CNS AROUSAL AND PERFORMANCE

The relationships among performance factors and the implications of traumatic brain injury.

LN Matheson, PhD (2011)
www.epicrehab.com
Yerkes–Dodson Law

- In complex tasks, performance is affected by arousal, with low arousal and high arousal producing lower levels of performance than moderate arousal.

- The process is illustrated graphically as a curvilinear, inverted U-shaped curve that increases to a maximum as arousal increases, and then decreases with higher levels of arousal (activation).

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Arousal / Activation - Performance Curve

The Zone
Flow

Peak Performance Window

Optimum Activation
Inverted-U: Arousal & Job Performance

• Simple tasks produce a linear arousal-performance curve.
• To the degree the task is complex, the curvilinear arousal mechanism predominates.
  • Multi-sensory
  • High-attention
  • Creativity and innovation
  • Complex problem-solving
• Competitive athletic performance
  • Across different sports and different athletes, the simple-complex differential is consistently observed.

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Activation-Performance Modulators

- A partial and incomplete list:
  - Pain
  - Fatigue
  - Opioid Pain Medications
  - Anxiety & PTSD
  - Depression
  - SSRIs & SNRIs
  - Aerobic Exercise
  - Nicotine & Caffeine
  - Alcohol & Marijuana
  - Amphetamines
  - Meditation & Prayer
  - Anabolic-Androgen Steroids
  - Rest & Timeout

mTBI places a ceiling on performance and interacts with modulators to make the slopes more severe.
Arousal / Activation - Performance Curve

Maximum

Peak Performance Window
“The Zone”
“Flow”

Optimum Activation

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Arousal / Activation - Performance Curve

Notice ceiling and slope effects.

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Ceiling - Slope Interaction

- If treated immediately, the ceiling effect of an mTBI is likely to be temporary.
- However, it produces anxiety when it is not understood or means to resolve are not provided.
- This new anxiety adds to arousal factors, which leads to asymmetrical diminution of performance (slope narrowing) and episodic breakdowns.
- Detrimental effects of anxiety are greatly under-appreciated.
Arousal / Activation - Performance Curve

Peak Performance Window
“The Zone”
“Flow”

Optimum Activation

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Arousal / Activation - Performance Curve

As client returns to prior activation, *overwhelm* occurs, leading to breakdowns, experienced as a variety of symptoms.
Ceiling - Slope Interaction

• The ceiling-anxiety arousal can trigger a self-perpetuating cycle.
• Un-checked, this will be resolved by the client with maladaptive methods.
  • Pain medication with tolerance and dependence.
  • Marijuana & alcohol use with tolerance & dependence.
  • Heroin and other opiates paired with anxiolytics; with tolerance & dependence, but high risk of overdose in the initial trials leading to coma and death.
Thank you!

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Please contact Dr. Matheson with comments or questions.
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