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DM-0001754
What is an expert?
How do we get more of them?
What is an expert in this context?
What is an expert in this context?
Traditional Performance Attributes-
Speed and Accuracy

Violinist
- Accuracy is important
- Speed is not

Long distance running
- Speed is important
- Accuracy is not
Attributes of our definition of experts in cybersecurity

- Job function level with generalizable tasks
- Reliability
- Speed of only accurate performance
Why do we care?

- Expert systems
- Socially-elected experts
- Personnel selection
- Training
Other impacts to the development of expertise

Organizational influences

Performance
Past research focused on these individual factors:

- Cognitive Abilities
- Personality Traits
- Attitudes and Beliefs
Our contribution:

- Cognitive Abilities
- Personality Traits
- Metacognitive Skills
- Teamwork Skills
- Attitudes and Beliefs
Multi-Year Research Process

Phase 1

Step 1. Map the Domain.

Step 2. Map the job roles using job task analysis.

Phase 2

Step 3: Identify Levels of Performance and Respective Performance Metrics.

Step 4. Create a test battery.

Phase 3

Step 5. Run new test battery on a large sample of operators and correlated predictors with performance.

Past FY13 Work
FY13 Research

Phase 1

Step 1. Map the Domain.

Step 2. Map the job roles using job task analysis.

Step 3: Identify Levels of Performance and Respective Performance Metrics.

Step 4. Create a test battery.

Step 5. Run new test battery on a large sample of operators and correlated predictors with performance.

Target Population

Malicious-code reverse engineers
Research Question

Predictors of the development of experts in malicious-code reverse engineering?
Types of Factors Responsible for Performance

- Domain-Specific Knowledge and Skills
- Meta Cognitive Skills
- Teamwork Knowledge and Skills
- Cognitive Abilities
- Personality
- Work History
- Other Personal Attributes

Performance
Results of Step 2

**Abilities**
- Large working memory capacity

**Personality:**
- Curious
- Self-motivated
- Conscientiousness

**Teamwork Attitudes:**
- Attracted to working with smart people

**Abilities**
- Abstraction
- LTWM

**Personality:**
- Passion for work
- Conscientiousness
- Autonomous

**Other:**
- Self-taught
- See the big picture

**FAST DEVELOPMENT**

Novice  Initiate  Apprentice  Journeyman  Expert  Master
Organizational Factors

- Time spent in deliberate practice = #1 predictor of expertise
- Create environment that maximizes deliberate task engagement
  - Attract interesting work
  - Minimize distractions
  - Evaluate policies and procedures that reduce task engagement time
  - Groom and retain experts
Current Work
FY14-15 Work

Phase 2

Step 1. Map the Domain.
Step 2. Map the job roles using job task analysis.
Step 3: Identify Levels of Performance and Respective Performance Metrics.
Step 4. Create a test battery.
Step 5. Run new test battery on a large sample of operators and correlated predictors with performance.
Step-by-step method

1. Generate all metrics for objective task performance
2. Use existing job analysis results to generate test battery
3. Beta-test metrics on student individuals and teams
4. Regress test battery factors on objective performance metrics
5. Evaluate metrics
Target Population

Cyber Defender Teams
## Teams and Events

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<td>West Point</td>
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Step 3 Task Performance Metrics Generated

• Individual Performance Metrics
  • Rotem Guttman’s work

• Team Performance Metrics
  • APL’s MATT tool
  • Booze Allen’s team performance metric
Step 4 Test Battery

- Neo PI-3 sub scales
- AIS Inventory
- Team Interaction Inventory
- Bio-data
Some dimensions tested in Team Interaction Inventory

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<tr>
<th>Knowledge</th>
<th>Skills</th>
<th>Attitudes</th>
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<td>- Shared task models</td>
<td>- Adaptability, flexibility, dynamic reallocation of function, compensatory behavior</td>
<td>- Team orientation</td>
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<tr>
<td>- Knowledge of team mission, objectives, norms</td>
<td>- Shared situation awareness</td>
<td>- Conflict efficacy</td>
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<tr>
<td>- Task sequencing</td>
<td>- Mutual performance monitoring and feedback self-correction</td>
<td>- Shared vision</td>
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<tr>
<td>- Accurate problem models</td>
<td>- Leadership/team management, conflict resolution assertiveness</td>
<td>- Team cohesion</td>
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<tr>
<td>- Understanding teamwork skills</td>
<td>- Coordination and task integration</td>
<td>- Mutual trust</td>
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<tr>
<td>- Knowledge of boundary spanning roles</td>
<td>- Communication</td>
<td>- Collective orientation</td>
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<td>- Teammate characteristics</td>
<td>- Decision making</td>
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What avenues does this research open up?

**Professionalization** - the social process by which any trade or occupation transforms itself into a true "profession of the highest integrity and competence"
Contact Information Slide Format

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Fuzzy Line Between *Identifiers* and *Predictors*

“FACTORS”