



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
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Federal Department of Defence,
Civil Protection and Sport DDPS
armasuisse
Sciences et Technologies



Technology Wargaming

*Experiencing future technologies
combining multiple approaches*

by

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Dr. Pascal van Overloop, IABG GmbH



**How can I experience something,
if this something does not exist ?**

Design & Preparation



Matrix Game

Two-sided, open arguments, referees, analysts, after-action review/survey

- Scenario 1
 - Counter-Terrorism, central public infrastructure
 - Half day (including introduction)
- Scenario 2
 - Hybrid threats, major city
 - Half day
- Scenario 3
 - Major attack, border/country region
 - Full day

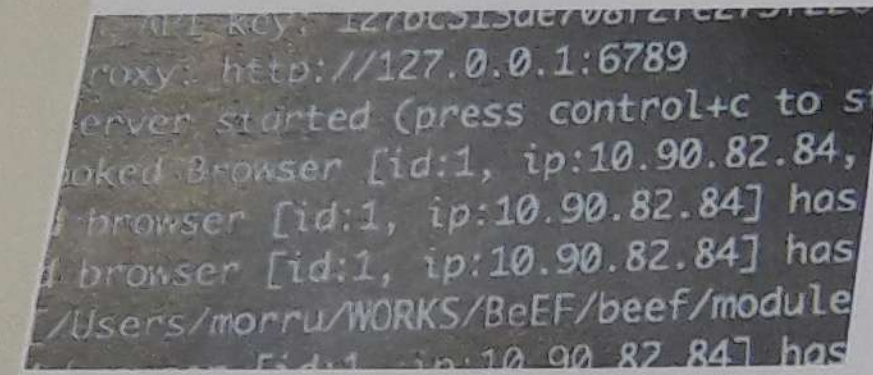


Red & Blue Cells



Selected New Technologies

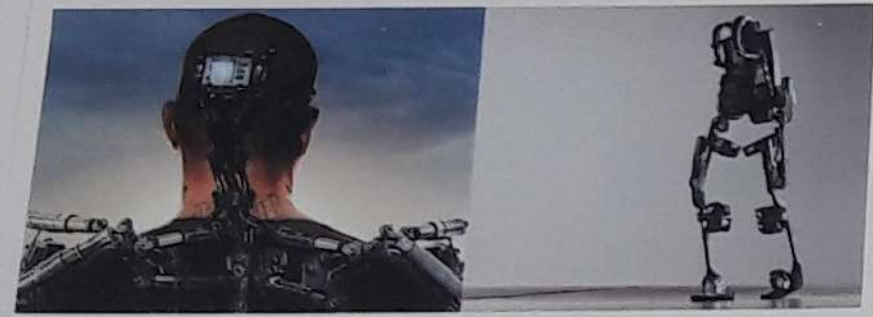
Cyberangriffe



Niemand weiss, ob eine digitale Information (Text, Image, Foto, Stimme) echt ist oder nicht. Da alle zivilen und militärischen Systeme digitale Komponenten haben, müssen diese aktiv gegen Cyberangriffe geschützt werden. Direkte Angriffe auf Infrastruktur können militärische Operationen direkt oder indirekt beeinflussen. Desinformationskampagnen werden durch offiziellen Sozialmedien aktiv geführt.

1. Alle OSINT Informationen können auf falschen Informationen beruhen.
2. Daten und Information, welche von Sensoren kommen, können gefälscht werden.
3. Systeme können durch Cyberattacke angegriffen werden.
4. Ressourcen wie Strom, Wasser, öffentlicher Verkehr können durch Cyberattacken angegriffen werden.
5. Alle Systeme, welche auf Prozessoren basieren, die im Ausland hergestellt, basieren, sind potenziell korrupt oder manipuliert.

Augmentierter Soldat (Cyborg Soldier with enhanced man-machine interface)



Der Trend zur Miniaturisierung zusammen mit immer günstigeren und leistungsfähigeren Sensoren führt zur Integration tragbarer Computer in die Ausrüstung des Soldaten. Künstliche Intelligenz erlaubt Augmentierung, welche nicht nur amputierte Extremitäten ersetzen, sondern die physikalischen und kognitiven Fähigkeiten des Soldaten signifikant verbessern. Dabei verschwindet die Grenze zwischen Mensch und Maschine zunehmend.

1. Dank dem Exoskeletton kann der Soldat ein Gewicht von 100 kg über eine Distanz von 100 km und eine Dauer von 100 Stunden transportieren.
2. Integriertes Nachtsichtgerät ermöglicht Tag-Nacht Kampf.
3. Durch "augmented reality" hat der Soldat ein vollständiges Lagebewusstsein in Echtzeit.
4. Moderne Stoffe machen den Soldaten unsichtbar für Sensoren im infraroten und sichtbaren Spektralbereich.
5. Sensoren und künstliche Intelligenz ermöglichen eine automatische Freund / Feind Erkennung sowie eine permanente Datenverbindung mit Kameraden und Systemen.

Roboterschwarm



Schwärme von Robotern sind so billig geworden, dass sie als Einweg-Systeme eingesetzt werden. Das Verhalten des Schwarms ist nicht von einzelnen Systemen abhängig. Der Einsatz voll-autonomer Roboter (UAVs, UGVs, etc.) als Kampfsystem führt zu ethischen Bedenken und heftigen Diskussionen.

1. Schwärme bestehend aus 1000 kleinen Dronen mit Sensoren und Sprengstoff (Granate).
2. Schwärme übernehmen verschiedene Funktionen: Von der Herstellung von Radionetzwerken für die Kommunikation bis zu letalen Angriffen.

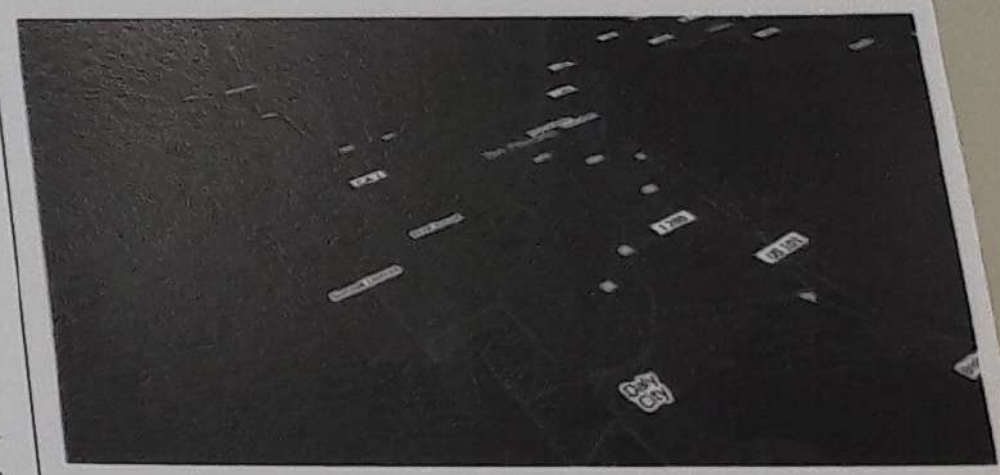
Autonome Systeme für Logistik und Sanität (Ground Surveillance Autonomous Robot)



Künstliche Intelligenz ermöglicht Fahrzeuge/Systeme mit autonomer Navigation und Entscheidungsfindung. Diese Systeme werden im Bereich Versorgung, Instandhaltung, Rettung von Verwundeten inkl. automatischer Diagnostik sowie Überwachung eingesetzt mit signifikanter Verbesserung der logistischen Fähigkeiten. Zudem reduzieren diese Systeme den Personalbedarf, so dass sich die Soldaten auf Aktivitäten, welche spezielle Fähigkeiten voraussetzen, konzentrieren können. Dadurch werden Soldaten gezielt entlastet, was die körperliche Verfassung und damit das Resultat von militärischen Missionen deutlich verbessert.

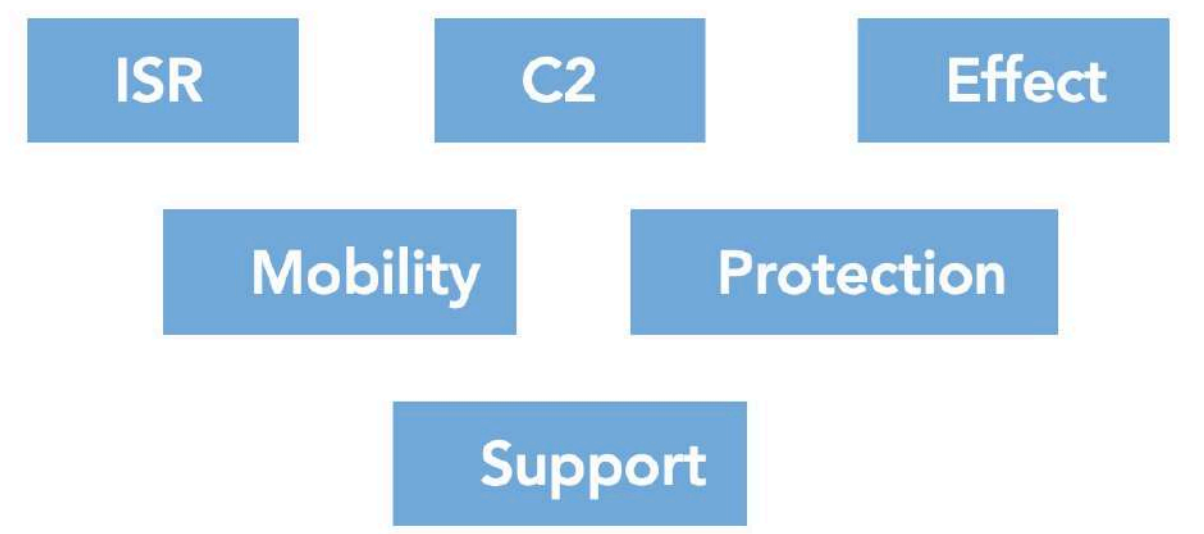
1. Soldaten werden mit Munition, Wasser und Nahrungsmitteln mit Hilfe von autonomen Systemen (UGV Kolonnen, UAV) versorgt.
2. Erste Hilfe kann, wenn nötig, durch autonome Systeme geleistet werden.
3. Die Fahrzeuge sind nicht zwingend auf Strassen angewiesen. Dank der künstlichen Intelligenz haben sie die Fähigkeit, Bedrohungen zu erkennen und Wege zum Ziel entsprechend anzupassen.
4. Die Systemen beruhen auf erneuerbaren Energie und haben eine Autonomie von einer Woche und 5.000 km bevor sie aufgeladen werden müssen.

Verteiltes Sensornetzwerk (Urban Sensor Web)



Sensoren sind überall und können die Analyse direkt vor Ort machen. Durch die Vernetzung der Sensoren über sämtliche Bereiche hinweg ist eine vollständige Tarnung praktisch unmöglich. Dieses Sensornetzwerk ermöglicht auf der einen Seite ein hohes Lagebewusstsein, auf der anderen Seite bietet es auch Angriffsfläche für Cyberattacken.

1. Sensoren um zu sehen, hören, messen sind miniaturisiert und „kostenlos“.
2. Alle Sensoren sind lokal mit künstlicher Intelligenz ausgestattet, um die gewünschte Analyse zu machen (Face recognition, Freund-Feind Erkennung, Detektion Bioindikatoren, usw).
3. Alle Sensoren sind über diverse Kommunikationskanäle miteinander verbunden.
4. Die Sensoren haben Zugriff auf dezentralisierte Rechenleistung und



Gameplay – Development of COA



Interactions & Arguments



Adjudication



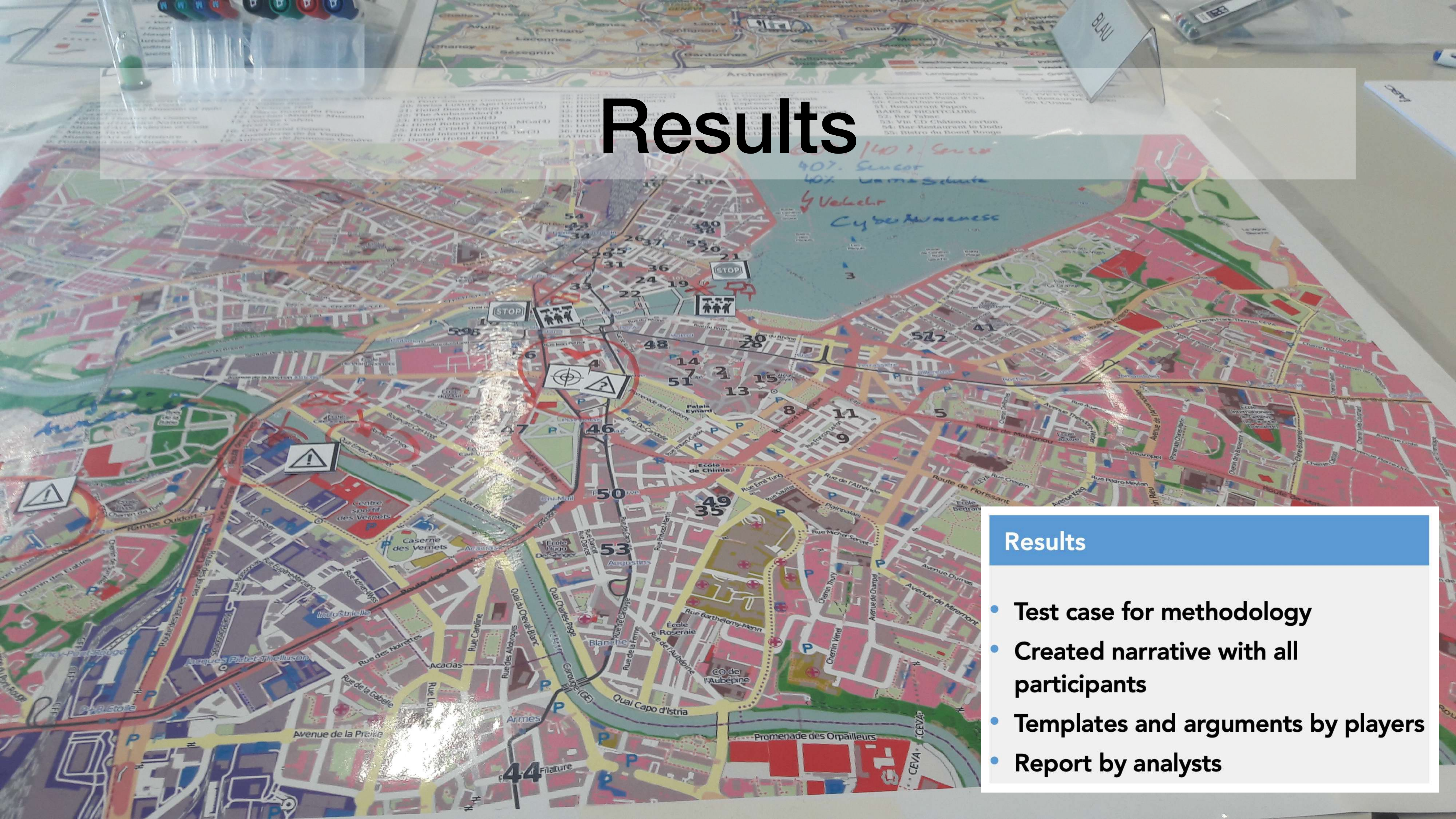
Result Determination (2 x D6) Cheat Card

| Dice Roll | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|-------------------------|------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|
| Single Probability | 2,8% | 5,6% | 8,3% | 11,1% | 13,9% | 16,7% | 13,9% | 11,1% | 8,3% | 5,6% | 2,8% |
| Accumulated Probability | 100% | 97,2% | 91,7% | 83,3% | 72,2% | 58,3% | 41,7% | 27,8% | 16,7% | 8,3% | 2,8% |

To account for a true 50 % chance, roll a red and green dice. If a „7“ is scored, with the **red dice** higher, **this is a failure.**

| | | | | |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Almost Certain | Probable | Chances About Uneven | Probably Not | Almost Certainly Not |
| 90% Chance of Success | 70% Chance of Success | 50% Chance of Success | 30% Chance of Success | 10% Chance of Success |

Results



- ## Results
- Test case for methodology
 - Created narrative with all participants
 - Templates and arguments by players
 - Report by analysts



IoS Inspirational Workshop



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Science and Technology

DEFTECH Inspirational Workshop

Science-Fictioning The Future of Military Systems

An epic drama of adventure and exploration



2001: a space odyssey



BLADE RUNNER 2049


THUN - Switzerland

2001
Experience



www.armsuisse.ch/wt

2018
8th May



sicherheitsforschung.ch

2049
Vision



wt.deftech.ch

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PROGRAM

- 08:30 Registration + Coffee
- 09:00 **Introduction, Presentation of the context**
Quentin Ladetto, armasuisse W+T
- 09:15 **Konzeption der Zukunft: "2001: a space Odyssey"**
Dr. Simon Spiegel, Universität Zürich
- 10:30 Coffee & Networking
- 11:00 **First Inspirational Experience**
- 12:30 Lunch - Buffet
- 13:30 **Second Inspirational Experience**
- 15:00 **Synthesis and outcome of the day**
- 16:00 End of the day

Registration and venue

Participation
limited to 50 people
Free of charge

Registration
Mandatory by email
to deftech@armsuisse.ch
subject: SFI DEFTECH Workshop

Deadline
1st of May 2018

Where
armsuisse S+T,
Feuerwerkerstrasse 39,
3602 Thun, Switzerland

Context

How are Science-Fiction movies constructed to anticipate a **realistic future**? Let's embark in a journey started 50 years ago and help **forecasting** it for the next 30 years!

Along the way, we will consider what went wrong for given systems not to have materialized today. Simultaneously we will analyse what **technologies** are expected to **develop** in the years to come and which systems can benefit from them in a linear or **radical, disruptive** way.

We will try then to translate how these new technologies could help solving Switzerland-specific hypothetical **security challenges**, both as **threats** and **opportunities**.

This day will change your way of watching Science-Fiction movies **for ever!**

Organizers

armsuisse Science and Technology is the research and technology agency of the Federal Department of Defence, Civil Protection and Sport. The agency conducts a multitude of research programs to advance knowledge and create innovative technologies, addressing the current problems of the armed forces (www.armsuisse.ch/wt).

This event is an initiative of the Technology Foresight research program which goal is to anticipate and get the necessary understanding of the emerging technologies which might have their implications for the military in general and the Swiss Armed Forces in particular.

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Email: quentin.ladetto@armsuisse.ch

2018

<https://deftech.ch>



IoS Creation Canvas



Idea of System Creation Canvas
Combine technologies to enable future capabilities

NAME

1 Description and Operational Interest
Conditions of use (opportunities/threats):
Main components:
Expected effects:
Operational capability & use cases concerned by the IoS:
Possible indirect impacts on other operational capabilities or doctrines:

2 Critical Performances of the IoS
Which properties are expected of the IoS?
Which limitations might occur?

3 State of Art Operational Capability
Current systems (will they be replaced by the IoS?):
Programs in progress:

4 Technologies
Contributing and key technologies:
Different Readiness Level (TRL) of the contributing technologies?

5 Critical Points
Major risks:
6 Affordability
7 Acceptability
8 Training Requirements

9 Studies, References, Remarks

Illustration

.....

Referral number from front page

Referral number from front page

Group Members *... including e-mails ...*

wt.deftech.ch Technology Foresight - armasuisse SiT



Vignette/Guidance Posters



Vignette
Tactical Situation Description

TITLE Seize Back Position

CHALLENGE
Taking back a government building secured by RED forces

RED
Challenges posed, tactics and technology

- RED has secured the surrounding areas by IEDs.
- RED snipers are on the roof of the building.
- RED wants the government look weak as it cannot secure its own buildings which are symbols of state authority.

BLUE
Objectives and associated tasks

- Destroy and neutralize RED
- Secure government symbols and infrastructure.

Use the technologies and your imagination to create systems that will help BLUE to achieve their objectives!

iABG Technology foresight - armasuisse S-T

Guidance
Lost time is never found again. Benjamin Franklin

1st step - 10 mins

BLUE HAS THE LEAD

- Pick one of the IoS Cards
- Explain vignette and the BLUE tasks and associated challenges
- Introduce the selected IoS according to the IoS Card Template
- Explain how the BLUE IoS contributes to achieve the operation goals

RED LISTENS

- RED needs to understand the vignette/operational environment/challenges.
- RED needs to understand how the BLUE IoS works in the given environment and vis-à-vis the mission goals.

2nd step - 20 mins

RED HAS THE LEAD

RED challenges the BLUE IoS:

- How and with which means does RED fight the BLUE system...
 - ...to contain its impact
 - ...to neutralise/ destroy it

BLUE LISTENS/ REACTS IF NECESSARY

- The BLUE IoS needs to be challenged from a RED perspective in the same scenario.
- Weaknesses and strengths of the BLUE IoS need to be revealed.
- Potential improvements/ countermeasures need to be considered.

3rd step - 15 mins

In a joint effort, BLUE and RED try to mitigate weak spots of the IoS and make it stronger and complement the IoS Card

iABG Technology Foresight - armasuisse S-T

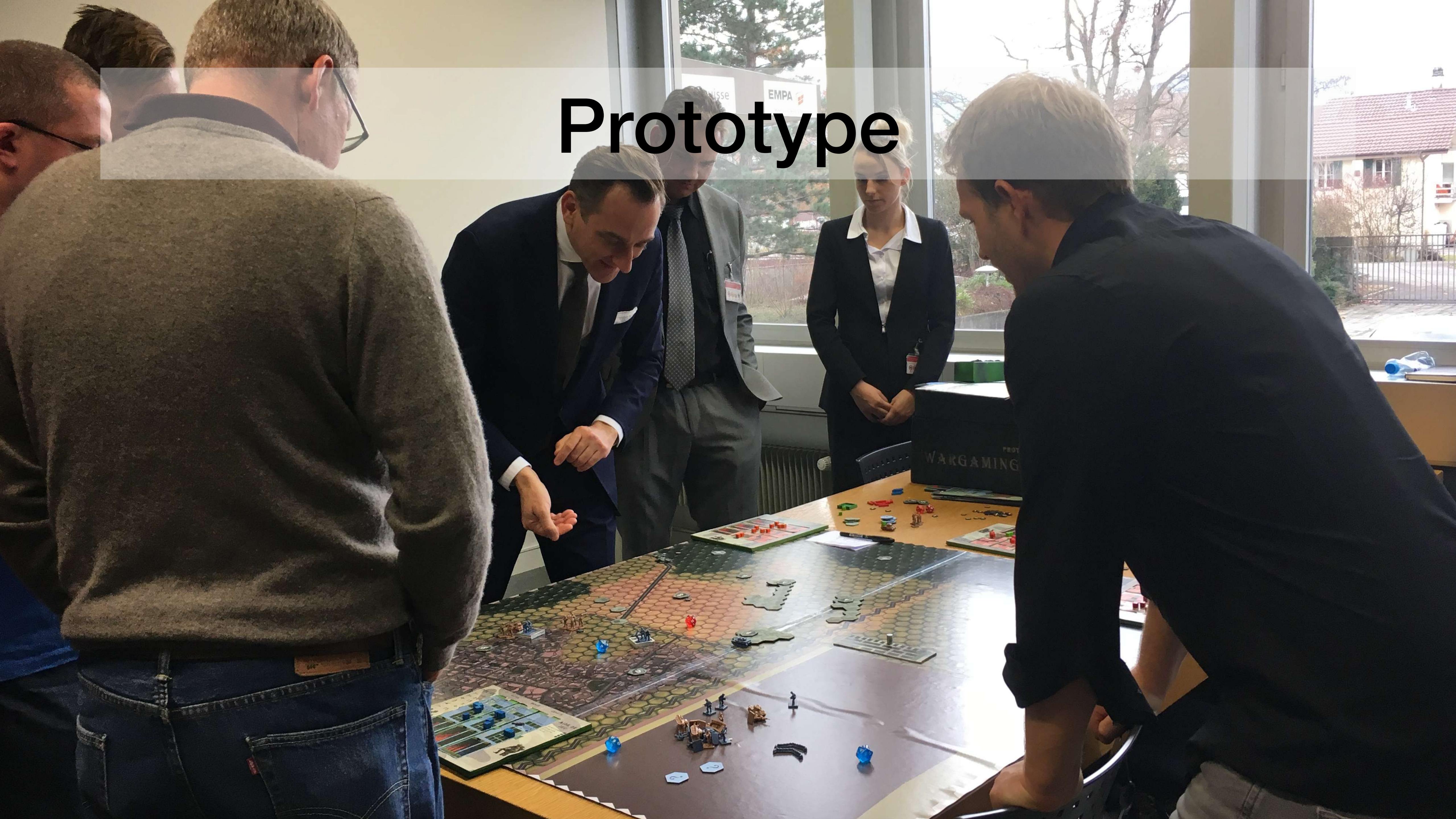


Strategy



Technology

Prototype



Military Involvement



Technology Appearance

ALPHA BRAVO CHARLIE

PORTÉE

- Y 10
- Y 24
- Y 18
- Y 3
- Y 8
- Y 75

EXOSQUELETTE

MUN

DURABILITE

4

4 5 5

4 4

3 3

2 2

1 1 1

0 0 0

EXOSQUELETTE

MUN

DURABILITE

4

4 5 5

4 4

3 3

2 2

1 1 1

0 0 0

Vhc bl roues

MUN

DURABILITE

4

8 4

7 3

4 5

2 3 1

0 1 0

AIDE DE JEU

EN MOUVEMENT

EN HAUTEUR

SOUS LE FEU

ISOLÉE

8

14

19

9

15

18

16

17

10

14

11/13

11/3/8

12/20

3

4

5

6

9

1

3

4

5

6

9

1

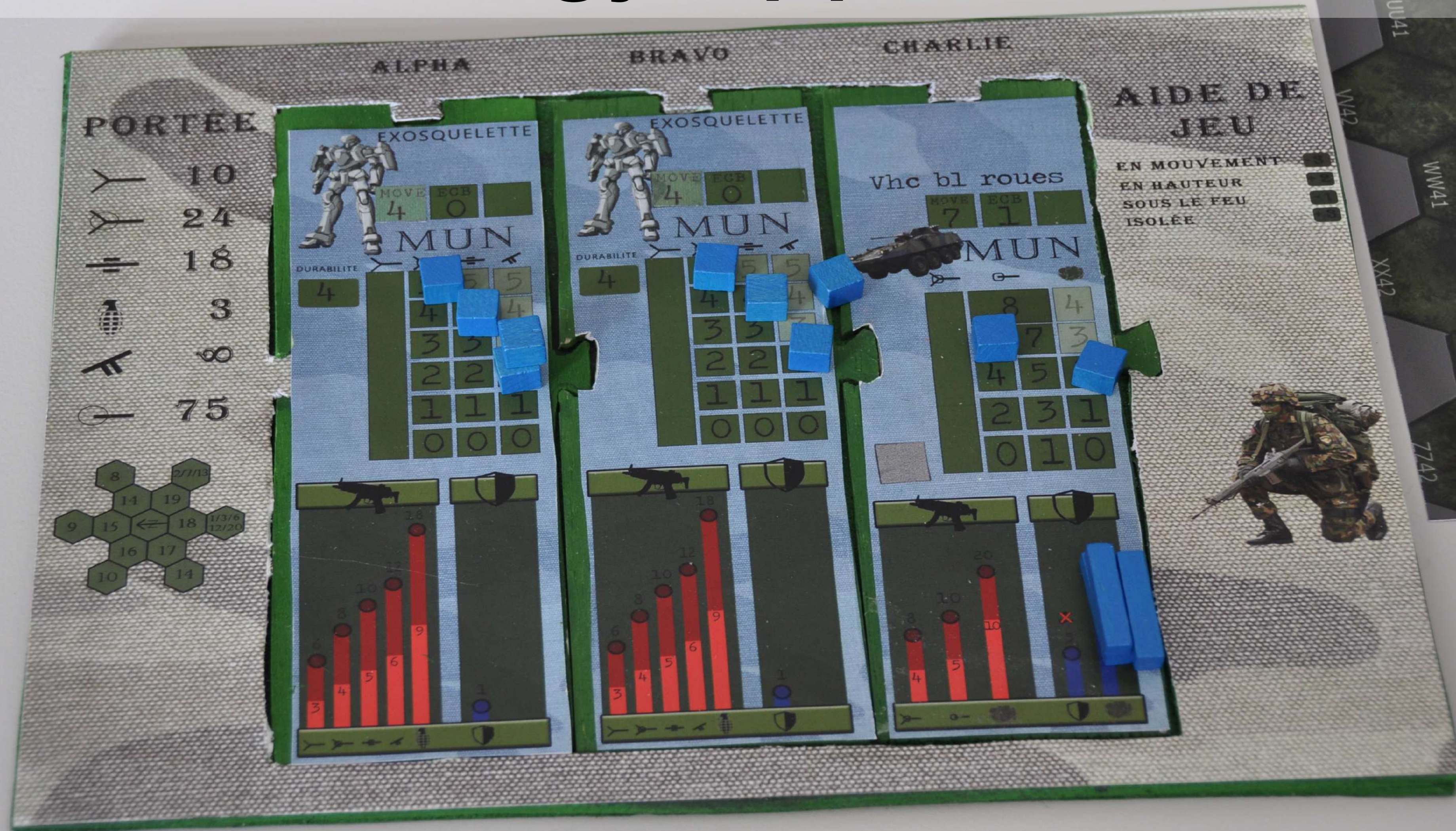
4

5

10

1

X



Gameplay



NEW TECHNO WAR

CHALLENGE TODAY TACTICS WITH SYSTEMS OF TOMORROW



EXOSKELETON
EXTENSION
INCLUDED

HENIGMA



Helen McGeachy

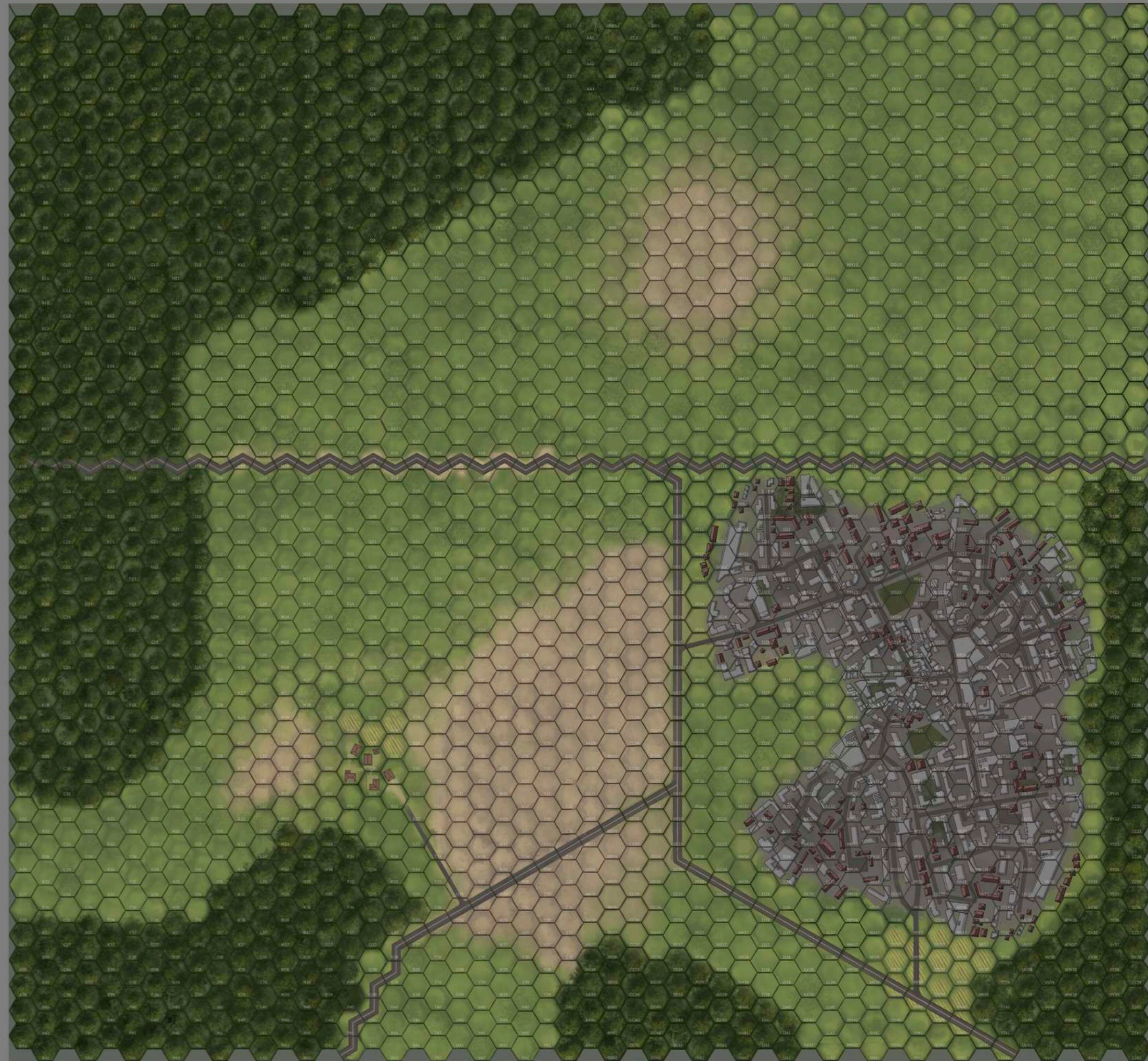
Création de scénario

► Carte:

Terrain ouvert

Ville

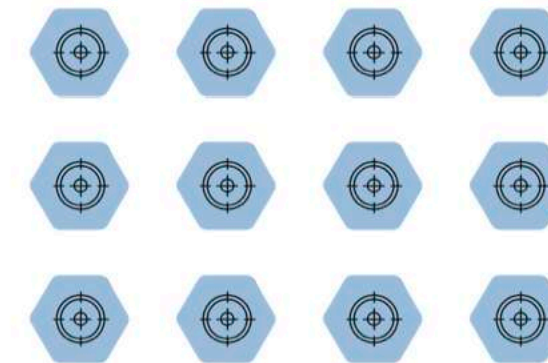
Internet Platform



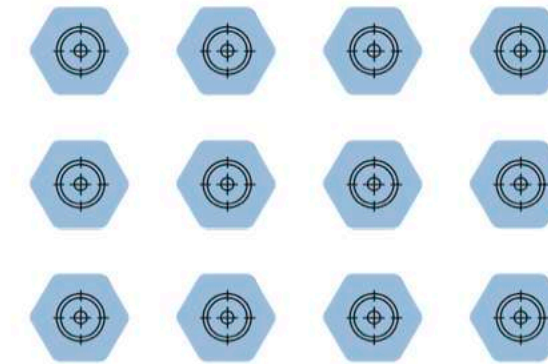
Troupes et Véhicules

Propre troupe

Infantries

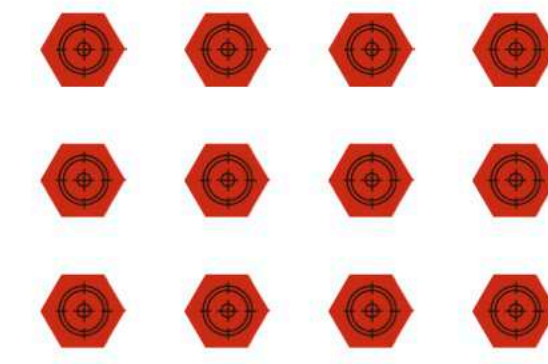


Véhicules



Adversaire

Infantries



Véhicules



drag and drop icons

Ordre

Situation générale

Situation particulière

Mission rouge



Mission bleue



Nombre de tours

 ▼

Début du jeu

 ▼

Remarque

ENREGISTRER

PUBLIER EN PDF



New Strategy

New Technology





**Multi-agent
Artificial Intelligence
Simulation**



**Artificial Intelligence
Powered
Automatic
Players**



**Interactive
Platform
Video Games**



**Multi-agent
Artificial Intelligence
Simulation**



**Artificial Intelligence
Powered
Automatic
Players**



**Interactive
Platform
Video Games**



Multi-agent simulations

Real World



Simulation

Digital Twin



Model

Agents



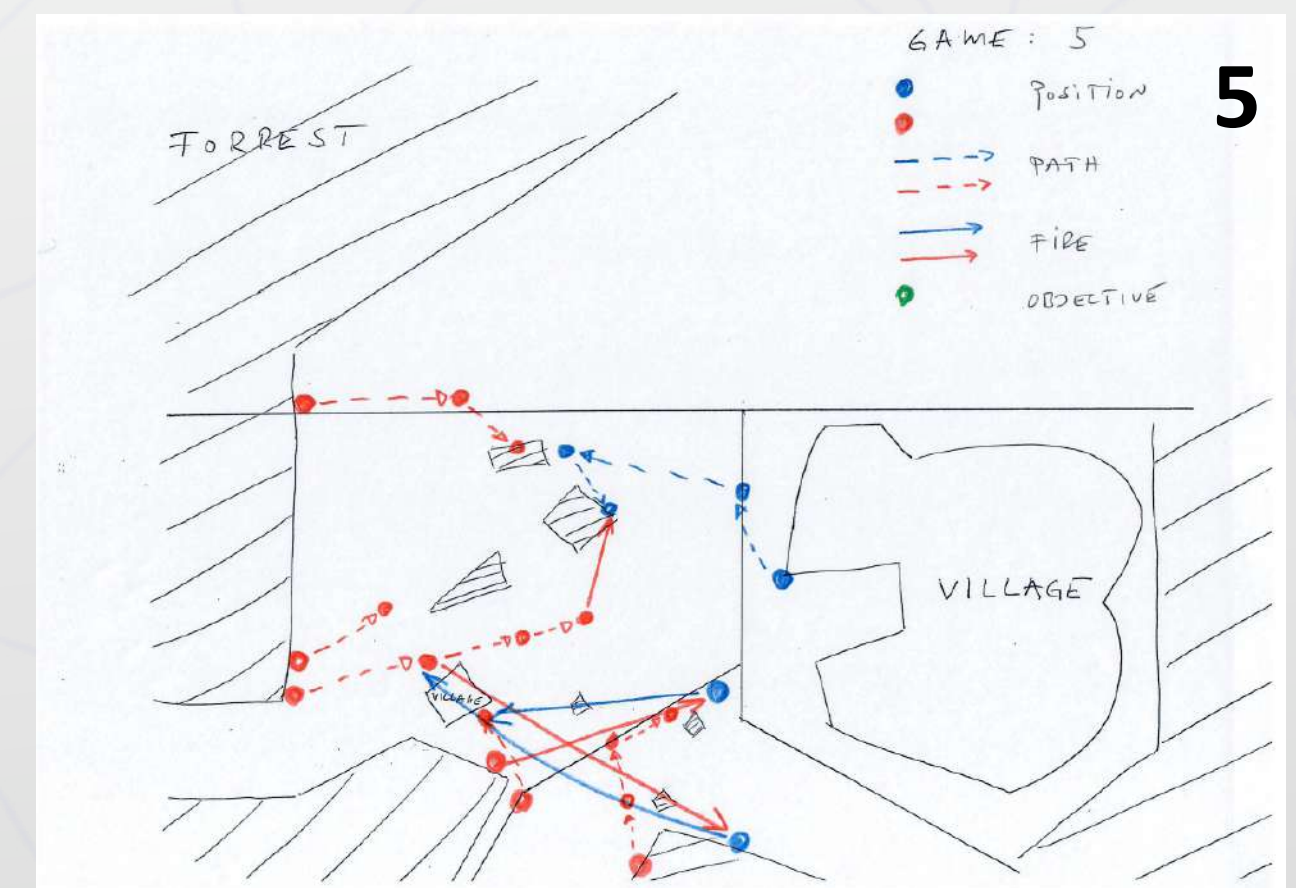
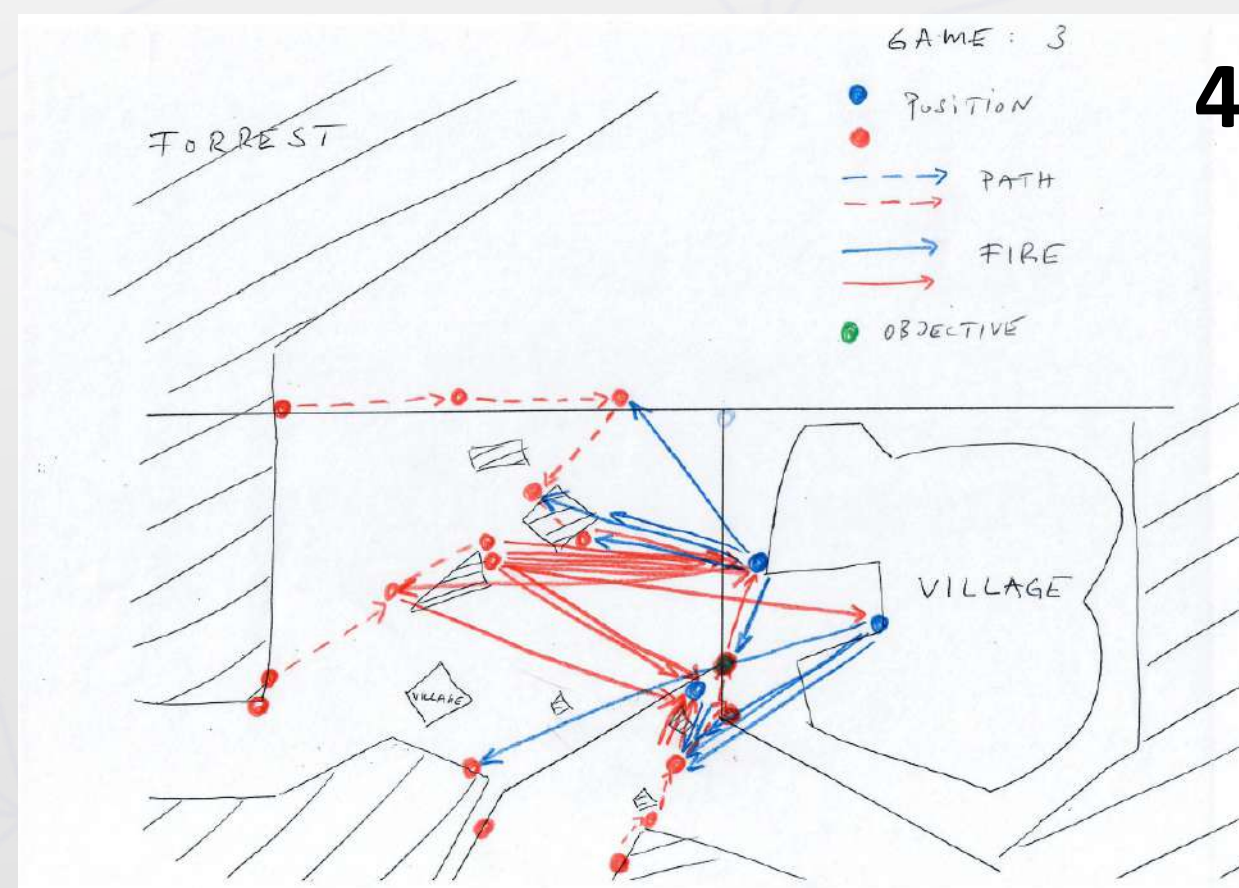
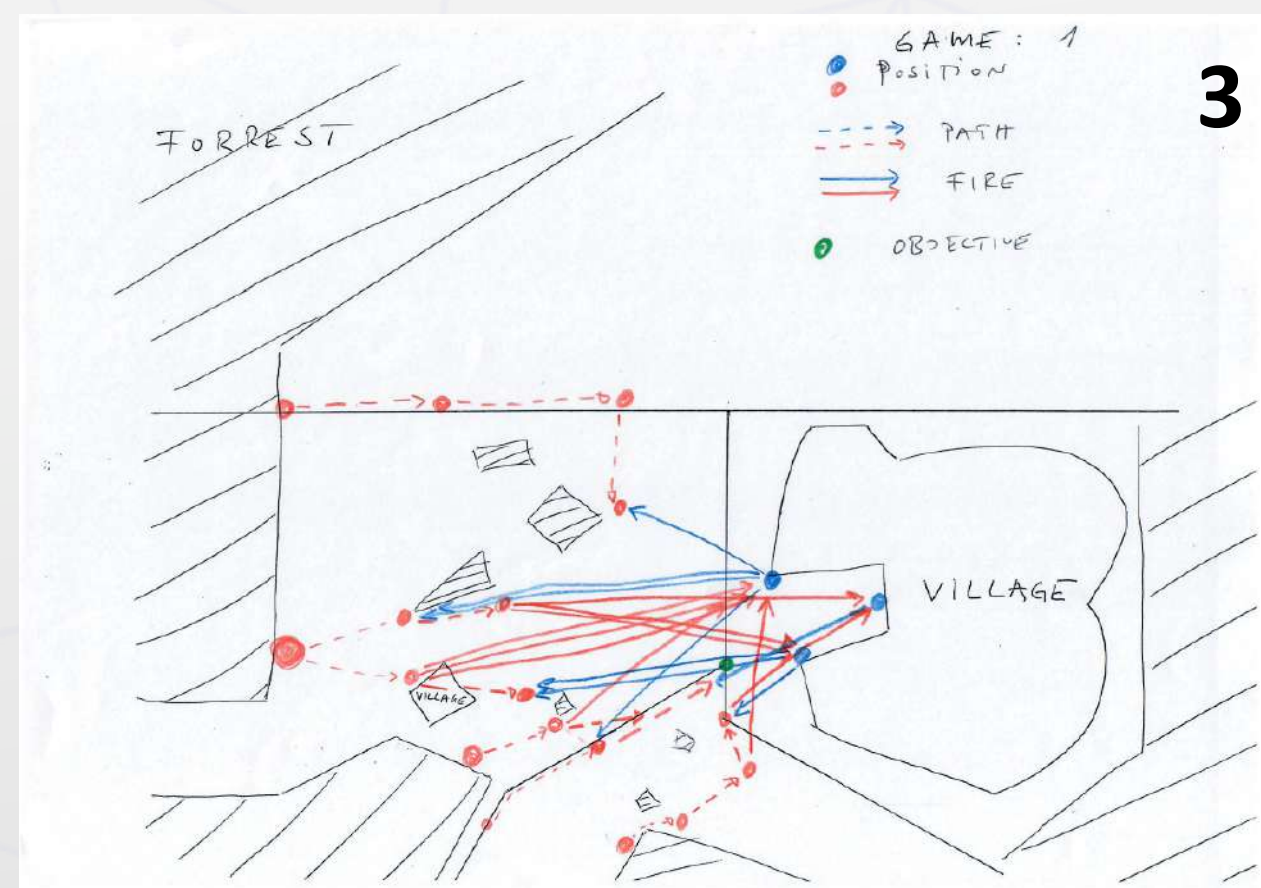
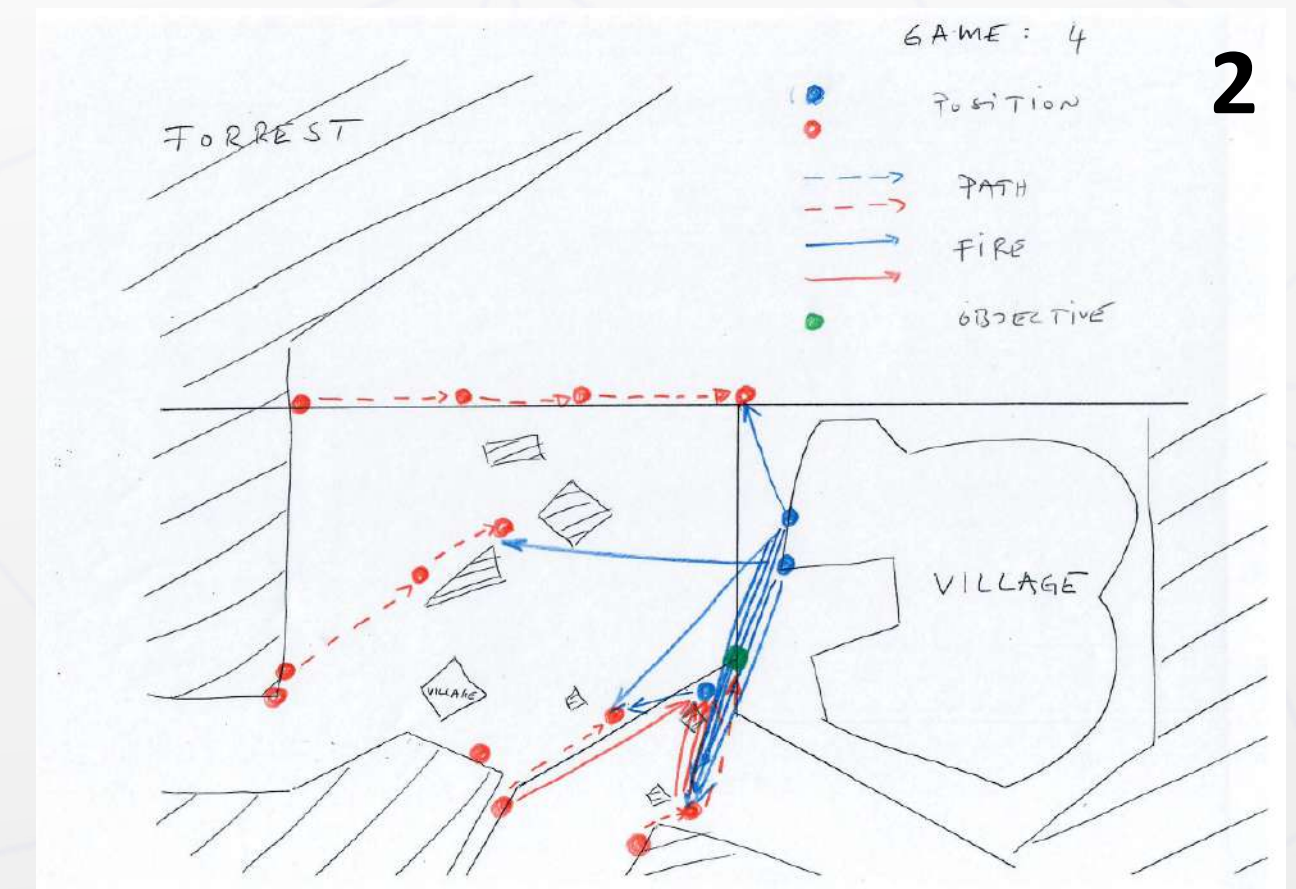
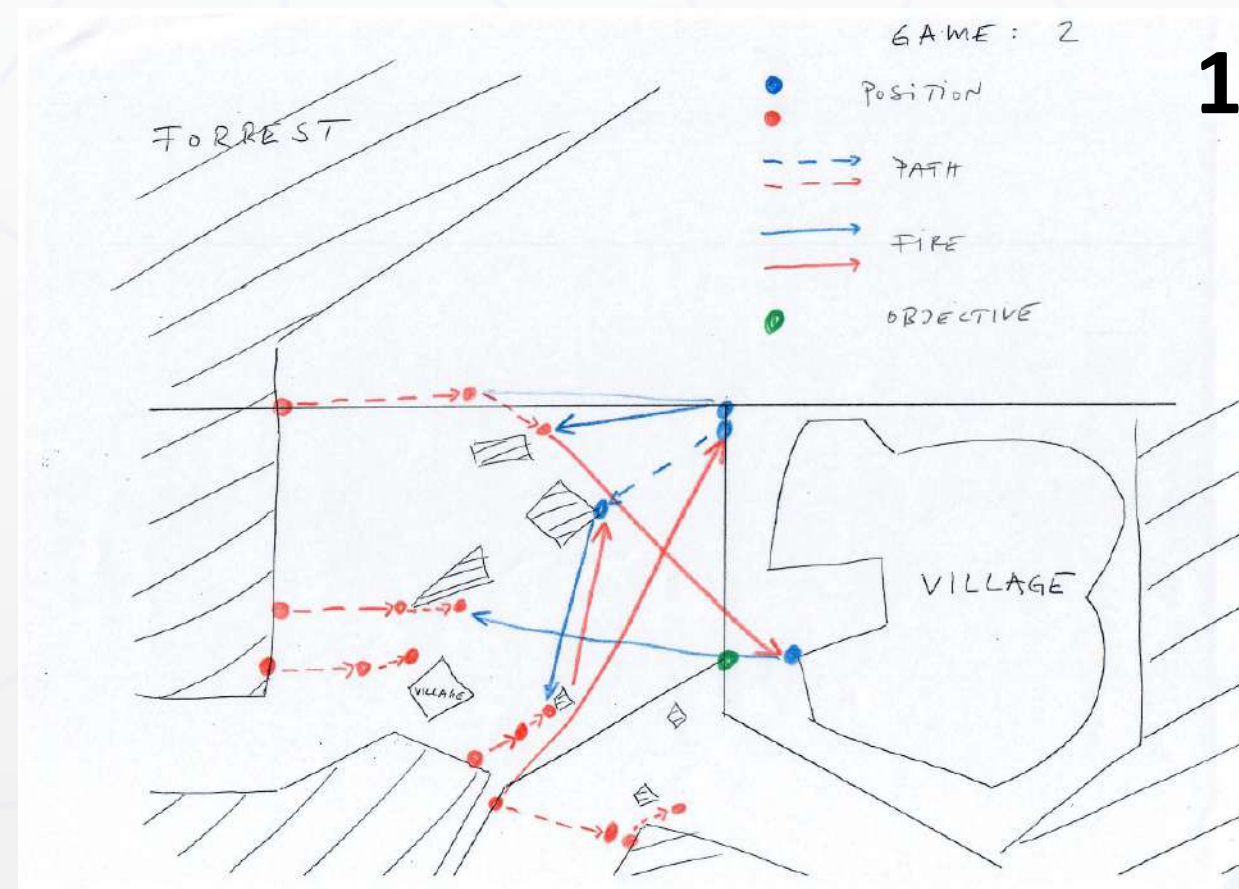
Social behavior

Reasoning





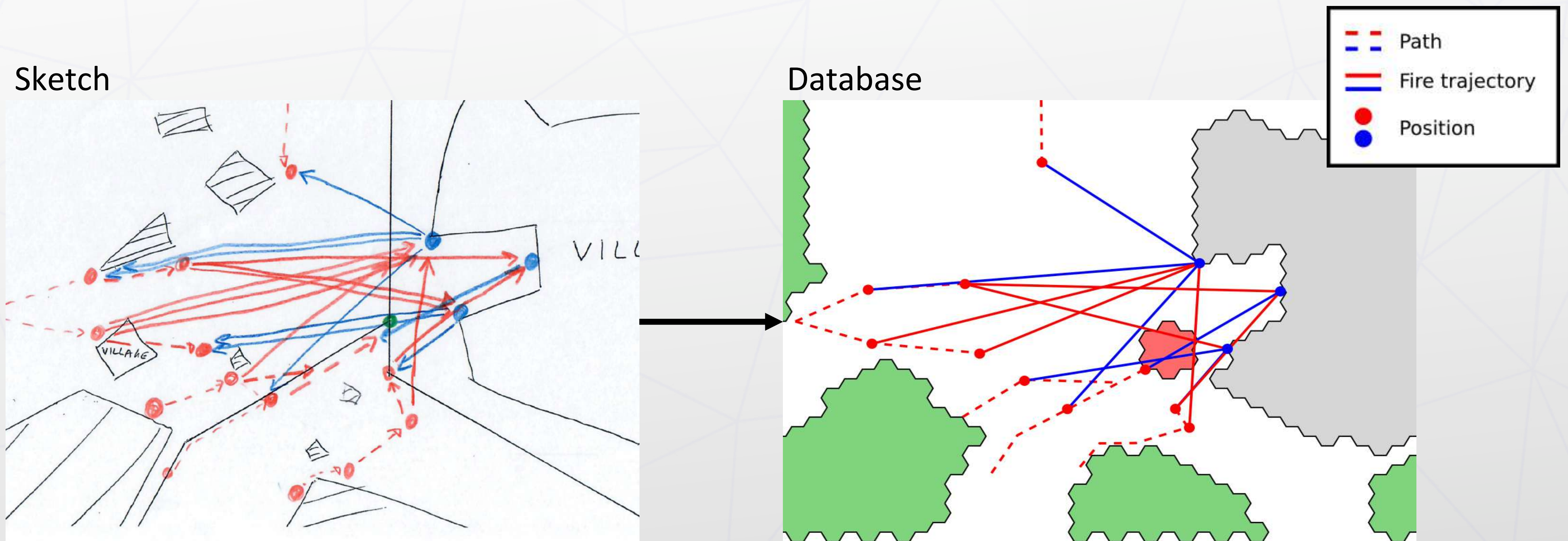
Step 1: Play the game





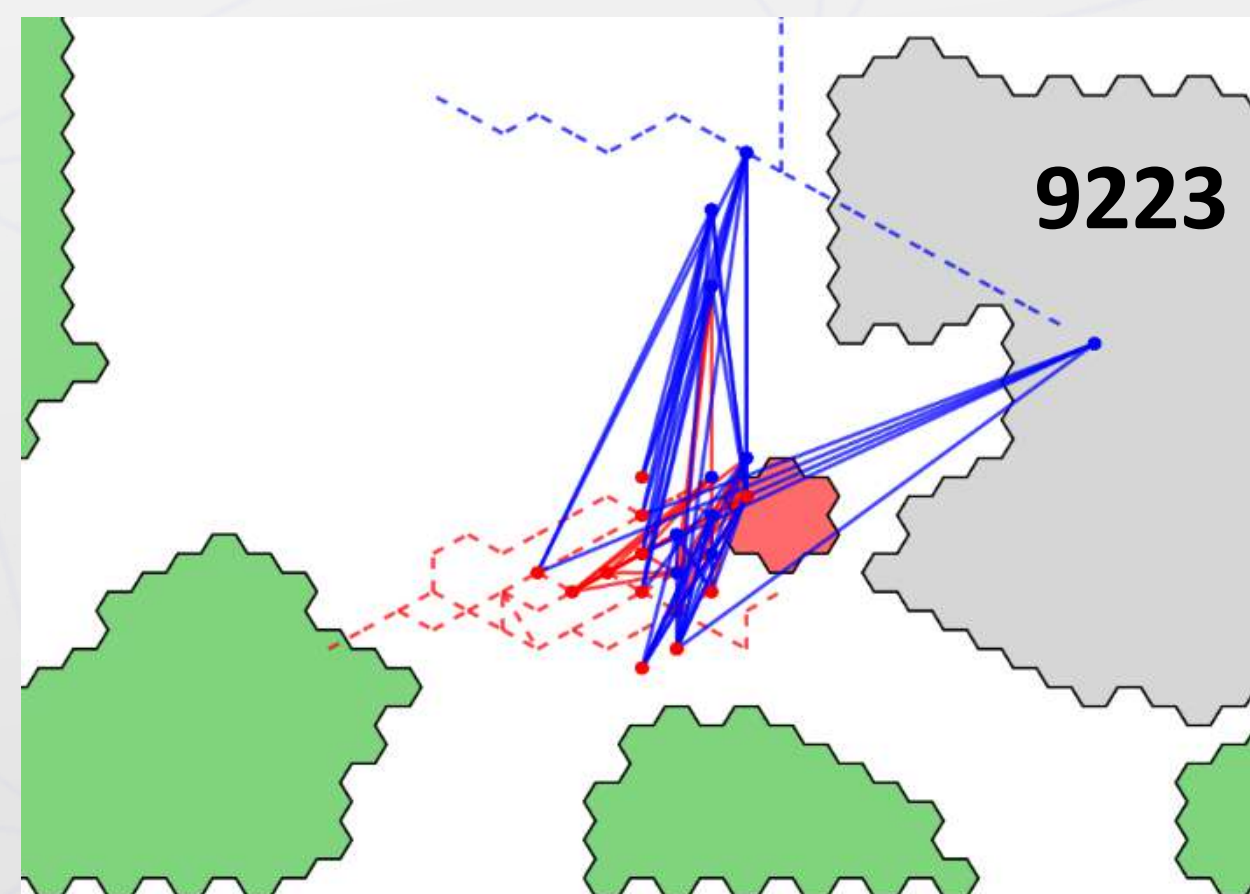
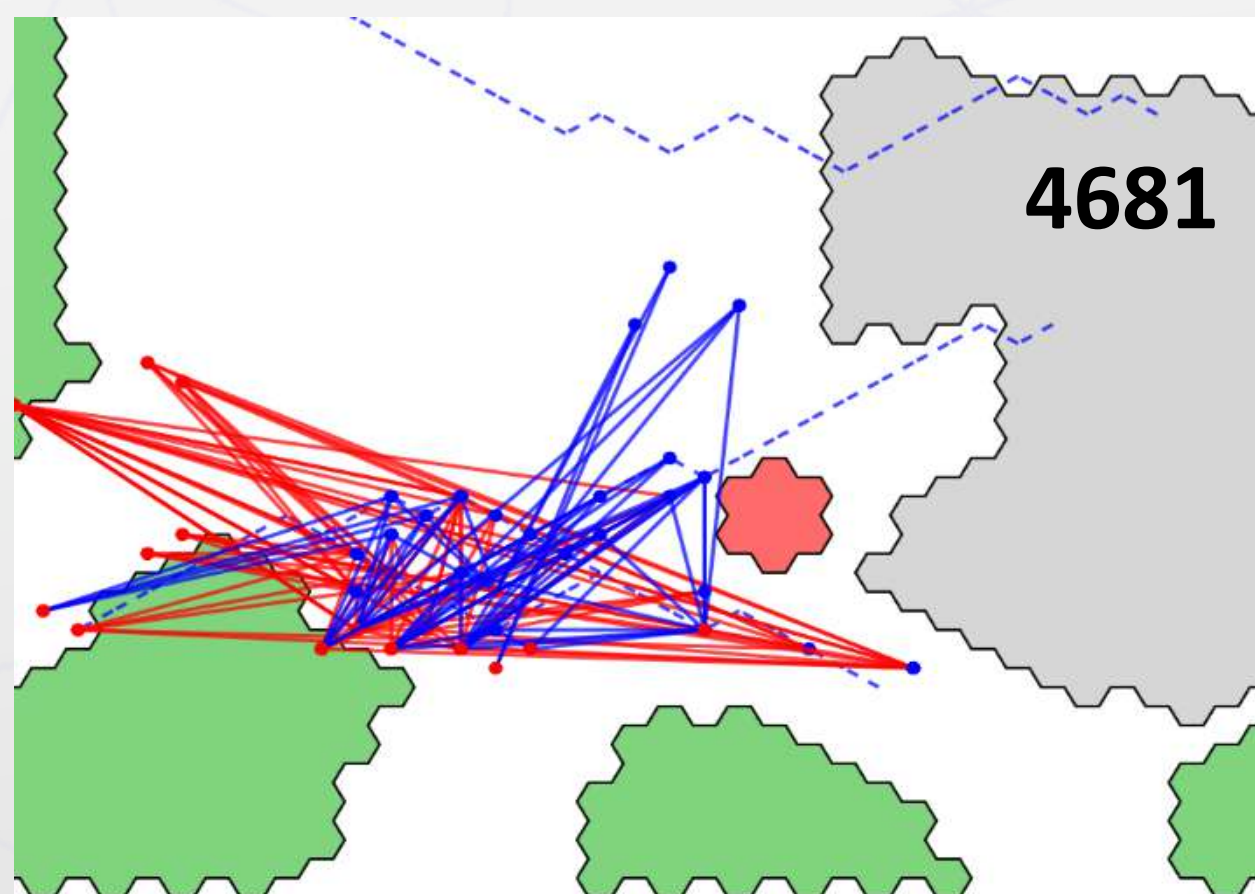
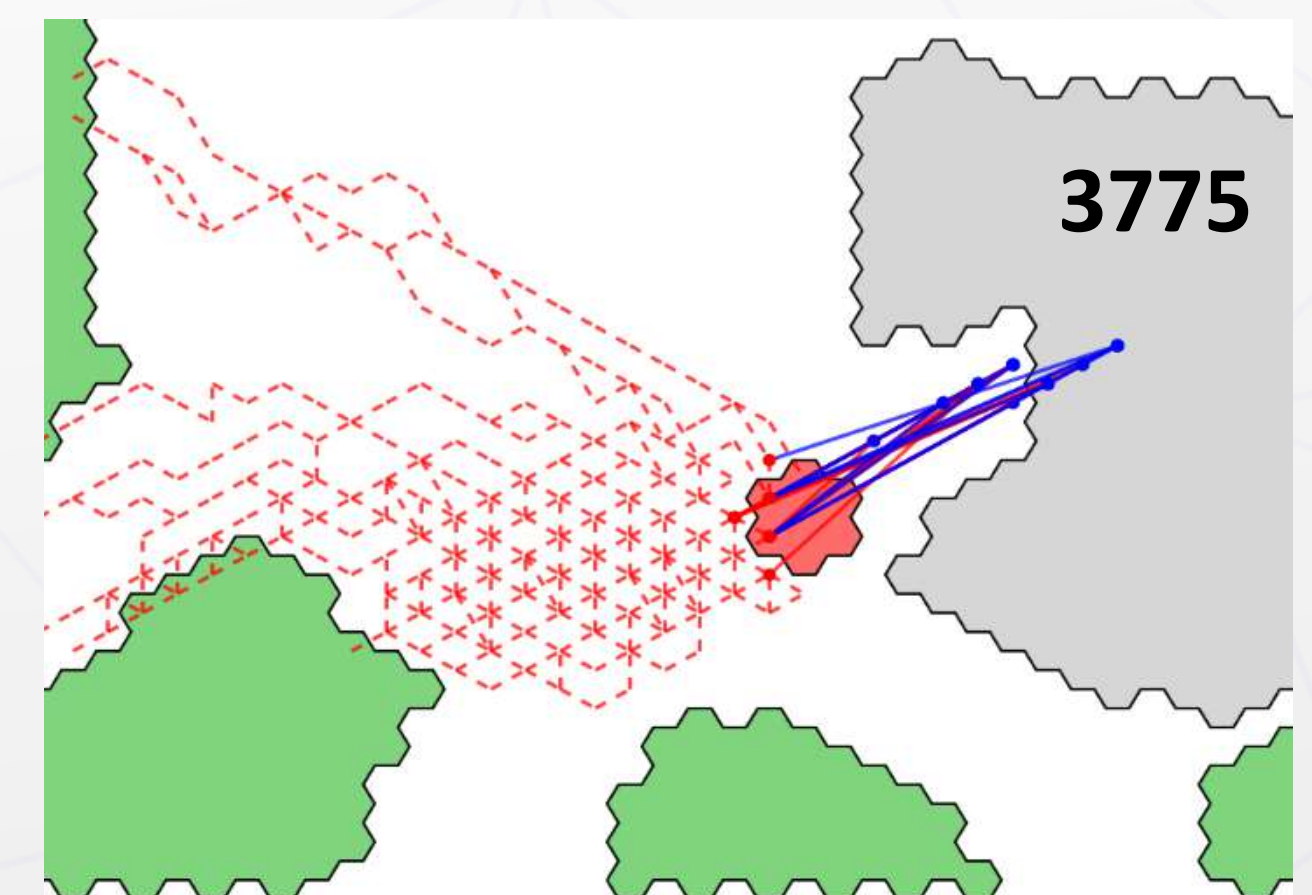
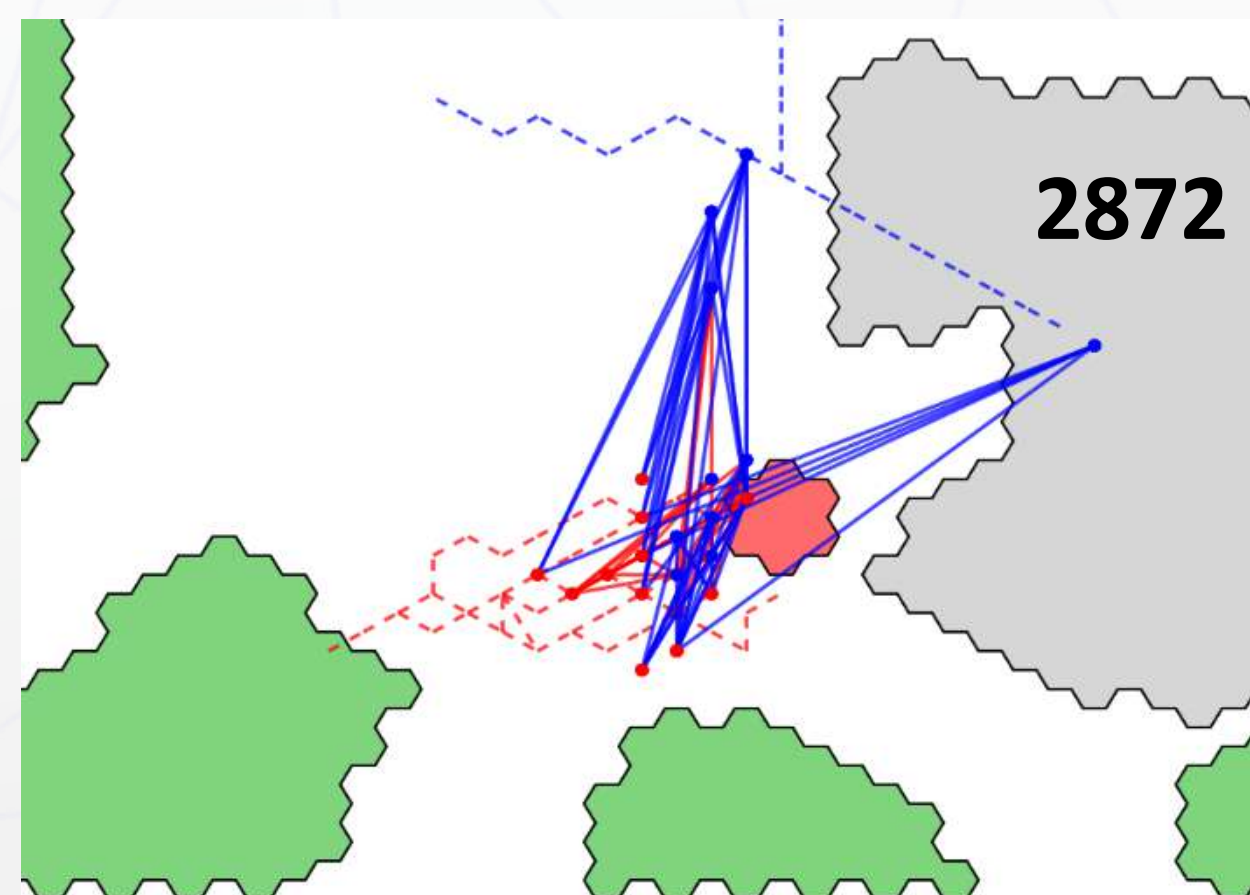
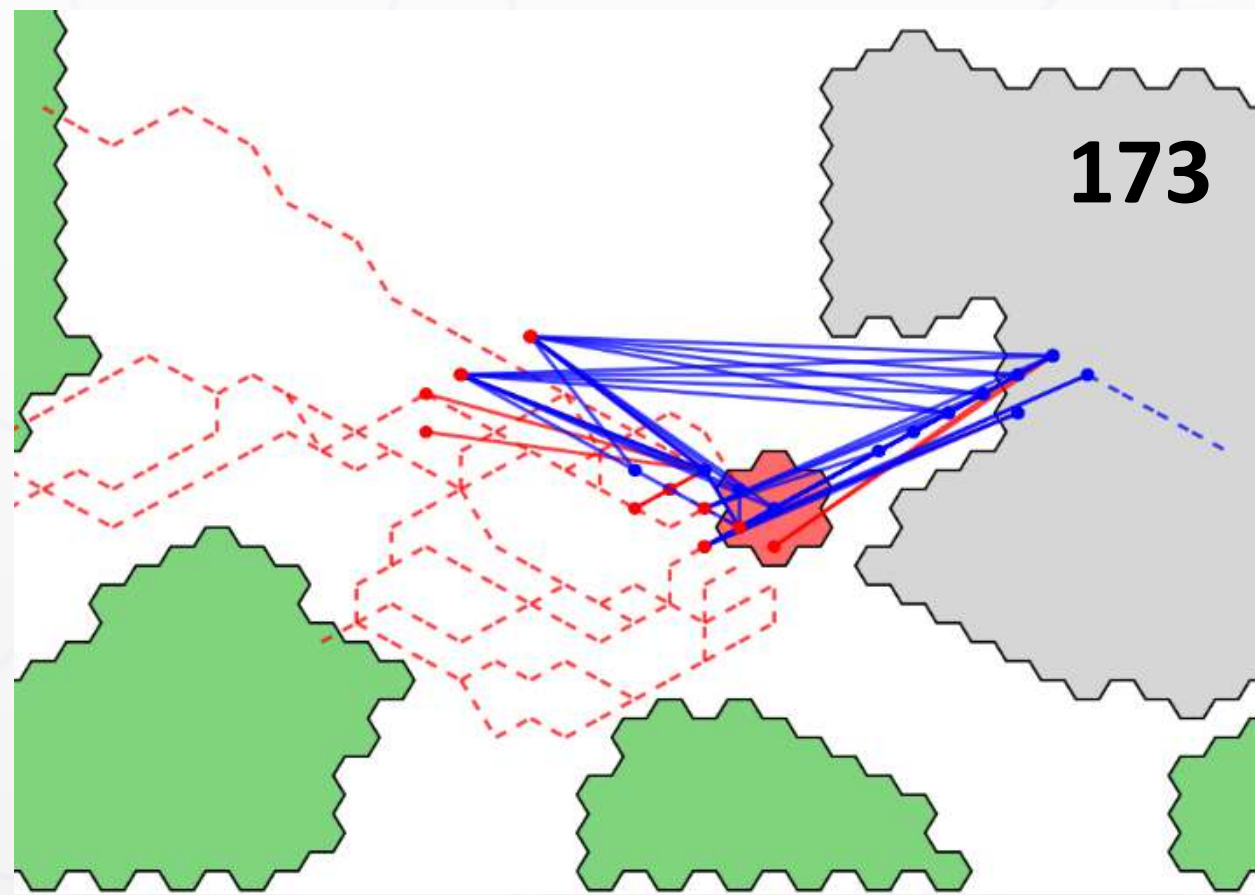
Step 2: Digitize results

Hand-drawn sketches were then traced and saved in the same database schema as the GameSim simulation.



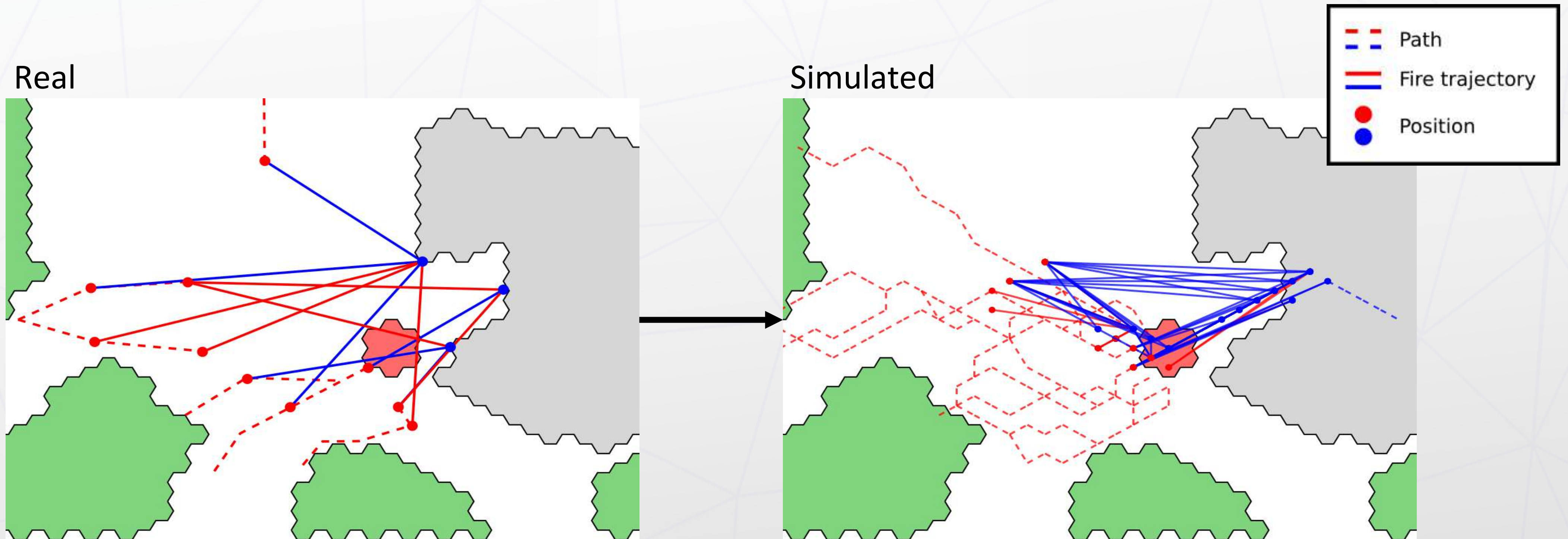


Step 3: Generate a simulated library





Step 4: Review game patterns





General results

1,000 simulations

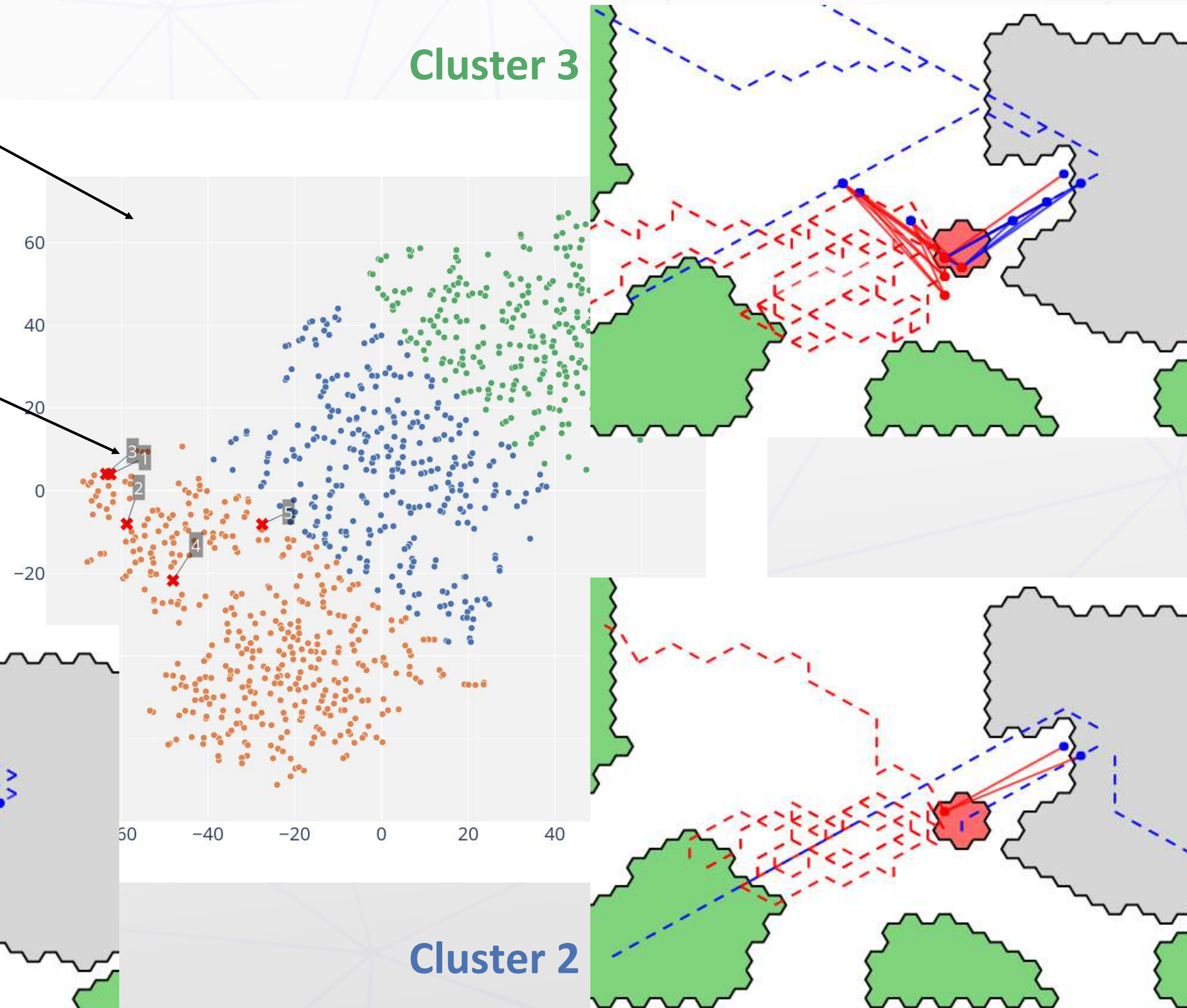
Real-life games
match "Cluster 1"

x Real-life games

Cluster 1

Cluster 3

Cluster 2



- Games played by humans may lead to 40% chance BLUE winning
- In the simulation BLUE wins about 1 out of 30 games
- Improving BLUE's win ratio by fine-tuning its AI made BLUE win 1 out of 10 times



**Multi-agent
Artificial Intelligence
Simulation**



**Artificial Intelligence
Powered
Automatic
Players**



**Interactive
Platform
Video Games**

PlayerDummy

| | | | | |
|---|--------------|---------|---------|----------------|
| | HP: 4/4 | MOVE: 1 | LOAD: 4 | WEAPONS: ∞ 5 |
| | rInf1 | | | 4 2 |
| M | In motion 2 | | | |

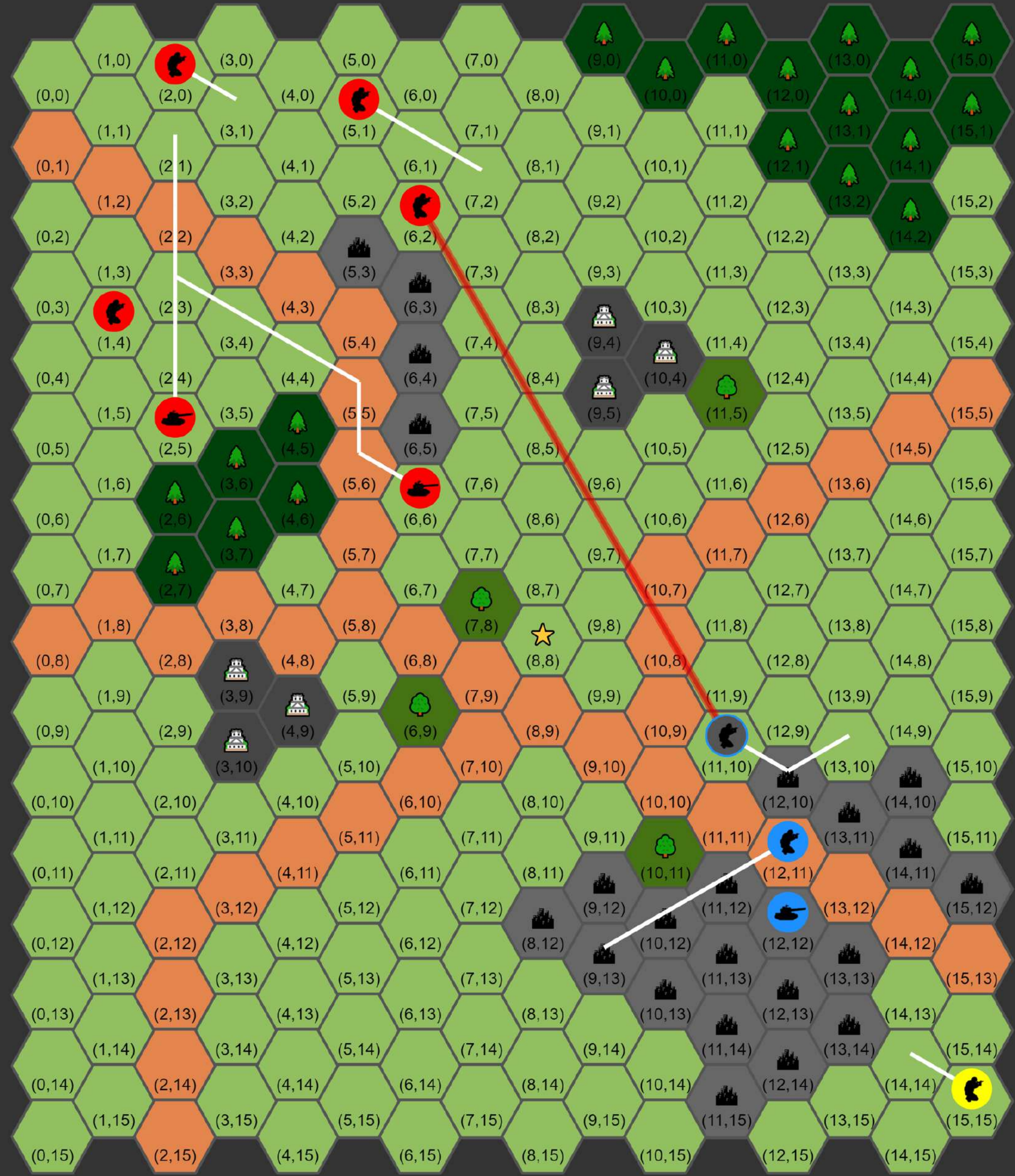
| | | | | |
|---|--------------|---------|---------|----------------|
| | HP: 4/4 | MOVE: 1 | LOAD: 4 | WEAPONS: ∞ 5 |
| | rInf2 | | | 4 2 |
| M | In motion 2 | | | |

| | | | | |
|---|--------------|---------|---------|-------------------|
| | HP: 4/4 | MOVE: 1 | LOAD: 4 | WEAPONS: ∞ 5 4 |
| | rInf3 | | | 4 2 |
| A | No effect 2 | | | |

| | | | | |
|---|--------------|---------|---------|----------------|
| | HP: 4/4 | MOVE: 1 | LOAD: 4 | WEAPONS: ∞ 5 |
| | rInf4 | | | 4 2 |
| P | No effect 2 | | | |

| | | | | |
|---|-----------|---------|---------|----------------|
| | HP: 1/1 | MOVE: 1 | LOAD: 7 | WEAPONS: ∞ 8 |
| | rTank1 | | | 2 |
| M | In motion | | | |

| | | | | |
|---|-----------|---------|---------|----------------|
| | HP: 1/1 | MOVE: 1 | LOAD: 7 | WEAPONS: ∞ 8 |
| | rTank2 | | | 2 |
| M | In motion | | | |



PlayerDummy

| | | | | |
|---|--------------|---------|---------|----------------|
| | HP: 4/4 | MOVE: 1 | LOAD: 4 | WEAPONS: ∞ 5 |
| | bInf1 | | | 4 2 |
| M | In motion 2 | | | |

| | | | | |
|--|---------------|---------|---------|----------------|
| | HP: 0/4 | MOVE: 1 | LOAD: 4 | WEAPONS: ∞ 5 |
| | bInf2 | | | 4 2 |
| | Under fire 2 | | | |

| | | | | |
|---|--------------|---------|---------|----------------|
| | HP: 4/4 | MOVE: 1 | LOAD: 4 | WEAPONS: ∞ 5 |
| | bInf3 | | | 4 2 |
| M | In motion 2 | | | |

| | | | | |
|---|---------|---------|---------|----------------|
| | HP: 1/1 | MOVE: 1 | LOAD: 7 | WEAPONS: ∞ 8 |
| | bTank1 | | | 2 |
| P | Hidden | | | |



**Multi-agent
Artificial Intelligence
Simulation**



**Artificial Intelligence
Powered
Automatic
Players**



**Interactive
Platform
Video Games**



THE SOLDIER'S COMPANION
NEW TECHNO WAR

Start

Options

Credits

OPTIONS

< English >

Music

Sound FX

Terms & Conditions


Privacy Policy

Privacy Settings

Exit

Mission Select

Mission 1




Select

Exit

Mission 01

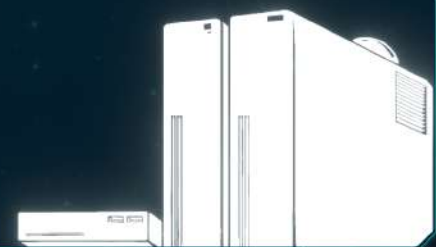
An enemy group succeeded in passing the first lines of defense. Armored transport vehicles try to bring troops in order to take control of research laboratories located in the center of the city.

Helped by your assistant named "Companion"—an artificial intelligence—it is for you to make the right decisions to prevent the enemy from advancing.



Exit

Objectif 1



> It would be wise to remain discreet.

> Maybe we could even take the opportunity to get more information?

Go!

Exit

Objectif 1

OBJECTIVE 1 OBJECTIVE 2 OBJECTIVE 3 OBJECTIVE 4

Which option among the following do you think is the most effective?

Time 10:14

Send a swarm of reconnaissance drones.

Send a reconnaissance unit.

Fortify defenses.

Exit

Objectif 2

OBJECTIVE 1 OBJECTIVE 2 OBJECTIVE 3 OBJECTIVE 4

32% of players made the same decision.

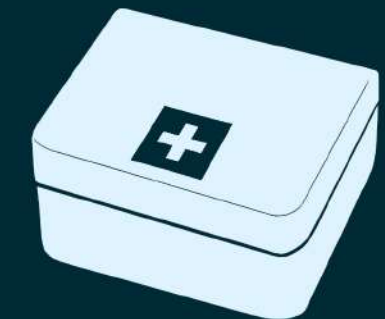
When the enemy advanced towards the laboratories, what was your reasoning?

The stake was to defeat the adversary.

The goal was to slow down the opponent.

The researchers evacuation was the priority.

Well done!



But only a full success will allow you to open the box !

Ok!

Objectif 2

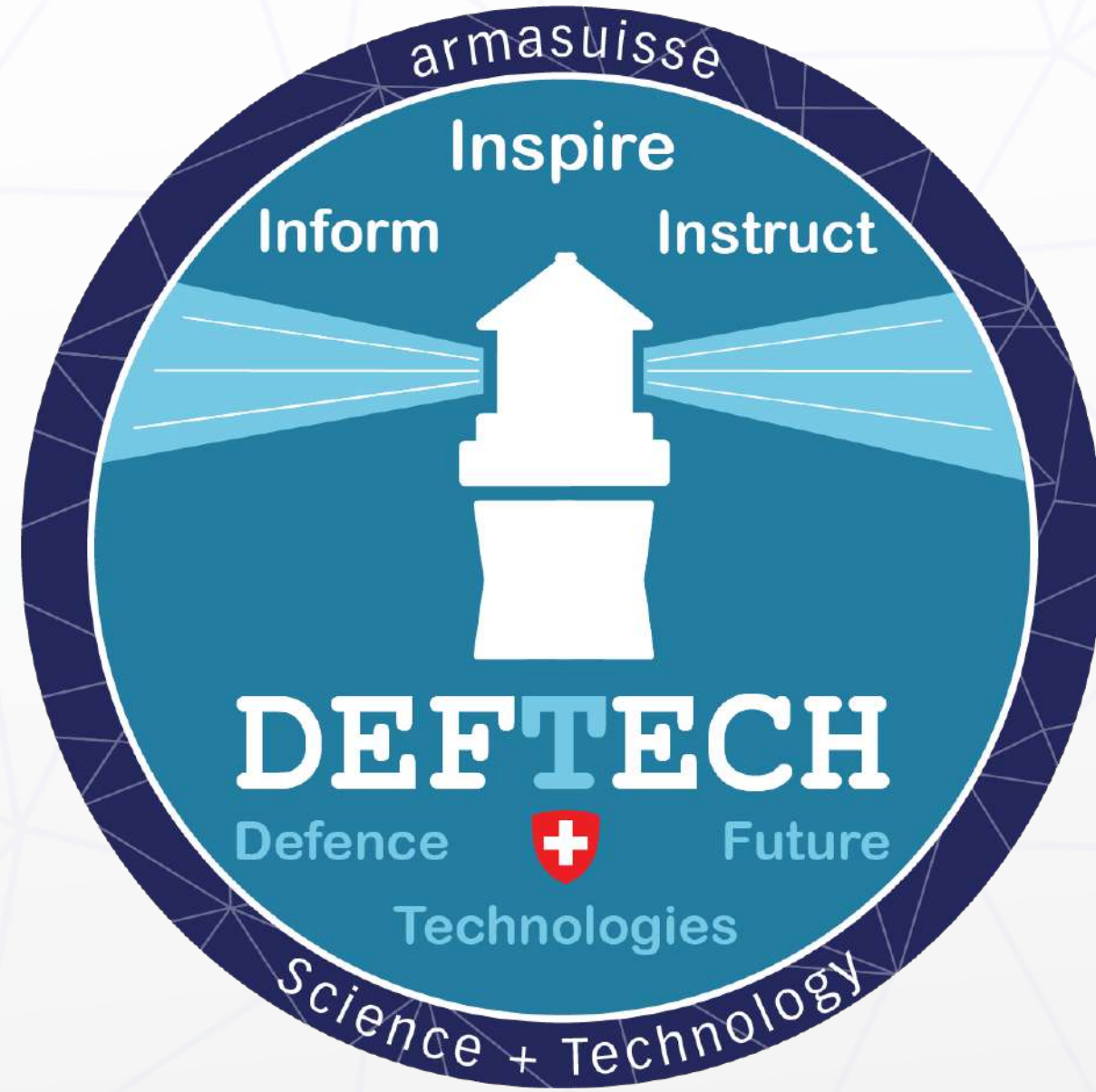
1st

Gold path!

You made the best choices!

Mission analysis

SHALL WE PLAY A GAME



<https://deftech.ch>

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