U.S. Army Research Institute
for the
Behavioral and Social Sciences

Army Selection and Training
Research Interests

Army Science Conference

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Standard Form 298 (Rev. 8-98)
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Purpose

Provide an overview of ARI's research mission

For Soldier selection and training:

• Describe key Army challenges and research interests

• Highlight ARI research efforts

• Outline challenges for neuroscience research

Some Army S&T Labs & Mission Areas

Deputy Chief of Staff, G-1

Army Research Institute (ARI)

- Personnel
- Training
- Leader development

Research psychologists
- Experimental
- Social
- Cognitive
- Industrial/organizational

U.S. Army Medical Command

Medical Research and Materiel Command (MRMC)

Walter Reed Army Institute of Research

- Physical and psychological health

Army Materiel Command

Research, Development, and Engineering Cmd (RDECOM)

Human Research Engineering Directorate (HRED), ARL
- Human-systems design

Simulation & Training Technology Center (STTC)
- Simulation technology

NATICK Soldier System Center
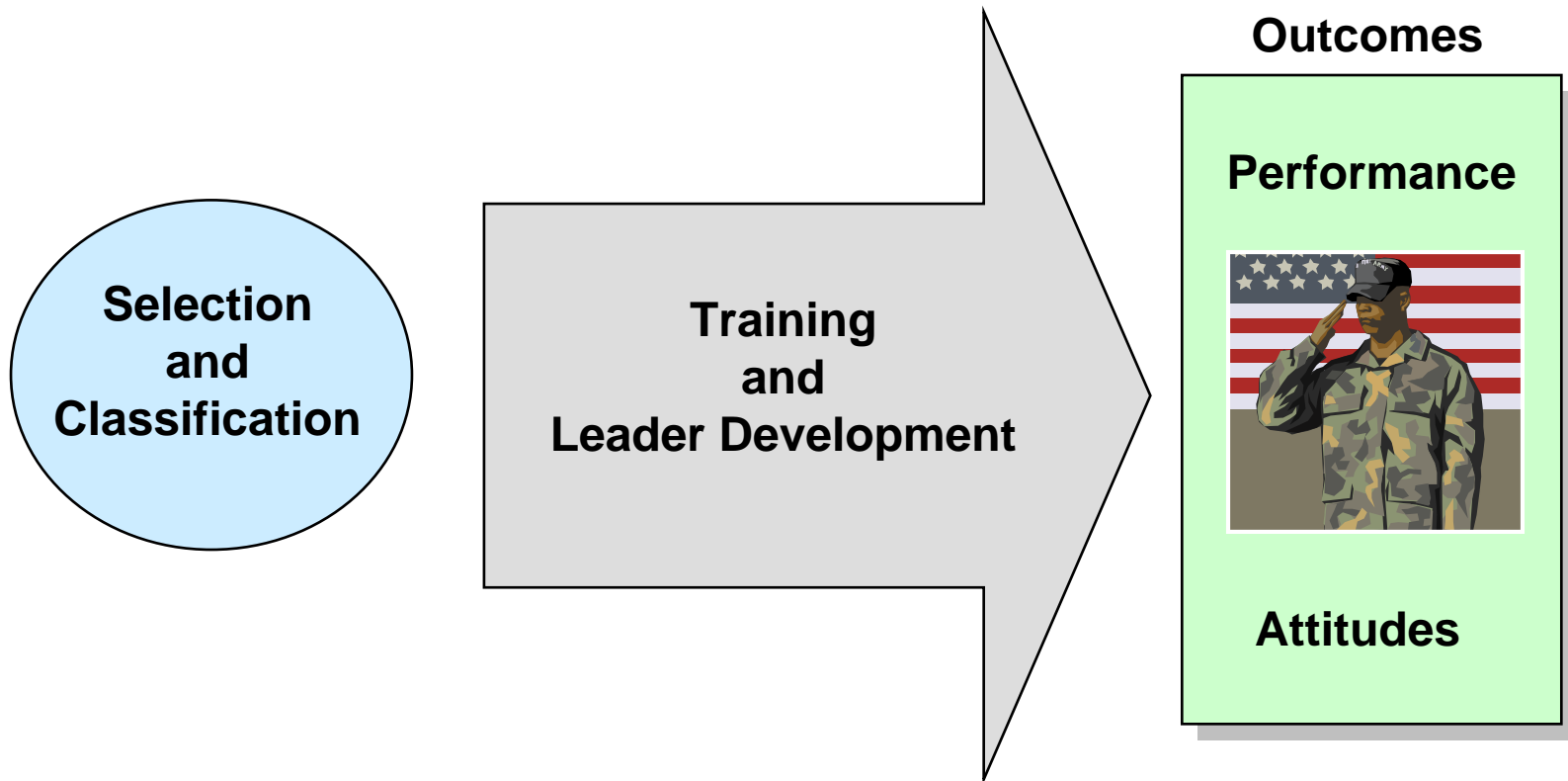- Food, clothing, shelter,…

Communications-Electronics Research Development Center
- Communication/info technologies

ARI Overarching Research Goals

- Develop new measures to meet Army personnel goals without reducing quality.
- Develop effective methods to train Soldiers and units, and grow agile leaders.

Selection and Classification → **Training and Leader Development** →

Outcomes

Performance

Attitudes

Trainability Continuum for Characteristics Related to Human Performance

Stable Attributes
(less trainable)

Malleable Attributes
(more trainable)

Abilities & Traits

- Cognitive ability
- Resiliency
- Tolerance for ambiguity
- Achievement motivation
- General self-efficacy
- Other temperament and personality characteristics (e.g., openness, conscientiousness)

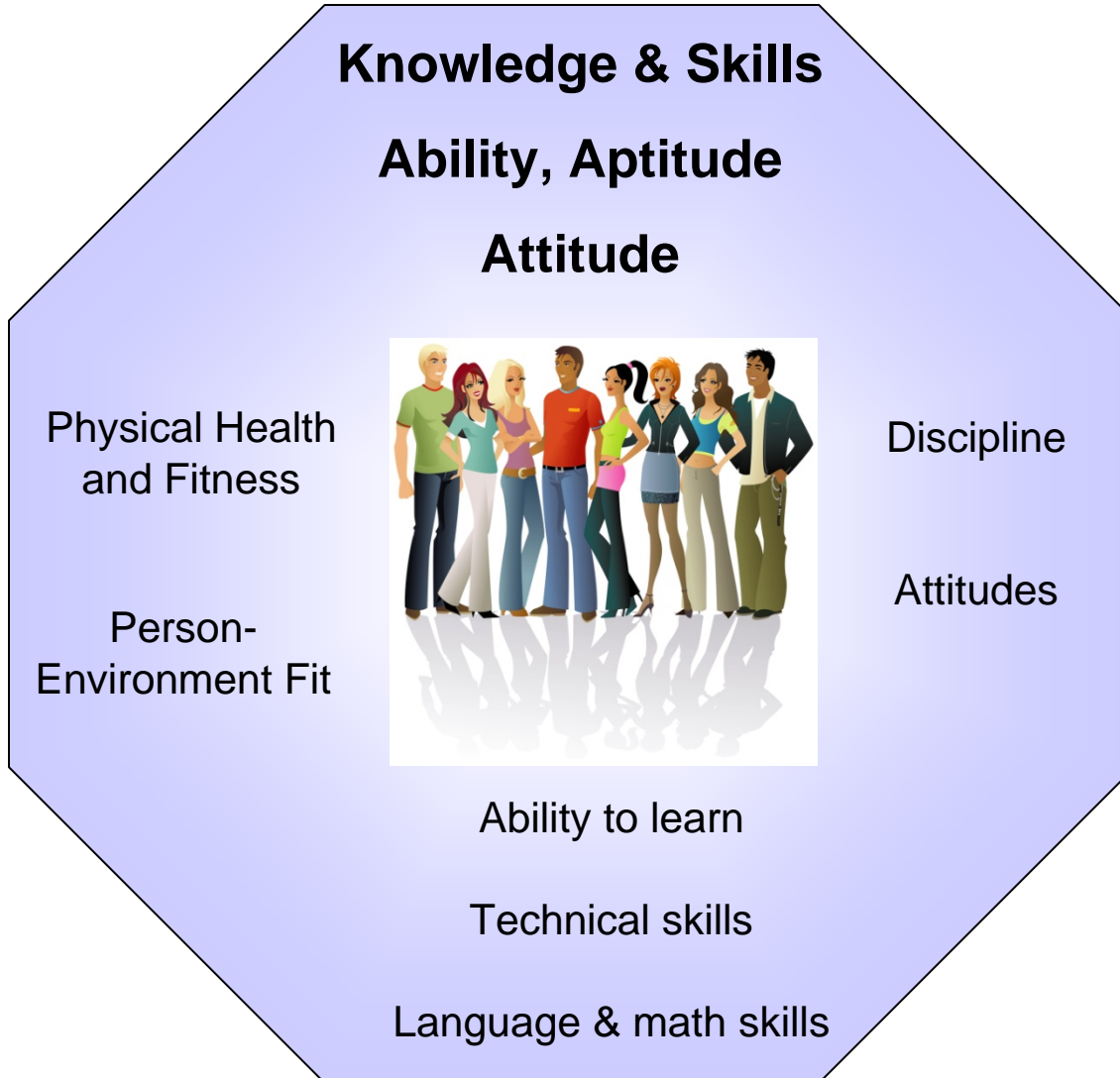### Higher Order Skills & Attributes

- Problem solving/decision making skills
- Metacognitive skills
- Interpersonal skills
- Communication skills (e.g., negotiation, persuasion, collaboration)
- Awareness (self, others, situation)
- Complex motor and physical skills
- Moral development/ ethical reasoning
- Goal orientation (learning, mastery)

Knowledge

- Domain-specific knowledge
- General knowledge acquired through diverse experiences
- Routine procedures and tasks

Army Enlisted Selection

Knowledge & Skills

Ability, Aptitude

Attitude

Physical Health and Fitness

Person-Environment Fit

Discipline

Attitudes

Ability to learn

Technical skills

Language & math skills

Current Measures

Physical Fitness and Medical Exams

Credentials and Records

- High School Diploma
- Alternative (e.g., GED)
- Criminal history

Knowledge & Analytical Tests

Armed Forces Qualification Test
- Language and math
- Technical (e.g., mechanical)

Army Selection: Research Areas

Need: Army must meet accessions goals without reducing quality.

Challenges: Decreasing percentage of population meets Army enlistment standards. Declining propensity to enlist.   Changing demographics.

Current measures: Predict trainability and attainment of knowledge and skill during training, but do not account for all the variance in job performance.   Weak predictors of attitudes, attrition, and career intentions.

Areas of research interest:
- Assessment of cognitive potential (ability to learn, mental flexibility,…)
- Assessment of temperament (motivation, dependability, …)
- Integrated 'whole person' assessment of cognitive and non-cognitive attributes
- Prediction of best match for an Army career/ specific jobs

ARI Research: Selection Measures

Mental Flexibility

Tests to assess abilities such as:

• Flexible inference

• Flexible mapping of rules

Select the best word to complete the analogy (pretend that the statements are true):

Toothbrushes are made of ice.

tool : toolbox   ::   toothbrush : ?

freezer   garage   tool shed   bathroom

Prelim findings: Adequate reliability and construct validity with college population (Matthew & Stemler, 2007).

Temperament

Self-report measures assess constructs such as:

• Dependability

• Leadership

• Excitement seeking

Which of these statements is most like you?

• I like roller coasters.
• I enjoy parties.

Findings: Predicts Soldier attrition.

Prelim findings: Predicts Soldier discipline rates and physical fitness. Contributes to prediction of training exam scores.
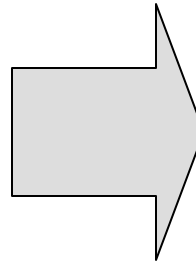
Neuroscience Challenge

Can measures based on neuroscience improve the assessment of an individual's potential and predict behaviors and attitudes?

Valid   **Reliable**   **Feasible (cost, efficiency, practical)**

- *above and beyond existing measures*

Specific metrics for:

• Knowledge & skills

• Ability

• Aptitude

• Attitude

That predict measurable behaviors and attitudes

- Training and performance scores

- Discipline rates

- Career intention/ progression

Army Training and Leader Development

**Knowledge
Skills
Attitudes**

Basic combat skills

Tactical & technical proficiency

Command & control

Army Values

Leadership and team skills

Interpersonal skills

Cross-cultural competence

Current Methods

- Instruction
- Demonstration
- Practice with feedback
- Mentoring
- Self-development

Environments
- Live (Classroom, Field)
- Virtual (simulations, computer-based instruction)

Current Measures

- Objective measures
  - time, accuracy
  - behavioral-anchored rating scales
  - mission accomplishment

- Subjective measures
  - Leader/peer ratings
  - Self-assessment/report

Army Training and Leader Development

Need: Army must develop effective training methods for individuals and units.   Develop agile leaders.

Challenges: Increasing (and continually evolving) training requirements. Decreasing resources and time for training.   Increased responsibility and operational challenges at lower levels of command.

Areas of research interest:
- Basic Combat Training (civilians to Soldiers)
- Unit training and collective measurement
- Developing leader skills (influence, team building, complex organizations)
- Developing cross-cultural competence and language skills
- Rapidly turning lessons learned into training
- Determining skill decay and methods to sustain skills
- Tactical employment of new technologies
- Optimal blend of live, live co-located and distributed training
- Effective design of virtual and game-based simulations

ARI Research: Training & Leader Dev

Flexible Thinking Skills

Leaders develop flexible thinking skills during operational experience.

Research challenge: Create method to capture tacit knowledge of experts. Develop effective training method to accelerate development of flexible battlefield thinking skills.

Research findings: Training method accelerates development of tactical thinking skills of junior officers.

Tailored Training

Extensive empirical evidence to conclude that tailoring training and feedback to the individual accelerates the rate of learning.

Research challenge: Create intelligent agents that can provide individualized tutoring/coaching in synthetic training environments.

Components
- Model of domain/expert
- Model of instructor/coach
- Model of learner
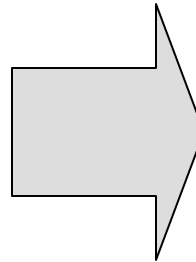
Neuroscience Challenge

Can neuroscience improve the measures and methods to train Soldiers and develop Leaders?

Valid   Reliable   Feasible (cost, efficiency, practical)

- above and beyond existing measures and methods

Measures and methods
to develop:

- Psychomotor Skills

- Knowledge

- Situation Understanding

- Reasoning

- Leadership

That achieve measurable behaviors
and attitudes for differing levels of
required proficiency.

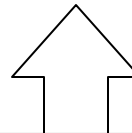- Training and performance scores

- Mission outcomes

Neuroscience and Behavioral Science

Hypothesis: Experts are more cognitively efficient than novices.
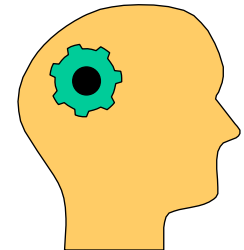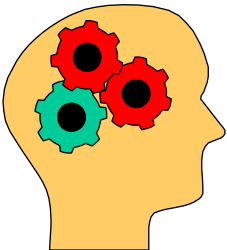
Primary Evidence: Behavioral Science

• Primary task performance (time, accuracy, quality)

• Secondary and multi-task performance (quantity, quality)

Expertise is determined by observable performance.

Corroborating evidence: Neuroscience

Fewer neural resources needed.

A Learning Taxonomy

Competence   **Skills Demonstrated**

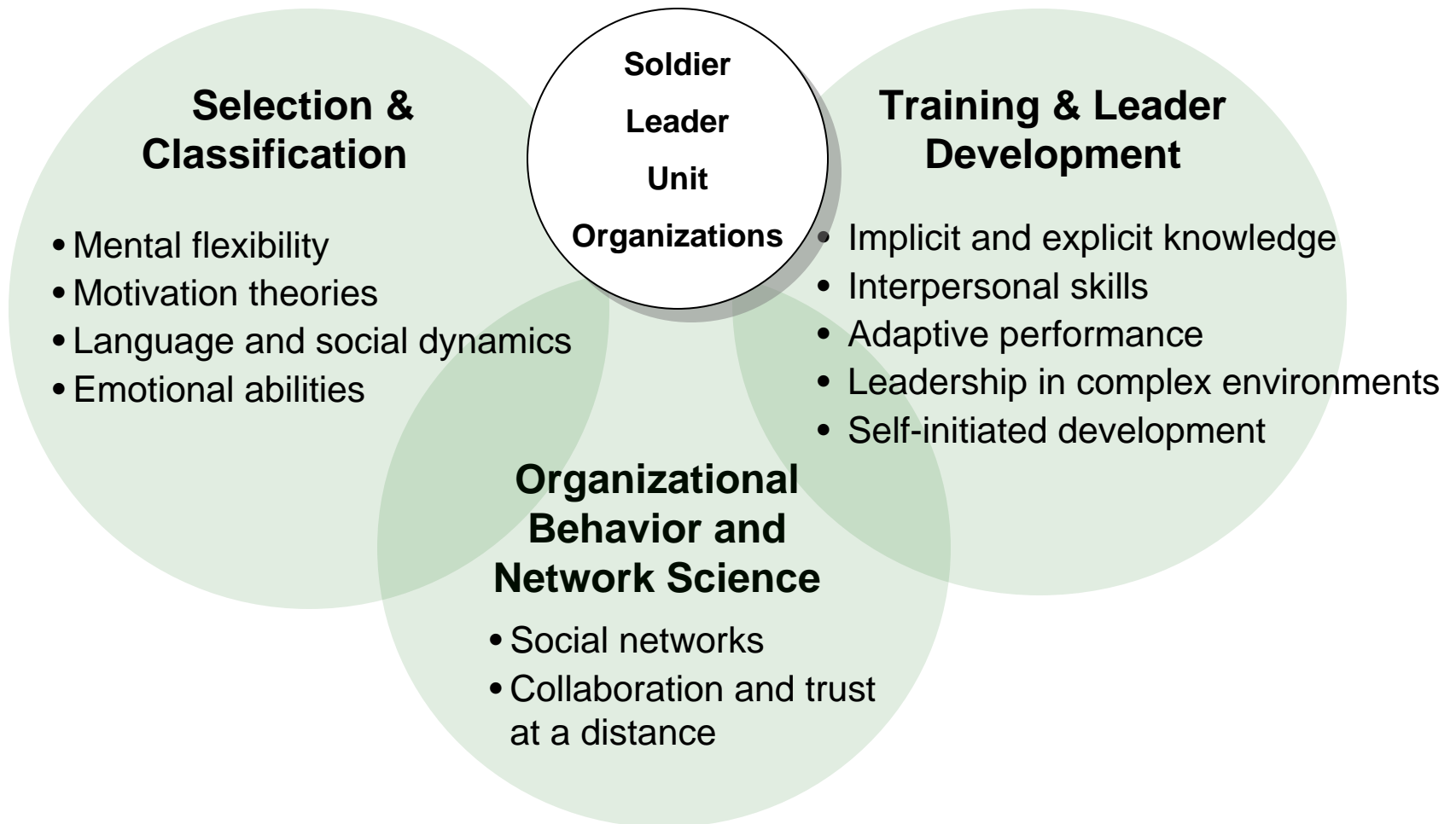| Knowledge	Observe and recall information, knowledge of dates, events, places, major ideas, mastery of subject matter
Comprehension	Understand information and meaning, grasp meaning, translate knowledge into new context, interpret facts, compare, contrast, infer causes, predict consequences
Application	Use information, methods, concepts in new situations, solve problems using required skills or knowledge
Analysis	See patterns, organization of parts, recognize hidden meanings, identify components
Synthesis	Use old ideas to create new ones, generalize from given facts, relate knowledge from several areas, predict, draw conclusions
Evaluation	Compare and discriminate between ideas, assess value of theories, make choices based on reasoned argument, verify value of evidence, recognize subjectivity

Bloom (1956)

ARI Basic Research

Advance scientific theories, models, methods, measures, and technologies relevant to Army needs.

Selection & Classification

- Mental flexibility
- Motivation theories
- Language and social dynamics
- Emotional abilities

Soldier
Leader
Unit
Organizations

Training & Leader Development

- Implicit and explicit knowledge
- Interpersonal skills
- Adaptive performance
- Leadership in complex environments
- Self-initiated development

Organizational Behavior and Network Science

- Social networks
- Collaboration and trust at a distance

Learning Theory and Strategies

Conventional warfare	Cold War 'chess moves'	Guerilla warfare	Technology superiority	Network operations	Counter-insurgency Stability operations Major combat ops
1950	**1970**		**1980**	**2000**	**Emerging**

Behaviorism	**Cognitivism**	**Constructivism**	**Blend**	**Biopsychosocial**
Theory: Learning occurs through repetition and reinforcement.	Theory: Learning is an information management process.	Theory: Learning occurs by active construction of knowledge not just receiving it.	Integrated/ modified models - Constructivism - Cognitivism - Behaviorism	Holistic theory of - Biology - Psychology - Sociology
Strategies: Drill and practice Mastery learning	Strategies: Cognitive analysis Structured learning	Strategies: Discovery learning Collaboration Guided experiences		**Cyber-psychology** Models of human and non-human entities and networks

U.S. Army Research Institute

Enhancing performance of Soldiers and Units and sustaining a quality all-volunteer Army during an era of persistent conflict.