



Back to the Future: Meet your Digital Twin

Rusmat Ahmed. MilSim CEE, 15 October 2019



Paris Motor Show, 2016



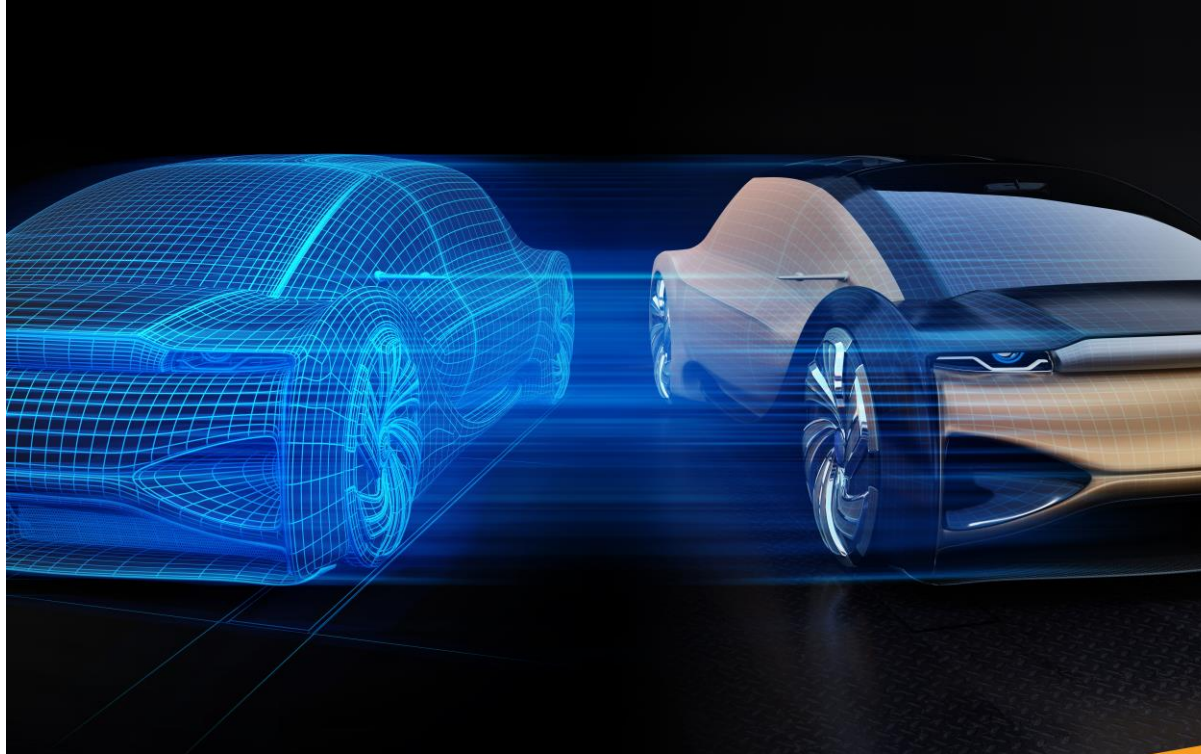
TOYOTA

We believe chauffeur 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

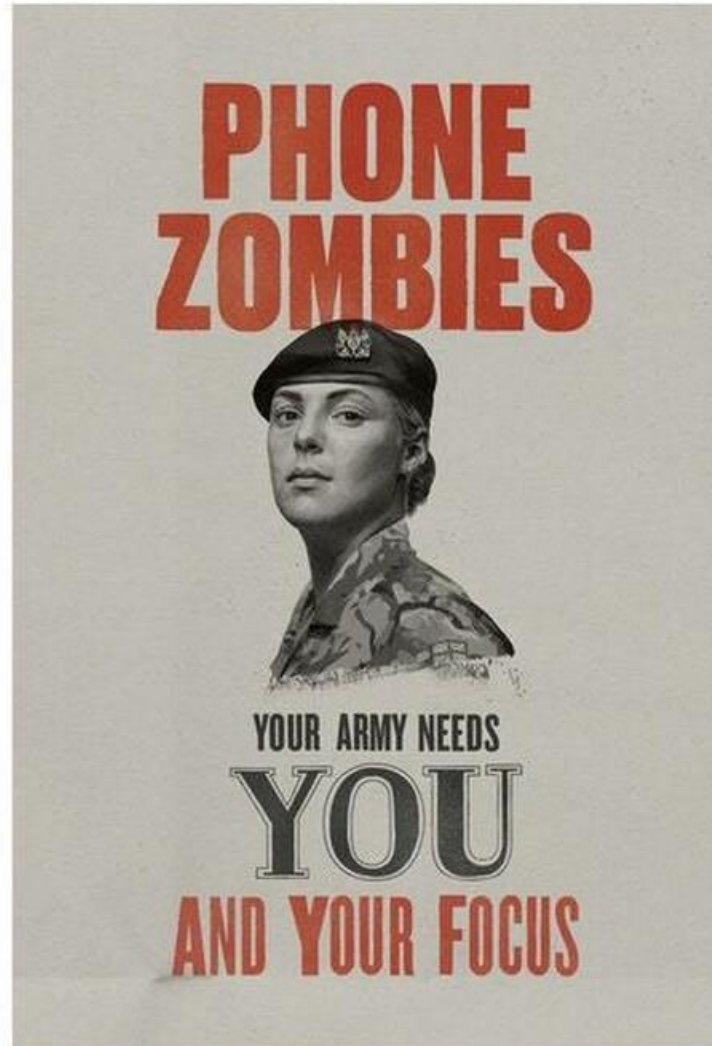
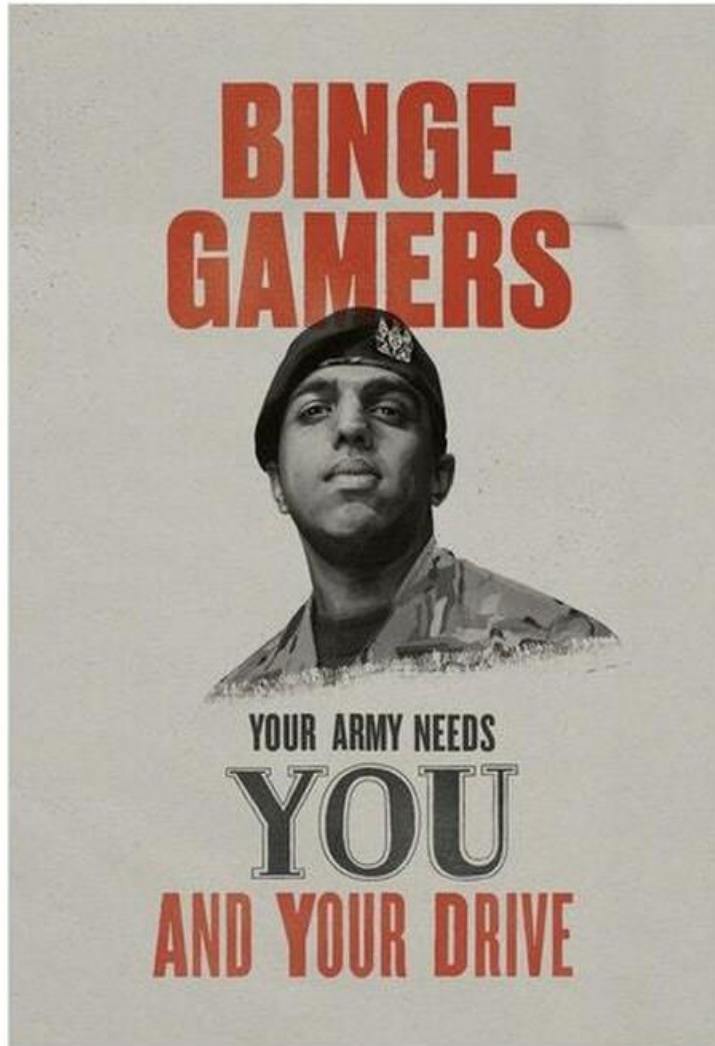


Link to Industry 4.0





Generation Z



FIND WHERE YOU BELONG
SEARCH **ARMY** JOBS



FIND WHERE YOU BELONG
SEARCH **ARMY** JOBS



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

IN FRONT | ISSUE 1 THE BRITISH ARMY NEWSLETTER AUTUMN 2018

INTRODUCTION RUSI OPS, TRG & STTT MDP MANNING THE ARMY CASTLE PES CLARION SEG NEXUS EQUIPMENT PLAN NEWS CTTT INFRASTRUCTURE

COLLECTIVE TRAINING TRANSFORMATION PROGRAMME

The Future Collective Training System will deliver collective training that is *"a surrogate for warfare"*, technologically enabled, and which better replicates the complexity of the modern battlefield.

This will improve professional satisfaction, encourage ownership, maintain morale and prepare the Army to fight in an era of constant competition.

BETTER CONTRIBUTE TO STRATEGIC EFFECT

- Align collective training to regions of the world that cement our joint and international partnerships
- Train in a way that allows us to focus on better support to notice to effect in Europe
- Increase responsiveness to future strategic demands and change
- An expeditionary approach that preserves and improves our ability to respond to changing threats

DELIVER BETTER COLLECTIVE TRAINING

- Design training around the man and the team
- Increase professional satisfaction
- Allow people to train, reflect, learn and train again
- Improve the experience of those undertaking collective training
- More realistic, adversarial training
- Develop combat ethos and drive innovation
- Match training to the complexities of warfare in the 21st century

DRIVE ADAPTATION AND EFFICIENCY

- Increase responsiveness to future operational demands
- Create a flexible, responsive system which is representative of the threat
- Exploit the benefits of live, virtual and constructive domains
- Increase instrumentation to allow data to be collated and exploited

DEVELOP AN ALLIANCE WITH THE BEST OF INDUSTRY

- A core common purpose
- Achievement of mutual benefits
- Shared risk
- Deeper integration
- An ability to seize opportunities and incentivise innovation
- Adaptation a consistent theme

← Betterment of existing Collective Training (2019-2025) Transformation (2023-2025) Development and Improvement (2026-2028) →

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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



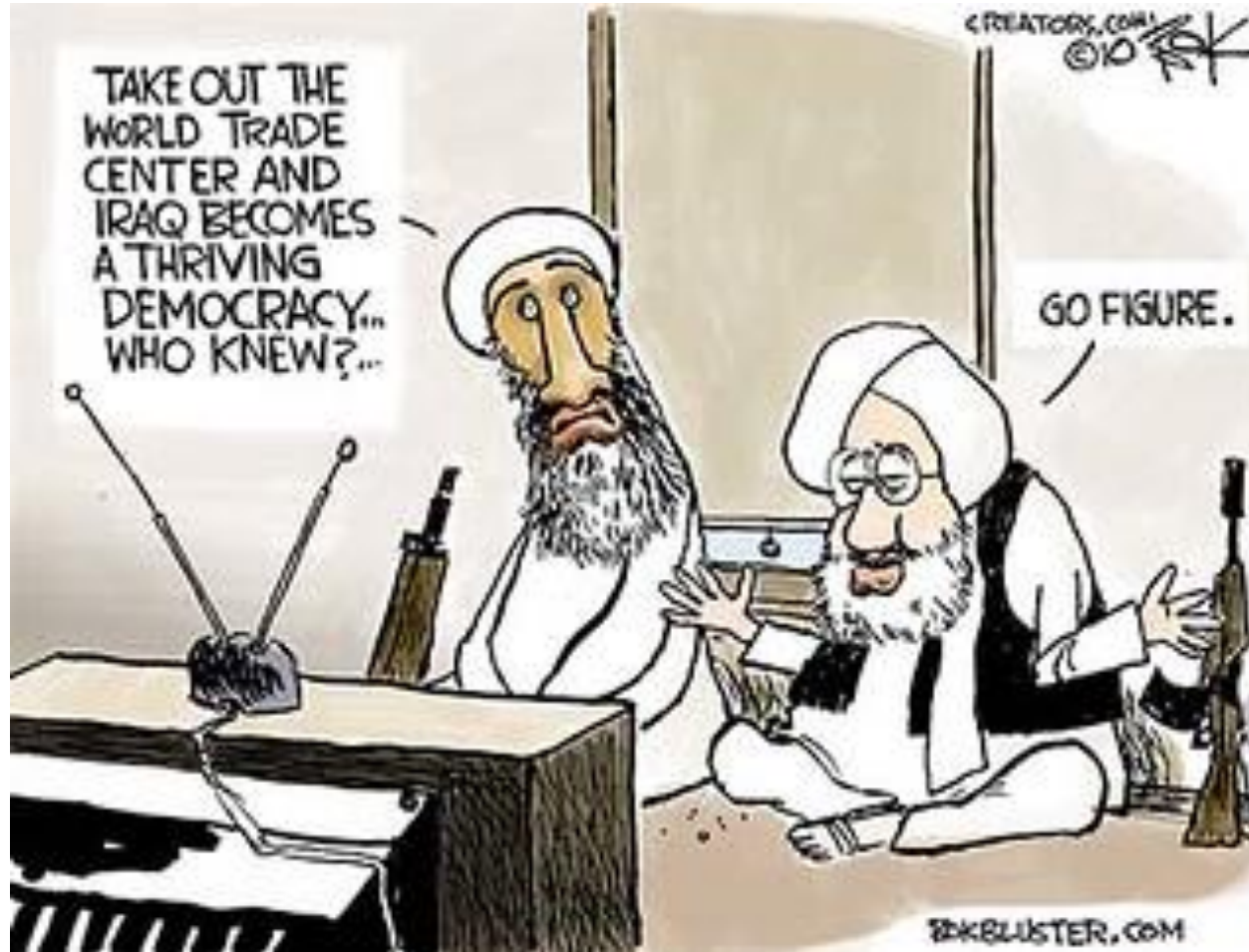
Digital = Analysis



Image: courtesy C4 Strategies



Law of Unintended Consequences ...



www.creators.com/editorialcartoons/chip-bok/14785.html

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Consequences?: Training and Selection

A back-up generator is delivered, but the local militia control the fuel supply which is of unknown quality. What should you do?

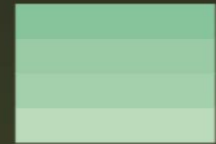


Y #1

#2

NT POWER #3

#4



ORGANISATION



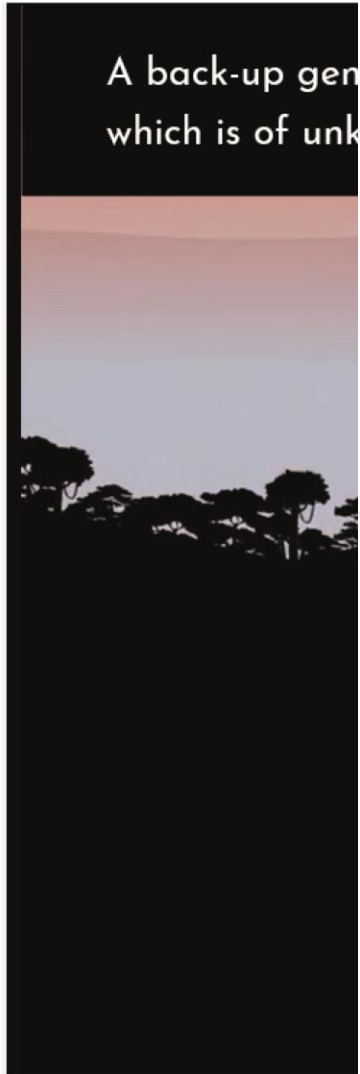
13

Out of 32

[Click here to understand what your results mean](#)



Consequences?: Training and Selection



MEET WITH THE MILITIA TO NEGOTIATE A DEAL
[Risk: The kidnapping of aid workers for ransom is not unheard of].

ISSUE THE VACCINES ANYWAY #1

CONTINUE WITH INTERMITTENT POWER #3

SUSPEND THE VACCINATION PROGRAMME UNTIL REFRIGERATION IS STABLE
[Risk: Impacting on infection rates].

STOP!

REPLAY ANIMATION

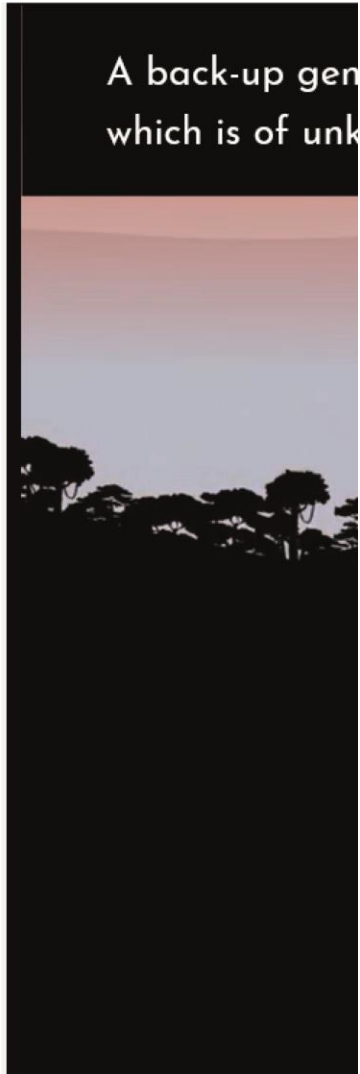
ORGANISATION

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Consequences?: Training and Selection



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Smart Tutor





4 Platforms of Learning & Simulation

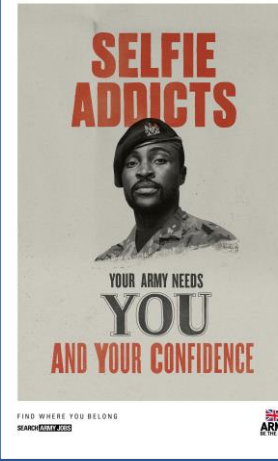
Digital Twin



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

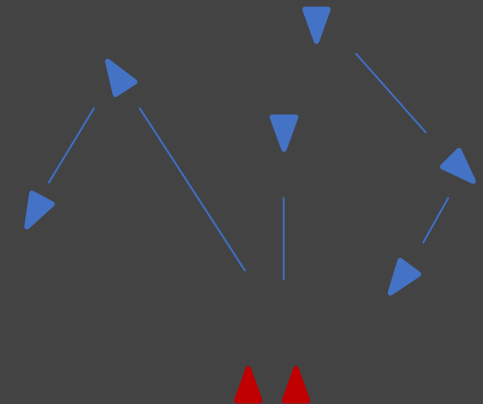
Future: smart, agile, intelligent agents serve as enemies to smartly exercise trainee skills on demand

Freeman, Watz, Bennett, ITEC 2019

Operational Target



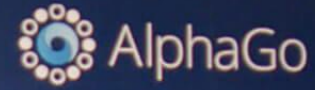
Training Reality





Google DeepMind Challenge Match

8 - 15 March 2016

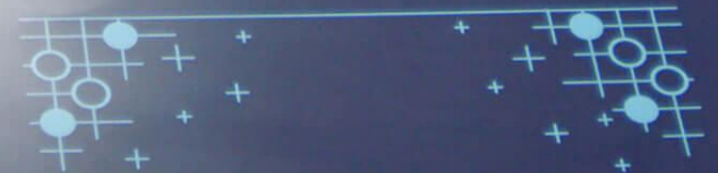


ALPHAGO
00:12:30

LEE SEDOL
00:34:31

AlphaGo

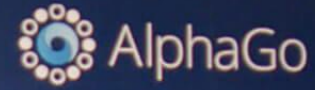
Lee Sedol





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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

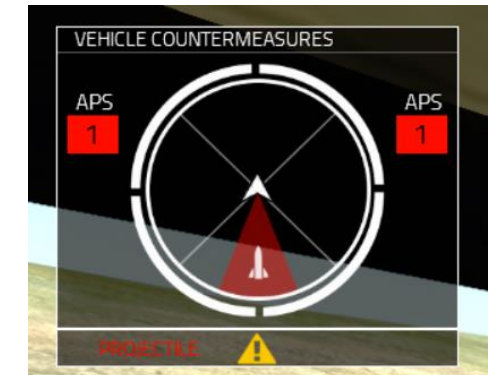
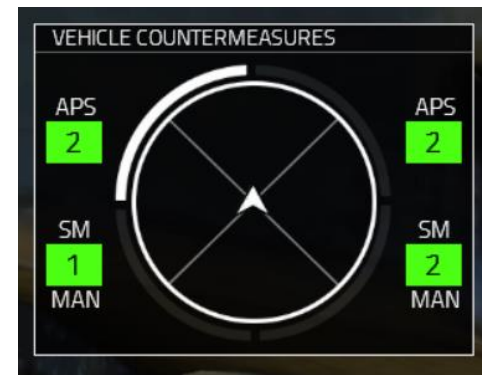
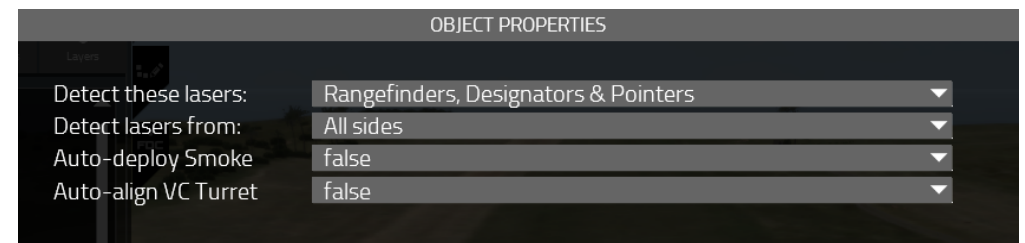
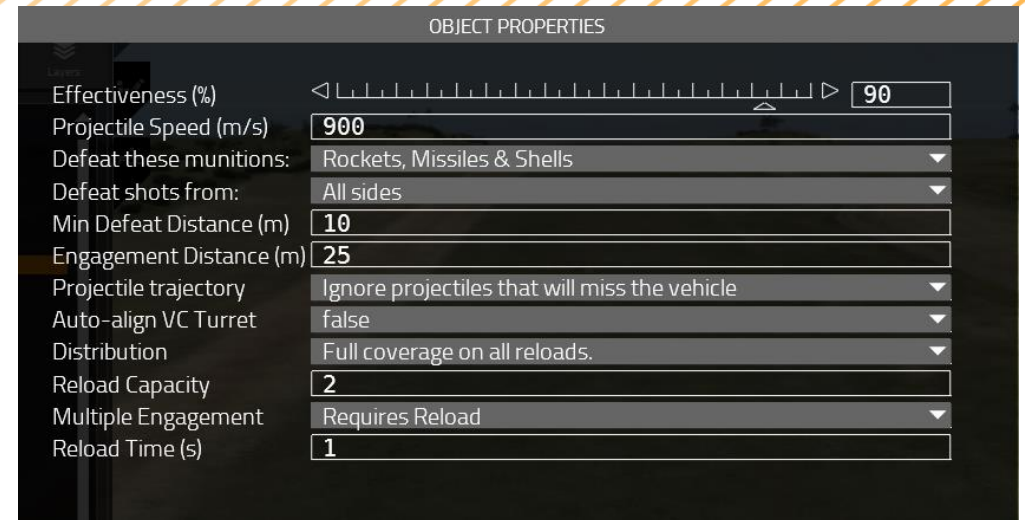
- Standard editor object that can be linked to any vehicle
- Content Agnostic
- Simulates:
 - Active Protection System (APS) – **Hard Kill**
 - Active Integrated Protection System (AIPS) – **Hard Kill**
 - Laser Warning Receiver (LWR) – **Soft Kill**

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



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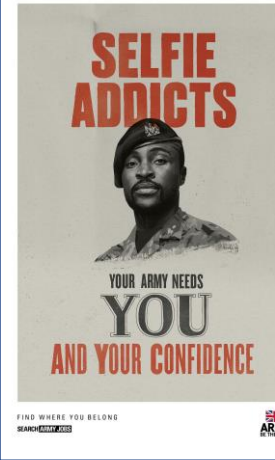
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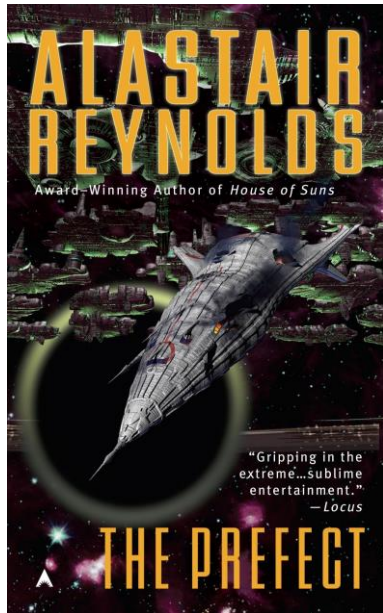
Physical Models





MilSim CEE 2029

Prediction is very difficult, especially about the future



The Prefect / Aurora Rising, Alastair Reynolds, 2007



Thank you for your Attention

