



The Human Dimension and U.S. National Security: Our Current Challenge, but Greatest Opportunity

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Routinely, we turn to technology, afterward recognizing the human dimension



**Perplexity of
early avionics**

**Nuclear reactor
accidents**



**Aviation and maritime
accidents**



**Espionage within
intelligence
agencies**



Counterinsurgency



Cyber Defense



Unmanned Vehicles

1960's

1970's

1980's

1990's

2000's

A perspective persists in which the human is primarily seen as a problem to be solved



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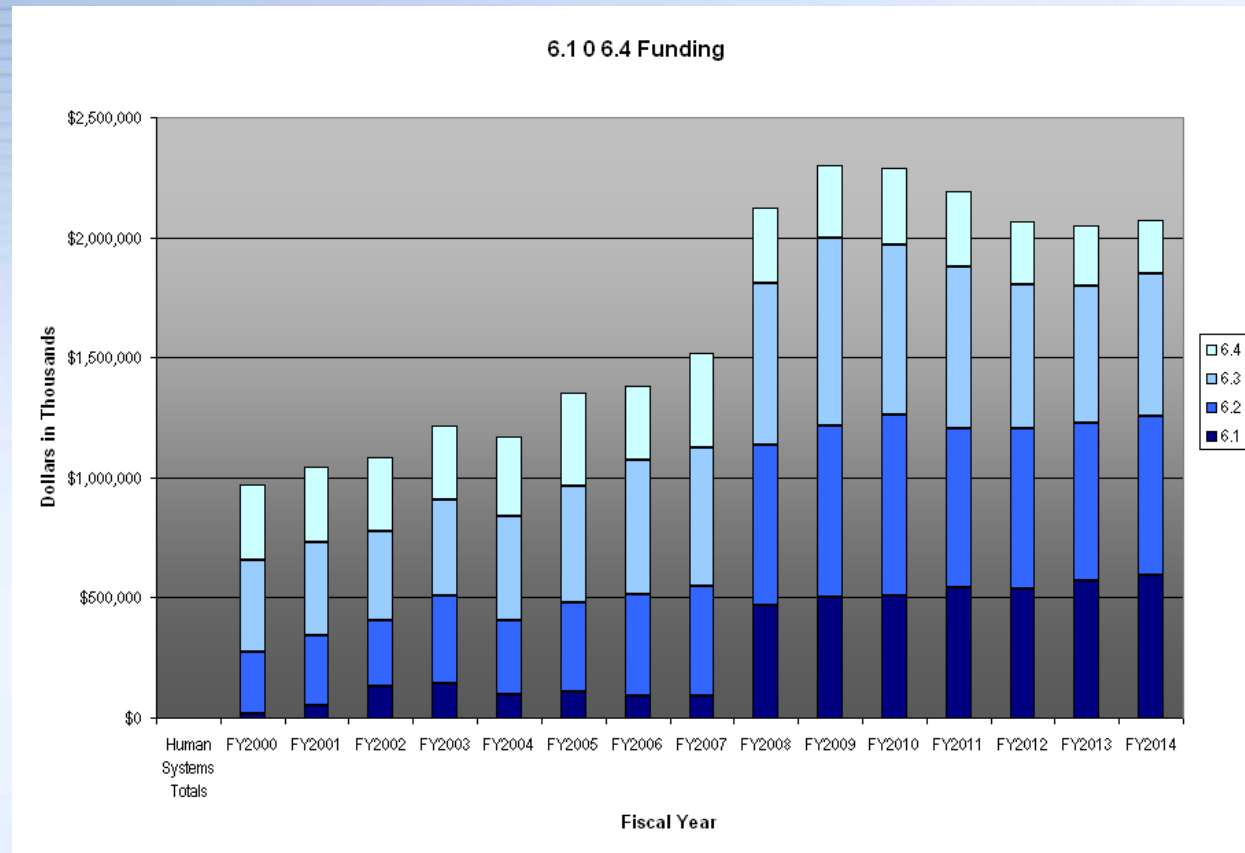
Across the Services, S&T investments address the human dimension

<i>"fundamental knowledge is needed to understand, measure and optimize human capabilities,"</i>	<i>Air Force RDT&E justification for Human Performance program</i>
<i>"applied research to enhance human sensory, cognitive and physical capabilities,"</i>	<i>Air Force RDT&E justification for Performance Evaluation in Extreme Environments program</i>
<i>"Basic research in Cognitive Sciences focused on theories, approaches, and models that have the highest potential to improve human performance,"</i>	<i>Army RDT&E justification for ARI in-house laboratory independent research</i>
<i>"provides non-material solutions to ensure that Soldiers can adapt and excel and improve the Army's capability to fully leverage advances in networks, systems and technologies,"</i>	<i>Army RDT&E justification for Personnel Performance and Training Technology program</i>
<i>"advanced training technology and technologies that enhance neural and cognitive aspects of human performance,"</i>	<i>Navy RDT&E justification for Human Performance, Training and Education program</i>



This need is reflected in substantial R&D commitments

Annual investments in human systems research and development by the U.S. Department of Defense.



Source Defense Technical Information Center,
<http://www.dtic.mil/descriptivesum/>.



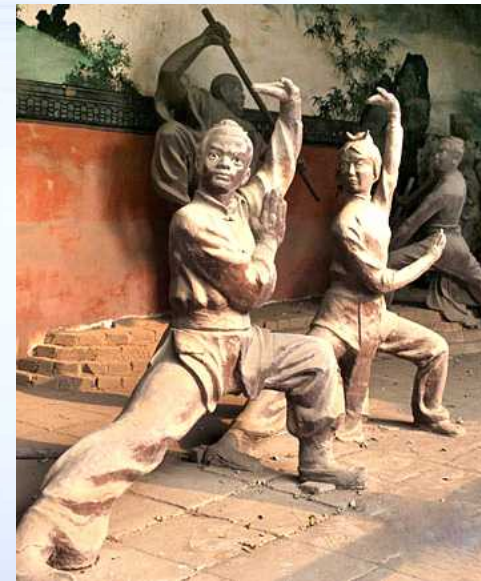
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History provides legendary examples of human excellence



At Thermopylae, 300 Spartan warriors blocked a Persian army of thousands, including their most elite units, long enough for the Greek army to escape

After Prince Li Shimin's army had been defeated, 13 Shaolin monks ambushed a unit of the rebel army rescuing the prince and capturing the rebel General.



These warriors were markedly superior to their adversaries, both mentally and physically

Those who excel may be distinguished from their counterparts

Not about doing more work, but working more effectively

May make mistakes, but recover

Know when to be up, and when to take a break

Distinguish signal from noise, ignoring decoys

While others may be of equal aptitude, they are the most motivated

Read events and react faster



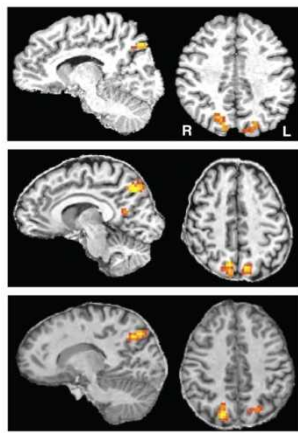
Appreciate diminishing returns, when to stop learning, listening, etc.

See connections underlying hidden assumptions and unexpected consequences

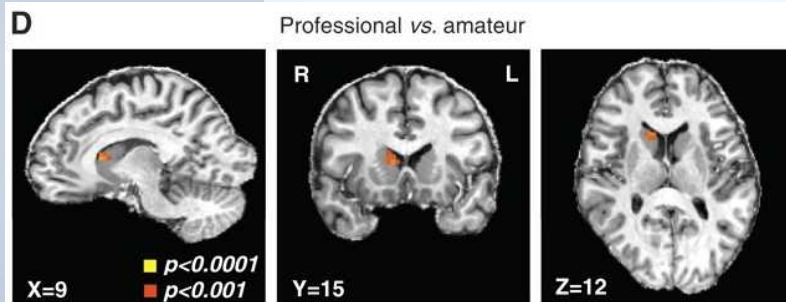
At the right place, at the right time

Certain individuals will routinely triumph over others of equal aptitude, but are they fundamentally different?

More recently, there has been progress toward elucidating brain mechanisms of expertise



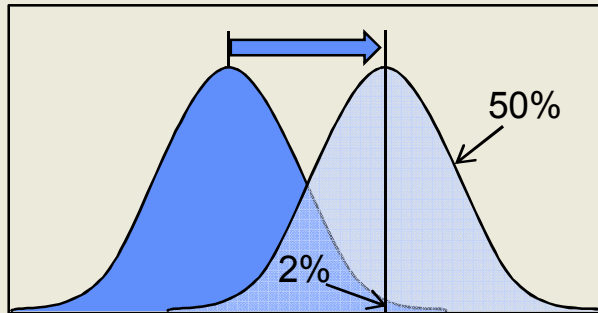
- Wan and colleagues (2011) investigated brain activation of professional and amateur shogi players
- Experts could be discriminated from novices on the basis of:
 - Activation in precuneus of parietal lobe during perception of board patterns
 - Activation of caudate nucleus during generation of their next move



We do not know the achievable limits of individual human cognitive performance

Shift the Curve

through multi-faceted initiative to achieve human excellence



50% perform at or above the levels of current top 2%

No factor has been clearly identified that would limit excellence to a small minority of uniquely endowed individuals

Whatever situation:

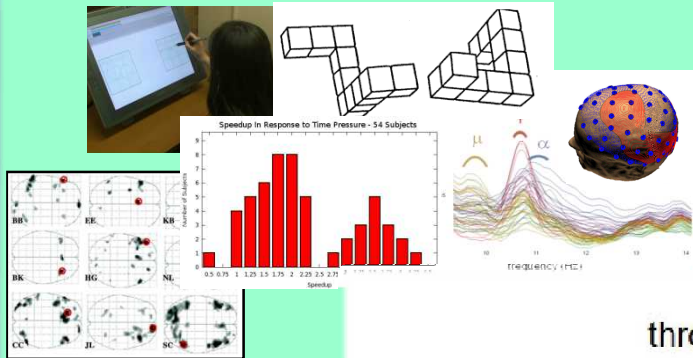
Individual → team → organization

- quickest, fastest comprehension
- best solution
- most proficient response

Instead of a problem to be solved, the human presents the opportunity to achieve an indomitable advantage

Substantial, sustainable gains will require a multi-faceted systems approach

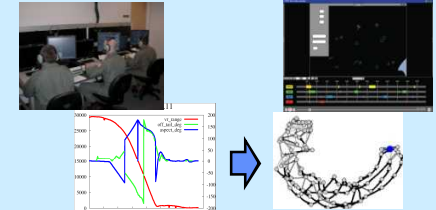
Science of Human Performance



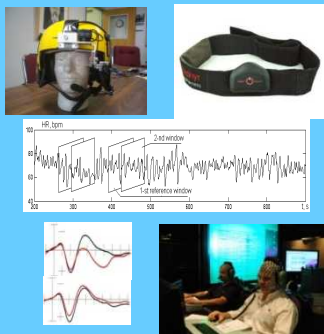
Innovation



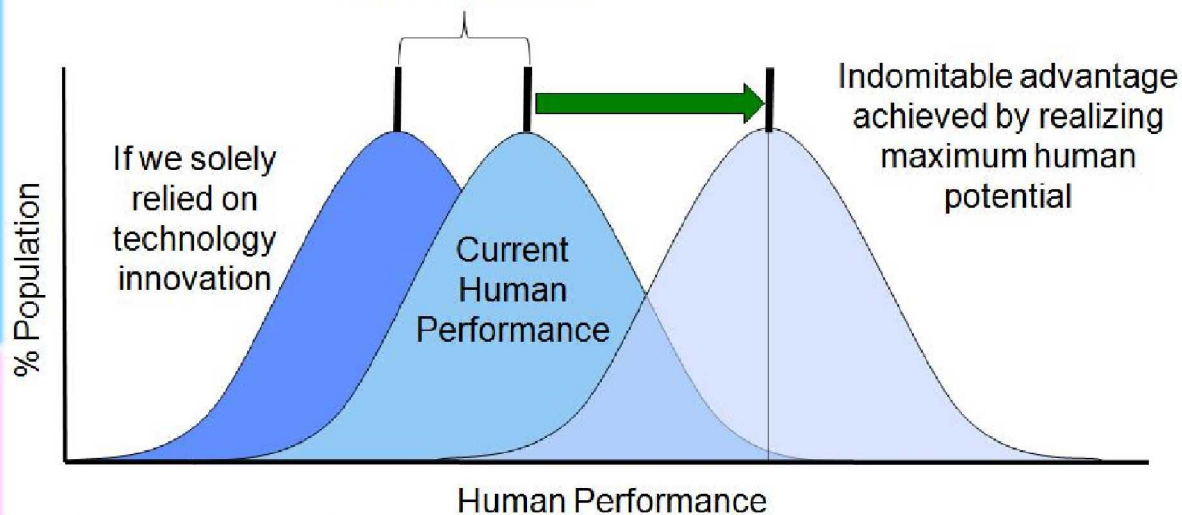
Personalization Individualized -- Targeted



Biometrics



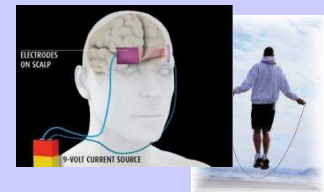
Gains achieved through MAPRINT, HSI and other human-centric approaches



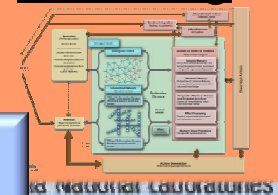
Adaptive



Enhancement



Modeling

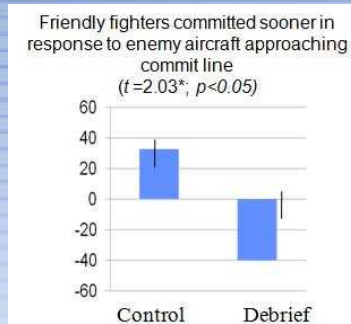


There is no single "silver bullet."

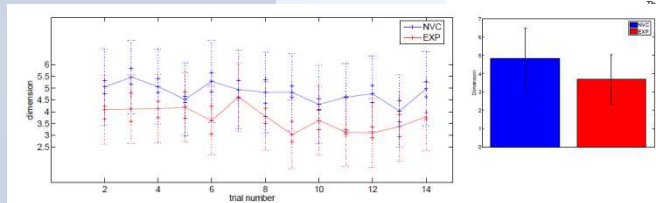
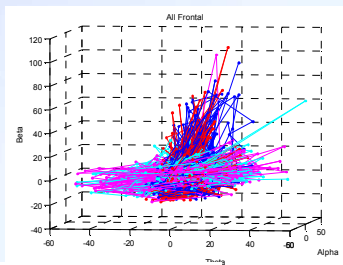
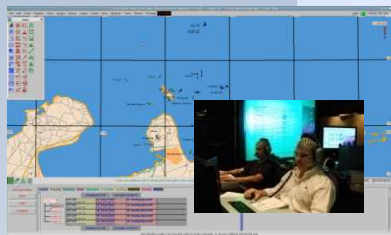
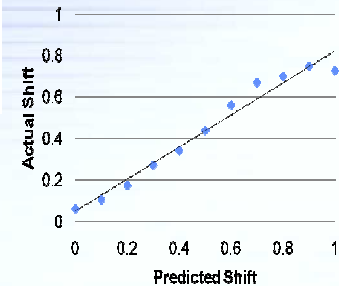
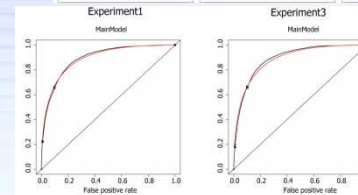
Sandia National Laboratories S&T addresses key pieces to the puzzle



Targeting training to individual needs produces better performance

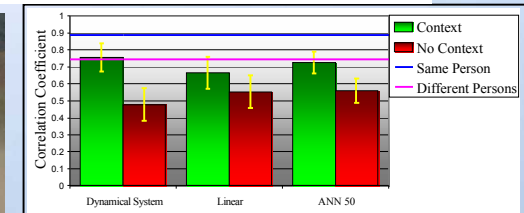
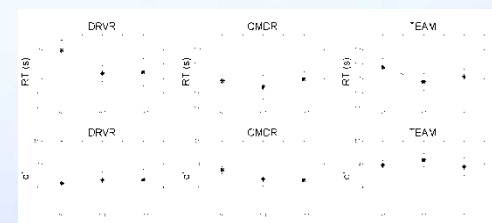


Task strategy shifts may be predicted with remarkable accuracy



Biometrics may discriminate expert from novice teams

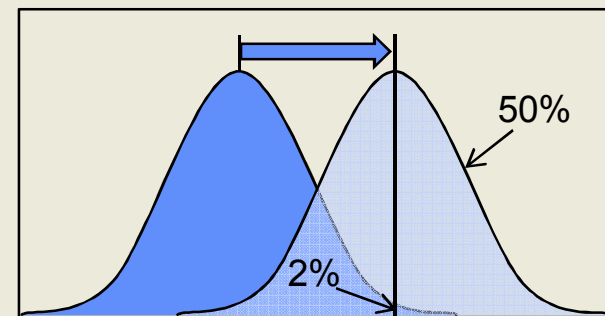
Team performance enhanced through real-time adaptation to cognitive workload



The human dimension may be converted from a re-emerging problem to a ubiquitous strength



Shift the Curve



50% perform at or above the levels of current top 2%

The outcome will be more immediate results at lower costs, with each successive generation of threats to U.S. national security