# Human Factors Considerations in Autonomous Lethal Unmanned Aerial Systems

Kristy Kiernan

A3IRCON 2015

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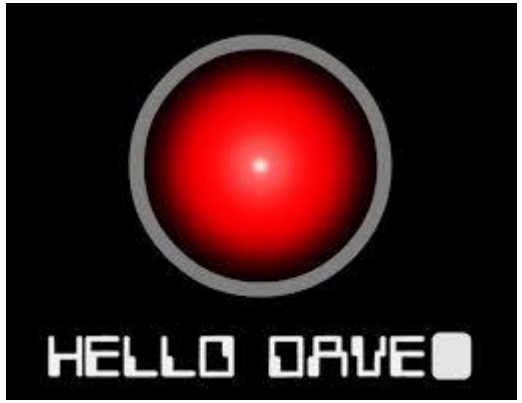
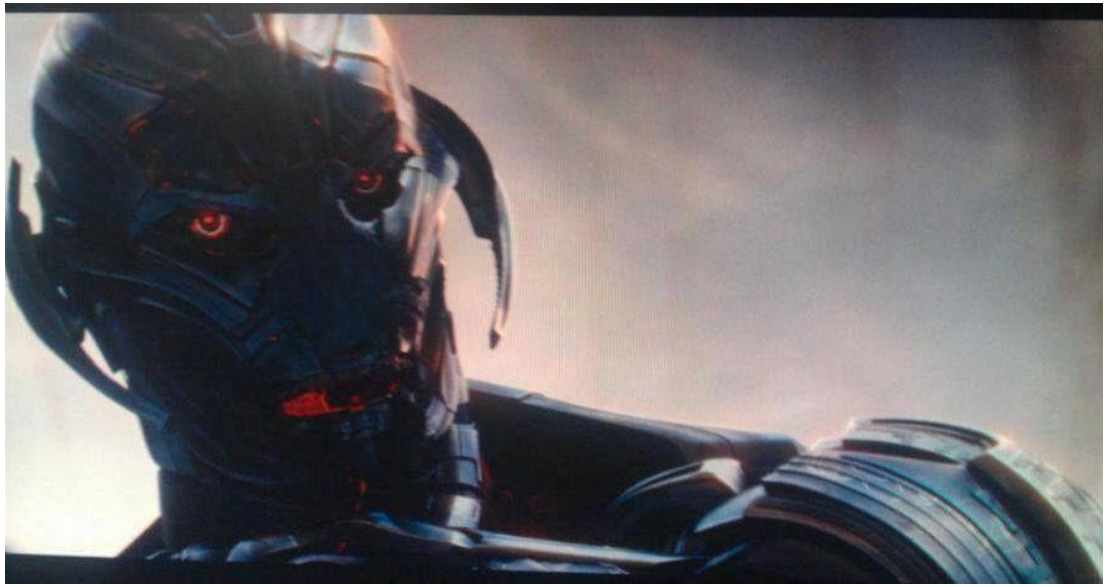
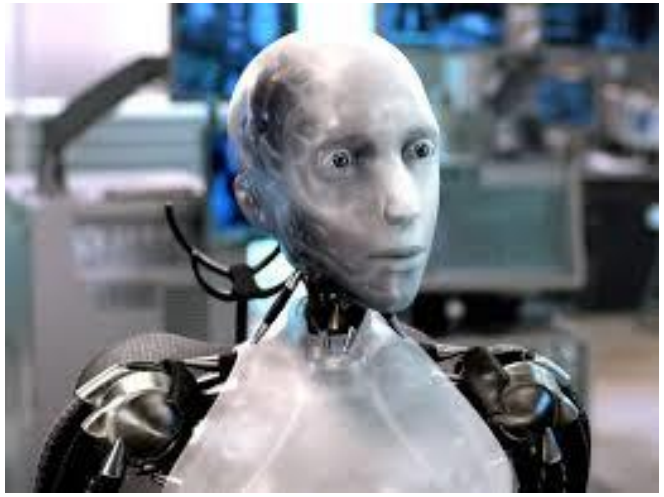

HELLO DAVE


SCHWARZENEGGER
THE
TERMINATOR





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# Outline

- Definitions
- Approaches to creating moral machines
- Implications for human factors

# Common Terms, Specific Meanings

- Operator
- Supervisor
- Robot
- Autonomy

# Autonomy

- Philosophical Perspective
  - Autonomy of Will
  - Autonomy of Means
- Practical Perspective
  - Levels of autonomy

# Parasuraman, Sheridan, and Wickens (2000)

| | |
|---|---|
| HIGH | 10. The computer decides everything, acts autonomously, ignoring the human. |
| | 9. informs the human only if it, the computer, decides to |
| | 8. informs the human only if asked, or |
| | 7. executes automatically, then necessarily informs the human, and |
| | 6. allows the human a restricted time to veto before automatic execution, or |
| | 5. executes that suggestion if the human approves, or |
| | 4. suggests one alternative |
| | 3. narrows the selection down to a few, or |
| | 2. The computer offers a complete set of decision/action alternatives, or |
| LOW | 1. The computer offers no assistance: human must take all decisions and actions. |

# DoD Unmanned Systems Roadmap 2011

- Automatic Systems: "fully preprogrammed and act repeatedly and independently of external influence or control" (DoD Unmanned Systems Roadmap)
- Autonomous Systems: "self-directed toward a goal in that they do not require outside control, but rather are governed by laws and strategies that direct their behavior" (DoD Unmanned Systems Roadmap)

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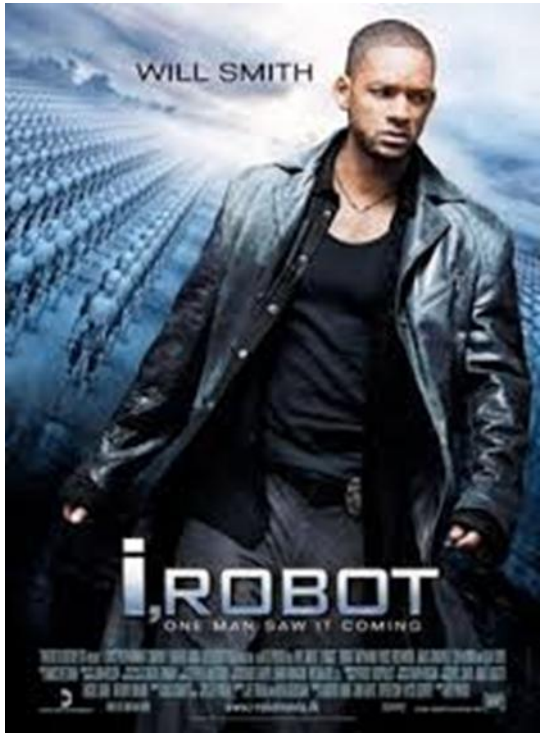
# Taxonomy of Autonomy

# Autonomy

- "the capacity to operate in the real-world environment without any form of external control for extended periods of time" (Lin, Bekey, & Abney, 2008, p. 103).

# Designing Moral Machines

- Top Down
  - Rule based
  - Laws of Armed Conflict



# Just War theory and the Laws of Armed Conflict

- Jus in bello
- Proportionality
- Discrimination

# Designing Moral Machines

- Top Down
  - Rule based
  - Laws of Armed Conflict
  - Clear and precise
  - Difficult to operationalize
  - Inflexible

# Designing Moral Machines

- Bottom Up
  - Experiential
  - Situational
  - Difficult to guarantee
  - Difficult to trace errors
  - Natural law

# Designing Moral Machines

- Hybrid
  - Virtue Ethics

# Human Factors Issues

- Reduced situation awareness (SA)
- System observability
- Mode confusion
- Automation surprise
- Trust
- Reliability
- Overreliance
- Complacency
- Skill degradation

# Situation Awareness

- Reduced situation awareness (SA)
  - System observability
  - Lack of mental model
  - Mode confusion
  - Automation surprise

# Trust and Reliability

- Trust
  - Trust affects performance
  - Building trust
    - Transparency
    - Operations that meet expectations
    - Reliability

# Overreliance and Complacency

- Effect of high workload
- Ratio of supervisors to UAS

# Skill Degradation

# Solutions

- Discussion
- Design
- Training