Back to the Future: Meet your Digital Twin

Rusmat Ahmed. MilSim CEE, 15 October 2019

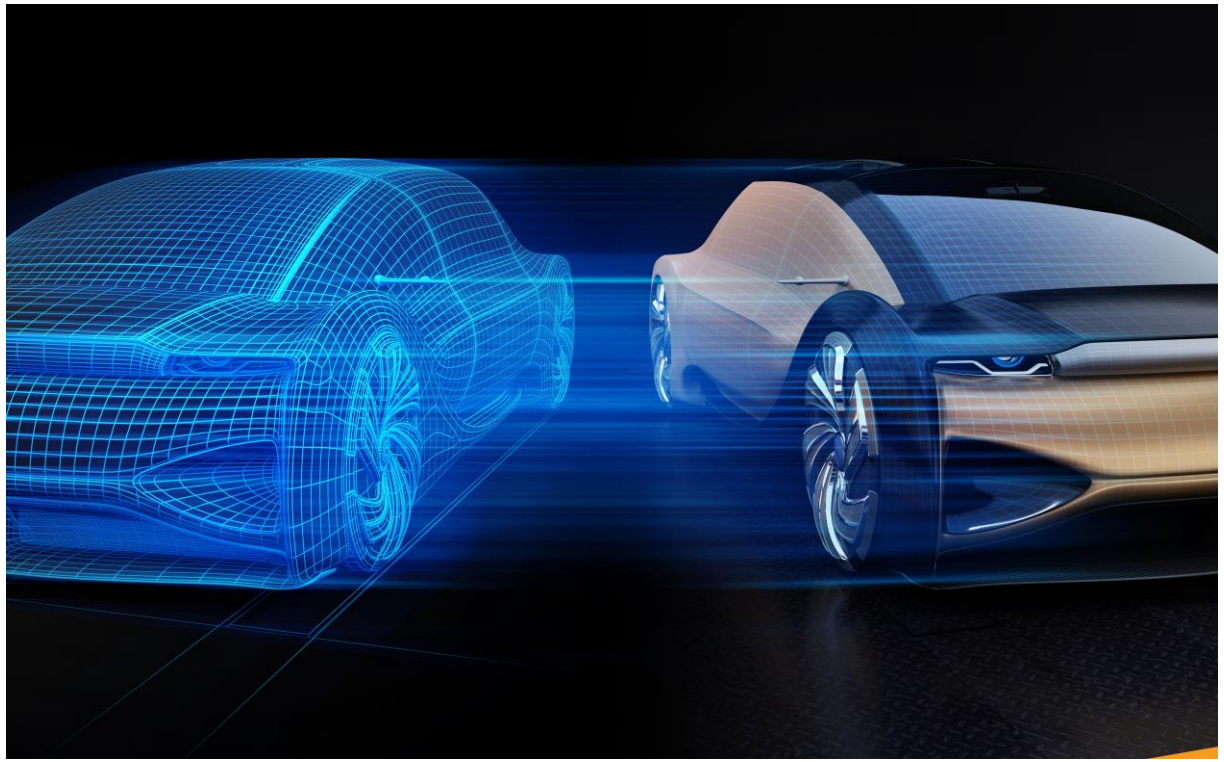
Paris Motor Show, 2016

TOYOTA

We believe chauffer mode, or total autonomy, will only be 100% accident free by testing a minimum of 14.2 billion kilometres

Toyota President and CEO Akio Toyoda

Paris Motor Show, 2016



… which in practical terms, would take decades of real-world driving.

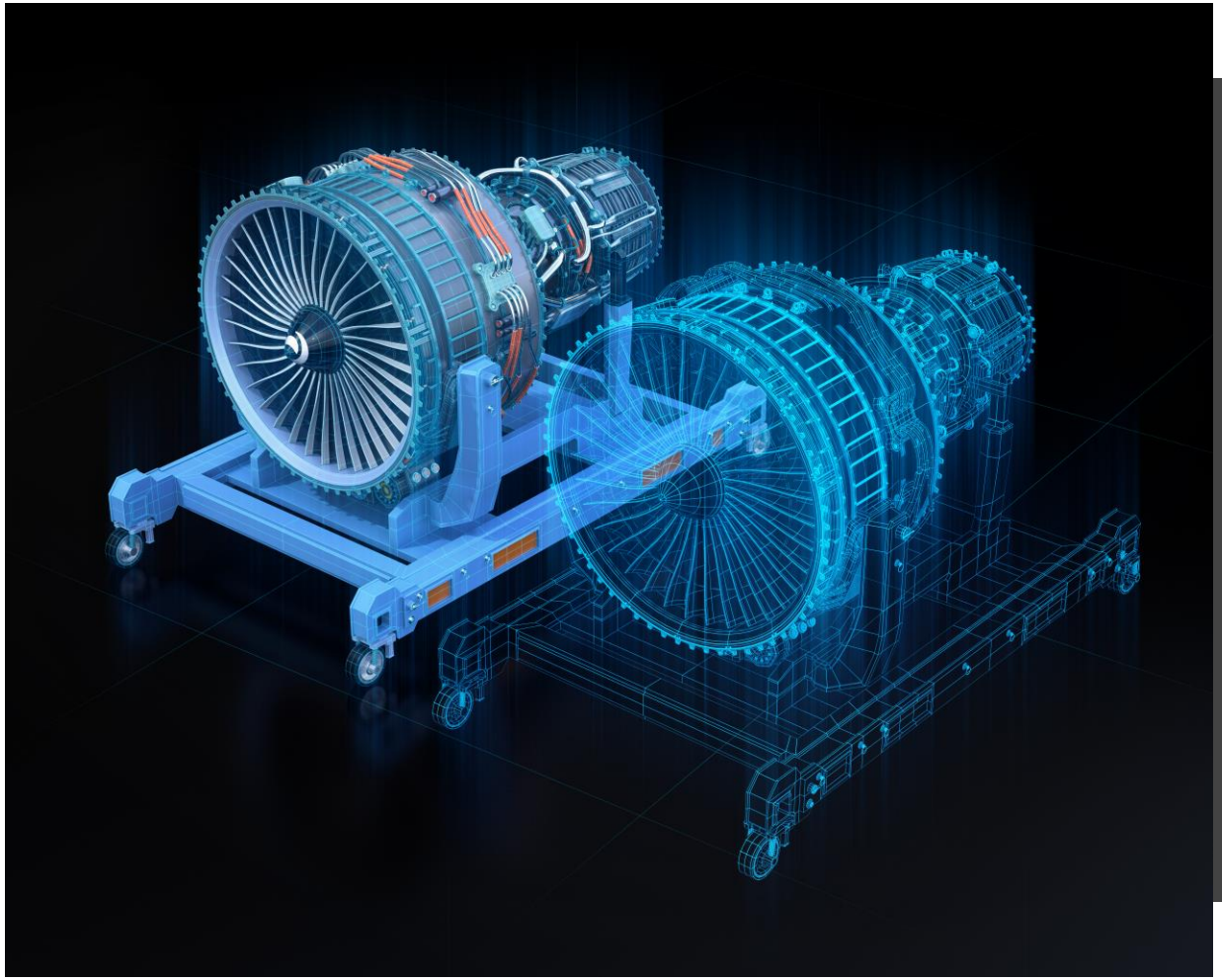
Therefore, the only way to accomplish this goal safely, and in a timely manner, is through the use of multi-agent computer simulation which we have developed.

Meet your Digital Twin

A **digital twin** is a digital replica of a living or non-living physical entity.[1] By bridging the physical and the virtual world, data is transmitted seamlessly allowing the virtual entity to exist simultaneously with the physical entity. Digital twin refers to a digital replica of potential and actual physical assets (physical twin), processes, people, places, systems and devices that can be used for various purposes.

wikipedia

Digital Twins



- Engines
- Wind turbines
- Oil rigs
- Cities
- Factories
- Products
- Components

Digital Twins look like …

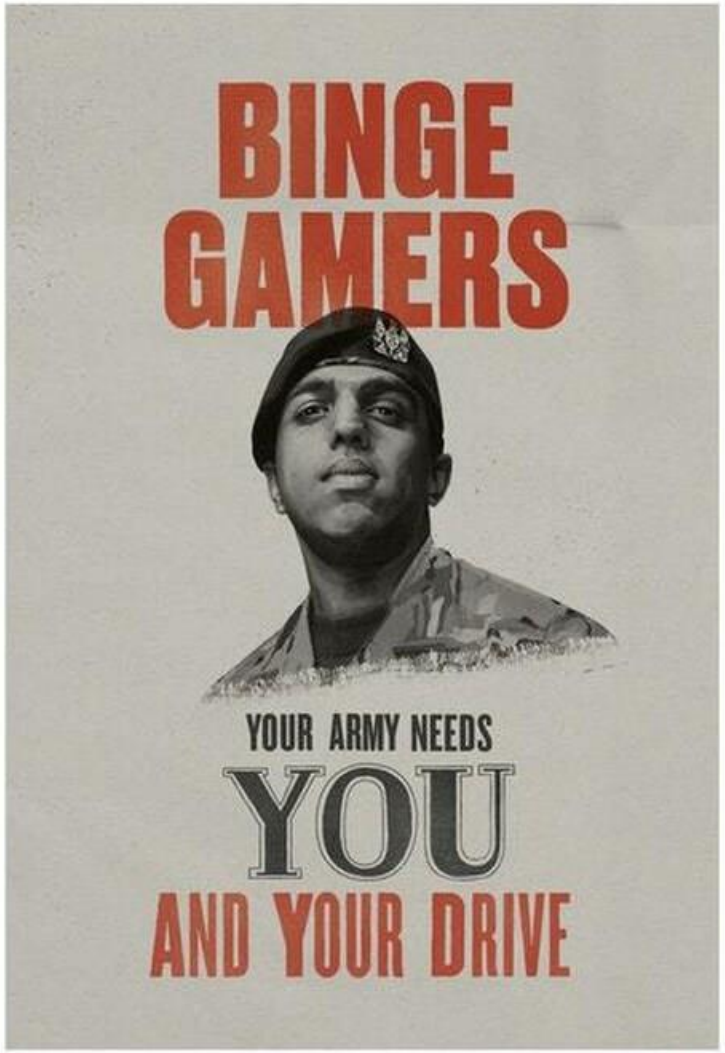
Digital Twins look like …

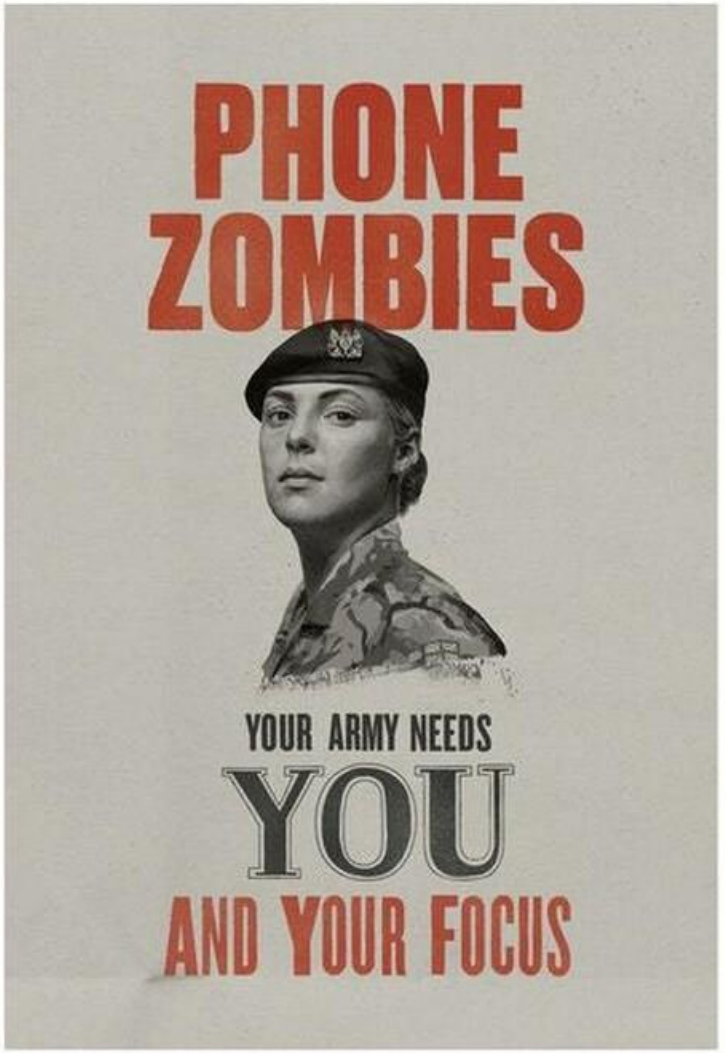
Mirror Worlds
or the day software puts the universe in a shoebox. How it will happen and what it will mean

David Gerlertner, 1991

Link to Industry 4.0

Generation Z





Digital natives with huge dependency on communications

Greater reliance upon technology and with a different approach to problem solving

Individualistic, impatient and with differing levels of attention span

See greater value in work experience than education

Approach risks differently

Sparks and Honey Report, June 2017:

Meet Generation Z, Forget Everything You Learned about Millennials

Deliver Better Collective Training

Design training around the man and the team

Increase professional satisfaction

Allow people to train, reflect, learn and train again

More realistic, adversarial training

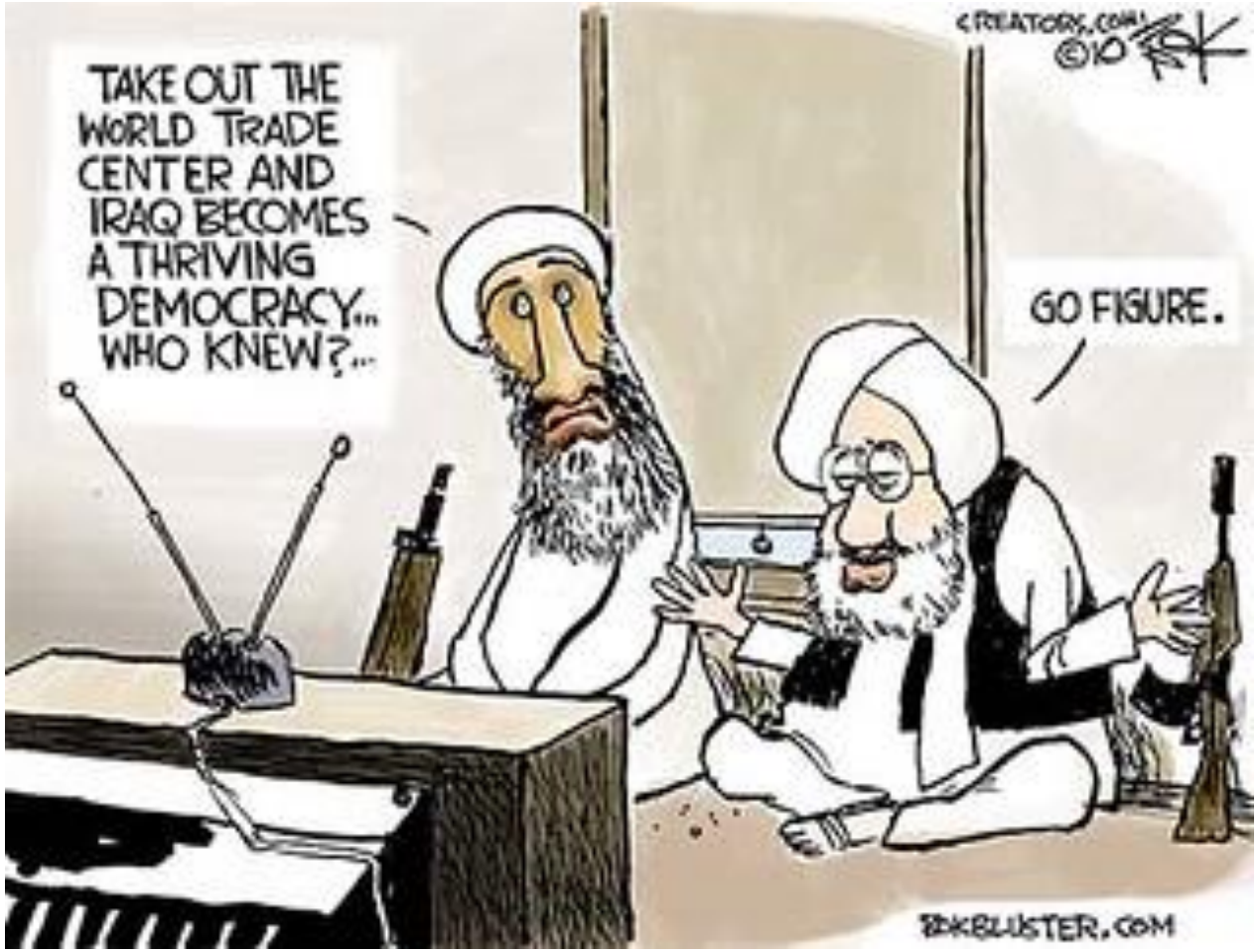
Develop combat ethos and drive innovation

Match training to the complexities of warfare in the 21st century

Digital = Analysis

Image: courtesy C4 Strategies

Law of Unintended Consequences …



www.creators.com/editorialcartoons/chip-bok/14785.html
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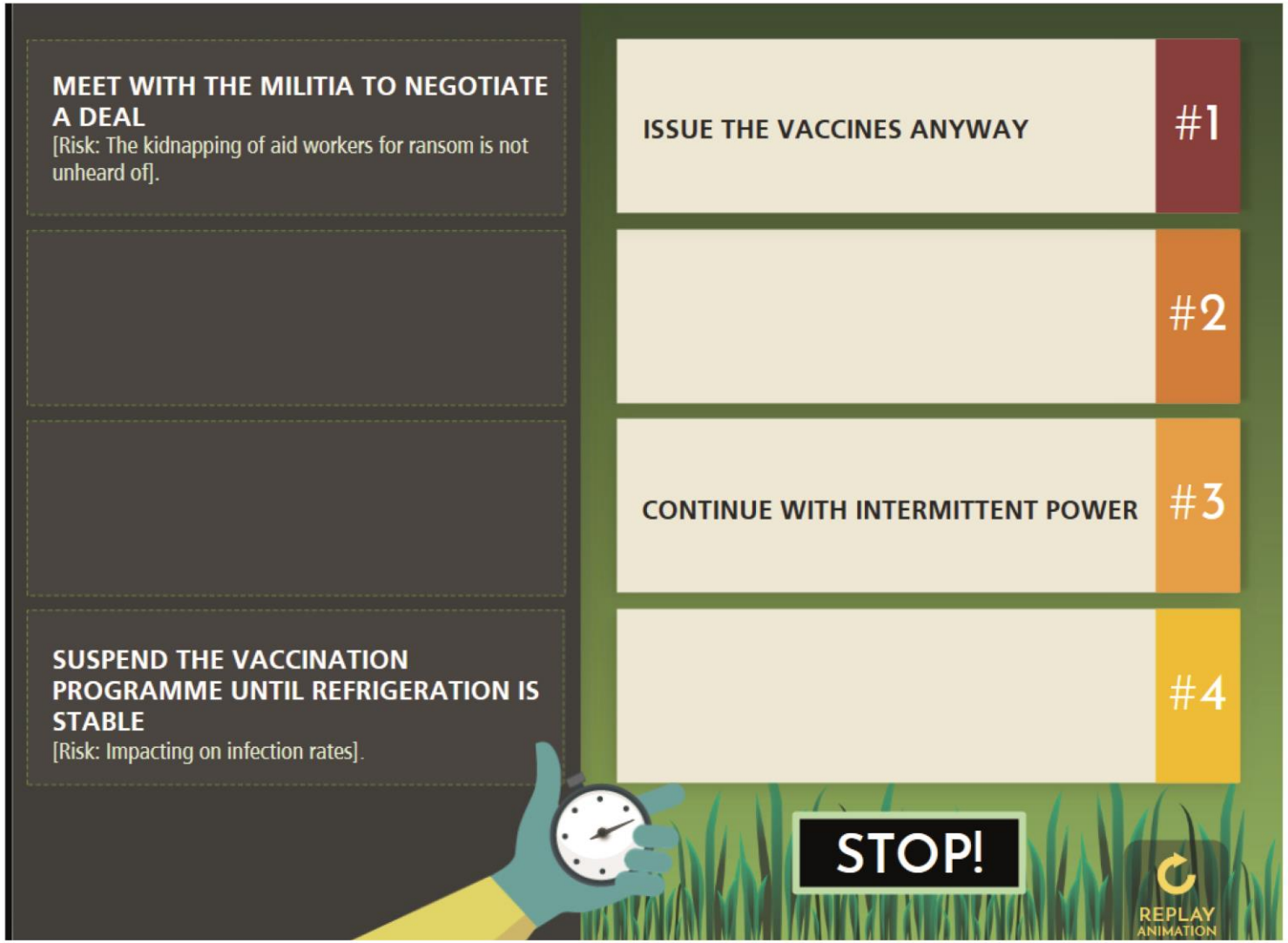
Consequences?: Training and Selection

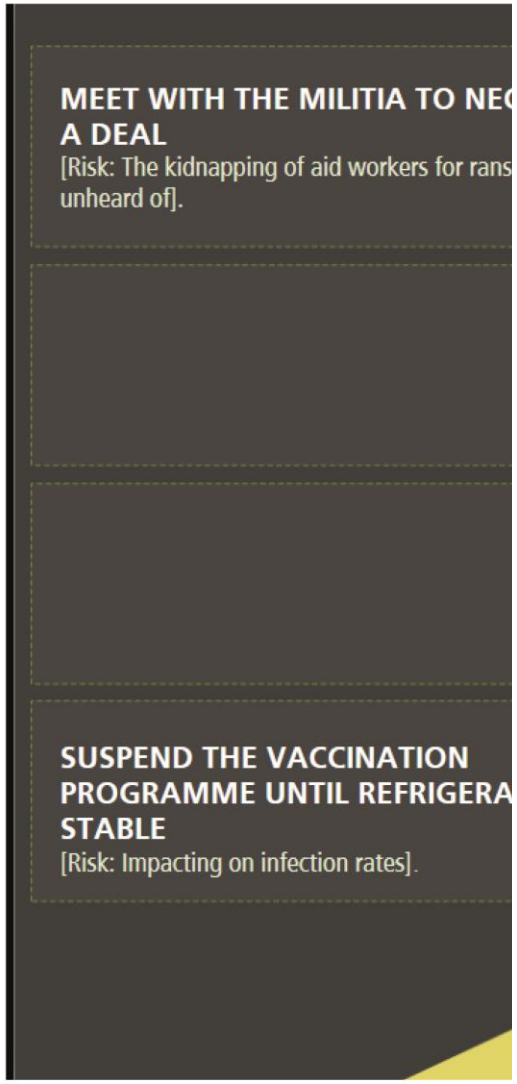
Images: courtesy CDS Defence & Security

Consequences?: Training and Selection



Images: courtesy CDS Defence & Security

Consequences?: Training and Selection



Images: courtesy CDS Defence & Security

Smart Tutor

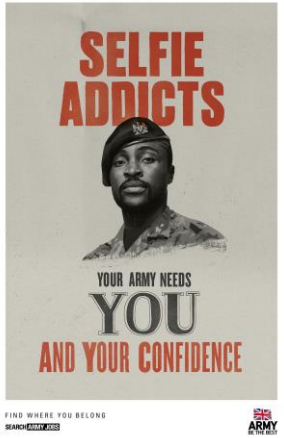
4 Platforms of Learning & Simulation

Digital Twin

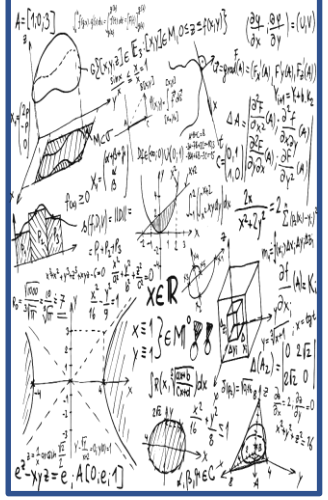
Smart Tutor

Ai

Trainees



Physical Models



Knowledge Transfer, Smart Tutor

The Challenge - Operations vs Training

Ops: enemy pilots are smart, agile
Training: CGFs are predictable or unresponsive to trainees' tactical actions

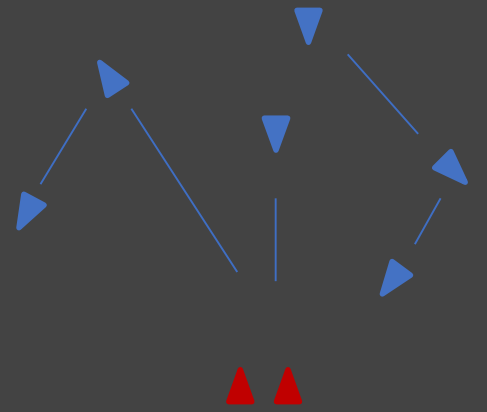
Cures

Current: SMEs control Red agents, raising costs, lowering availability of training
Future: *smart, agile, intelligent agents* serve as enemies to smartly exercise trainee skills on demand

Freeman, Watz, Bennett, ITEC 2019

Operational Target

Training Reality




KBA
Korea Baduk Association
Google DeepMind
Challenge Match
8 - 15 March 2016
AlphaGo
ALPHAGO
00:12:30
LEE SEDOL
00:34:31
AlphaGo
Lee Sedol

NETFLIX ALPHAGO, 2017

Autonomous Forklift Trucks

TOYOTA

Autonomous Forklift Trucks

... how do they learn?

TOYOTA

Active Protection System (APS)

Generic Active Protection System Capabilities

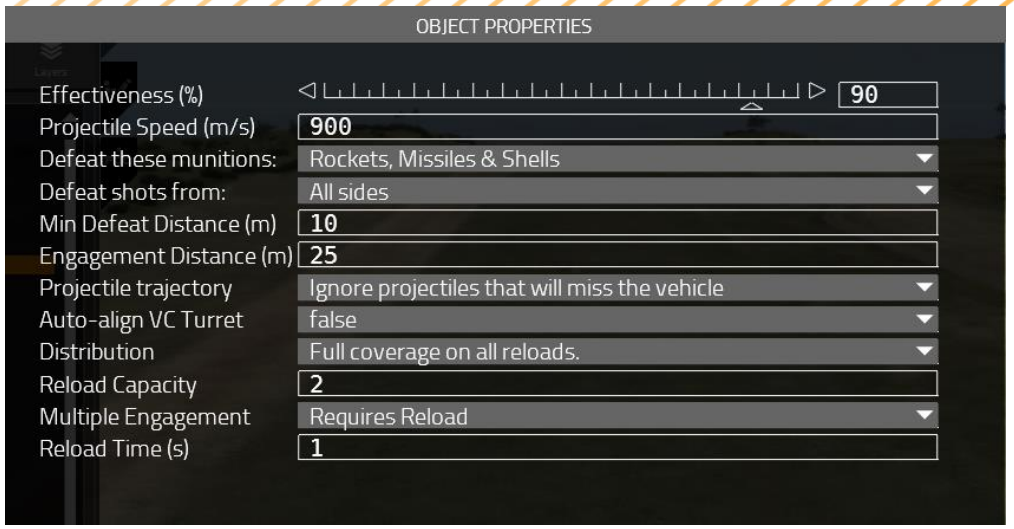
- Standard editor object that can be linked to any vehicle
- Content Agnostic
- Simulates:
  - Active Protection System (APS) **– Hard Kill**
  - Active Integrated Protection System (AIPS) **– Hard Kill**
  - Laser Warning Receiver (LWR) **– Soft Kill**

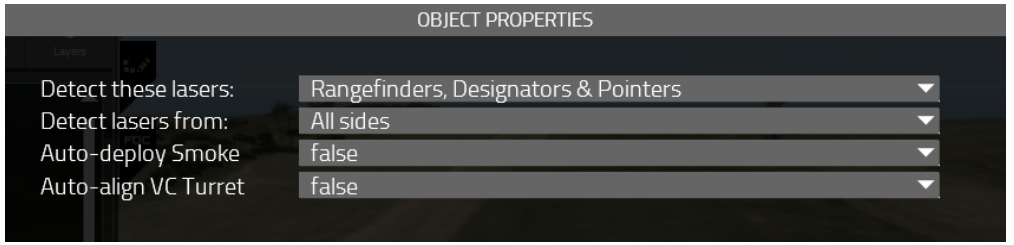
Tuneable Performance

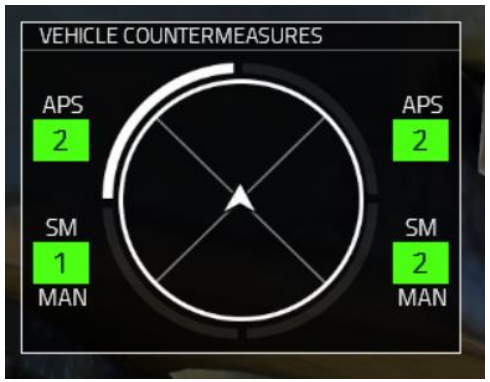
- All parameters configurable by Admin
- Multiple engagement parameters can be tuned by users to replicate real world functionality
- Replicate existing APS technology, or experiment with future APS capabilities
- Multiple, differently configured APS can be placed in the scenario
- Specific munition types can be targeted
- Auto slew turret, commander optics to threat

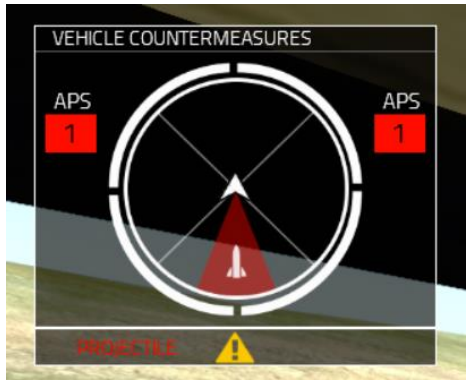
In vehicle HMI

- Audible and Visual cues of incoming threats, APS engagements and APS status









Future Force Development - Autonomous Vehicles

MilSim CEE 2029

Prediction is very difficult, especially about the future

Attributed to Nils Bohr

MilSim CEE 2029

Prediction is very difficult, especially about the future

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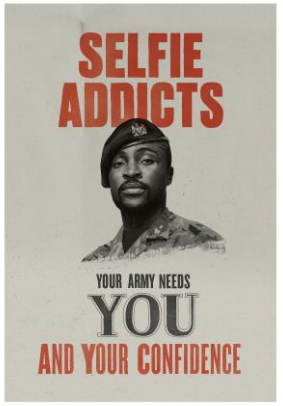

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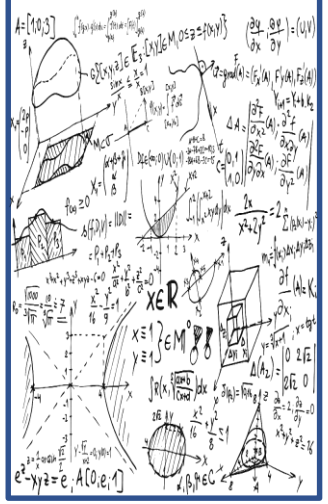

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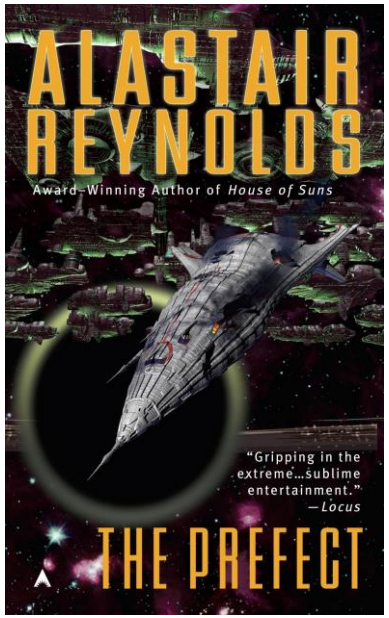

The Prefect / Aurora Rising, Alastair Reynolds, 2007

Thank you for your Attention