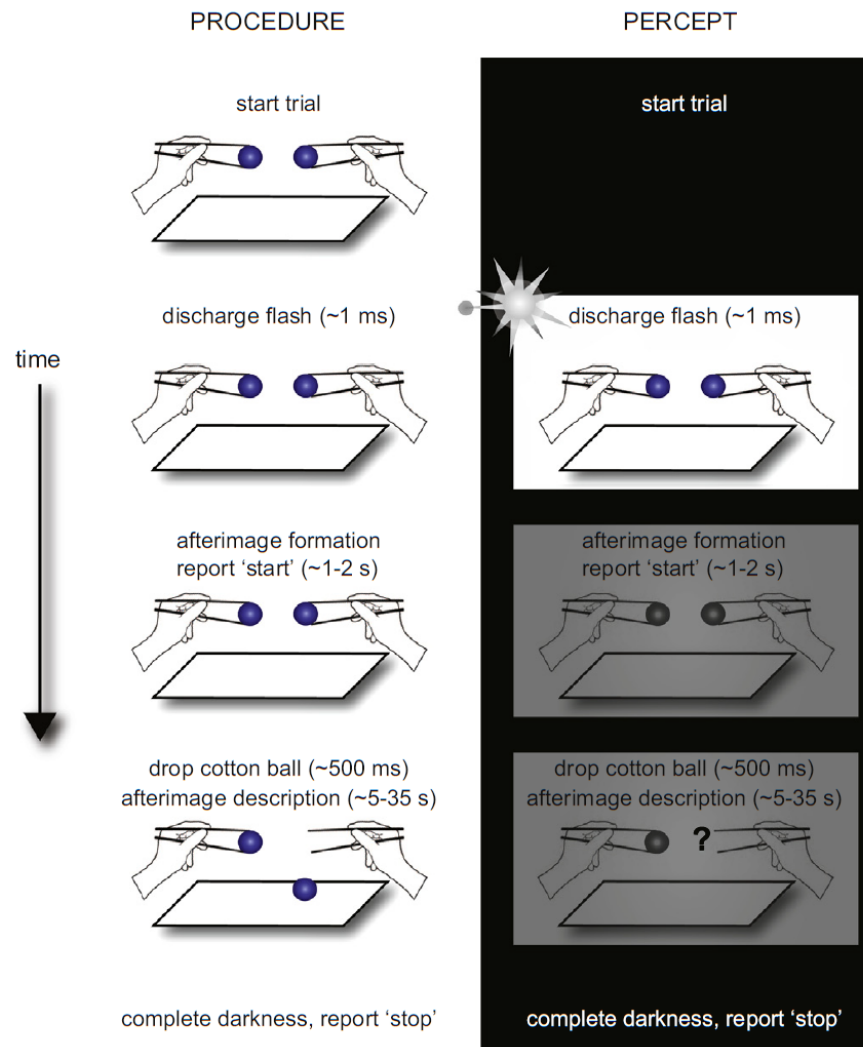
- Approach – Noise Reduction
- Sensitivity – Covariation



Define  
Skills  
Psych  
Neuro  
Apply

# Stage Combat is built on Functional Skills

- Posture
- Locomotion
- Prehension
- Target Interception
  - Tool Use
- Movement Sequencing



Define

Skills

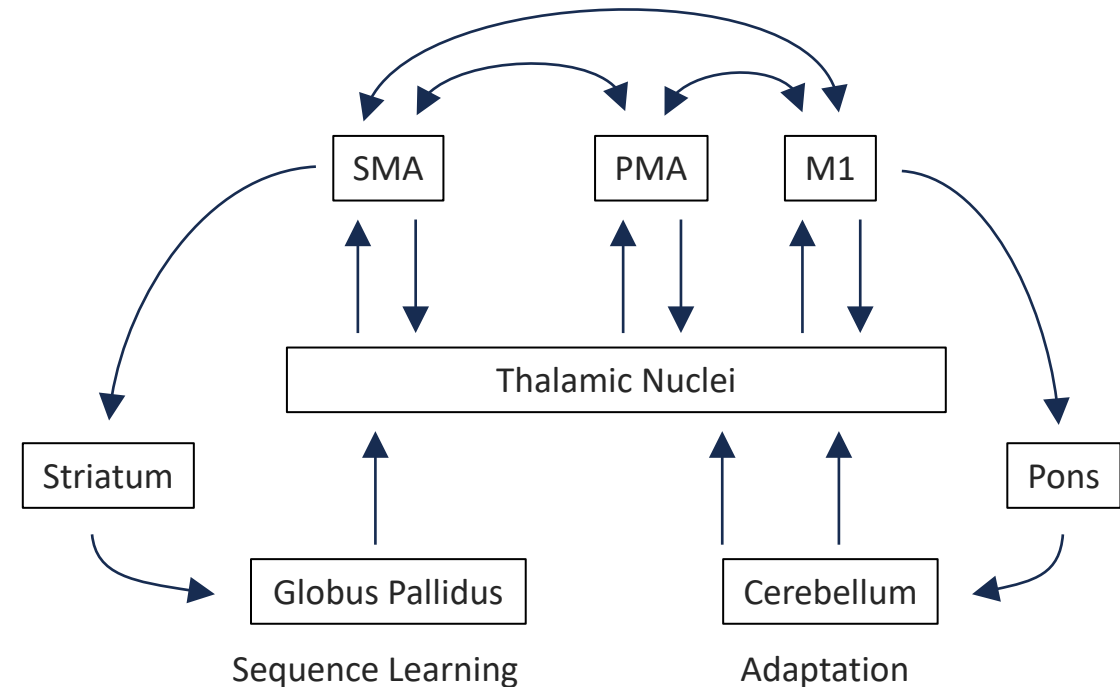
Psych

Neuro

Apply

# Stage Combat is built on Functional Skills

- Posture
- Locomotion
- Prehension
- Target Interception
  - Tool Use
- **Movement Sequencing**





Define

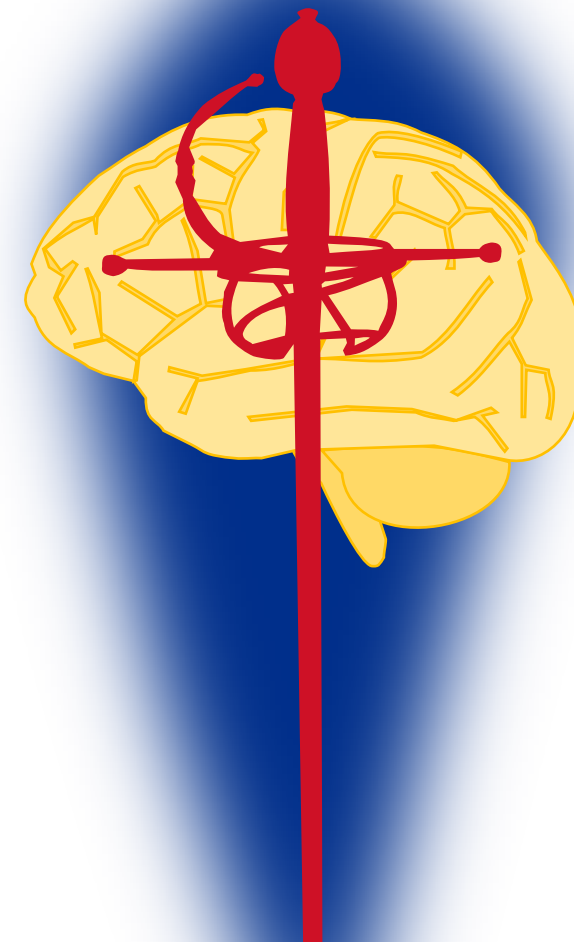
Skills

Psych

Neuro

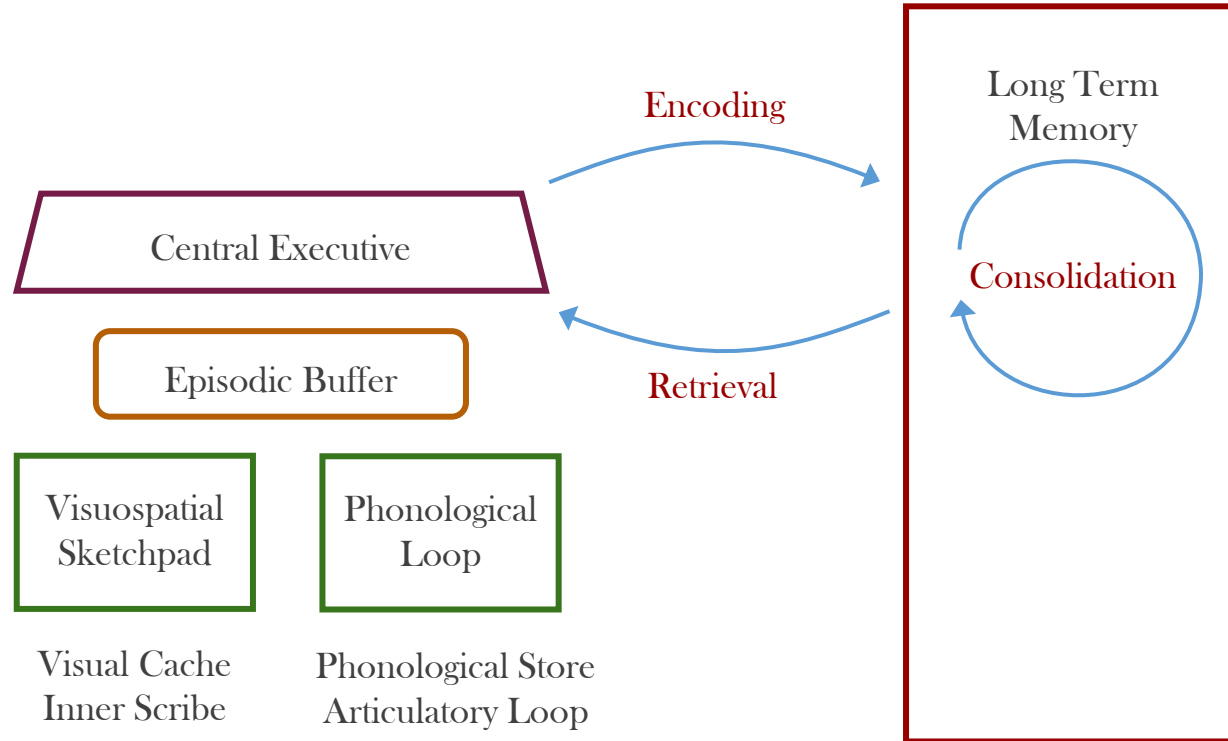
Apply

# Psychological Processes which support Stage Combat



- Define
- Skills
- Psych
- Neuro
- Apply

# Working Memory



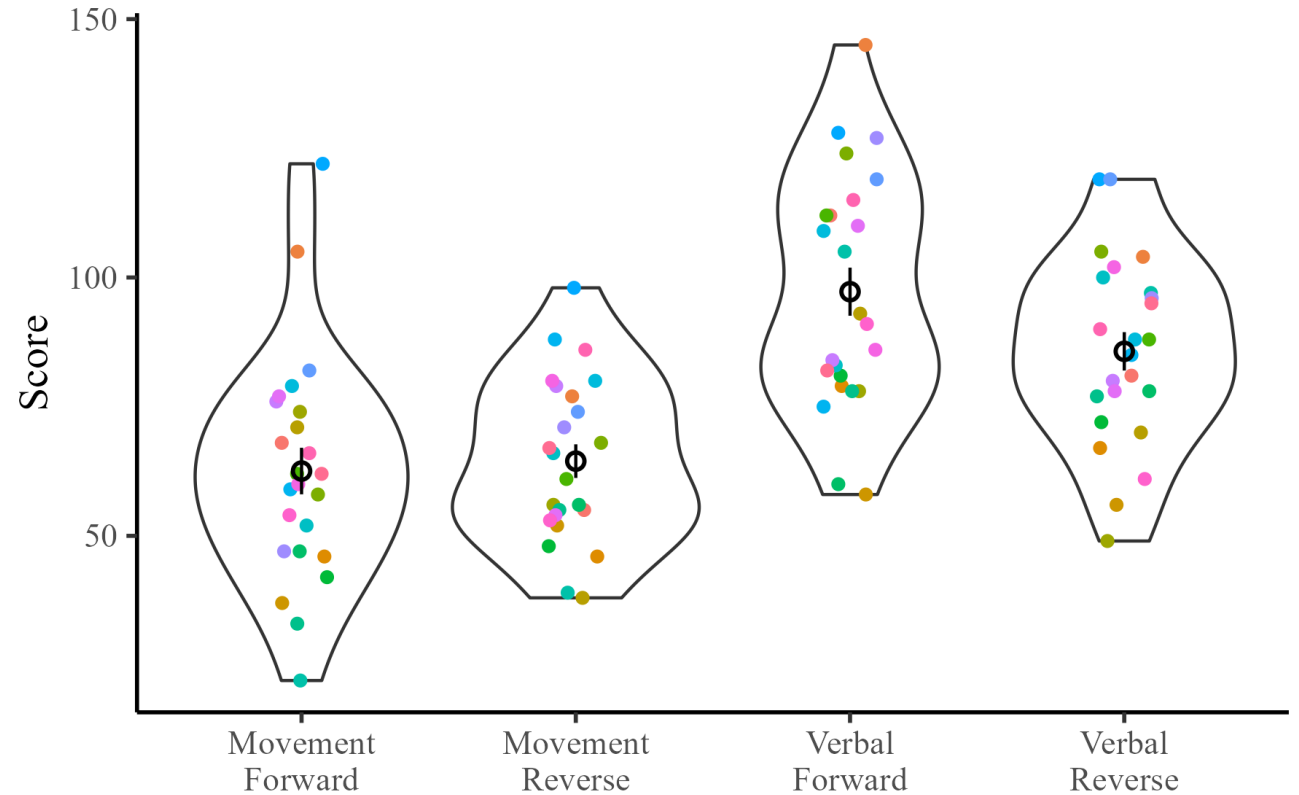
- Miller's Magical Number  $7 \pm 2$
- Cowan's Magical Mystery  $4 \pm 1$
- Bodily Movement

- Define
- Skills
- Psych
- Neuro
- Apply

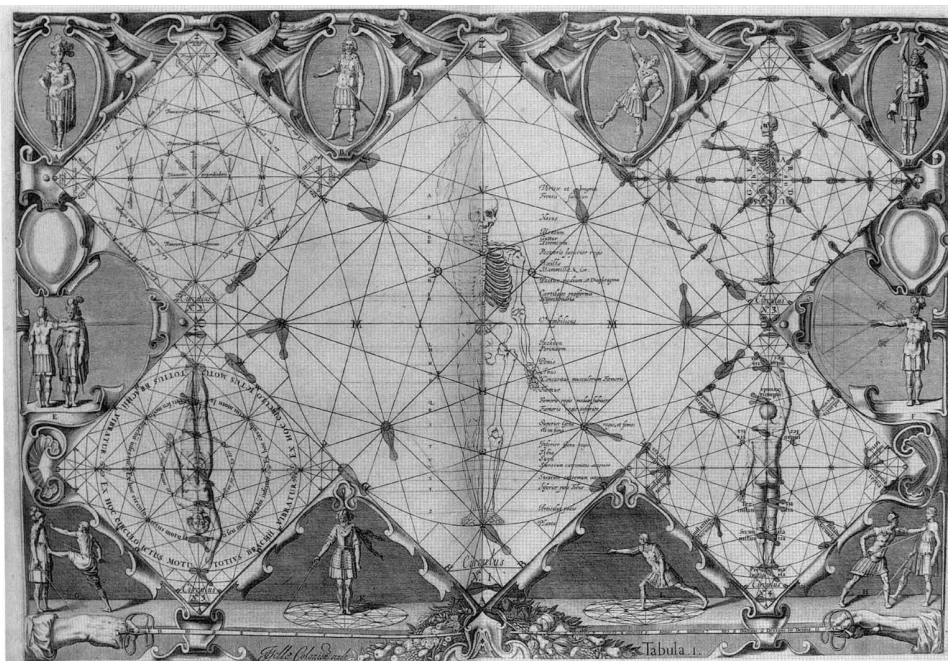
# Working Memory in Actor-Combatants

Span	Forward	Reverse
Movement	5.63 (1.10 SD)	5.42 (0.97 SD)
Verbal	7.08 (1.21 SD)	6.50 (1.02 SD)

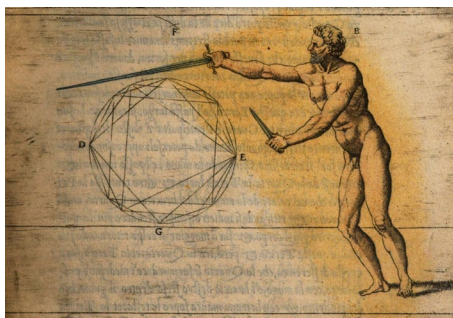
Effect	F(1, 92)	p
Modality	47.204	$7.44 \times 10^{-10}$
Modality *	2.730	0.102
Direction		



Define  
Skills  
Psych  
Neuro  
Apply



Thibault, 1630



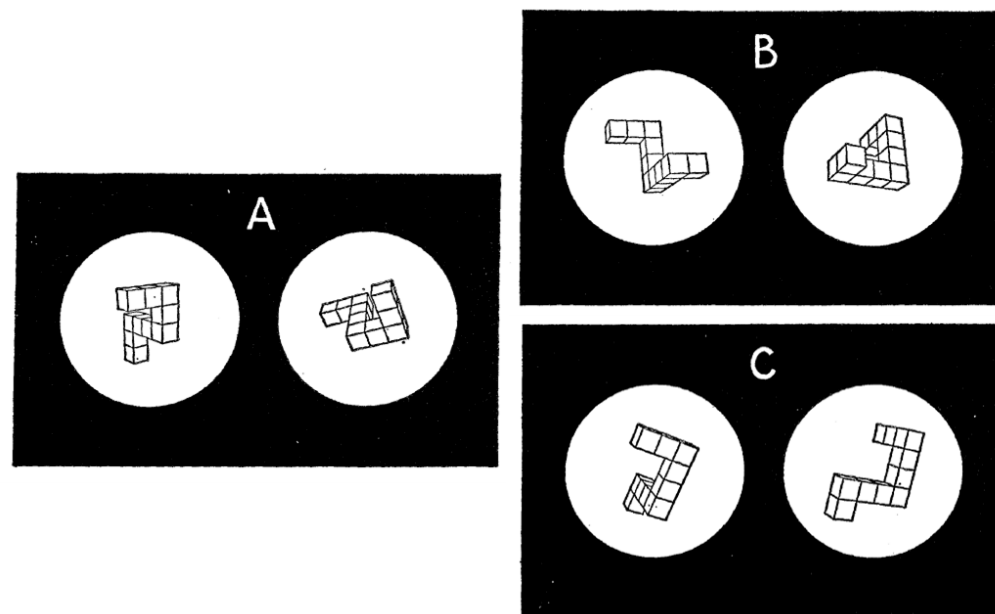
Agrippa, 1553



Capo Ferro, 1629

# Spatial Processing

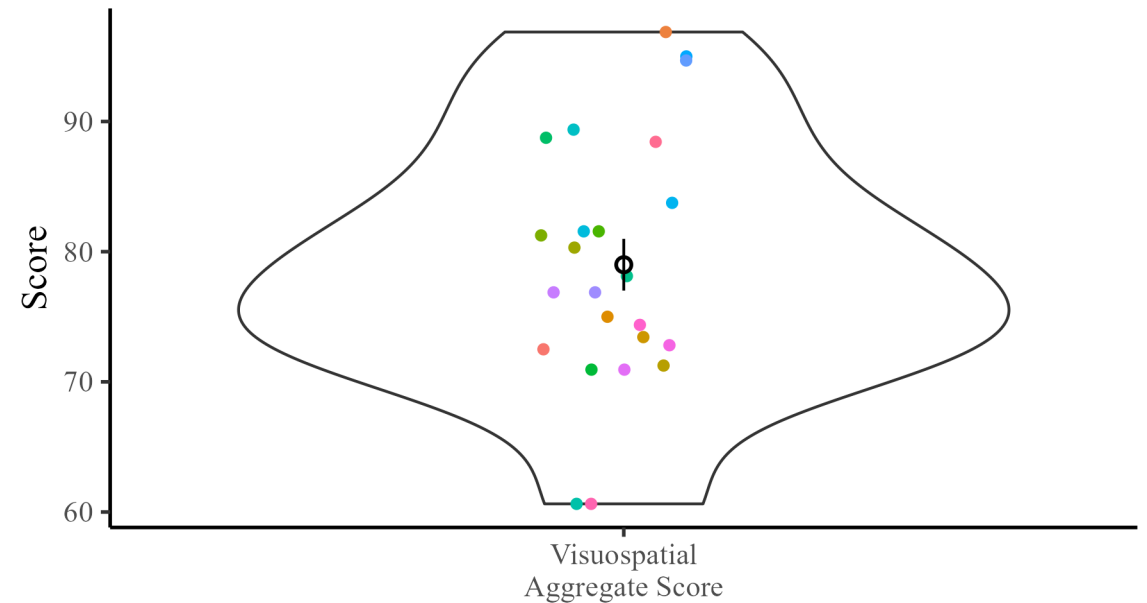
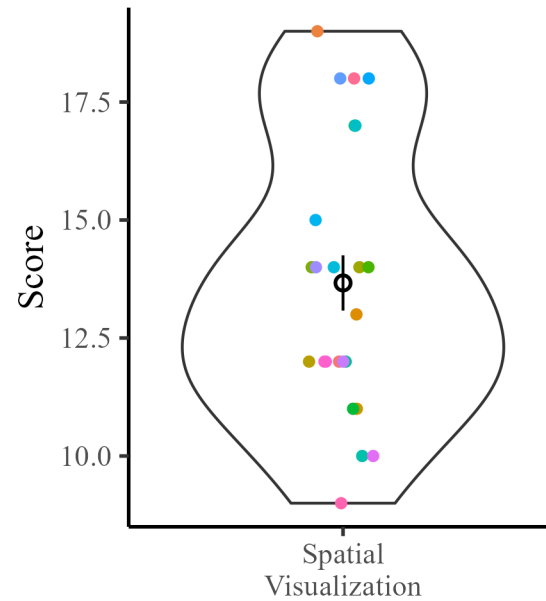
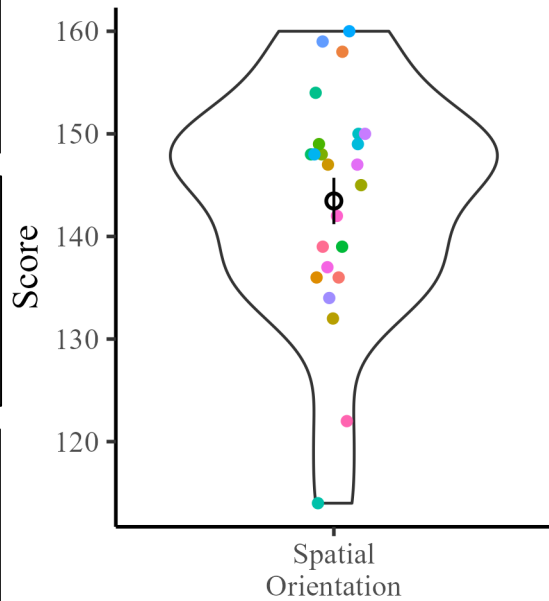
- Spatial Perception
- Mental Rotation
- Spatial Visualization



Define  
Skills  
Psych  
Neuro  
Apply

# Spatial Processing in Actor-Combatants

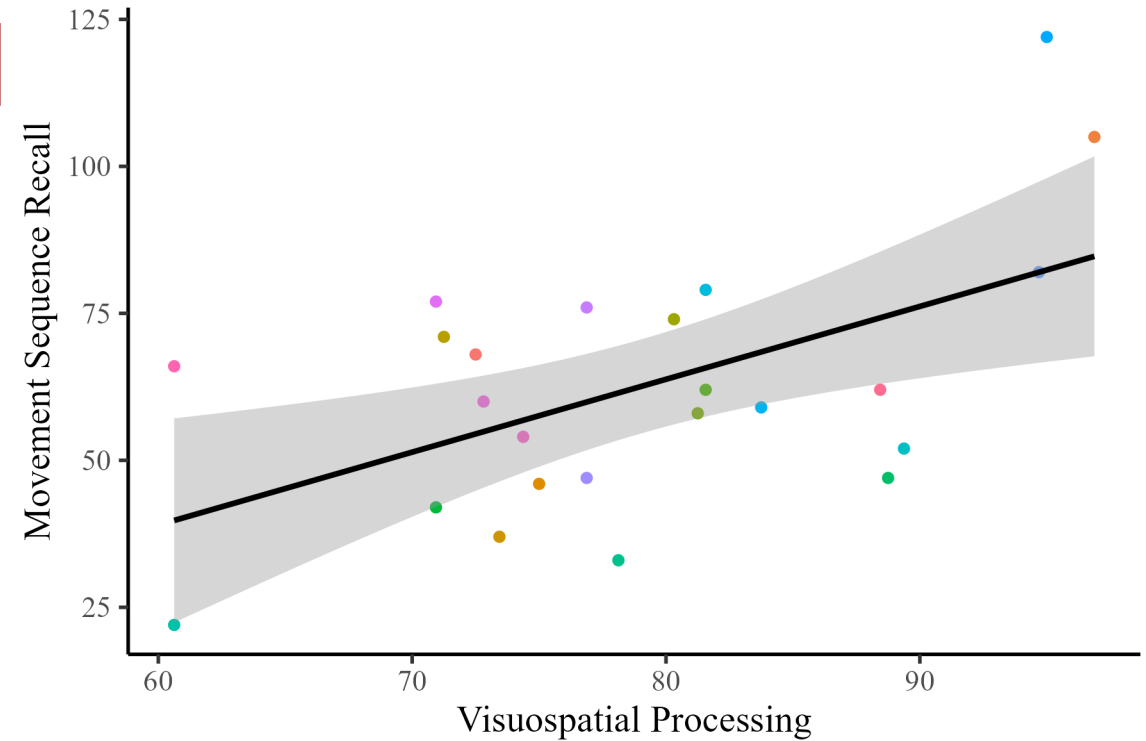
Rotation = Spatial Orientation: out of 160  
 Folding = Spatial Visualization: out of 20  
 Aggregate = evenly weighted out of 100



Define  
Skills  
Psych  
Neuro  
Apply

# Associations between Working Memory and Visuospatial Processing in Actor-Combatants

	r	95% CI	t(22)	p
M → VS	0.55	[0.18, 0.78]	3.06	0.011*
M ← VS	0.46	[0.06, 0.73]	2.40	0.039*
V → VS	0.18	[-.25, 0.54]	0.84	0.412
V ← VS	0.45	[0.06, 0.72]	2.37	0.039*
M → M ←	0.61	[0.28, 0.82]	3.64	0.005**
V → V ←	0.65	[0.33, 0.83]	3.98	0.005**
M → V →	0.57	[0.21, 0.79]	3.23	0.010**
M ← V ←	0.61	[0.27, 0.81]	3.59	0.005**
M → V ←	0.40	[0.00, 0.69]	2.07	0.063
M ← V →	0.38	[-.03, 0.68]	1.91	0.077



- Define
- Skills
- Psych
- Neuro
- Apply

# Acting requires social-emotional imagination

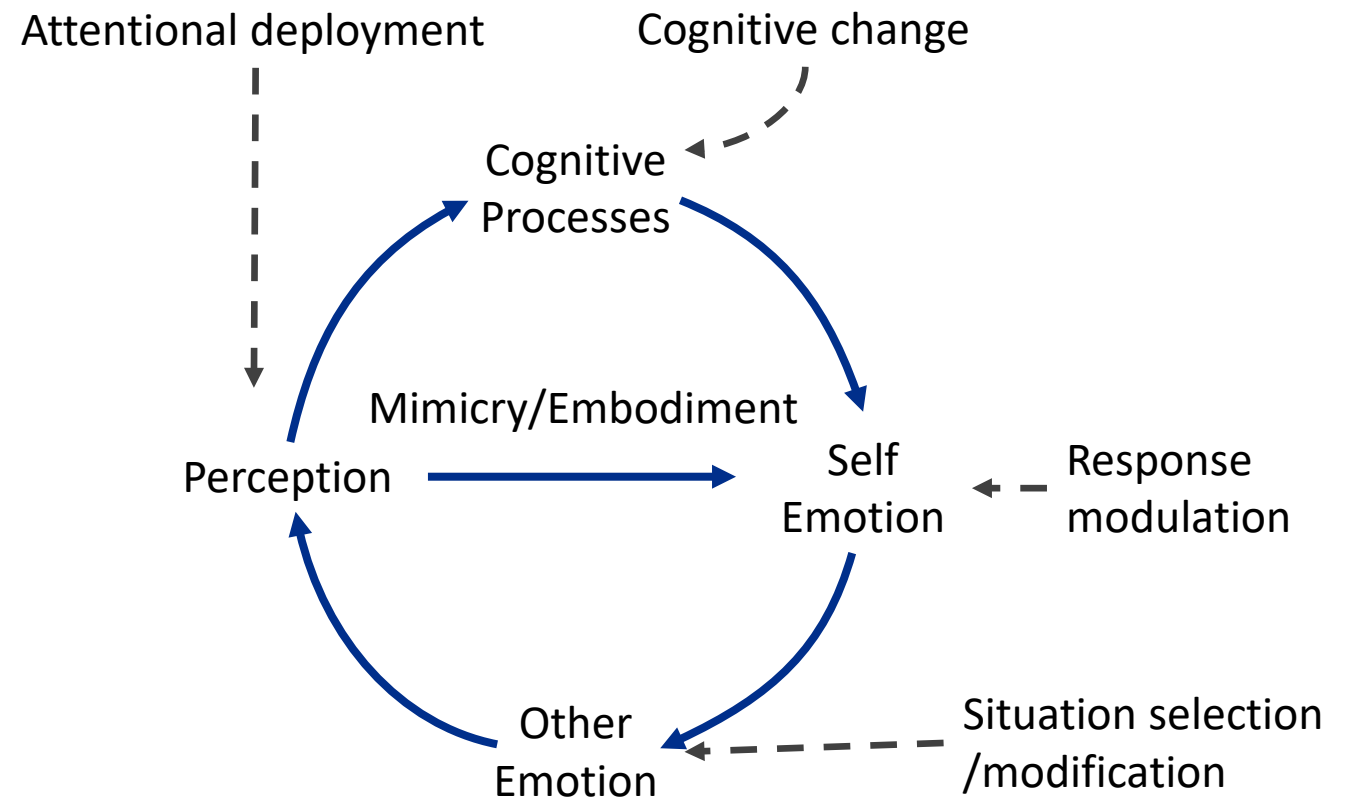
**Theory of Mind:** inferring the thoughts of others

**Empathy:** inferring the emotions of others

**Cognitive and Affective**

**Emotion Regulation:** noticing and influencing the emotions of oneself and others

“The actor is an athlete of the heart.”  
- Antonin Artaud, 1958, p. 133



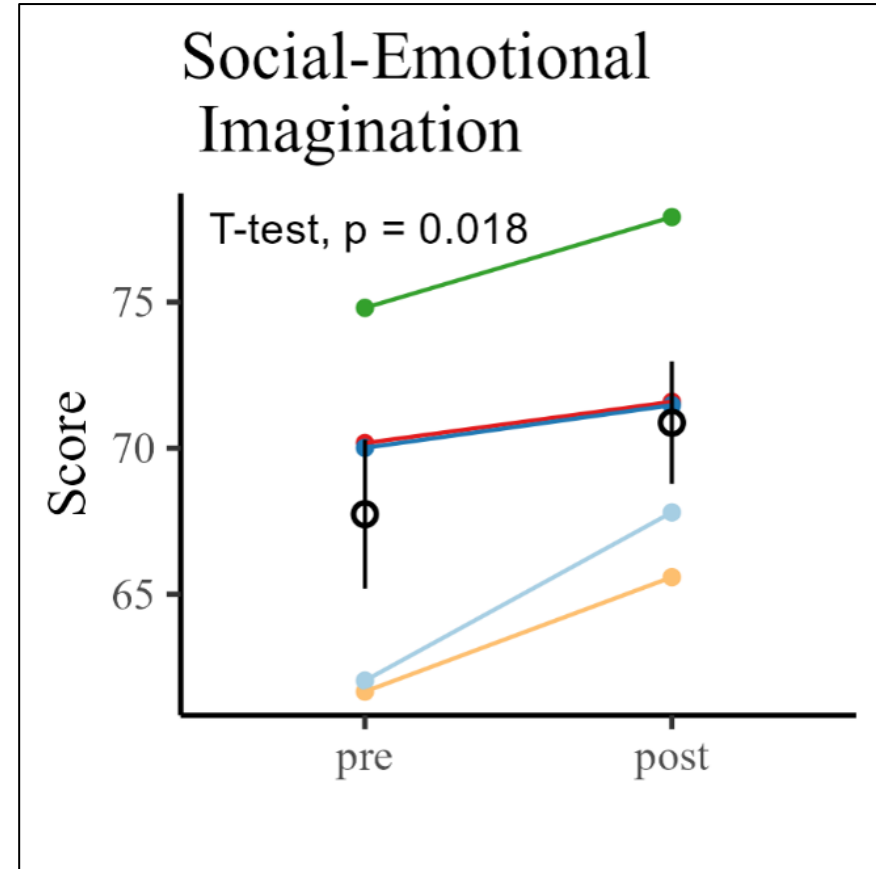
- Define
- Skills
- Psych
- Neuro
- Apply

# Stage Combat training may improve social-emotional imagination in novice learners

n = 5

2 weeks of Staff stage combat training

Aggregate measure of social-emotional imagination





Define

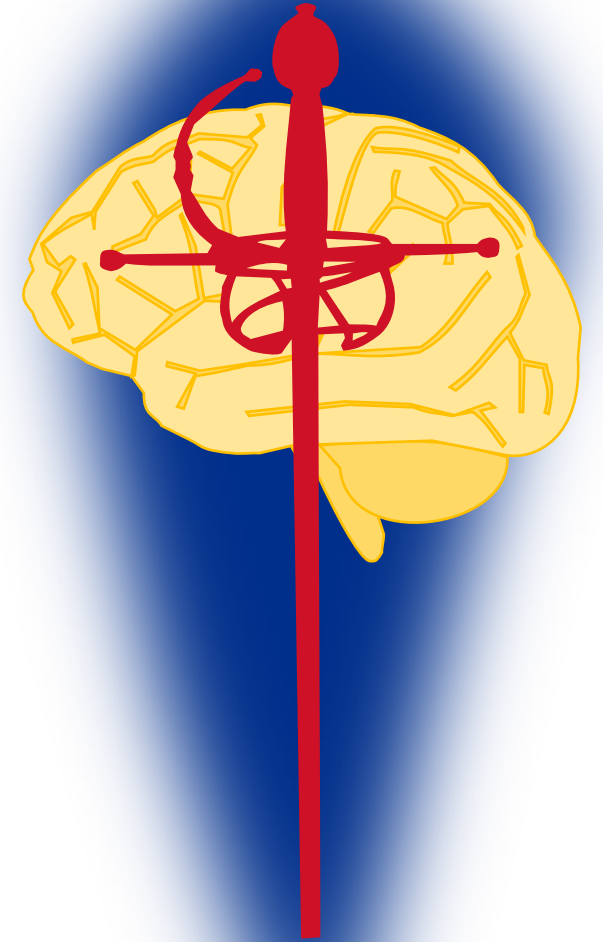
Skills

Psych

Neuro

Apply

# Neuromotor Processes which support Stage Combat



Define

Skills

Psych

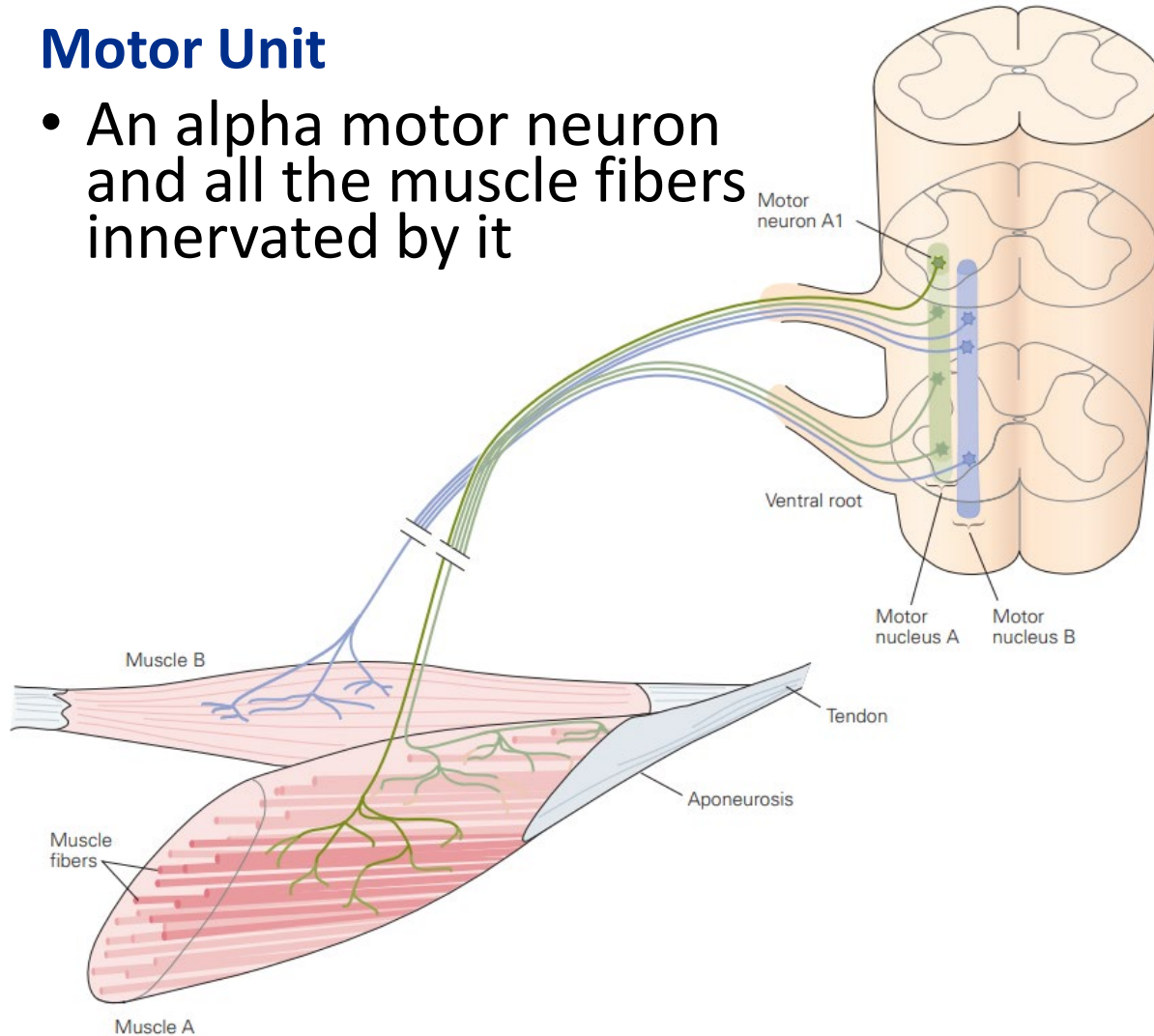
Neuro

Apply

# Movement Execution

## Motor Unit

- An alpha motor neuron and all the muscle fibers innervated by it



## Size Principle

- Small
  - Slow twitch, slow to fatigue
    - Type I
  - Low threshold
  - Few muscle fibers
- Large
  - Fast twitch, fast to fatigue
    - Type IIb
  - High threshold
  - Many muscle fibers
- Medium
  - Moderate number of fibers and threshold
    - Type Iia/x
  - Fast(er) twitch, slow(er) to fatigue

Define

Skills

Psych

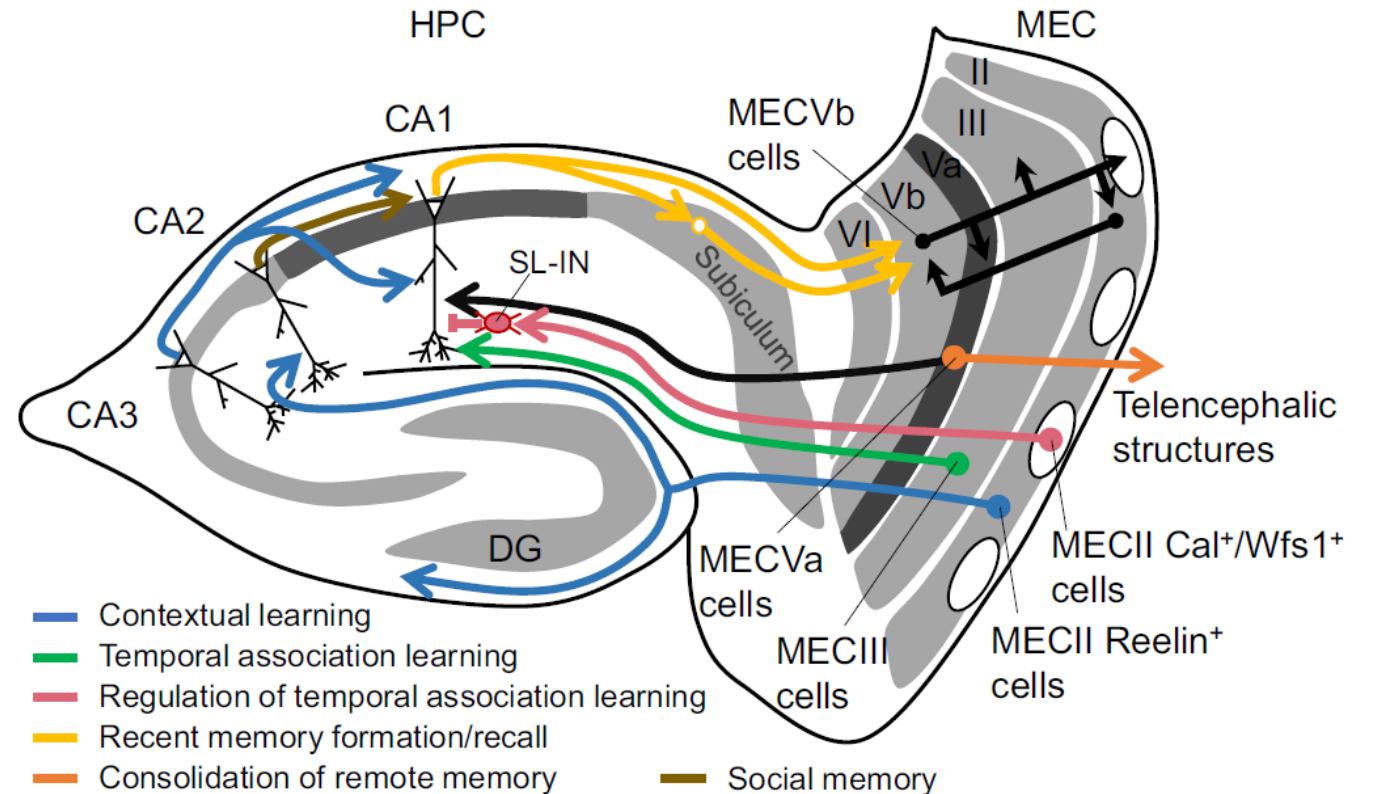
Neuro

Apply

# Anticipation and Planning – Hippocampus

**Place cells:** in hippocampus; create place field

**Grid cells:** in MEC; create coordinate map, a sensory independent spatial metric



Define

Skills

Psych

Neuro

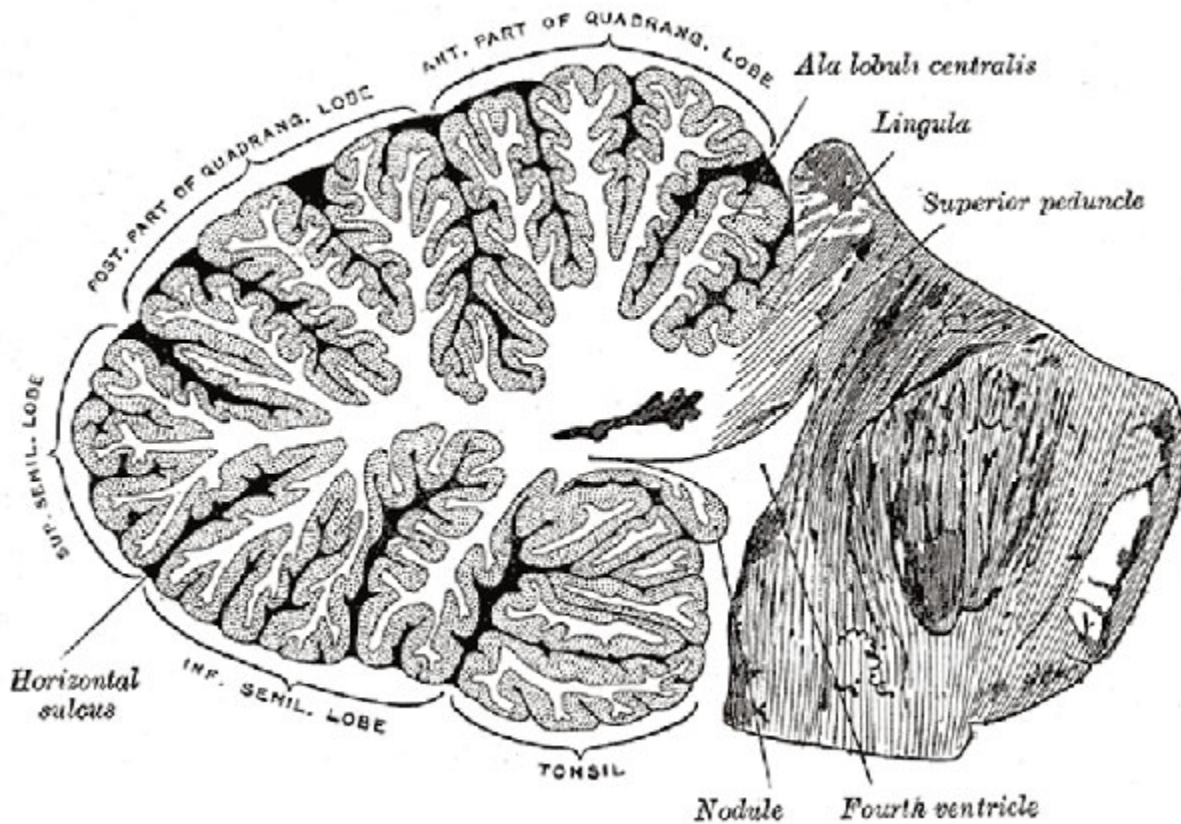
Apply

# Anticipation and Planning – Cerebellum

**Forward model:** anticipatory motor commands

**Efference copy:** a copy of the motor command (from M1) sent to the cerebellum through the pontine nuclei

**Corollary discharge:** through processing of the efference copy, the cerebellum provides an *expected sensory outcome* which can be compared against the actual sensory consequences



Define

# Anticipation and Planning – Parietal Lobe

Skills

**Movement cells:** fire whenever an animal moves in a specific direction (egocentric)

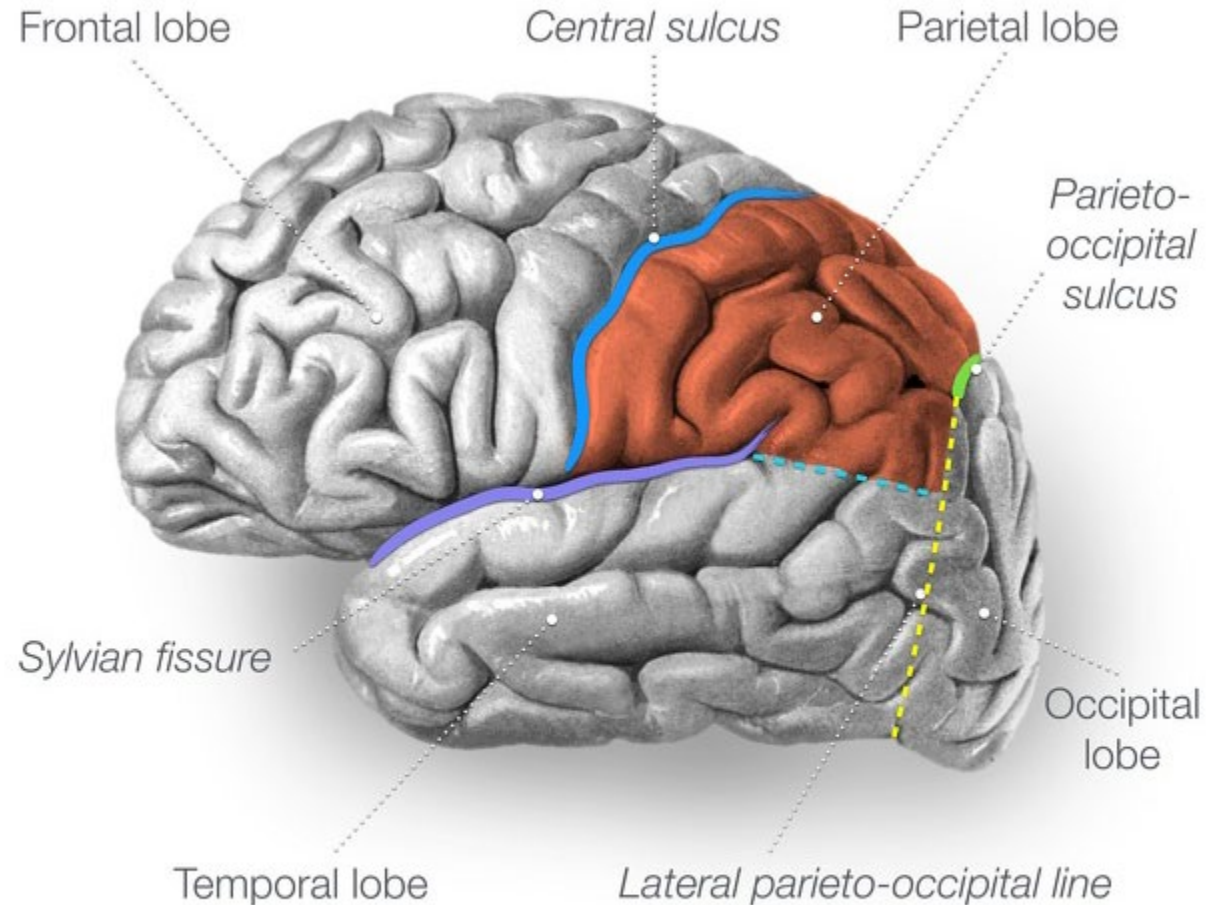
Psych

**Path cells:** encode the state of progression through a route (allocentric)

Neuro

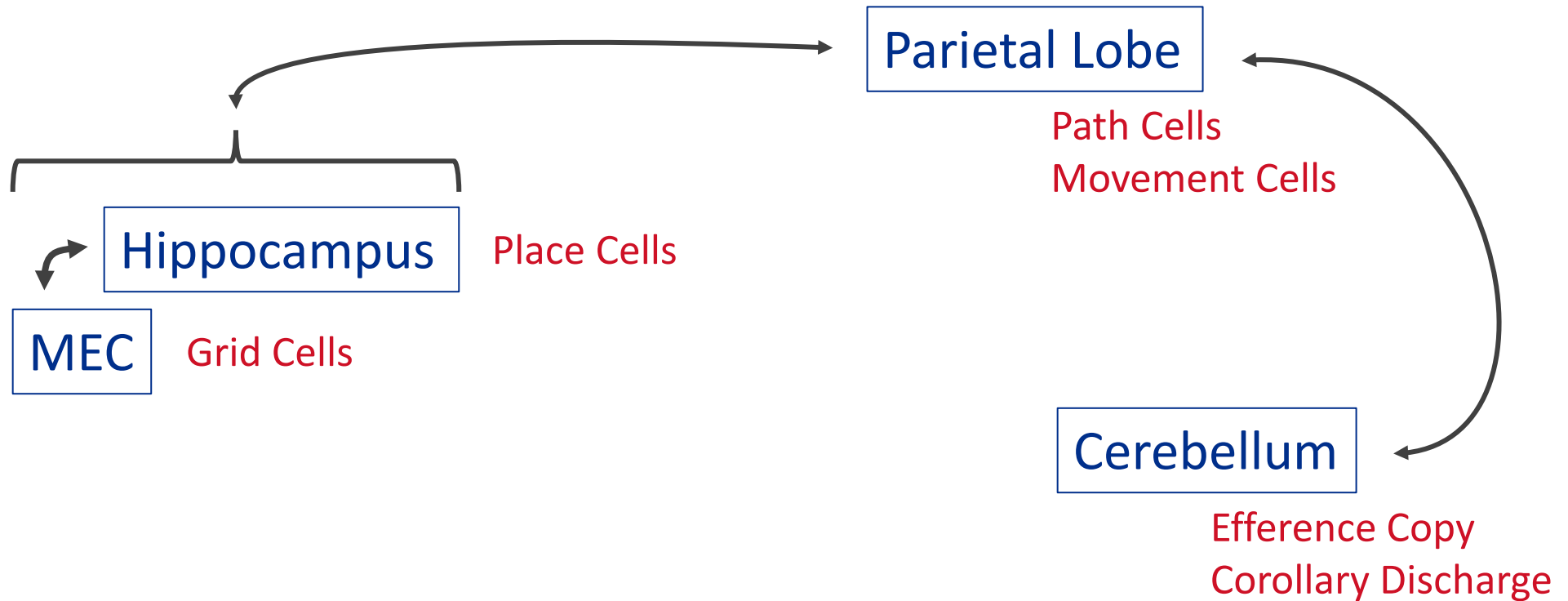
**Mirror neurons:** fire when performing an action and when observing another perform that action

Apply



- Define
- Skills
- Psych
- Neuro
- Apply

# Anticipation and Planning Schema





Define

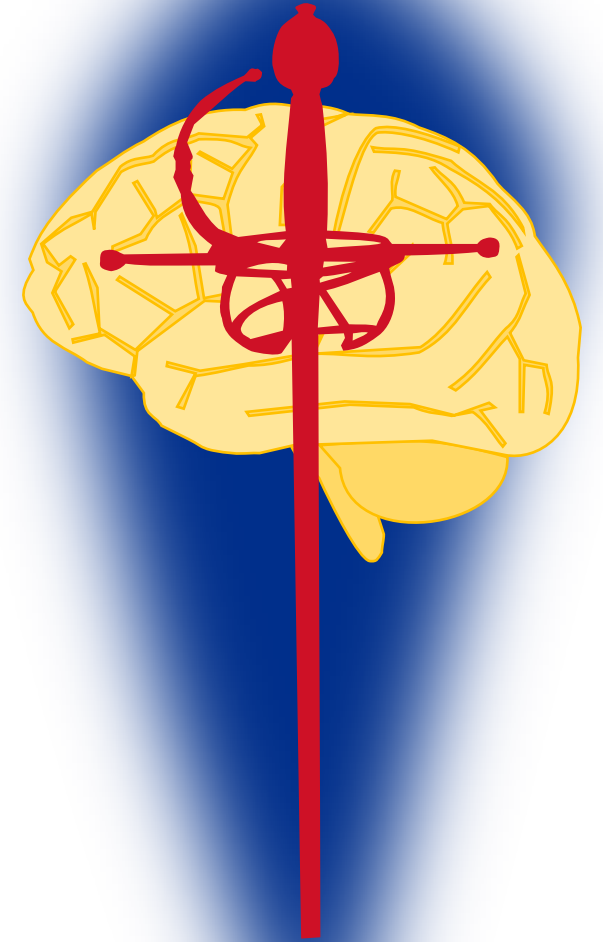
Skills

Psych

Neuro

Apply

# Implications for health, theatre, and education



Define

Skills

Psych

Neuro

Apply

# Health

## *A Short-Term Intervention to Enhance Cognitive and Affective Functioning in Older Adults*

HELGA NOICE

*Elmhurst College*

TONY NOICE

*Indiana State University*

GRAHAM STAINES

*National Development and Research Institutes, Inc., New York*

**Objective:** This study was designed to investigate the benefits of a short-term intervention for older adults that targeted cognitive functioning and quality of life issues important for independent living. **Method:** One hundred twenty-four community-dwelling participants (aged 60 to 86) took part in one of three study conditions: theater arts (primary intervention), visual arts (non-content-specific comparison group), and no-treatment controls. **Results:** After 4 weeks of instruction, those given theater training made significantly greater gains than did no-treatment controls on both cognitive and psychological well-being measures. A comparison of theater and visual arts training showed fewer benefits in fewer areas for visual arts. **Discussion:** The authors suggest reasons why various aspects of theater training appear to enhance healthy aging.

**Keywords:** *aging; cognitive improvement; psychological well-being; interventions; stimulating activities*

Article

## **Effects of Karate Training Versus Mindfulness Training on Emotional Well-Being and Cognitive Performance in Later Life**

**Petra Jansen<sup>1</sup>, Katharina Dahmen-Zimmer<sup>1</sup>,  
Brigitte M. Kudielka<sup>1</sup>, and Anja Schulz<sup>2</sup>**

### **Abstract**

In a randomized controlled trial, we investigated the effects of karate versus a mindfulness-based stress reduction (MBSR) intervention on well-being and cognitive functioning in older adults. Fifty-five adults (52–81 years old) participated in twice-weekly karate versus MBSR sessions or no training for 8 weeks. In pre- and postassessments, subjective well-being, health, cognitive functioning, and chronic stress were measured. Preassessment hair cortisol served as physiological stress marker. The results showed an improvement for the karate group, but not the MBSR and control group, in subjective mental health and anxiety as well as cognitive processing speed. The MBSR group showed by trend as a decrease in stress. No significant correlation between preassessment hair cortisol and postassessment outcomes could be established. But the higher the level of baseline self-reported perceived stress, the higher the increase in depression, anxiety, and chronic stress.

Research on Aging  
2017, Vol. 39(10) 1118–1144  
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# Theatre

Define

Acting is approached in various ways

Skills

Psychological Acting

Psych

Physical Acting

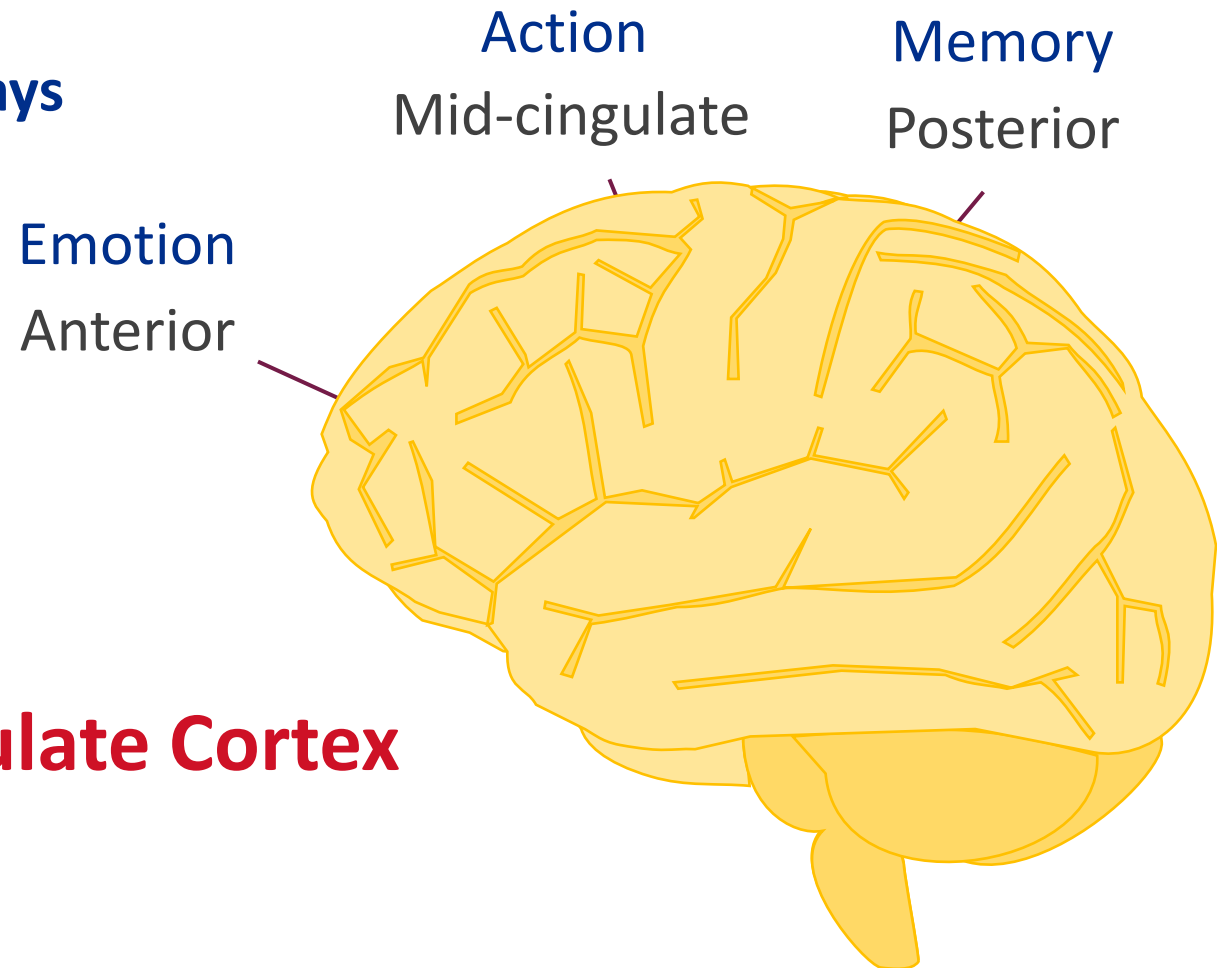
Neuro

Psychophysical Acting

Apply

Emotion – Action – Cognition

## Acting requires a Brain



## Cingulate Cortex



Define

**Education**

**Motivation**

Skills

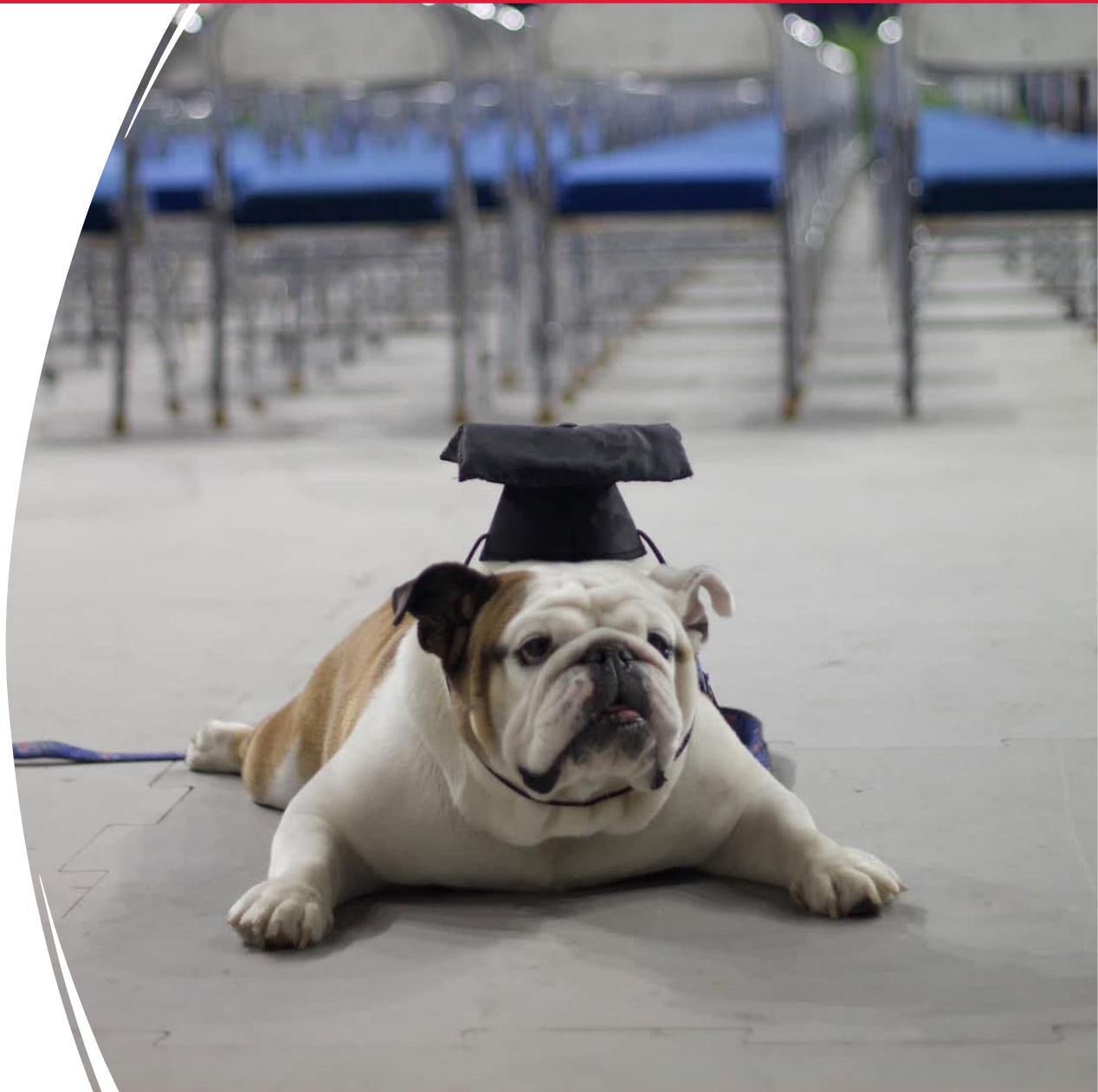
**Resilience**

Psych

**Movement**

Neuro

Apply





# Fight Kindly

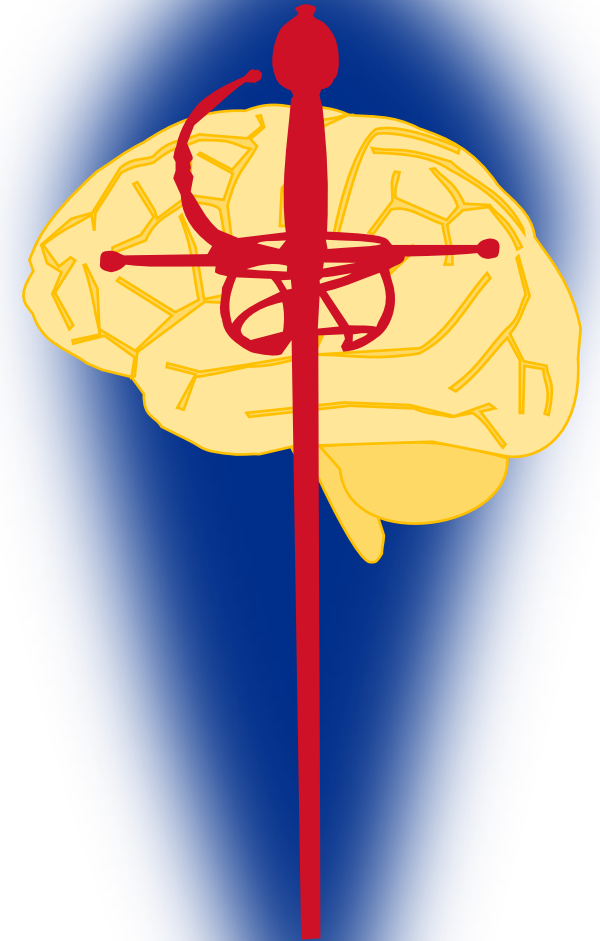


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STROKE



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NEUROPLASTICITY



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