
Emerging Technology + International Security

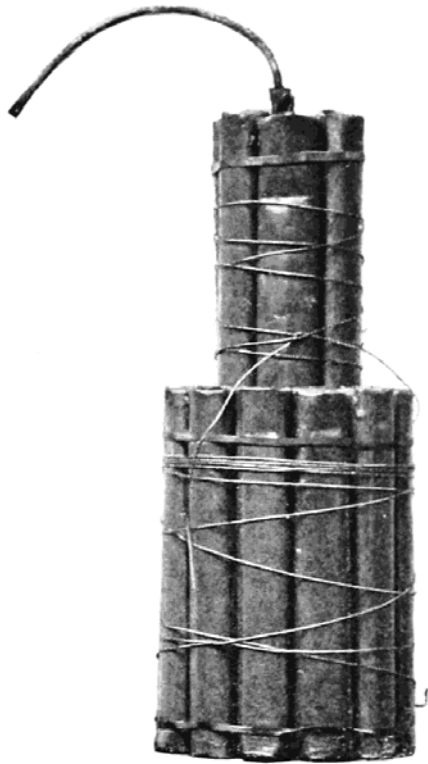
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Erik Lin-Greenberg

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Massachusetts Institute of Technology

Artificial Intelligence



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Artificial Intelligence



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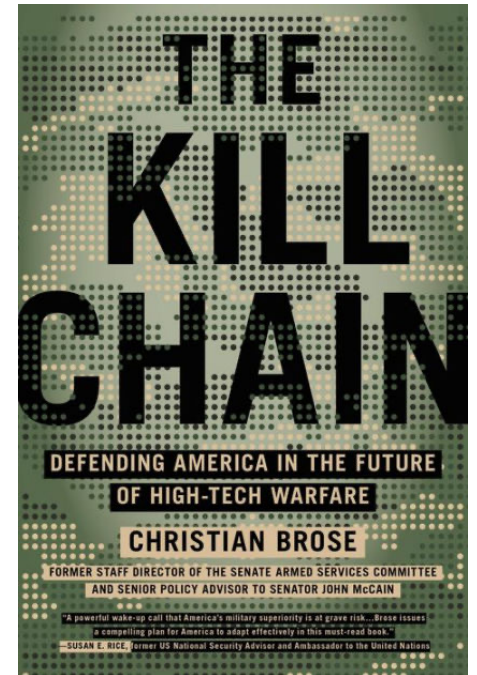
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Key Concepts

- Trust
- Reliability
- Delegation (vs. responsibility/accountability)
- Information (quality, sharing, etc.)
- Morality



Brose, Christian. *The Kill Chain: Defending America in the Future of High-Tech Warfare*. Grand Central Publishing, 2022. © Grand Central Publishing. All rights reserved. This content is excluded from our Creative Commons license. For more information, see <https://ocw.mit.edu/help/faq-fair-use/>.

Key Questions

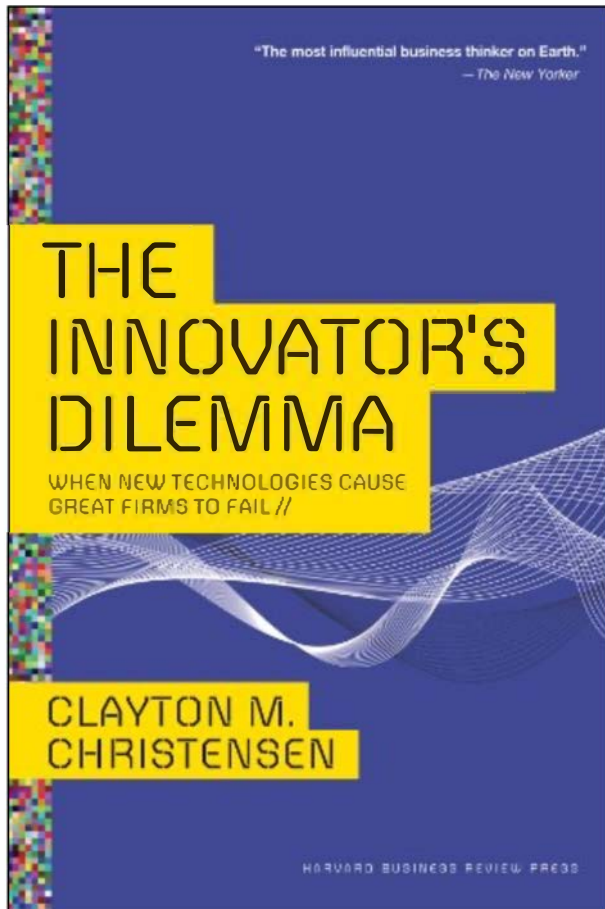
What is AI? How is it applied in the national security context?

What challenges states encounter when deploying AI?

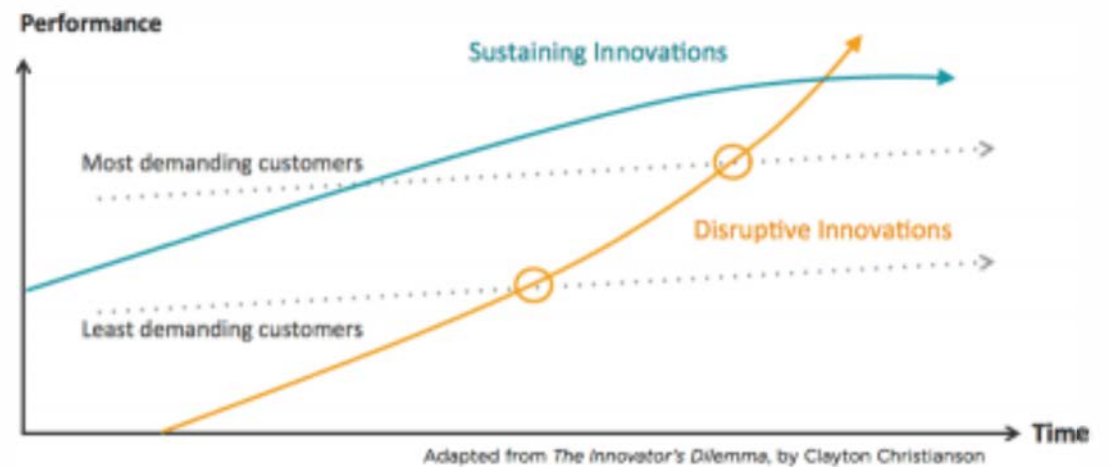
How might AI affect crisis decision-making?

What ethical considerations surround AI use?

How much human control should we have?



Christensen, Clayton M. *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. HarperCollins, 2011. © HarperCollins. All rights reserved. This content is excluded from our Creative Commons license. For more information, see <https://ocw.mit.edu/help/faq-fair-use/>.



Innovation: Open vs. Closed

- Two models (Cronin 2020)
 - Open: Accessible, collaborative
 - Closed: Restricted, secretive



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Adoption-Capacity Theory

- What's a theory?
- Two key factors:
 - Financial intensity
 - Organizational capital
- Financial intensity
 - Cost per unit of technology
 - \$: Commercial (Open) < Military (Closed)
 - Lower costs=more experimentation

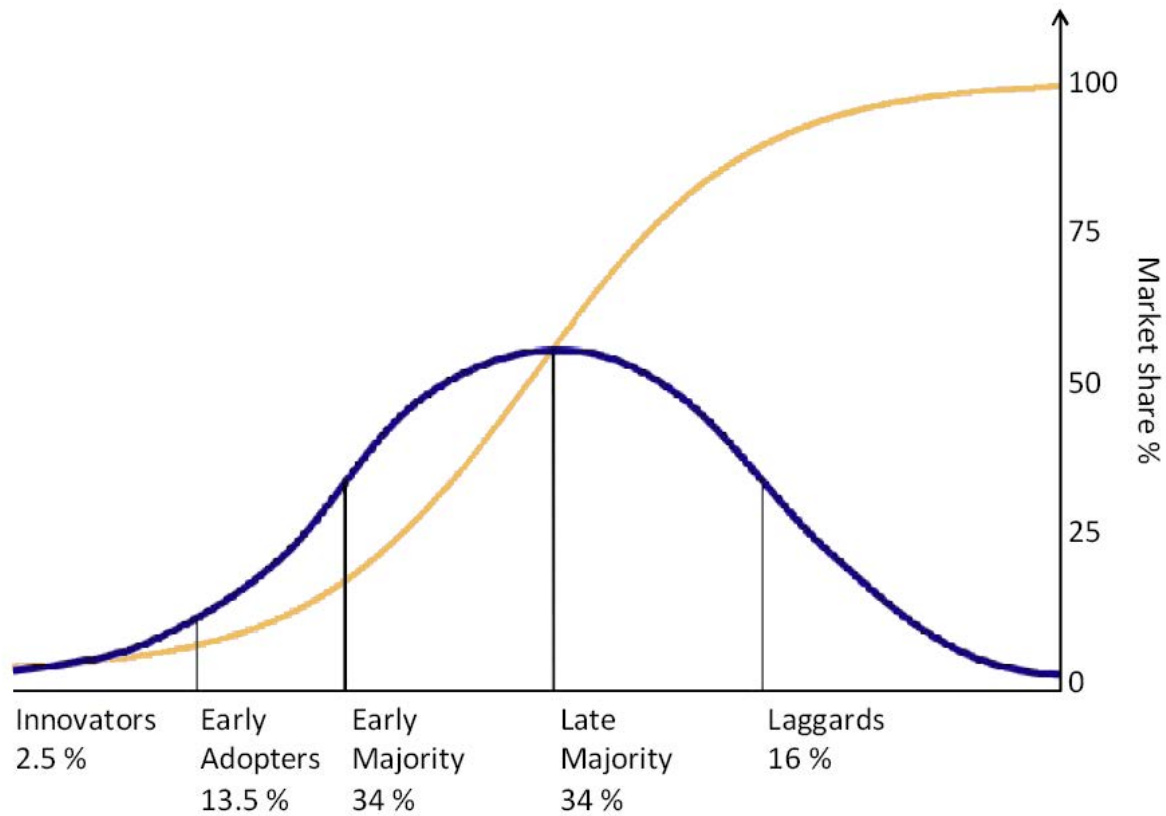


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Innovation: Diffusion



Concepts

AI: A branch of computer science dealing with the simulation of intelligent behavior in computers

Webster Dictionary

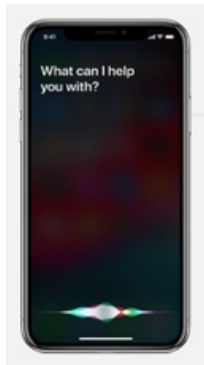
Concepts

AI refers to **the ability of machines to perform tasks that normally require human intelligence** – for example, recognizing patterns, learning from experience, drawing conclusions, making predictions, or taking action...

2018 DoD AI Strategy

Concepts

- AI is an **enabler**: Its effect depends on *what* it is enabling



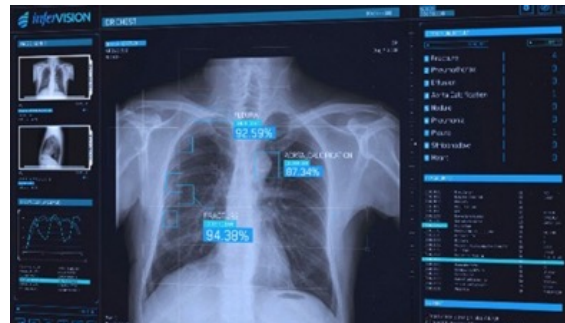
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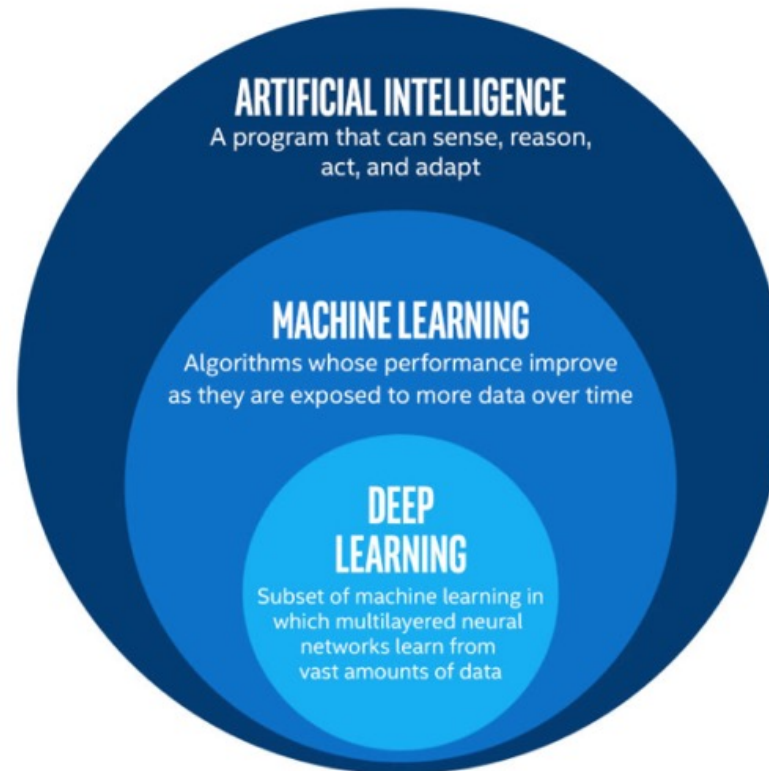
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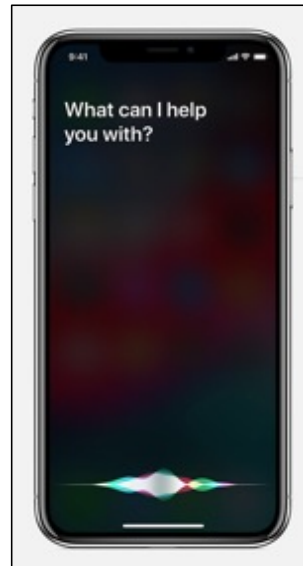
Artificial Intelligence: What

- Narrow AI
- General AI
- Machine Learning
- Deep Learning



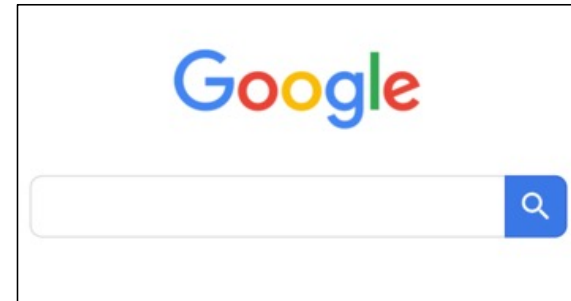
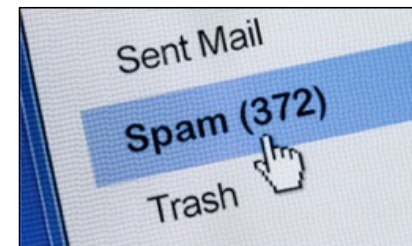
Artificial Intelligence: What

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Artificial Intelligence: What

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Artificial Intelligence: What

- Narrow AI
- General AI
- **Machine Learning**
- Deep Learning



Brownlee, Jason. "How to Classify Photos of Dogs and Cats (with 97% accuracy)." In *Deep Learning for Computer Vision: Image Classification, Object Detection, and Face Recognition in Python*. Machine Learning Mastery, 2019. © Guiding Tech Media. This content is excluded from our Creative Commons license. For more information, see <https://ocw.mit.edu/help/faq-fair-use/>.



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Artificial Intelligence: Why

- Increases efficiency
 - Manpower reductions
 - Enhanced safety
 - Increased speeds
- Data ubiquity; demands speed/accuracy
- Decreased costs/increased computing
- Growing political demand ("Arms Race")



"[Accelerating America's Leadership in Artificial Intelligence](#)." Office of Science and Technology Policy. February 11, 2019. License CC BY.



AI Applications

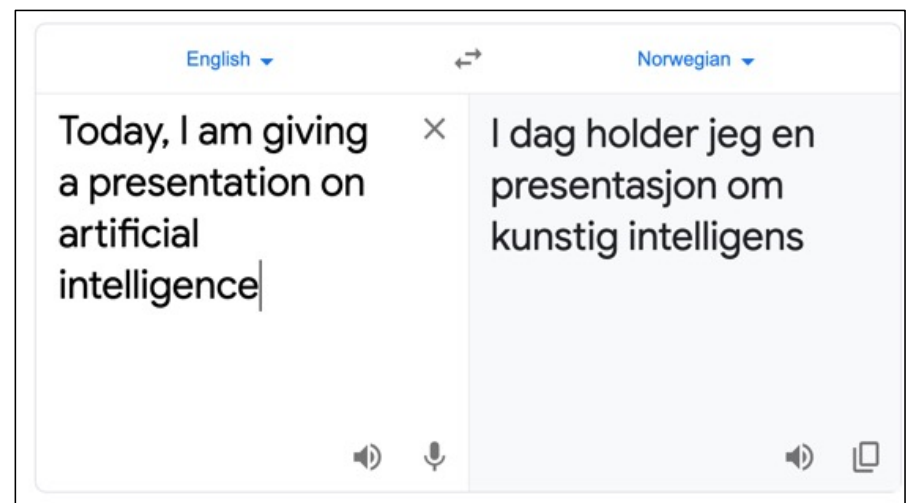
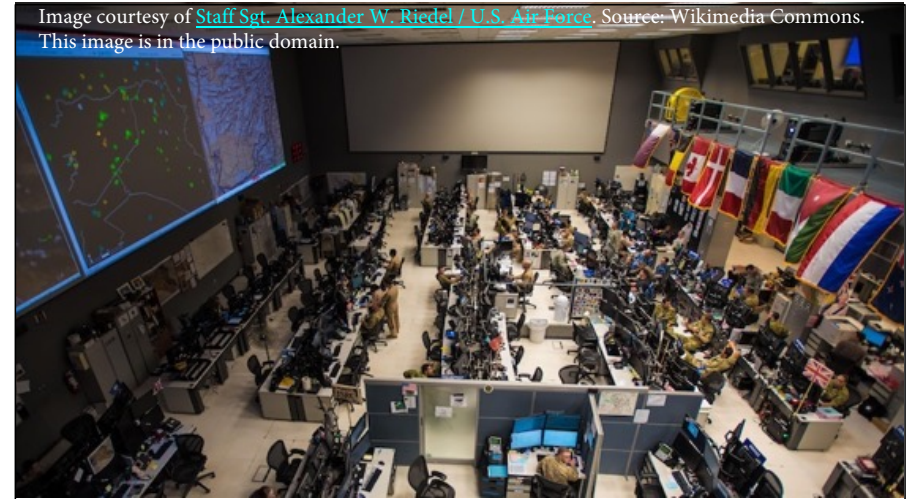
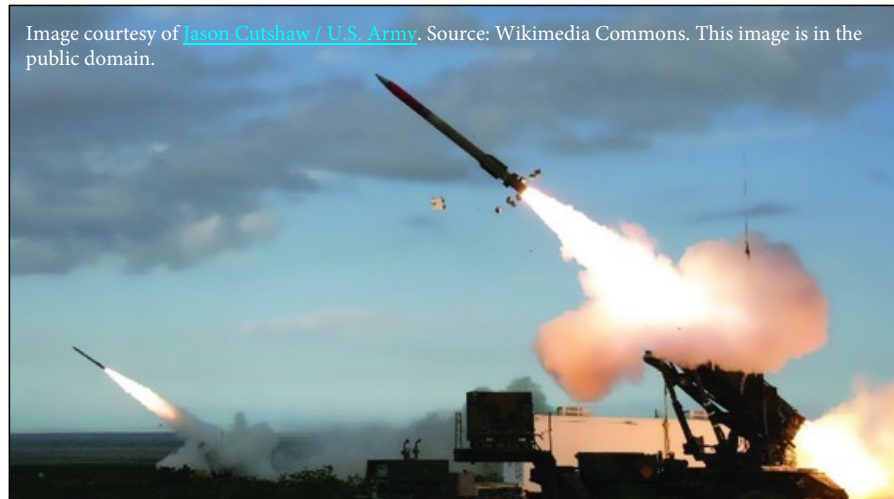




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Mars, Venus, What?

- Learning a function that maps well-defined inputs to well-defined outputs
- Large data sets that contain input output pairs exist (or can be created)
- Task provides clear feedback with clearly definable goals and metrics
- There are no long chains of logic/reasoning that depend on diverse background knowledge or common sense
- There is no need for a detail explanation of how the decision was made
- There is a tolerance for error
- Function being learned should not change rapidly over time
- No specialized skills, dexterity, or mobility is required

Do military leaders have sufficient trust in AI to use AI-enabled systems in combat?

Trust in AI-Delivered Information

"The way [our AI programs work] is like [how] your three-year-old plays...you work through it, have to teach it, and it learns and it's learning – but it hasn't learned to the point where you still don't have to go back and have mom or dad look over the shoulder of the three-year-old and say, 'yeah, that really is a car,' or 'yeah, that really is green.'"

Gen Mike Holmes

Commander Air Combat Command

2017-2020



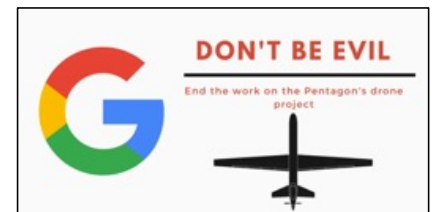
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Trust in AI-Delivered Information

- Variation in public support
 - Opposition to AWS: Germany (74%) vs. US (52%)
 - Barriers to operational use
 - Reluctant tech firms
- Cross-national variation in “AI Readiness”
 - Organizational capacity (e.g., JAIC)
 - Financial resources
 - Human capital



Shearer, Eleanor, Richard Stirling, and Walter Pasquarell. *Government AI Readiness Index 2020*. Oxford Insights, 2020. © Oxford Insights. All rights reserved. This content is excluded from our Creative Commons license. For more information, see <https://ocw.mit.edu/help/faq-fair-use/>.



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Trust in AI-Delivered Information

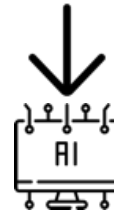
AI affects the *perceptions* and *interpretation* of information and state behavior

Scenario: Friendly AI Use

The U.S Secretary of Defense announces that after analyzing satellite imagery and intercepted communications...



military intelligence analysts have...



The military's artificial intelligence system has...

assessed with high confidence that a rival state is preparing to attack a U.S. base in the Middle East. The attack would kill approximately 500 American troops.

Scenario: Friendly AI Use

Based on this information, the president announces that he will carry out a limited operation to prevent the adversary attack.



The military operation has a 50% likelihood of preventing the rival's attack, would likely result in less than 10 U.S. casualties, and is unlikely to lead to further escalation.

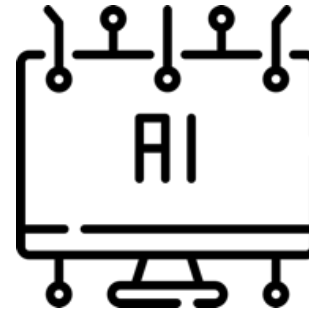


How much do you support military strikes in this situation?

Findings: Friendly AI Use



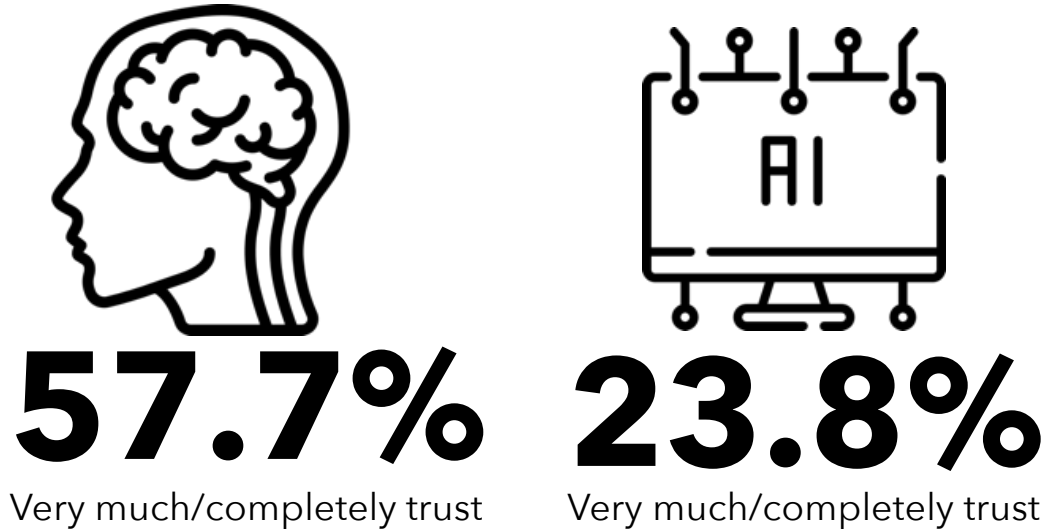
72.0%
Support or strongly support



49.6%
Support or strongly support

Recent Research: AI Use Experiment

How much do you trust that the intelligence is correct?



Challenges: Info Uncertainty

- AI typically operates in a “black box”
 - Neural networks are often opaque
 - Lack “explainability”
 - Explainable AI efforts (XAI)
- Might contribute to fog of war
 - Trust in AI-delivered information
 - Attribution for rival AI-enabled operations
- Significant cross-national variation
 - Japan: 13% Trust
 - US: 25% Trust
 - Turkey: 43% Trust



Alcorn, Michael A., Qi Li, et al. Figure 1 from "Strike (with) a Pose: Neural Networks Are Easily Fooled by Strange Poses of Familiar Objects." June 2019. © Michael A. Alcorn, Qi Li, Zhitao Gong, Chengfei Wang, Long Mai, Wei-Shinn Ku, Wei-Shinn Ku, Auburn University, and Adobe Inc. All rights reserved. This content is excluded from our Creative Commons license. For more information, see <https://ocw.mit.edu/help/faq-fair-use/>.

Challenges: AI Vulnerabilities

- Data Poisoning
 - Inserting fake data/making data flawed
 - Significant operational implications
 - Cascading effect in alliance contexts
- AI-enabled Deception
 - Military deception is common
 - Deepfakes
 - Decreasing costs/increasing quality
 - Alliances particularly vulnerable



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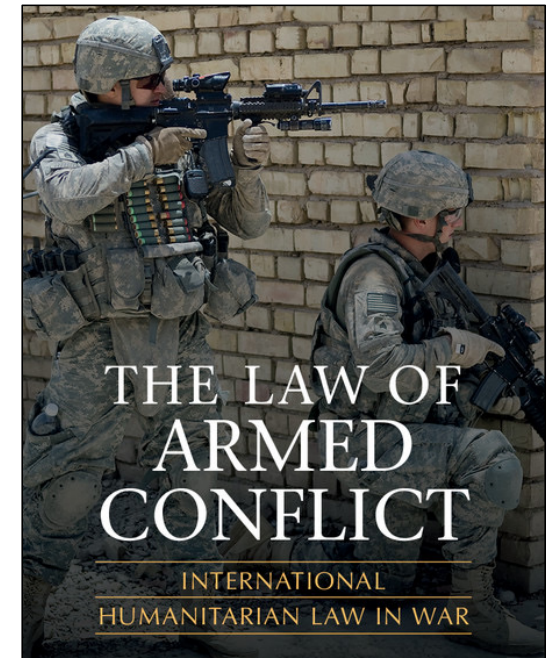
Deepfake Voice Used to Steal Over \$240,000 in AI-Powered Heist

The robots are stealing money now.

Kim, Matt. "Deepfake Voice Used to Steal Over \$240,000 in AI-Powered Heist." September 5, 2019. IGN. © IGN. All rights reserved. This content is excluded from our Creative Commons license. For more information, see <https://ocw.mit.edu/help/faq-fair-use/>.

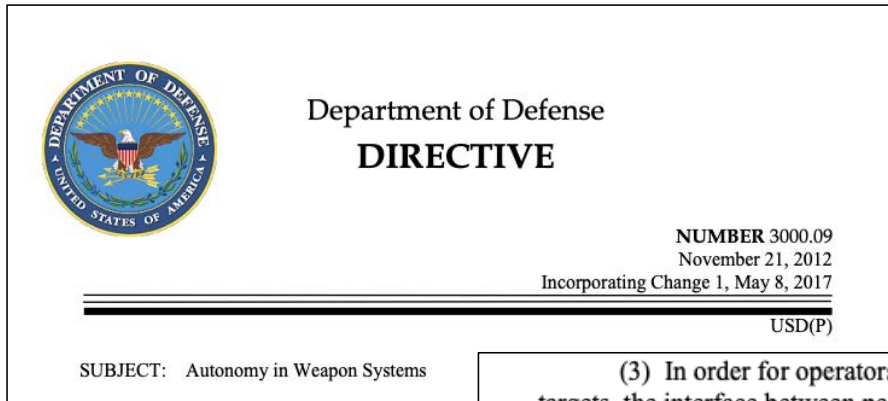
Challenges: Accountability/Responsibility

- Who is held accountable when things go awry?
- Commanders have long delegated
 - Delegate to junior troops
 - Trust, Testing, Training
- Is AI different?
 - Mistakes will always happen
- Means vs. Outcomes
 - Proportionality, no unnecessary suffering, no indiscriminate use of force



Solis, Gary D. *The Law of Armed Conflict: International Humanitarian Law in War*. Cambridge University Press, 2010.
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Challenges: Accountability/Responsibility



(3) In order for operators to make informed and appropriate decisions in engaging targets, the interface between people and machines for autonomous and semi-autonomous weapon systems shall:

- (a) Be readily understandable to trained operators.
- (b) Provide traceable feedback on system status.

4. POLICY. It is DoD policy that:

- a. Autonomous and semi-autonomous weapon systems shall be designed to allow commanders and operators to exercise appropriate levels of human judgment over the use of force.

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Challenges: Info Use/Sharing

"Data has stymied most of the services when they dive into AI...They realize how hard it is to get the right data to the right place, get it cleaned up, and train algorithms on it"

Lt Gen Jack Shanahan, 1st JAIC Director

Freedberg, Jr., Sydney J. From "EXCLUSIVE Pentagon's AI Problem Is 'Dirty' Data: Lt. Gen. Shanahan." *Breaking Defense*, November 23, 2019. © Breaking Media, Inc. All rights reserved. This content is excluded from our Creative Commons license. For more information, see <https://ocw.mit.edu/help/faq-fair-use/>.



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Challenges: Info Use/Sharing

- Technical challenges
 - Proprietary formats
 - Stove-piped networks
 - Non-standardized formatting
 - Data reliability, bias
 - Challenges multiplied as number of actors increases
- Political challenges
 - Reluctance to share sensitive raw data
 - Long history of intelligence sharing issues
 - Commitment problems, leaks, sources and methods
 - Often share finished products vs. raw data



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Challenges: AI + Alliances

- Exacerbates obstacles to operational coordination
- Increases strain on strategic level decision-making



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AI + Alliances: Key Principles



- Enables burden-sharing
- Increases legitimacy
 - Cue for domestic public
 - Assuage fears of int'l community



- Integration is challenging
 - Tactics and equipment
 - Language and culture
 - Barriers to intelligence sharing
- Shared threat vs. state interests
 - Political disagreements
 - Decision-making as “negotiation”

A Quick Final Exercise

- Should we allow AI integration?
- Does AI make the world more or less stable?
- Does AI represent an RMA?

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