Bottom-up Views of Distributed Learning: The Role of Distributed Cognition

Garett Howardson, Ph.D.
U.S. Army Research Institute
U.S. Army Research Institute for the Behavioral and Social Sciences

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Briefing for:

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Garett Howardson, Ph.D.
U.S. Army Research Institute for the Behavioral and Social Sciences (ARI)
Modern operating environment is **dynamic** and **nonlinear**

- Classic *Instructional Systems Design* (ISD) model is **linear** and relatively* **static**

Future success depends on individual-Soldier-driven and on-the-job learning

- Within broader context of U.S. Army / Military needs

Enter the role of distributed learning

- Eases ISD constraints on creation → delivery
• First distributed learning paradigm:
  – Centralized Information → Learners
  – Origins: “First Generation” learning

• Second distributed learning paradigm:
  – Learners → Centralized Information
  – Origins: “Second Generation” learning

• Third distributed learning paradigm:
  – Learners → Decentralized Information
  – Origins: “Third Generation” learning
• Socially de-centralized information not always desirable
  – Examples: lockout / tagout, trash compactor, M249

• What is needed is a distributed learning paradigm incorporating 1\textsuperscript{st}, 2\textsuperscript{nd}, & 3\textsuperscript{rd} features

• Modern operating environment is \textit{dynamic} and \textit{nonlinear}
Current Research Aims

• Integrate multidisciplinary research into dynamic, nonlinear distributed learning paradigm

• Emphasize theoretical concept of information gradient

• Span diverse spatial, social, and temporal scales

<table>
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<th>Machine Learning</th>
<th>Human Learning</th>
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<td>Multilayer perceptron</td>
<td>Self-regulated learning</td>
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<td>Hopfield nonlinear attractor network</td>
<td>Near and far transfer</td>
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<td>Stochastic gradient descent</td>
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• Systems-based
  – Bottom-up emergent phenomena (e.g., learning)
  – Top-down system constraints (e.g., training)

• Skill-centric
  – Open and closed skills

• Grounded in *cognitive extension* (Clark, 2010)
  – Coupled internal-external functions no different than qualitatively different internal functions
Information Gradient Distributed Learning

Open Skills

Open Skill Information
- Originates from **learner**
- Flows from **bottom-up**
- Exists **within** the learner
- Is learner- or self-regulated

Learn

Organization

Closed Skill Information
- Originates from **organization**
- Flows from the **top-down**
- Exists **beyond** the learner
- Is organization-regulated

Information Gradient

Learner

Train

Closed Skills
Upcoming Steps

• Now:
  – Multi-disciplinary narrative review integrating diverse learning science literatures via *information gradient* concept

• Near Future:
  – Collect critical incidents to derive prototypical bottom-up (i.e., learning) and top-down (i.e., training) experiences

• Far Future:
  – Develop open-source set of modeling tools spanning micro, meso, and macro distributed learning dynamics across diverse time (e.g., seconds, minutes, career) *and social* (e.g., individual, team) scales
Potential Implications

• Offer a common distributed learning language integrating micro, individual-level behavioral processes with macro, organizational-level processes

• Improve automatic and objective learner assessment in distributed high dimensional behavioral settings
  – Aggregate micro-level information to more meaningful level for learner feedback / training designers

• Improve communication between wide range of DoD stakeholders and policymakers interested in distributed learning
Thank you!

garett.n.howardson.civ@mail.mil