Cognitive Gym
Dr Eugene Aidman & Dr Diane Pomeroy

C&B STC
Land Human Sciences
Land Division
DST Group
8 Nov 2017
Background

- Army piloting 2 Human Performance Centres (HPCs)
  - one hosted by 3 Brigade (3BDE), Townsville
- HPCs aim: ADF personnel can **outperform** (physically and cognitively) and **outlast** an adversary that is intelligent, agile, and adaptable
- DST is supporting Army in the establishment and **evaluation** of the HPCs
- C&B STC has developed a **Cognitive Fitness Framework (CF2)** to guide research in support of the HPCs
- The **Cognitive Gym** concept is nested in the CF2
Cognitive Fitness Framework

Advanced training
- Controlled response ("The Zone")
- Energy management (arousal regulation)
- Situation Awareness (detect → interpret → predict)
- Decision making: bias & confidence calibration
- Adaptability
- Teamwork

Cognitive Readiness:
Tolerance & Resistance

Operational cognitive performance

Cognitive Fitness: Trainable cognitive primaries

Combat Trauma Prevention

Foundational Training
- Self-awareness
- Attention skills
- Task Switching
- Impulse control
- Co-action

Mission-ready training
- Tolerance to pain, stress, sleep loss, monotony, frustration, uncertainty, tactical surprise
- Resistance to distraction, deception, manipulation
- Resilience & recovery dynamics

Cognitive Recovery
- Sleep hygiene
- Meditation
- Nutrition
- Social support

Operational augmentation
- Cognitive state monitoring
- Fatigue countermeasures
- Adaptive decision aids
- Operator state-aware autonomy

Cog Gym

Gold-standard Training:
- Isolate
- Overload
- Over-recover
Cognitive Gym - Overview

- analogous to a physical gym

- allows Army personnel to enhance their cognitive performance and/or develop skills that enable them to maintain cognitive performance under stress

- still in its development stages
Knowledge Gaps

- What are the key operationally-relevant cognitive attributes?
- How do they map onto soldier competencies?
- How trainable are they?
- What are the best-practice tools to assess them?
- What types of training do they require? (e.g., foundational vs. mission-specific)
- Best-practice training protocols/design principles? (e.g., modalities/dosage/periodisation/training phases?)
- Potential inclusions: executive function training, dietary supplements, biofeedback, martial arts
Current Status

- Identification of key trainable cognitive attributes - critical to integrated framework for human performance & resilience

- Down-selection of cognitive primaries for Cognitive Gym trials

- DST Cognition Lab stood up to evaluate assessment tools & training protocols

- CogniPlus test drive complete → advice on HP trial inclusions in progress

- Collaborations established to progress evaluation of assessment tools & training protocols:
  - Current RA (U of Sydney)
  - CTD round 21 / Innovation (U of Newcastle): biomarkers of resilience and VR-based training
  - HPRnet project (U of Canberra/AIS)
  - Alertness CRC, RAAF AvMed

- Impact: selecting best-practice cognitive assessment & training protocols HPC to deliver measurable gains in cognitive fitness → add to overall soldier effectiveness (both performance and resilience)
HPC – Vasey Resilience Centre 3BDE

- Peak Performance Program (P3)
- 3 week course; groups of 20
- Holistic approach:
  - Strength and conditioning
  - Nutrition
  - Health awareness
  - Social and community engagement
  - Individual character enhancement
  - Combat shooting
  - Cognitive enhancement
## Current Status: Training & Assessment constructs

<table>
<thead>
<tr>
<th>Test</th>
<th>Time budget (minutes)</th>
<th>Target skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>COG</td>
<td>20</td>
<td>Cognitrone (attention &amp; concentration) (CogniPlus = FOCUS and SELECT)</td>
</tr>
<tr>
<td>DT</td>
<td>15</td>
<td>Determination Test (reaction time, stress tolerance, attention) (No CogniPlus equivalent)</td>
</tr>
<tr>
<td>INHIB</td>
<td>10</td>
<td>Response Inhibition (go-nog; behavioural shift) (CogniPlus = HIBIT-R)</td>
</tr>
<tr>
<td>NBN</td>
<td>11</td>
<td>Nonverbal n-back (visual Working Memory capacity) (CogniPlus = NBACK)</td>
</tr>
<tr>
<td>SIGNAL</td>
<td>20</td>
<td>Signal Detection: Sustained focussed attention (CogniPlus = VIG and SELECT)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
<th>Final Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>VTS</td>
<td>Cogniplus Training Program 1</td>
<td>Cogniplus Training Program 1</td>
<td>Cogniplus Training Program 1</td>
<td>Cogniplus Training Program 2</td>
<td>Cogniplus Training Program 2</td>
<td>and so on until the 4 Cogniplus training Programs have been completed</td>
</tr>
</tbody>
</table>
Performance Skills: Example

- Mental Skills Foundation
- Attention Control
- Building Confidence
- Energy Management
- Goal Setting
- Imagery

Mental Skills Training With Basic Combat Training Soldiers: A Group-Randomized Trial

Amy R. Adler and Paul D. Dilone
Walter Reed Army Institute of Research, Silver Spring, Maryland

Jason Williams
Research Triangle Institute, Research Triangle, North Carolina

Louis Crooks
Apex Performance, Inc., Charlotte, North Carolina

Laura Pickering and Jon Hammett
Eastern Washington University

Coreen Harada
Army Resilience Project, Crystal City, Virginia

Bernie Holliday and Carl Orlich
United States Military Academy

Cognitive skills training has been linked to greater skills, self-efficacy, and performance. Although research in a variety of organizational settings has documented training efficacy, few studies have examined cognitive skills training among soldiers using randomized trials with active controls. The present study assessed cognitive skills training as a high-risk intervention by using a randomized, controlled trial (N = 2,132 soldiers) in basic combat training to either an active skills training or a control condition (60 active control conditions in total). Soldiers in the skills training condition also participated in a high-risk combat simulation (70% combat exposure). Changes in knowledge, self-efficacy, and performance were measured using pre-post questionnaires and post-test simulations. Overall, effects were modest; however, given the nature of the design, these findings are consistent with the literature. By providing supportive evidence that cognitive skills training can enhance performance in occupational and military settings, future research should address gender and experience to determine the need for tailoring such training appropriately.

Numerous studies have examined how training can benefit workplace outcomes, including skills acquisition (e.g., Tuckman, 2006), self-efficacy (e.g., Frone & Gerhart, 2003), and job performance (e.g., Arthur, Hallstatt, & Bolin, 2003). Although training content may differ across organizations, training that emphasizes cognitive skills has been identified as particularly effective (Vazquez & Kram, 2000). Concerning the utility of training interventions, it is clear that cognitive skills training is essential for maintaining a high-risk occupation.

The Army Center for Enhanced Performance (ACEP) is an independent research and development organization that conducts research and development in the areas of cognitive skills, performance enhancement, and combat training for the United States Army.
Questions?