Transformative Gamification: Making Impact across the Federal Workforce
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Panel

Rotem Guttman
Rotem Guttman is a senior researcher and team lead at the Software Engineering Institute. His research focuses on leveraging non-traditional methods to reach the cybersecurity audience. His research interests include network security, cyber-physical modeling and simulation, cybersecurity training and education, gamification techniques for cybersecurity, cyber forensics and incident response.

Jessica Hammer
Jessica Hammer is the Thomas and Lydia Moran Associate Professor of Learning Science, jointly appointed in the HCI Institute and the Entertainment Technology Center at Carnegie Mellon University. Her research focuses on transformational games, which are games that change how players think, feel, or behave. She is also an award-winning game designer.

Dominic Ross
Dominic Ross is the broadcast media team lead at the SEI where his work focuses on multimedia research and transformative gamification. In that role, he designs and engineers production studios and systems used to acquire training, conferences, webinars, and broadcast video used by the federal cybersecurity workforce, Carnegie Mellon University, and the SEI.
**Transformative Gamification: Making Impact**

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**RESEARCH REVIEW 2022**

**Transformational Games**

- Hands On Experimentation
- Align Incentives
- Increase Receptivity
- Measure/ Improve Teamwork
- Skill Transfer
Hands-on Experimentation
- Rapid Feedback

- Wargaming
- Long DoD History – since 1800’s
- Modern era:
  - Two broad categories:
    - Data-generating / analytical
    - Exploratory / interactive
      - Must maintain analytical rigor
- These two are not mutually exclusive

Early, fast feedback can be critical to avoiding disaster.
Integrating Cyber-Kinetics
• Allowing combined arms training
  • Cyber effects propagate into kinetic domain and vice versa
  • Cyber supports larger mission

• Every team failed on the first attempt
• Rapid Iteration
Three Envelopes

Cybersecurity & Risk Board Game

- Requires no prior knowledge of networking, programming, or risk assessment
-Replicates organizations across different sectors of critical infrastructure
- Creates intuitive understanding of balancing risk and operational capabilities.
Improved Teamwork

Worst-case scenario – Ad Hoc workgroup
• Build trust
• Create willingness to share ideas
• Move rapidly to productivity

Strong data backing
• Randomized controlled trial
• Flow
• Cohesion
Large Team Coordination

- Massive scale
- Native coordination
- Replicatable to DoD context
- GIS Arta

Image courtesy of Animation Research Labs, University of Washington
Mandate from EO 13870:
- “to identify, challenge, and reward the United States Government's best cybersecurity practitioners and teams across offensive and defensive cybersecurity disciplines.”
- Team Finals Client
- Immersive
- Team oriented challenges
- Narratively driven
Human-AI Decision Evaluation System (HADES)

Narratively driven example

- Evaluating the effect of:
  - Stakes
  - AI recommendations
    - Not all explainability is helpful!

- Simulated AI with drop-in capability
  - Full lifecycle support

A demonstration of the HADES test harness in use
Aligned Incentives

You get the behavior you incentivize, *not* the behavior you ask for.

Games allow us to change the incentive structure

- Incentives ≠ Payment
- Incentives tied to motivation
- Games can provide motivation
  - Narrative Engagement
  - Competitive / Cooperative
  - Status / Power / Vengeance / Collection
Aligned Incentives

“Cheating” as a benefit

- Properly aligned incentives encourage beneficial “cheating”
- Rules of Engagement violation → Mission Focus
- Studying history to “Cheat” at Civilization\(^1\), Ars Magica\(^2\)
- SAT Vocabulary preparation via Magic the Gathering\(^3\)

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Transfer of Skills

Learning works best *in context*
- Games can provide that context
- Games can enhance future learning

Examples:
- Foreign Language Role Playing Game
  - Avg. 8.7 words learned in ~40 min
- Phishing Training Game
  - 36.7% improvement in player’s ability to identify phishing email compared to control group

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Transfer of Skills

Experiences must be designed to support skills transfer!

• Multiple approaches to evaluating games
• Not all games provide utility!

• Preparation for Future Learning (PFL)\(^1\)
  - Clear goals
  - Immediate feedback
  - Specific knowledge
  - Outward pointers

• Limited DoD resources

• Leverage personal time by making content engaging enough for the audience to self-select during leisure time.

• Extend reach beyond DoD enterprise (defend the nation).

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VR Prototyping

Examples
• F-16 Connection Requirements
• Connecting to larger scale simulations
• Forensics use case
Improved Receptivity

Games can provide an alternative reality
Properly designed these can create:
- Increased comfort asking questions\(^1\)
- Disrupt established power dynamics to elicit better data\(^2\)
- Allow practice in a safe environment\(^3\)

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Improved Receptivity

- Semi-Fantastic Setting
- Suspension of Disbelief
  - Prevent defensiveness
- Retain applicability to prevent negative training value
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Questions?