


Concurrent Presentation Session
LEARNING SCIENCE FOR OUTCOMES



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

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

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Background: Military Problem



- 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



Background: Scientific Problem



- 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 → **De**centralized Information
 - Origins: “Third Generation” learning



Background: Scientific & Military Problem



- Socially de-centralized information not always desirable
 - Examples: lockout / tagout, trash compactor, M249
- What is needed is a distributed learning paradigm incorporating 1st, 2nd, & 3rd features
- Modern operating environment is **dynamic** and **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

Machine Learning	Human Learning
Multilayer perceptron	Self-regulated learning
Hopfield nonlinear attractor network	Near and far transfer
Stochastic gradient descent	Part-task training



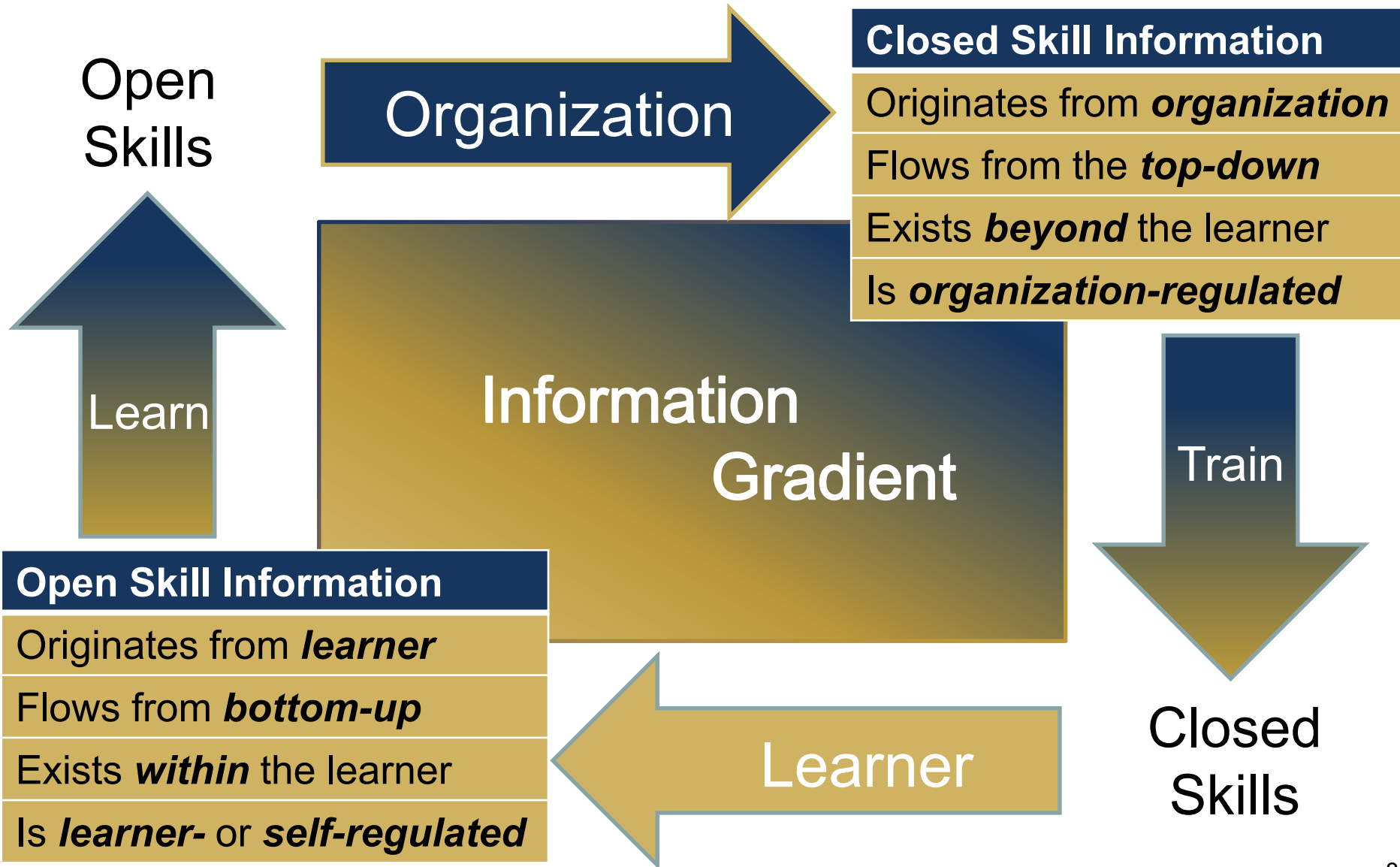
Information Gradient Paradigm



- 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





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!

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