SQUAD

COORDINATION IN

DAYS GONE

- Tobias Karlsson
- Senior Staff AI Programmer
- Sony Bend Studio

WHAT IS DAYS GONE?

This is Fred.

Fred likes hugs,
ice cream,
and human flesh.

Tobias Karlsson | Senior Staff AI Programmer

Fred
Looking
for a hug

Groups of AIs will be fighting enemies.

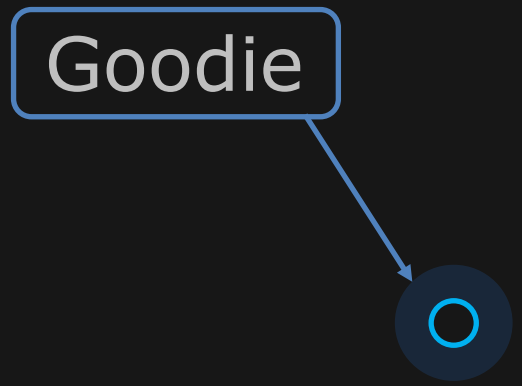
Coordination is hard.

Coordination is hard.

Coordination in an open world is harder.

We need to solve:

- Group goal/behavior
- Roles and role assignment
- Positioning
- Timing


Goodie

Goodie
Baddie

BEGINNINGS

Combat was hard to read without coordination.

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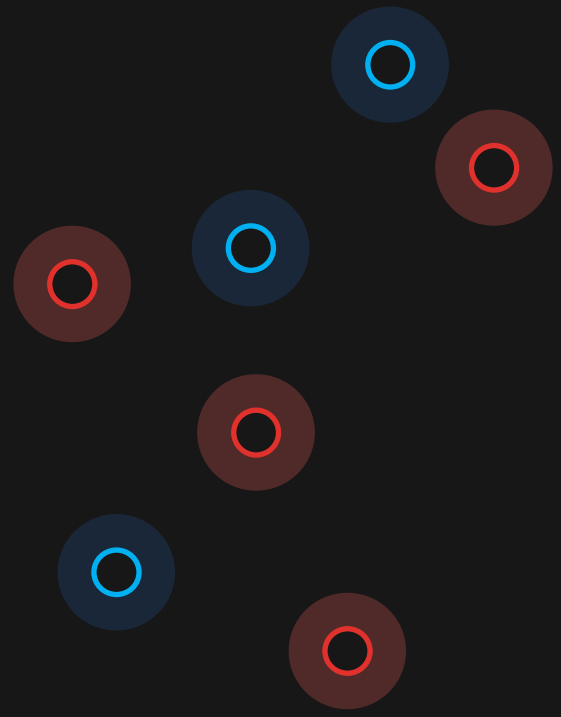

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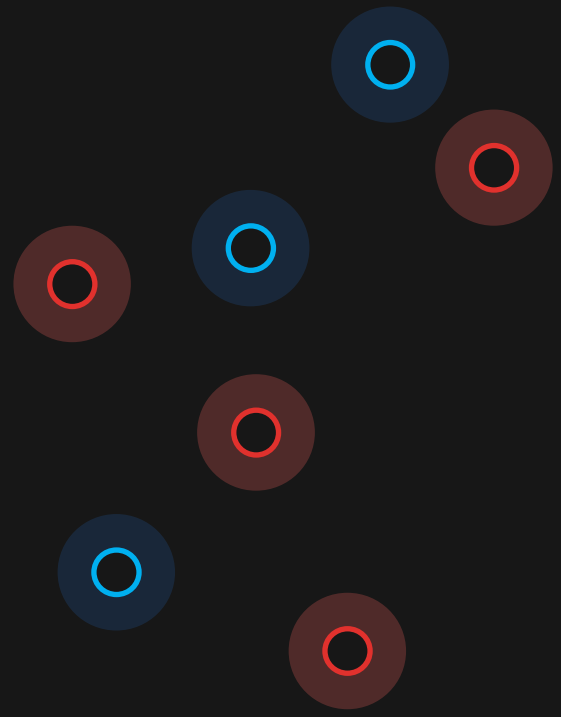

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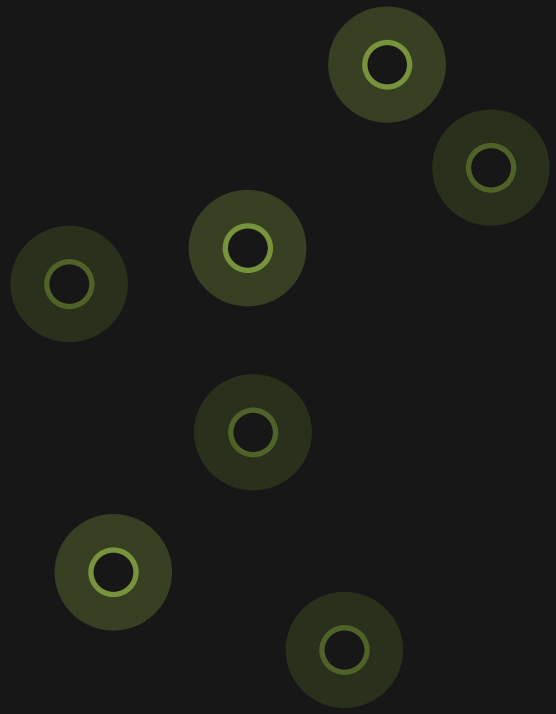

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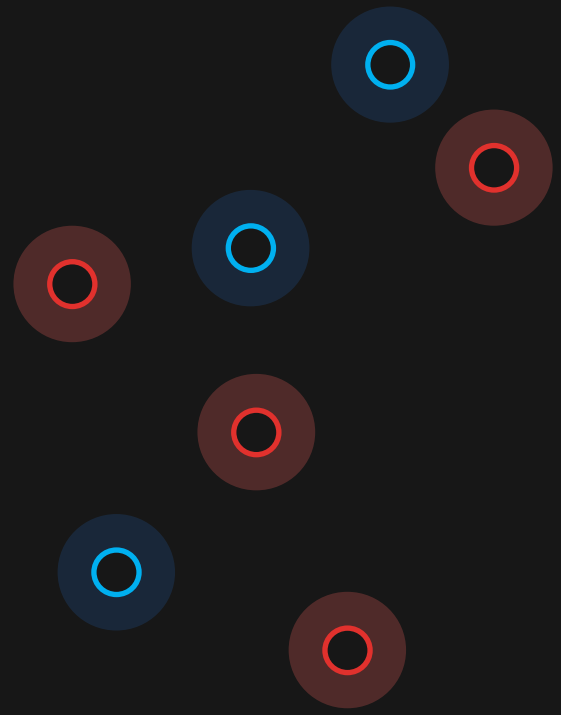

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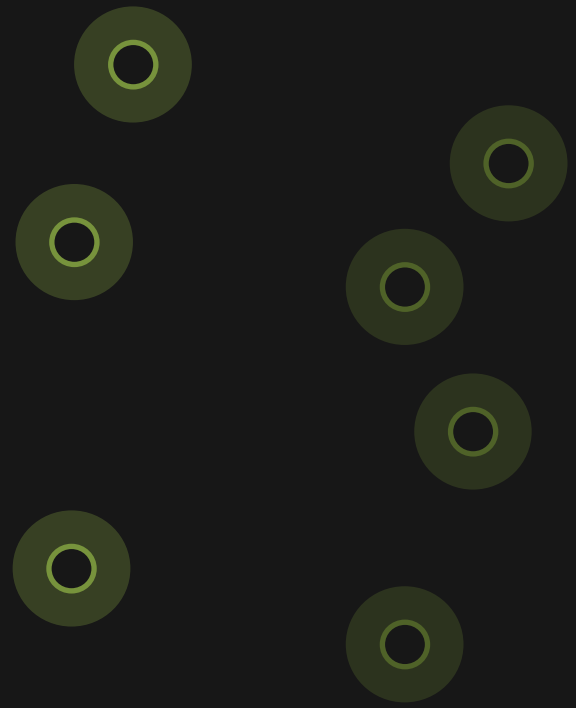

SQUADS

AIs are organized in *squads*.

- All AIs belong to a squad.

Squads are automatically merged.

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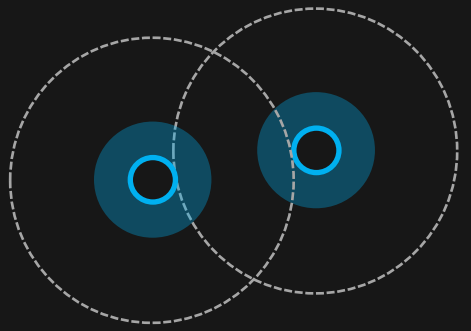

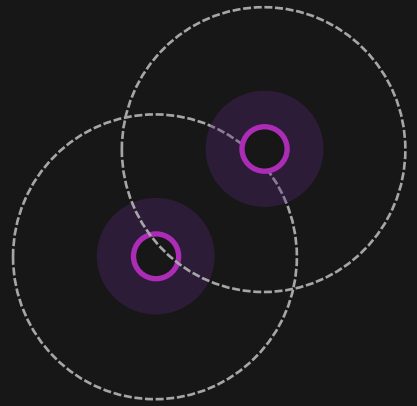

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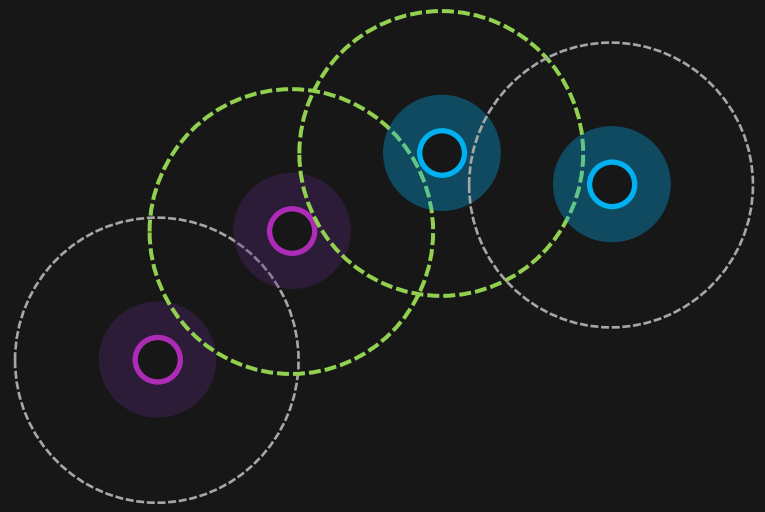

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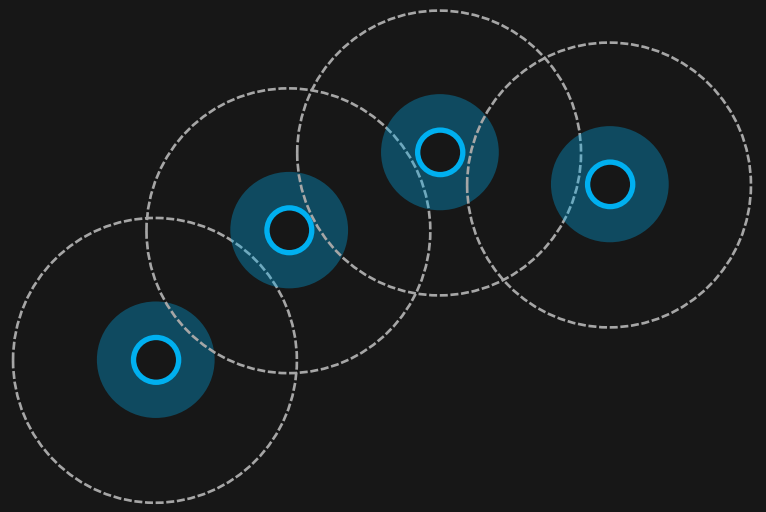
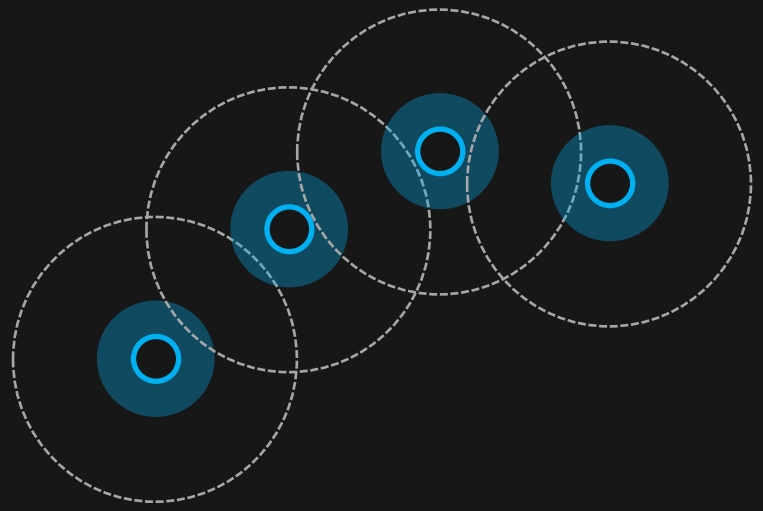


Squads are automatically split.



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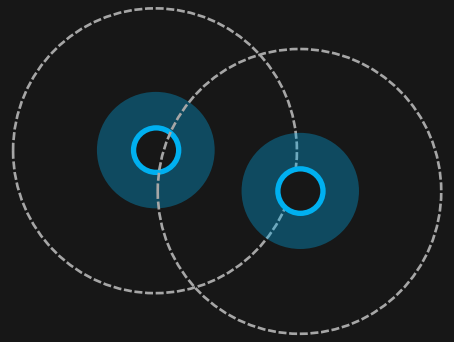
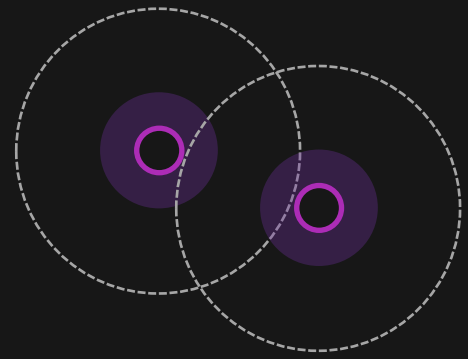




Squads select behavior.

Squads assign roles.

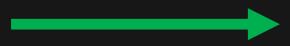
Individual AIs perform those roles.

Roles are behaviors.

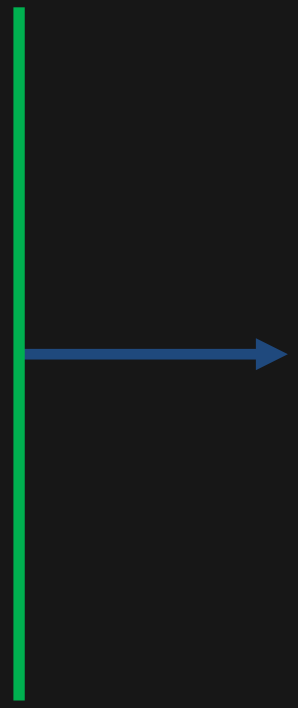
THE FRONTLINE

The *frontline* describes the spatial relationship between a squad and its enemies.

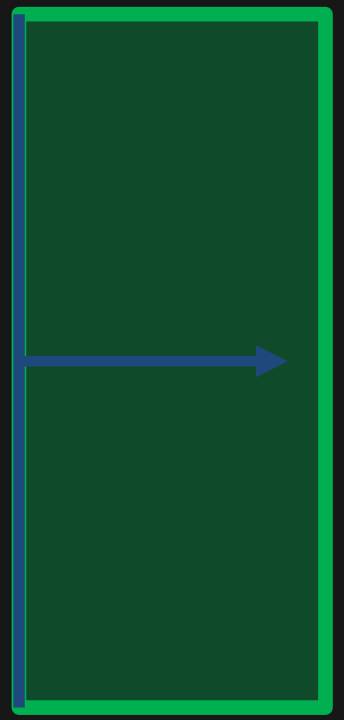
A direction of combat.



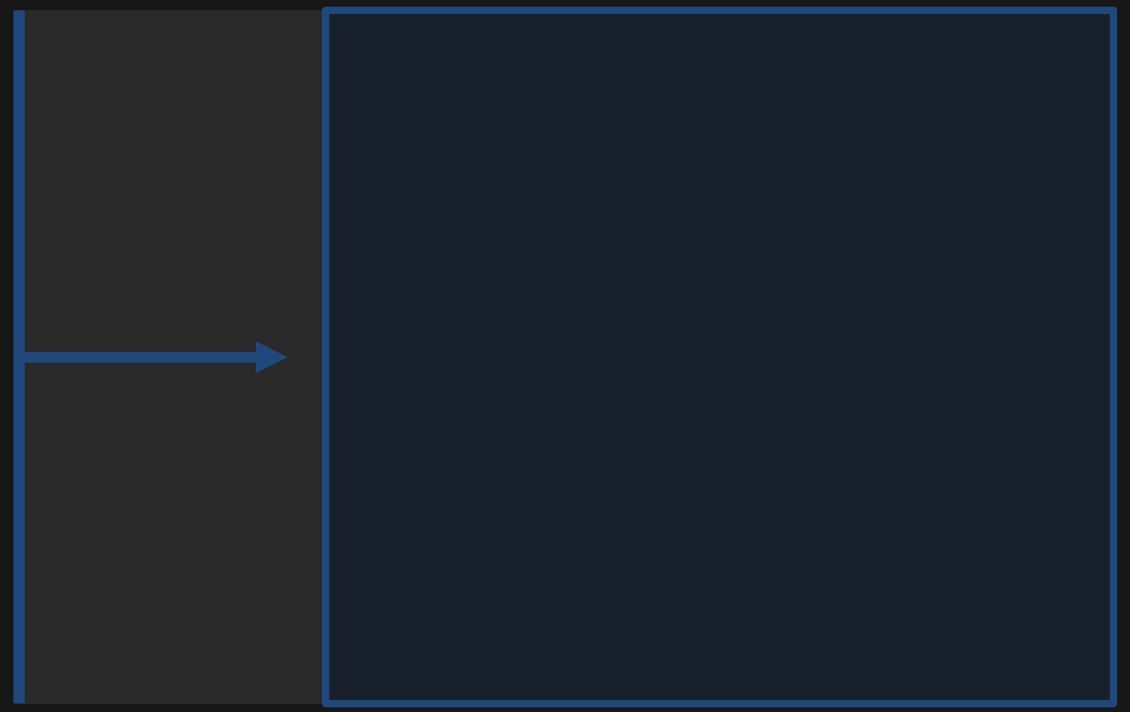
A width of the front.



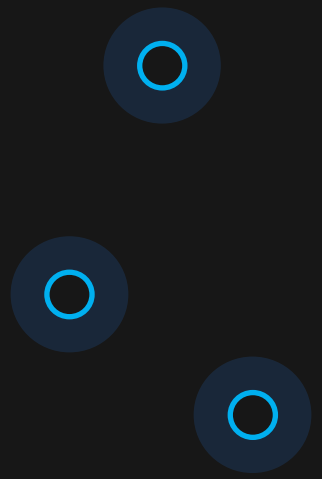
A neutral area.



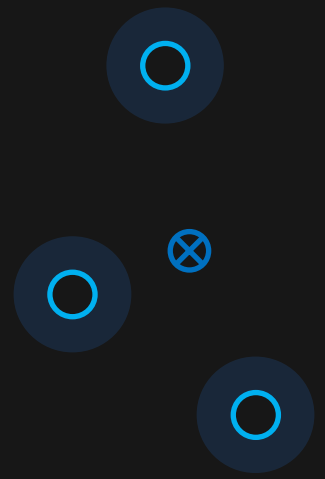
The area controlled by the enemy.



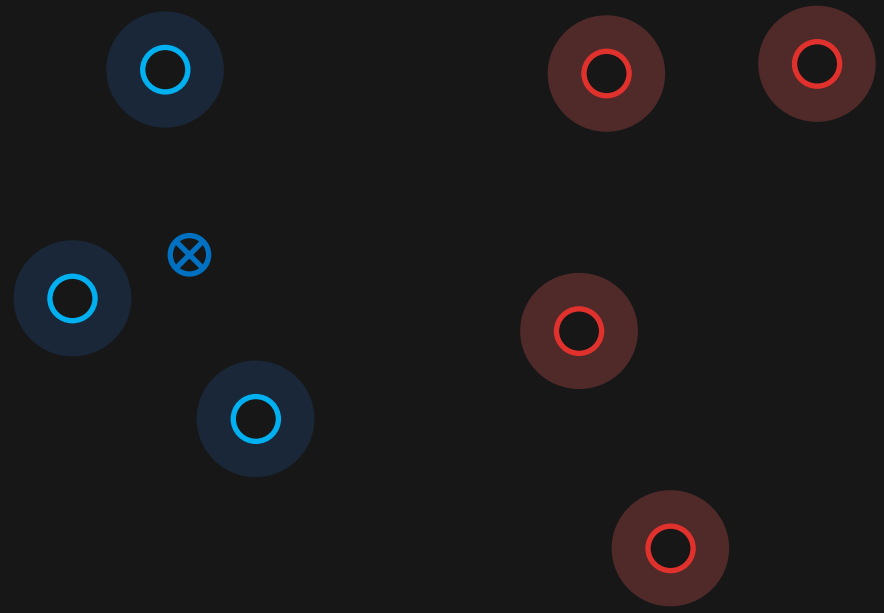
Calculating the direction of combat.



The center of gravity of squad.



The center of gravity of the enemies.



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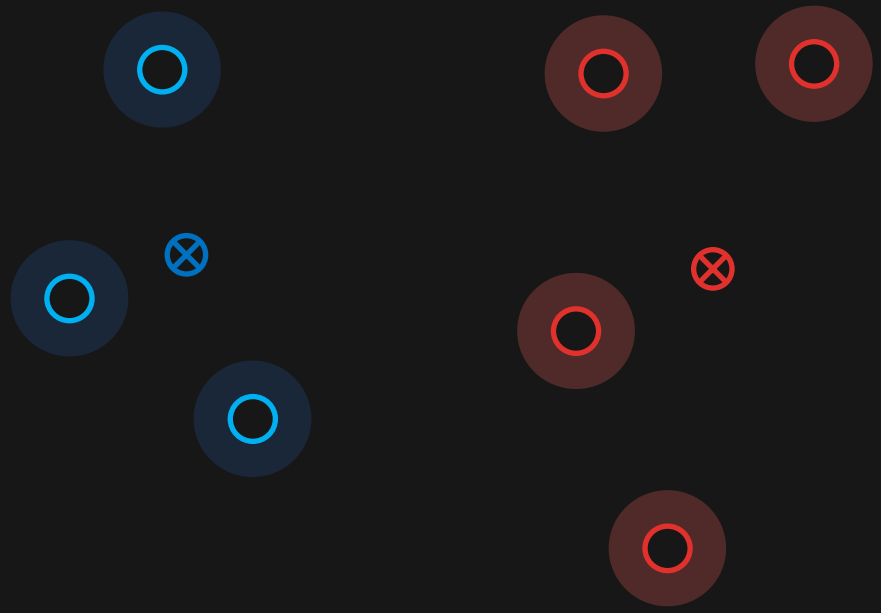

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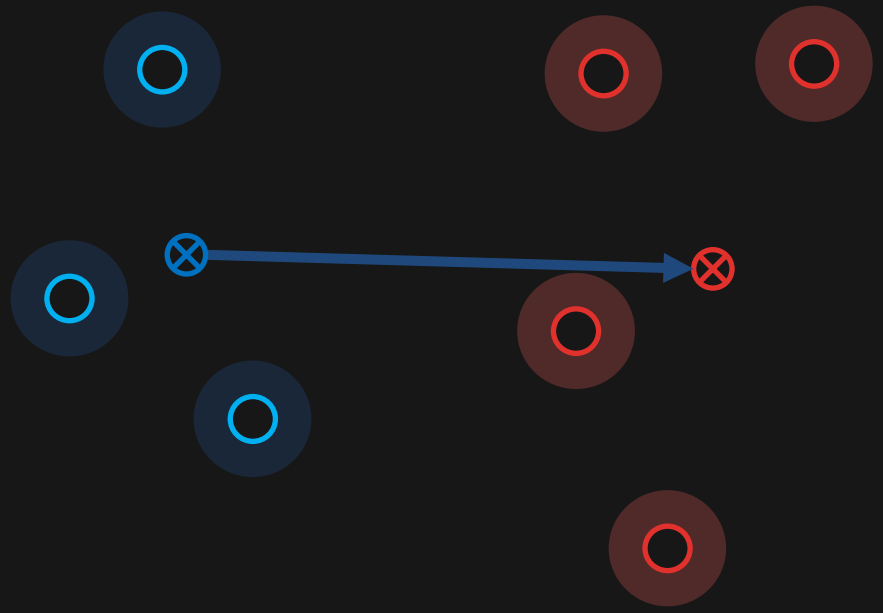
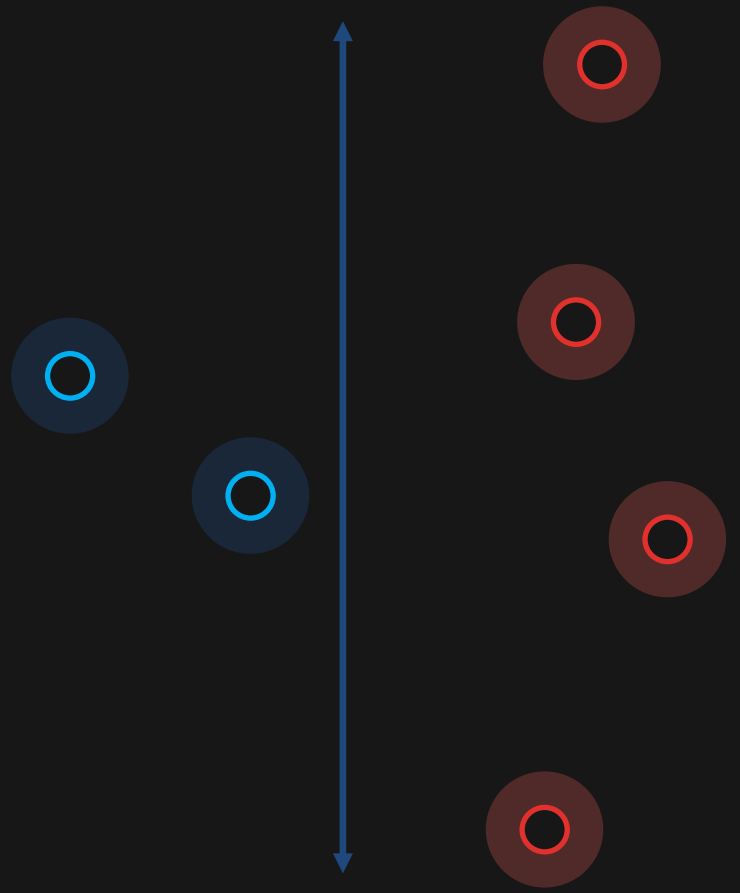
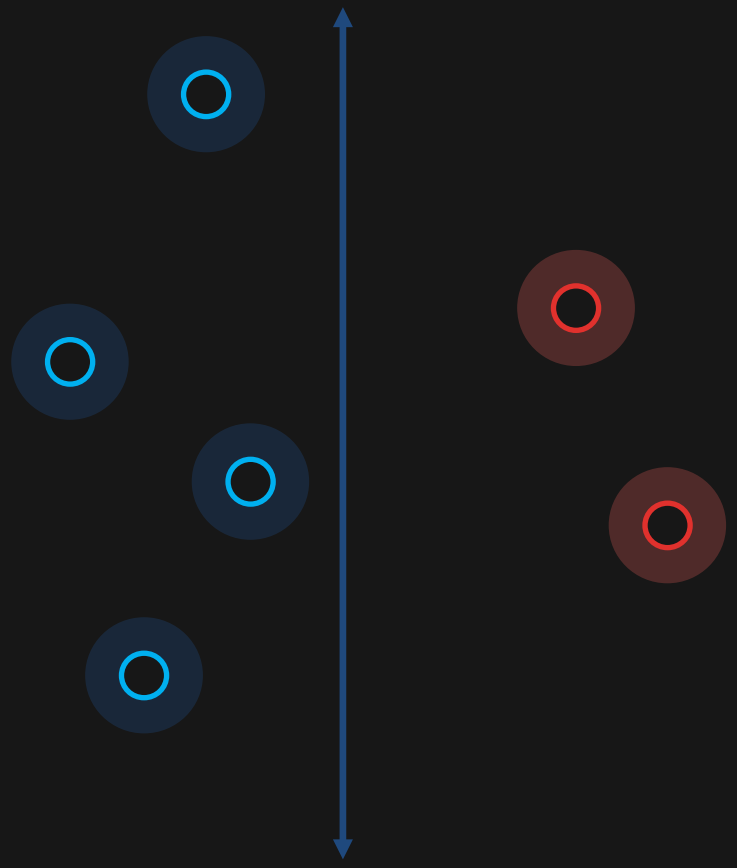


The width of the front the enemy is presenting.



Or a minimum width.



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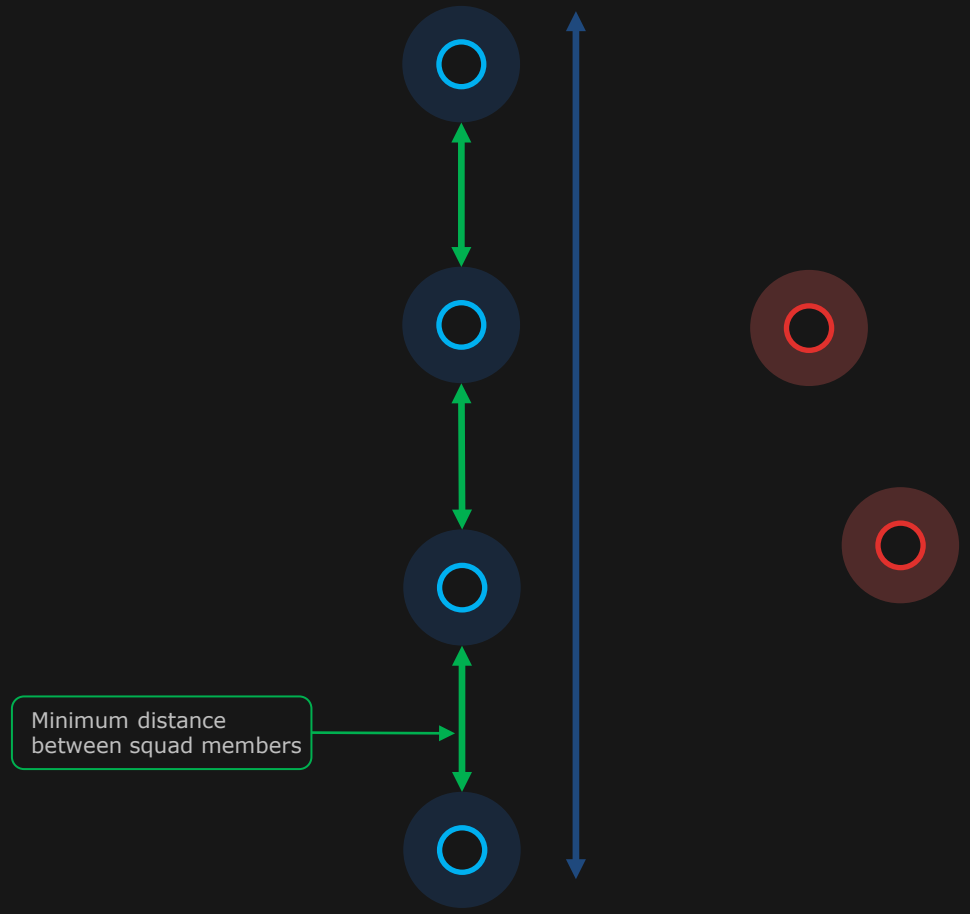
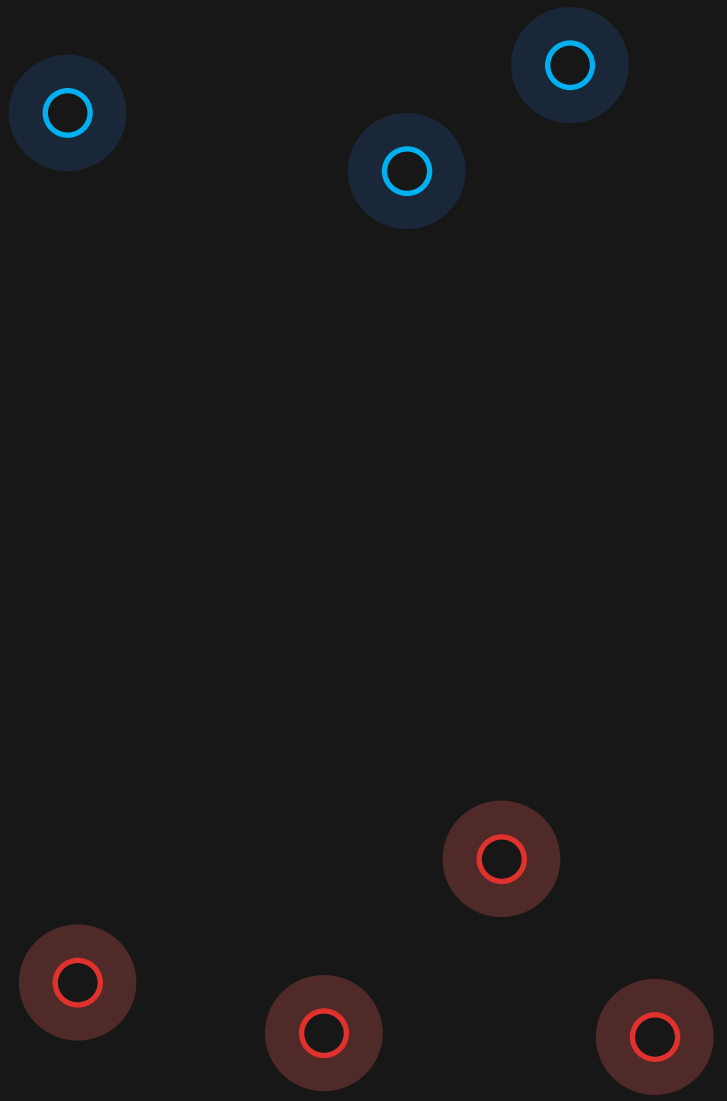
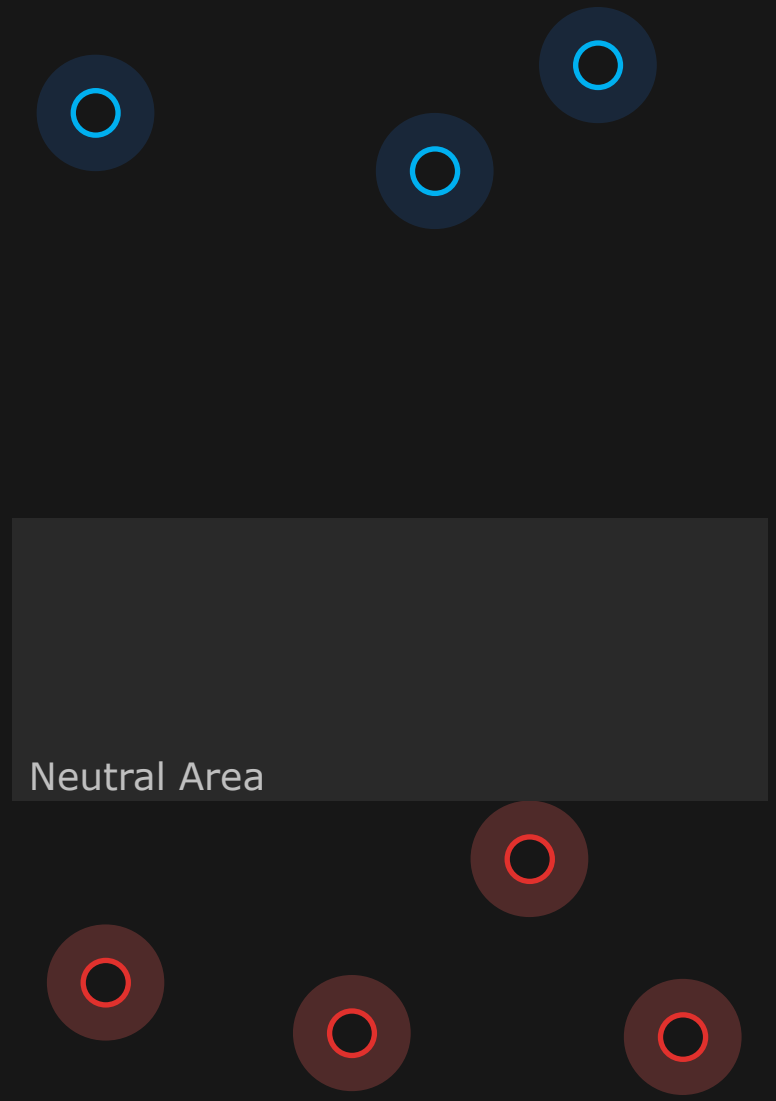


The Frontline can be in “close” or a “far” mode.



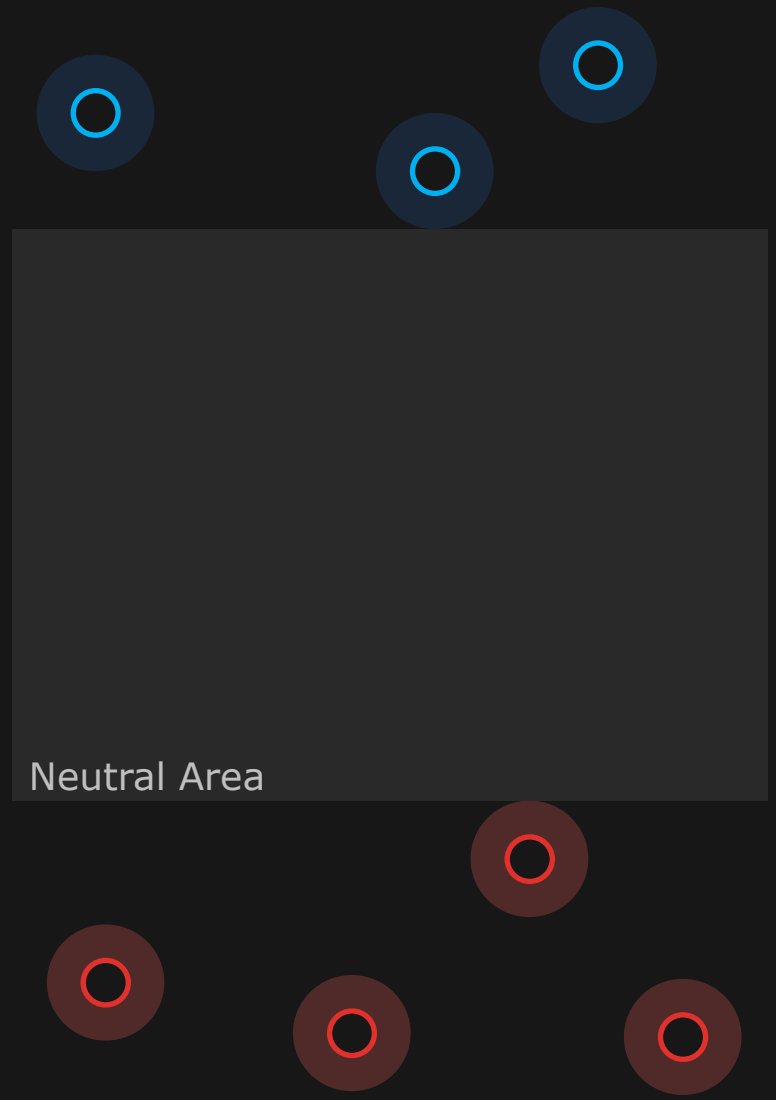
Close mode uses a fixed depth for the neutral area.

- The squad can move with the enemy.

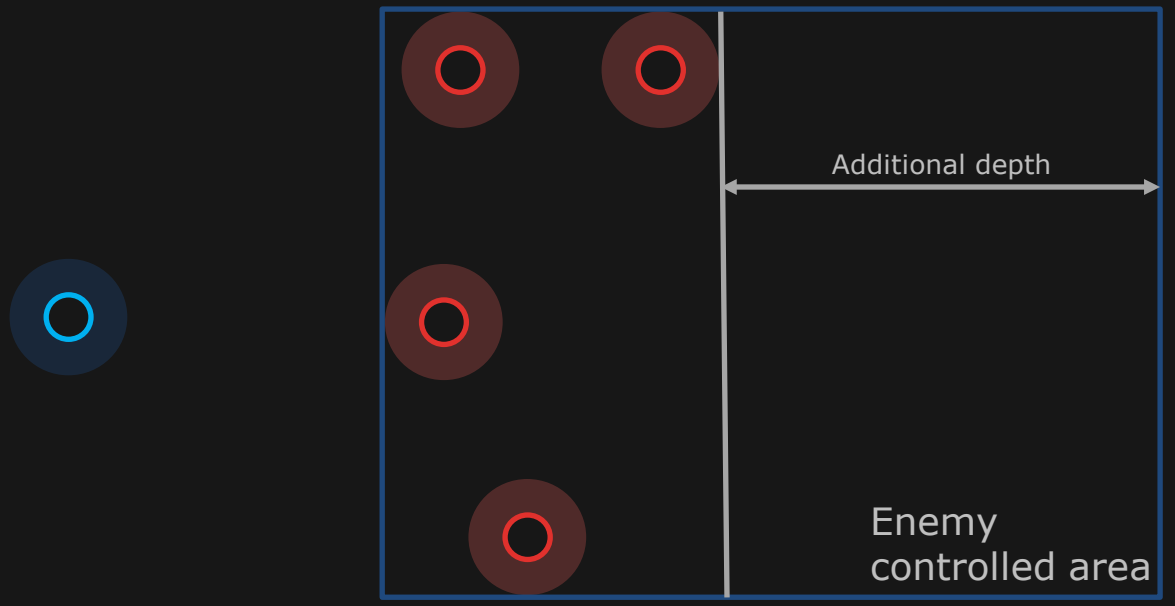


Far mode extends the neutral area to the closest squad member.

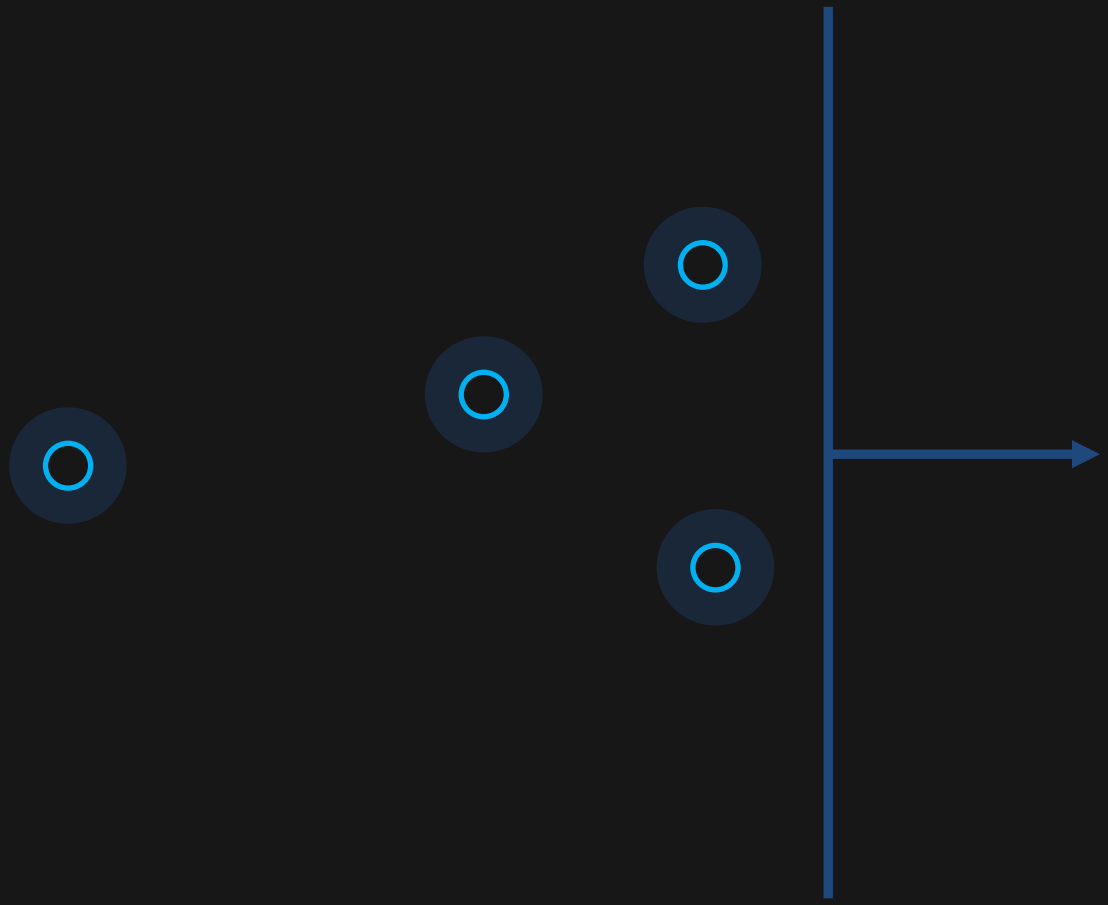
- The squad must stay in place.

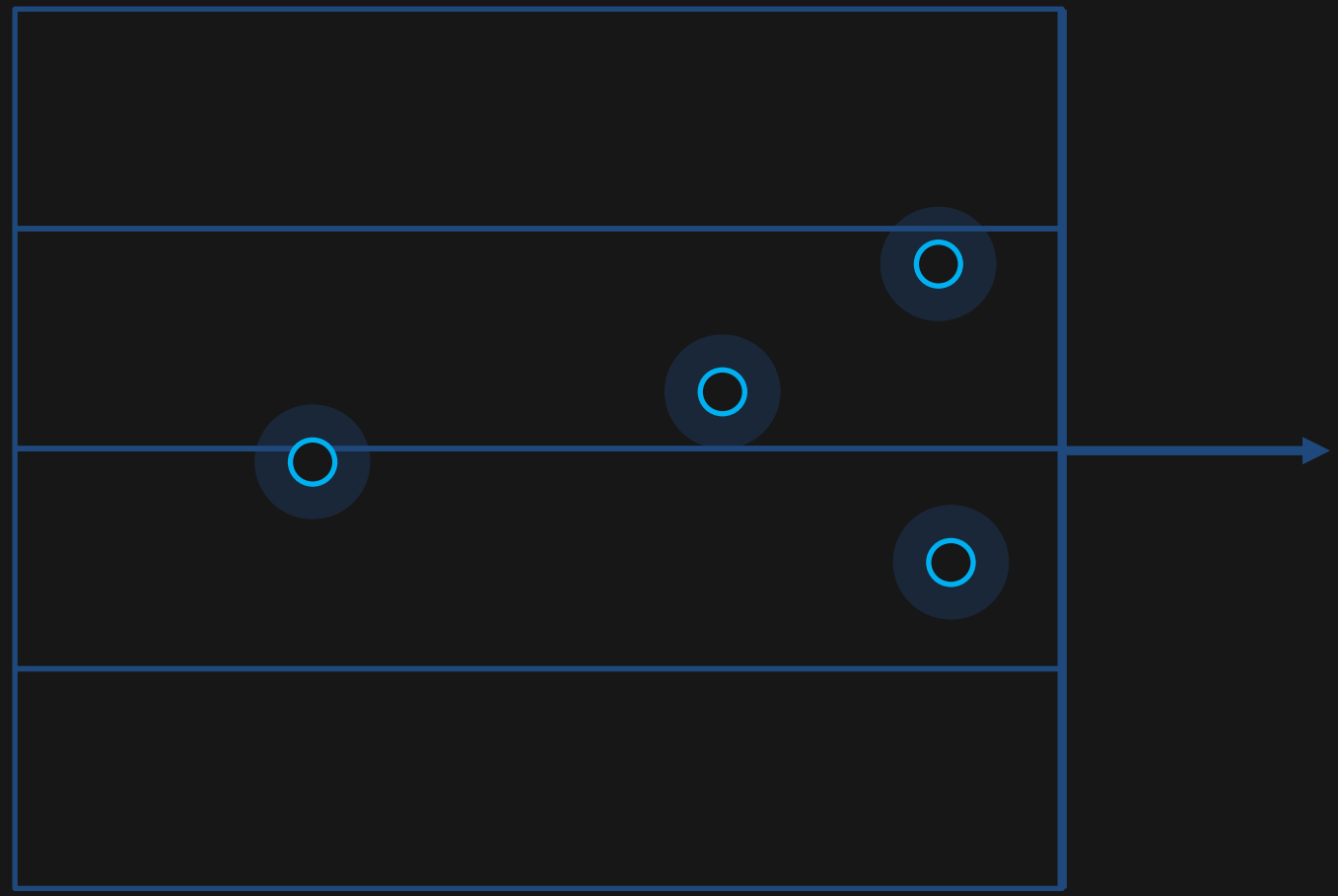


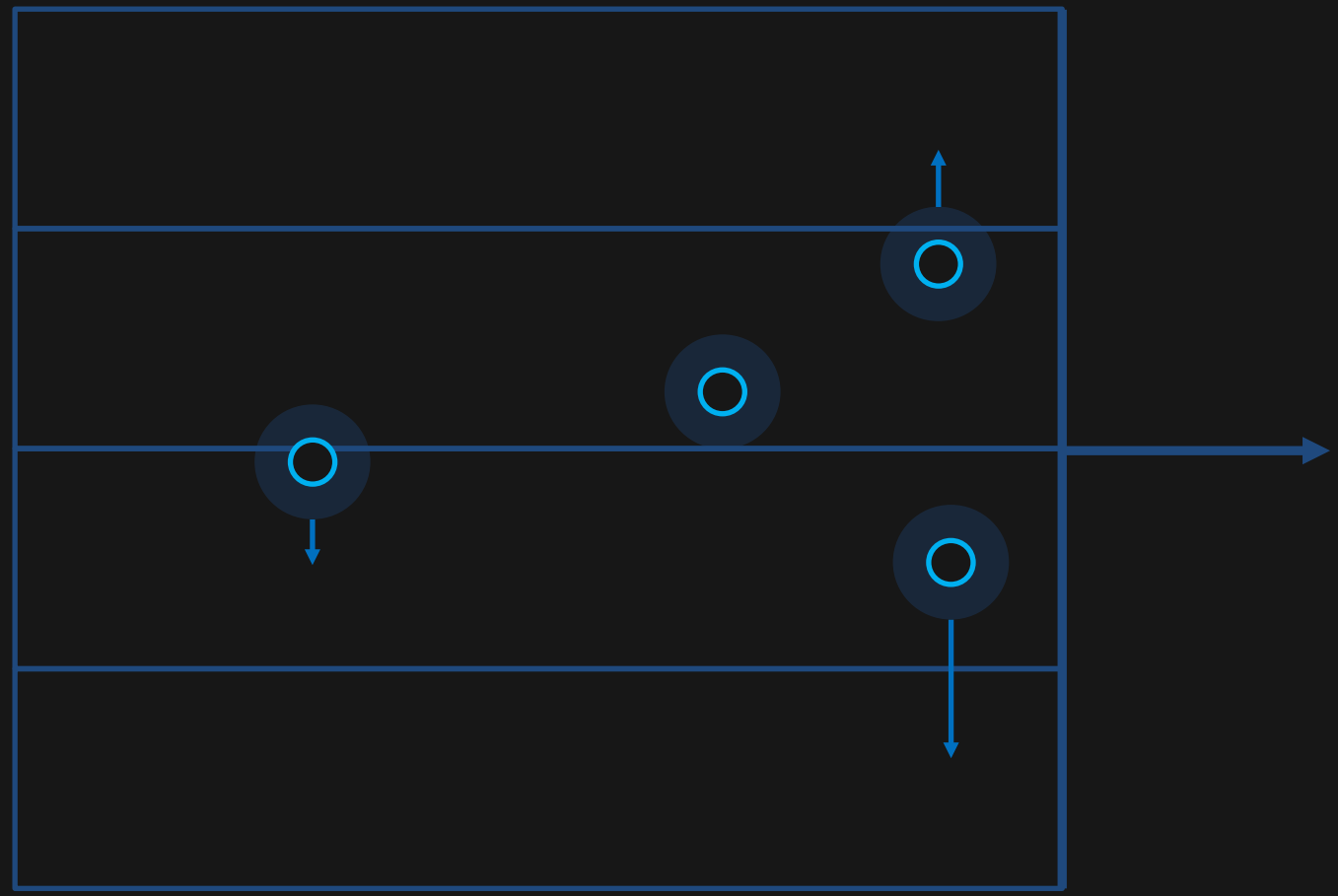
Enemy controlled area is the area that contains the enemy.

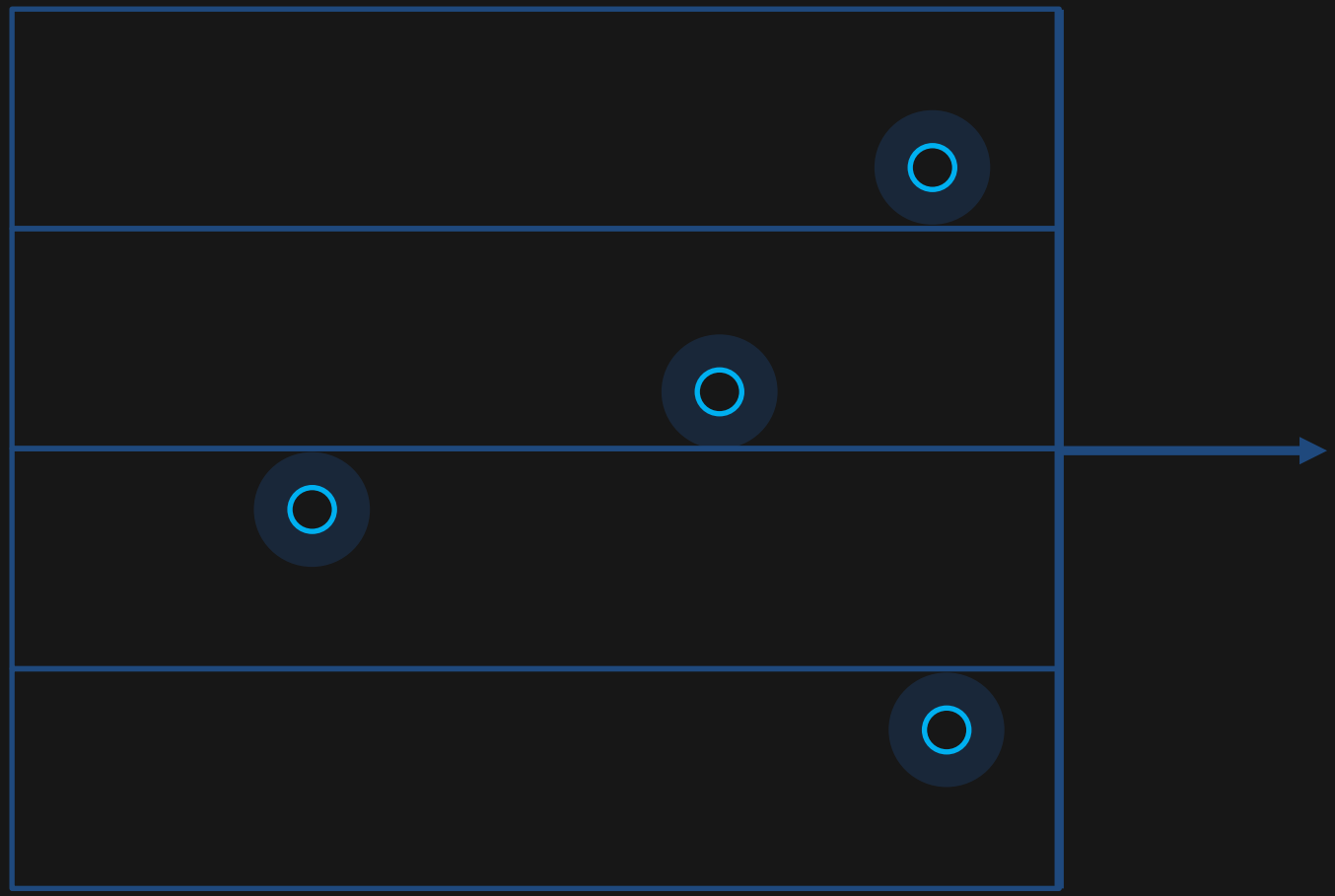


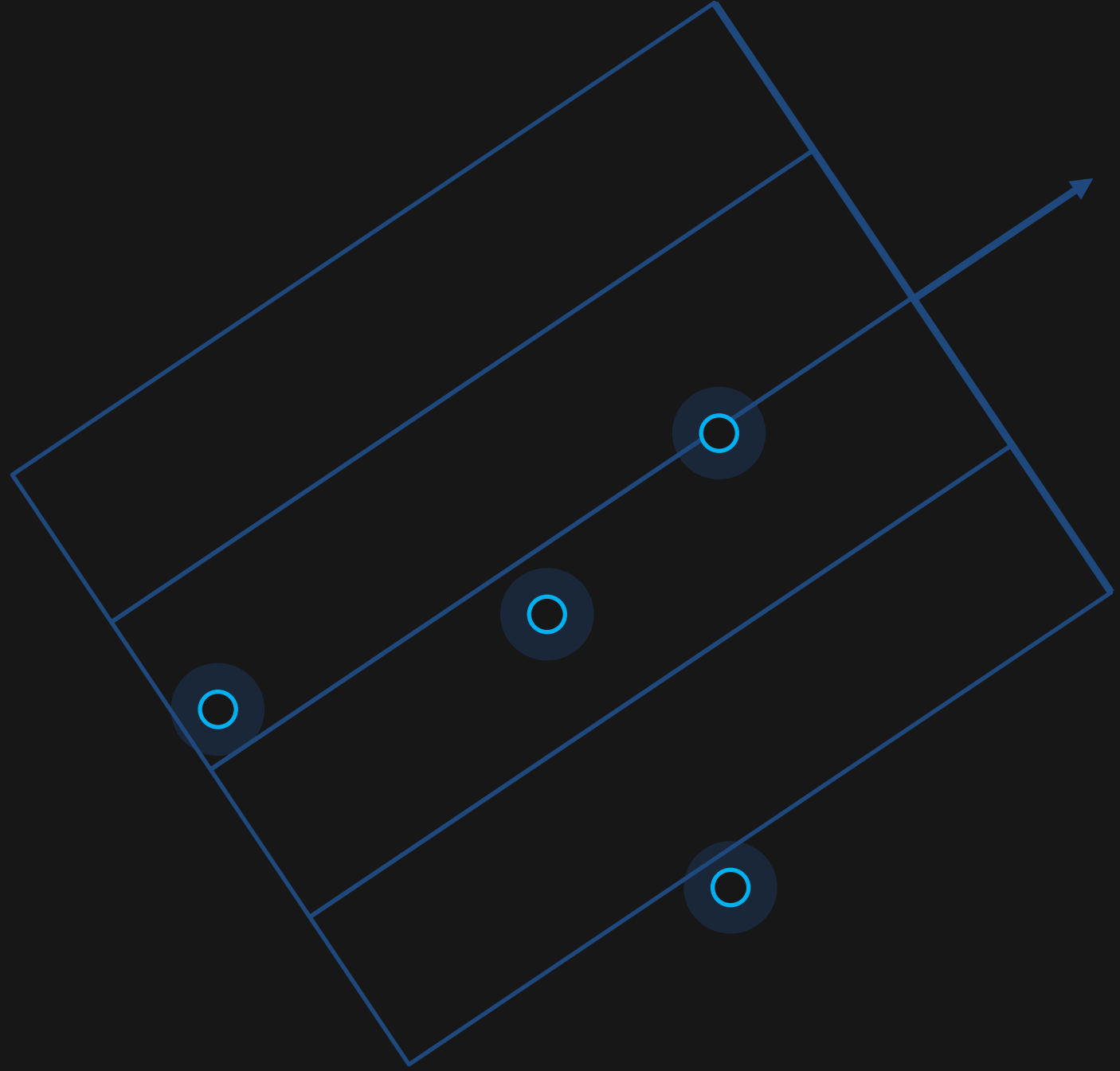
The space behind the Frontline is divided into lanes.

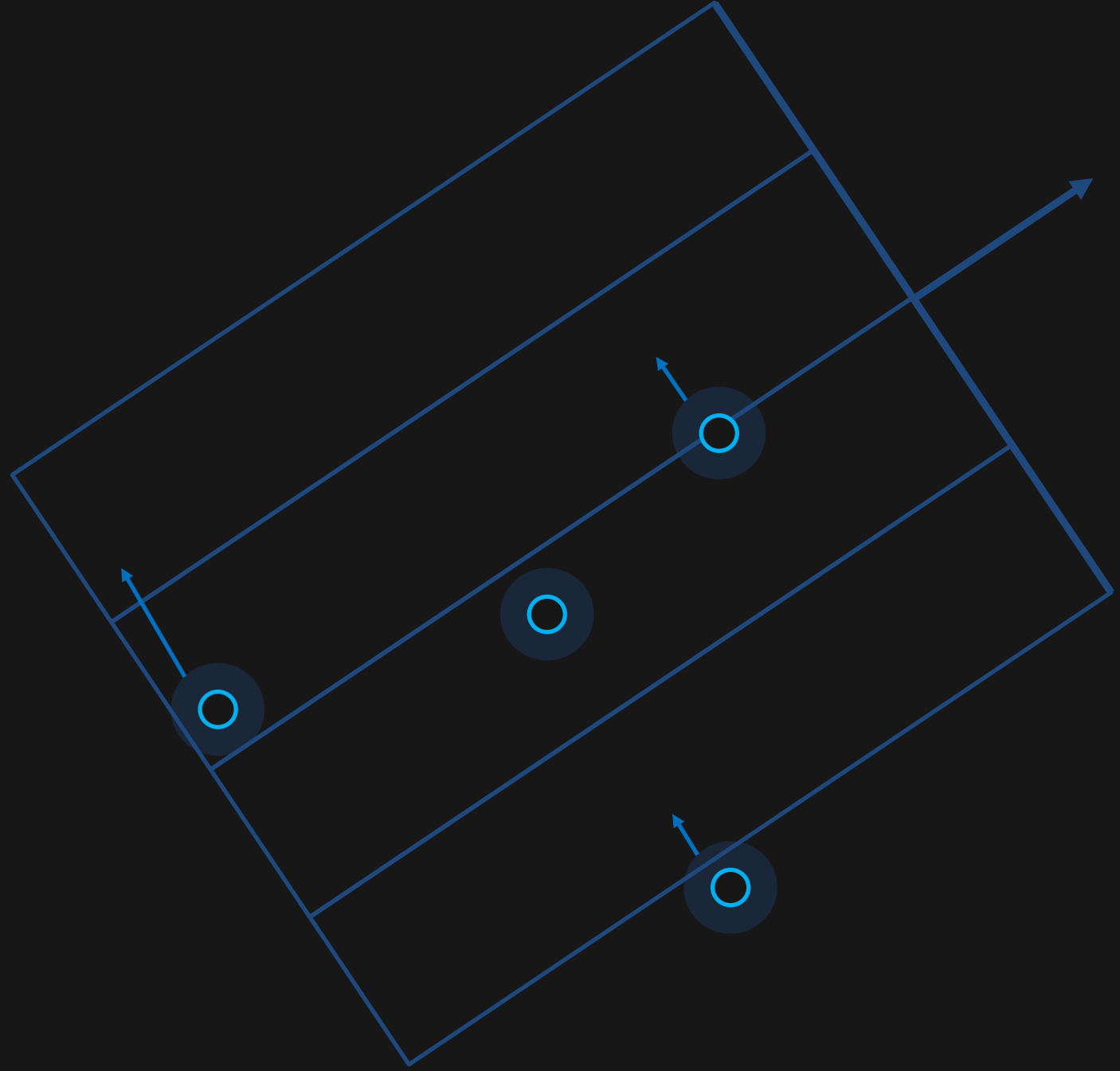


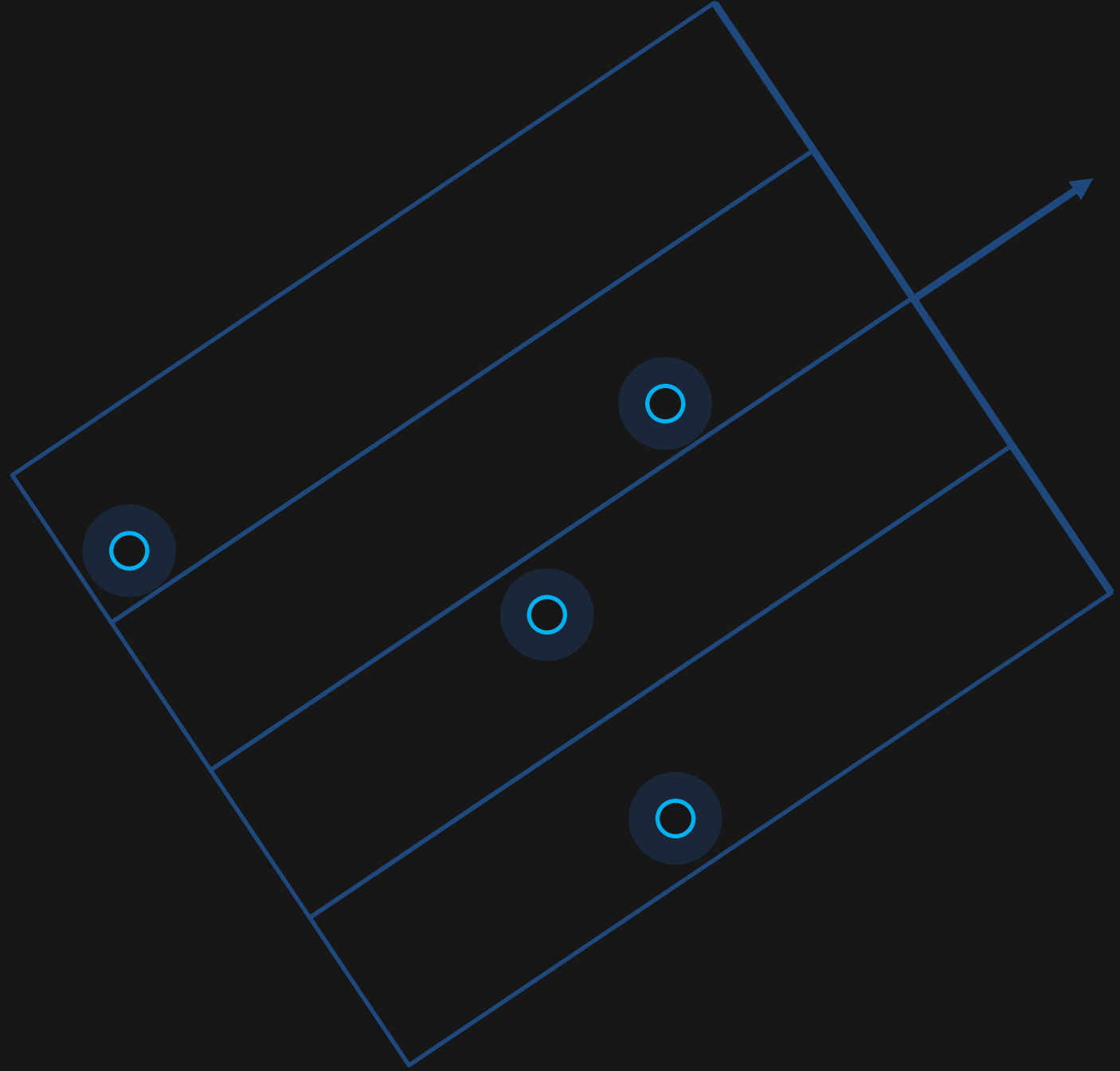












CONFIDENCE

Confidence measures if an AI thinks it will win.

Squads use the average confidence of its members.

- Heroic
- Confident
- Neutral
- Worried
- Panicked

To calculate an AI’s confidence, each side’s perceived total strength is calculated.

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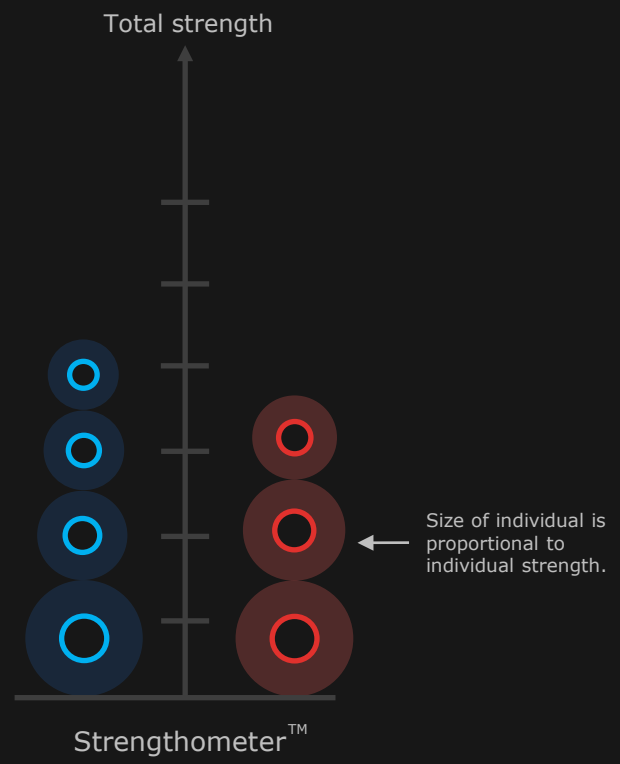
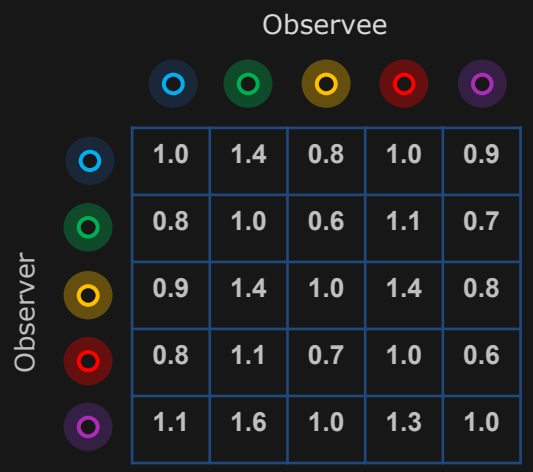
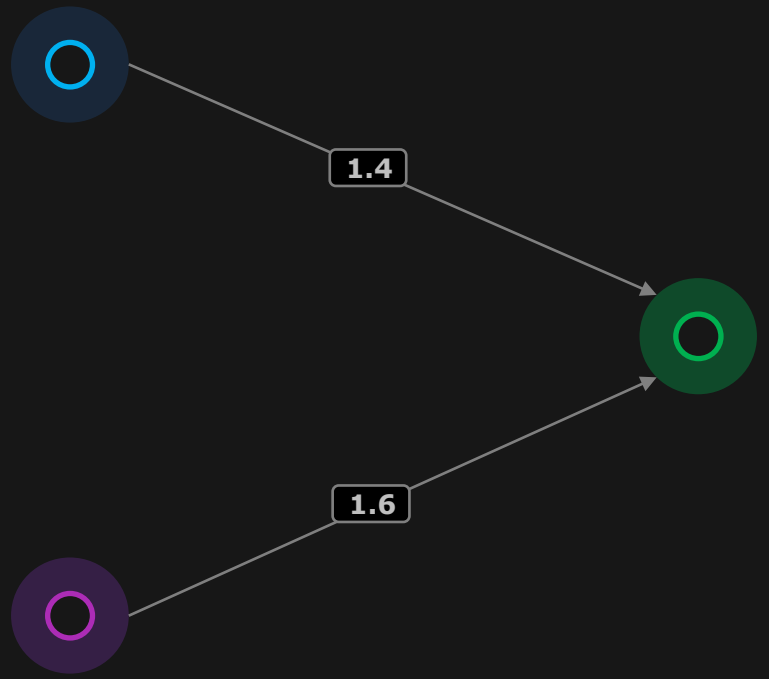


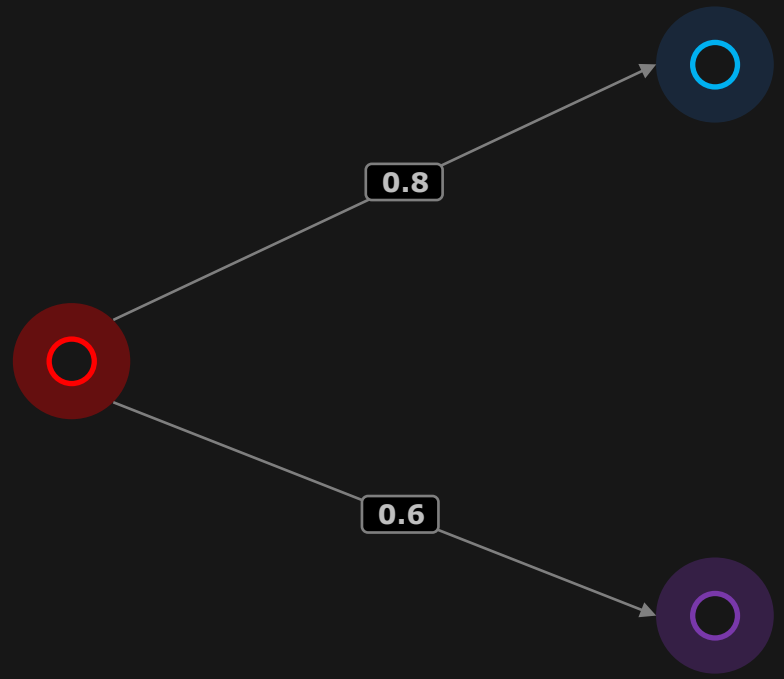
Each character starts with a strength.

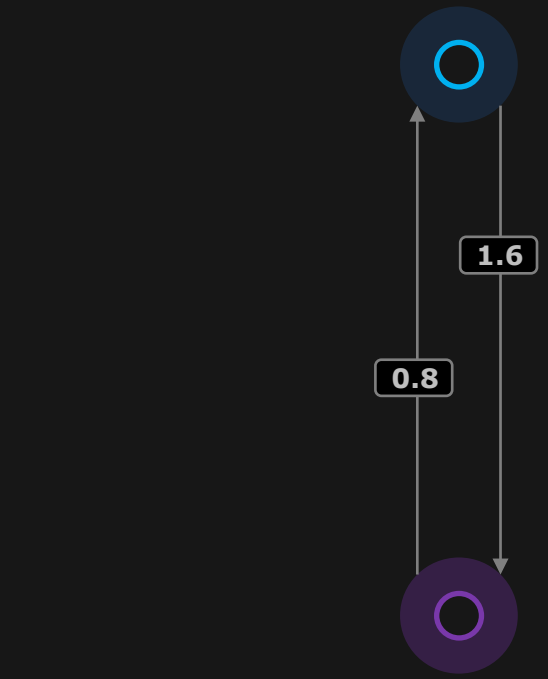
Based on the character's faction.

And the faction viewing the character.




1.4
1.6


0.8
0.6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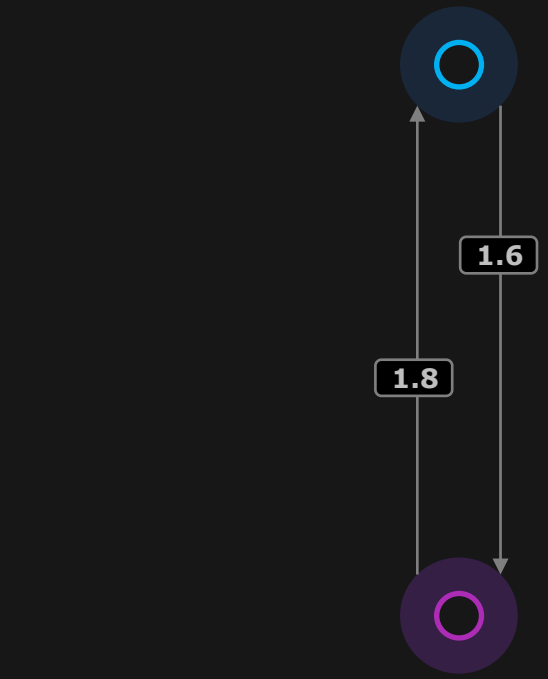
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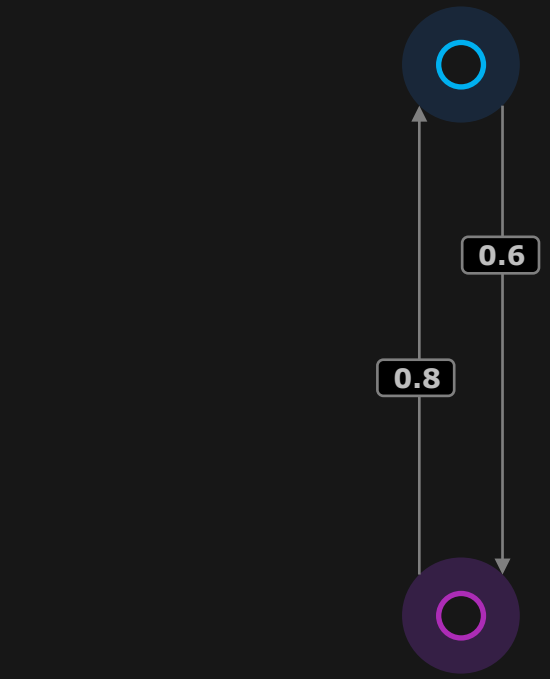
0.6
0.8

Modify the strength by:

- Weapon
- Armor
- Health
- Confidence

The strengths of casualties are added to the totals.

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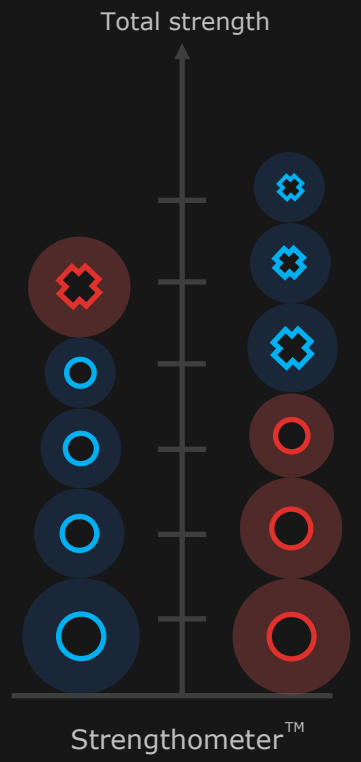


Confidence is a good predictor of outcome.

This is not good enough for the player.

- We use AI confidence to encourage desired player behavior.

Confidence will increase if player is:

- Not moving
- Hunkering in cover
- Taking hits

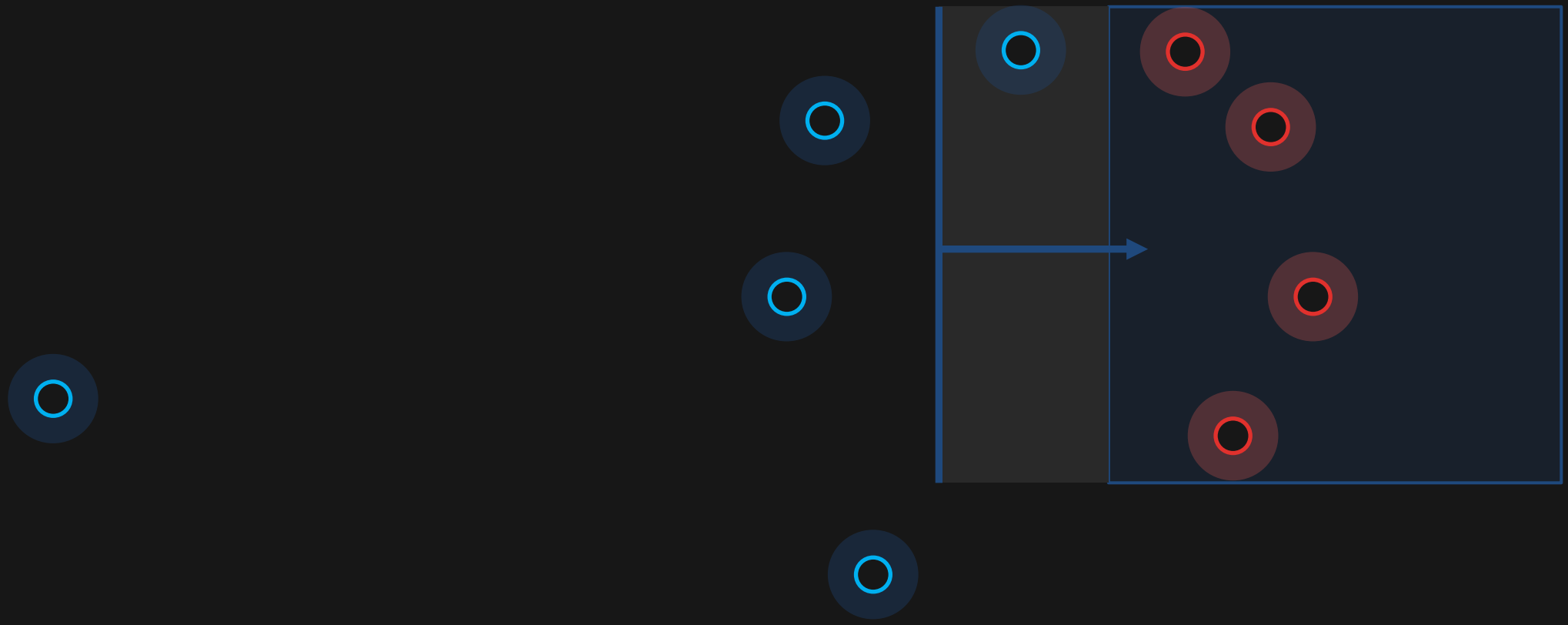
Confidence will decrease if player is:

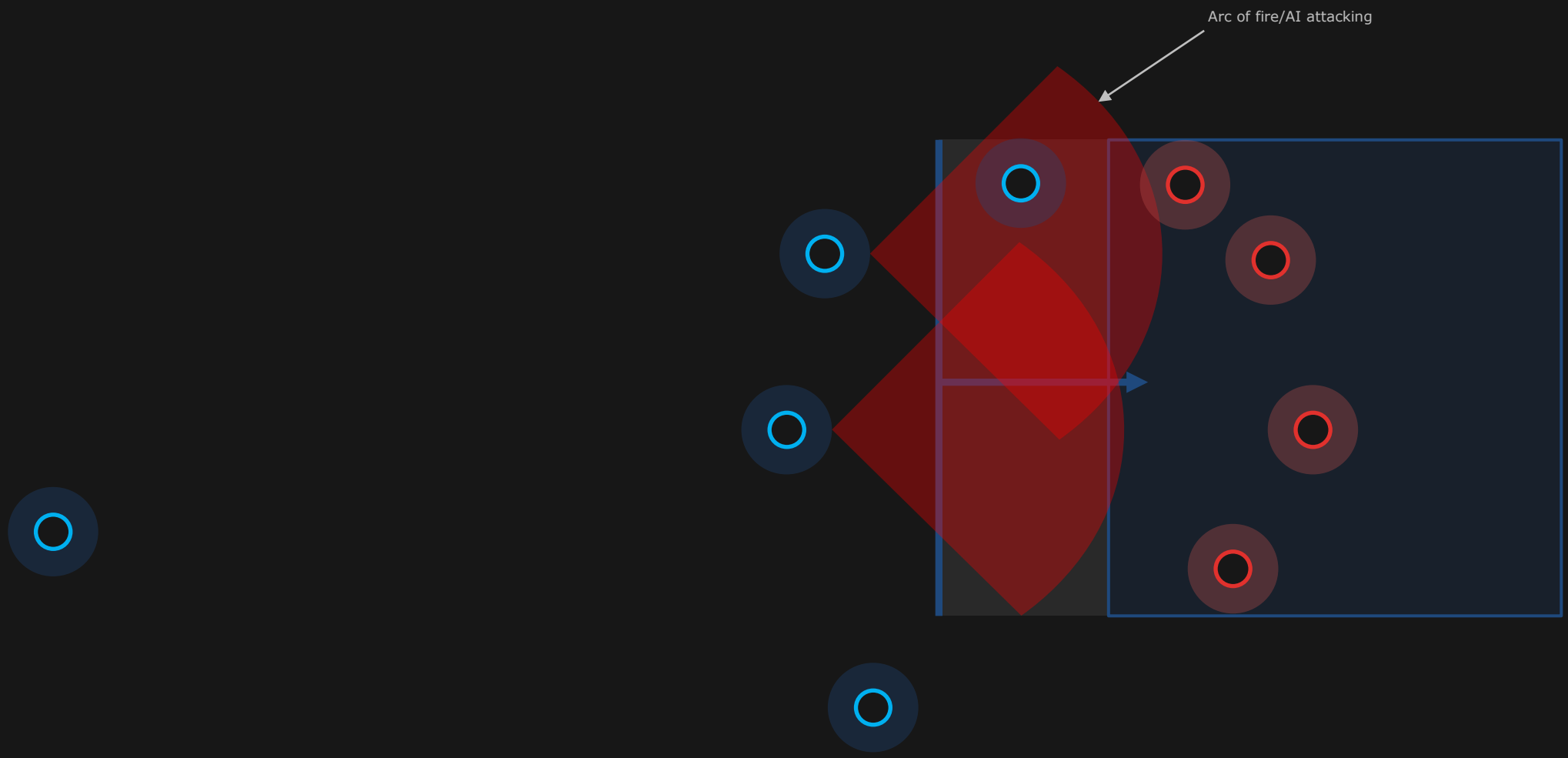
- Flanking/invalidating covers
- Targeting the AI
- Engaging in melee

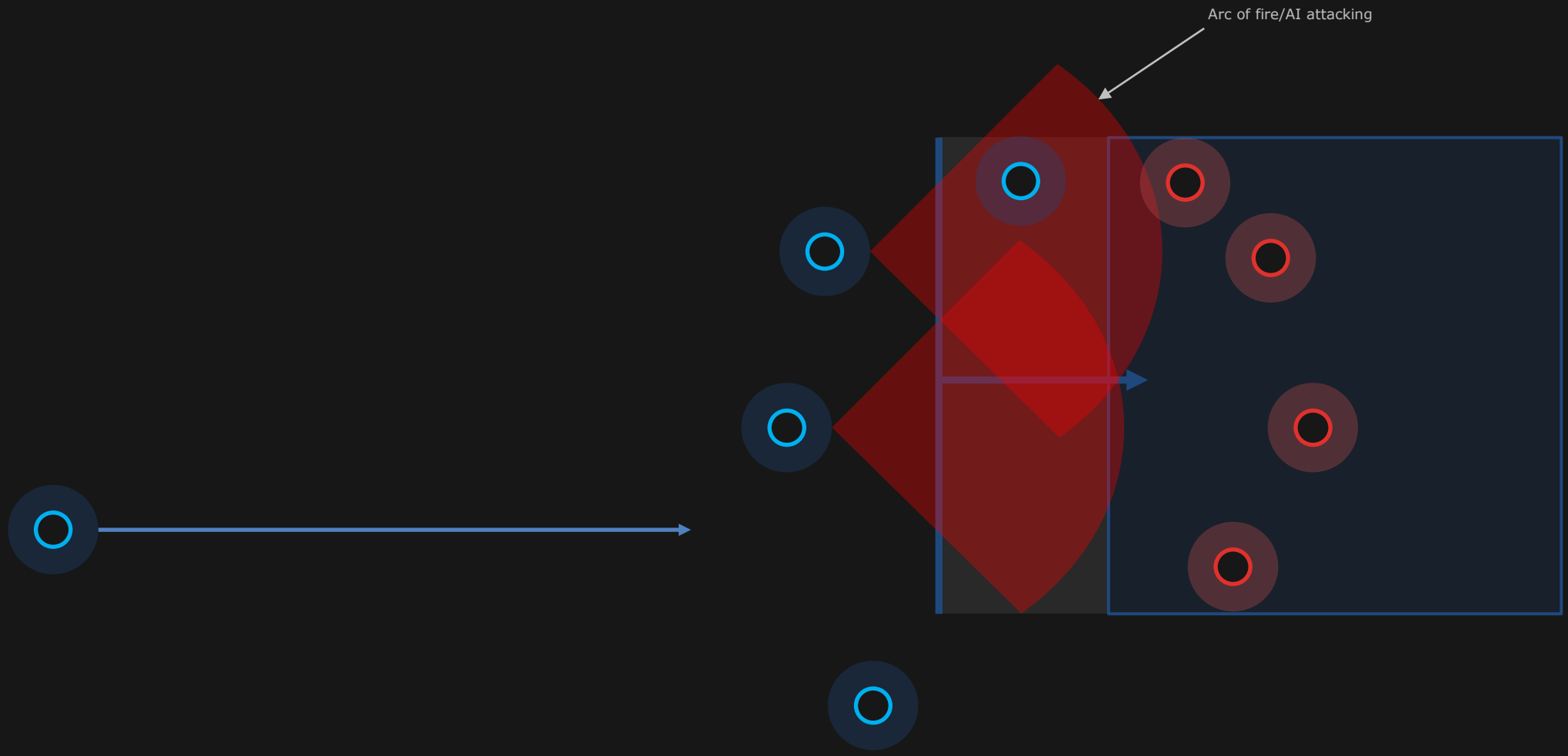
SQUAD BEHAVIORS

- A squad in combat can be:
  - Forming up
  - In normal combat
  - Retreating
  - Pressing the attack

Forming up: When some of the squad members are out of position.




Arc of fire/AI attacking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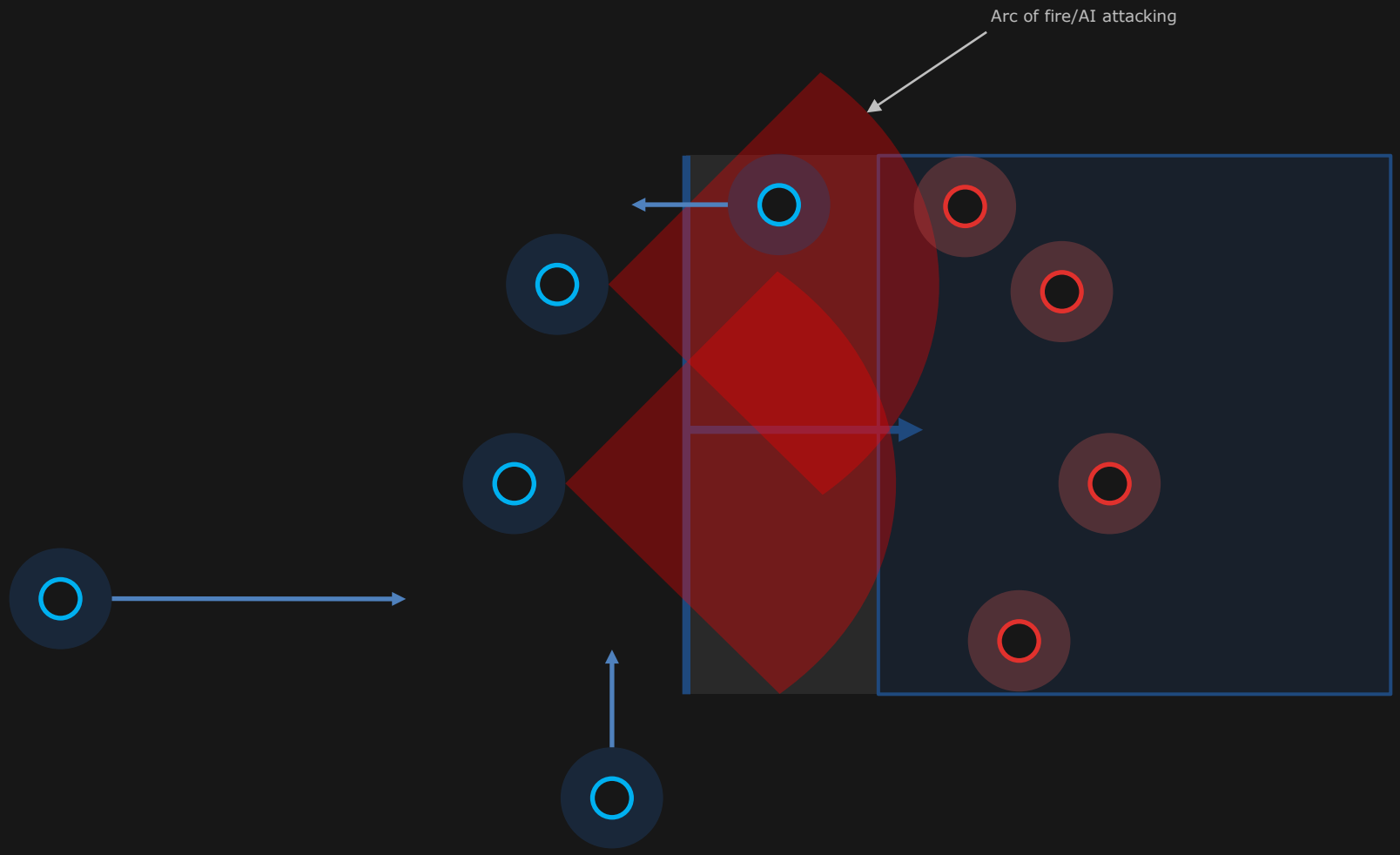
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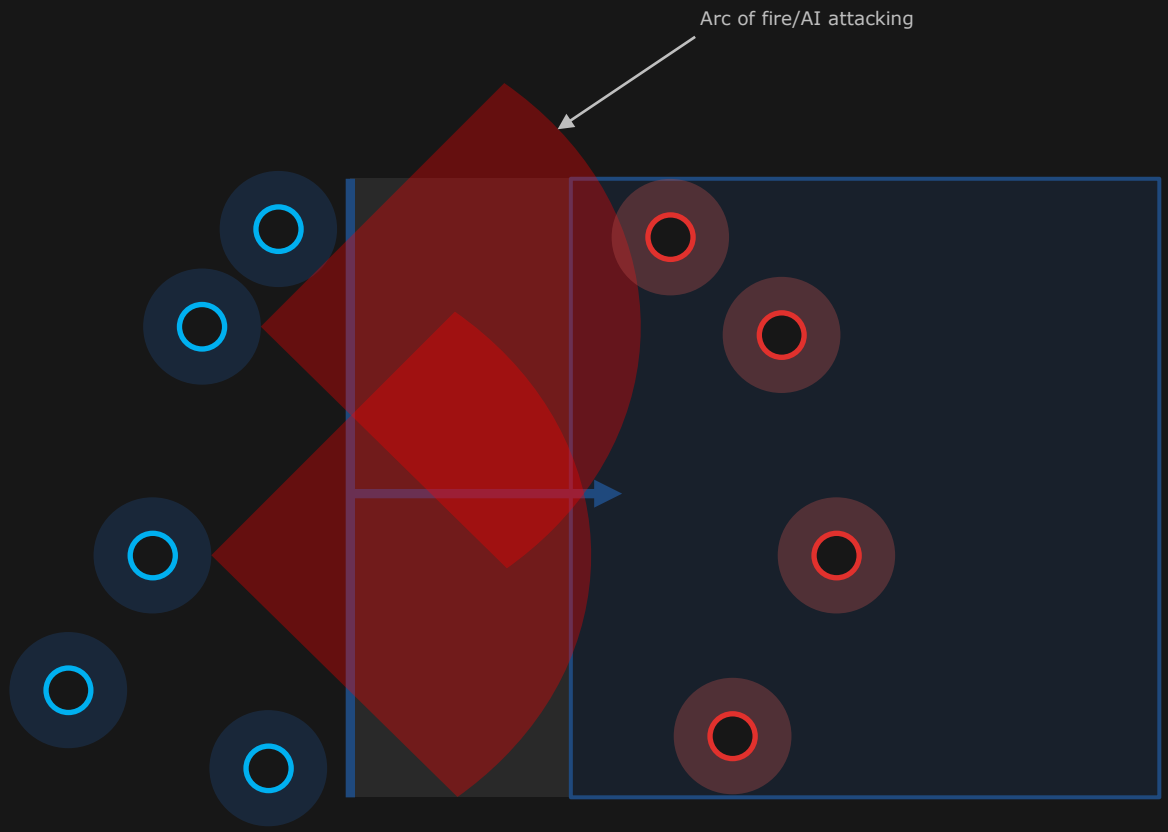
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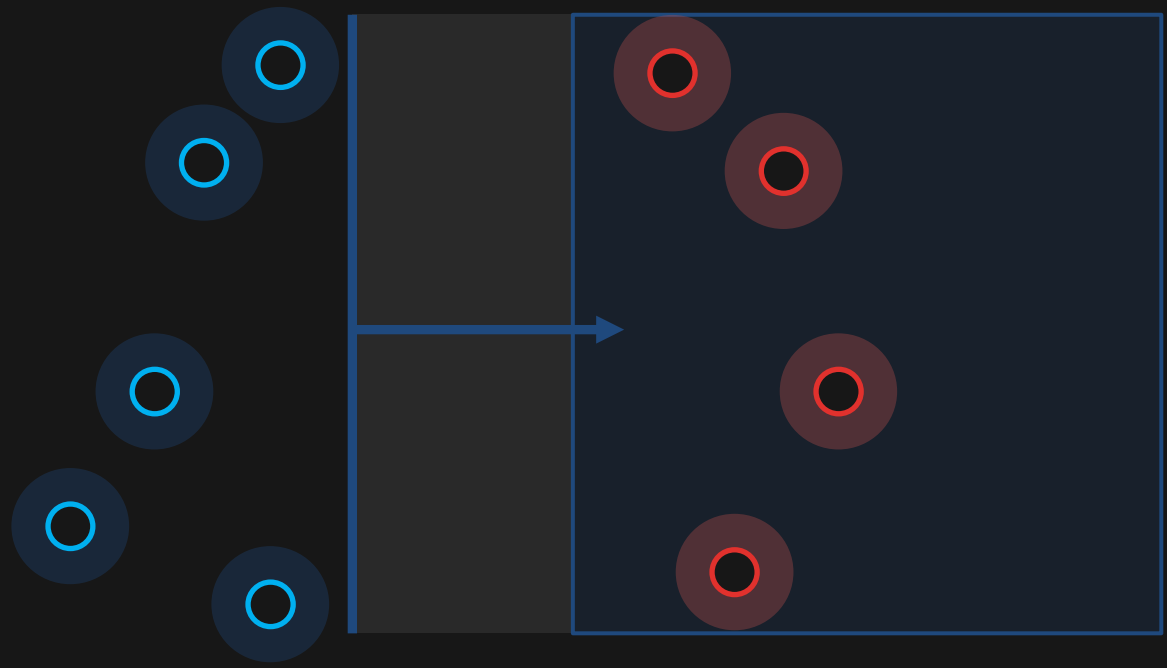
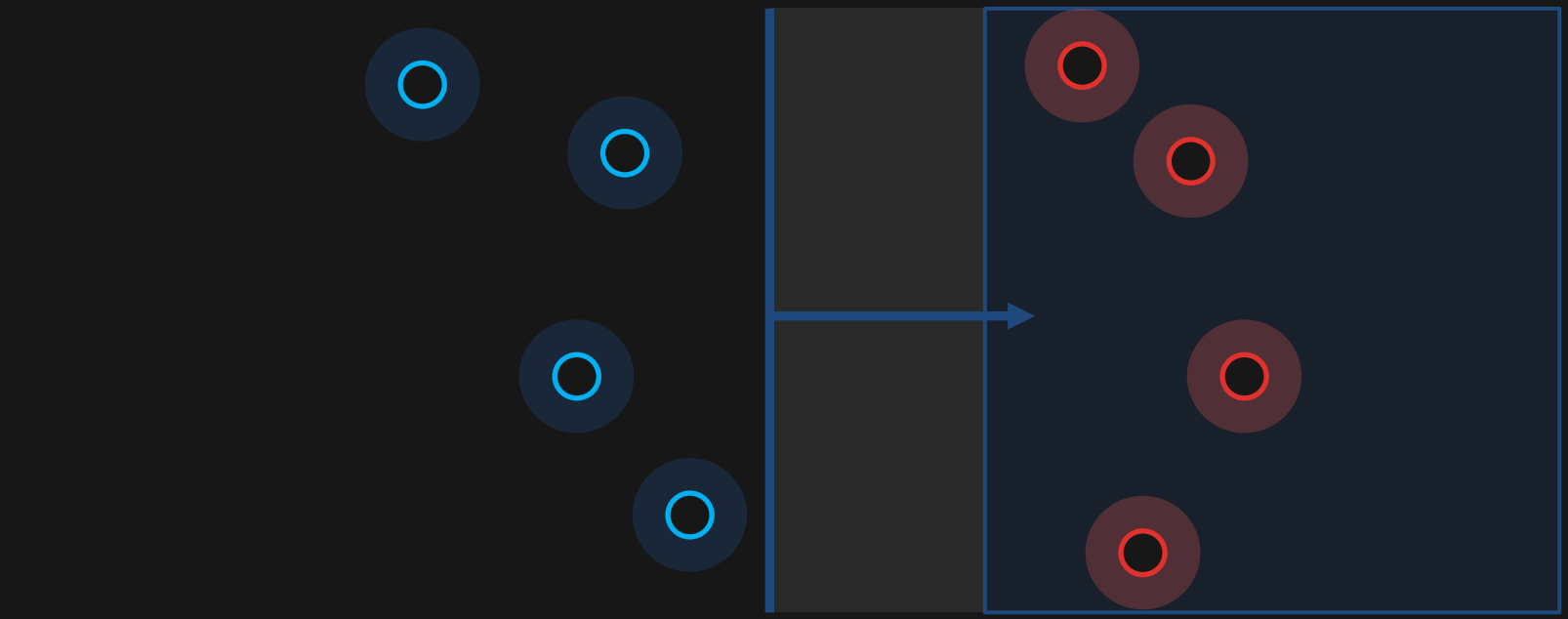
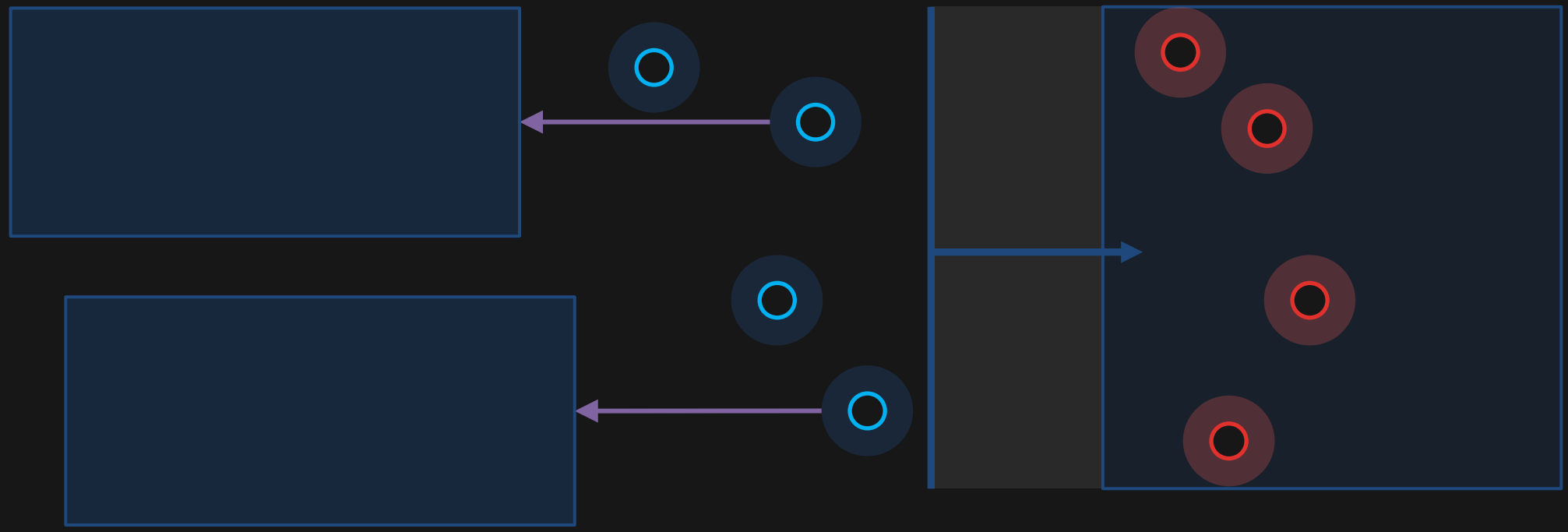


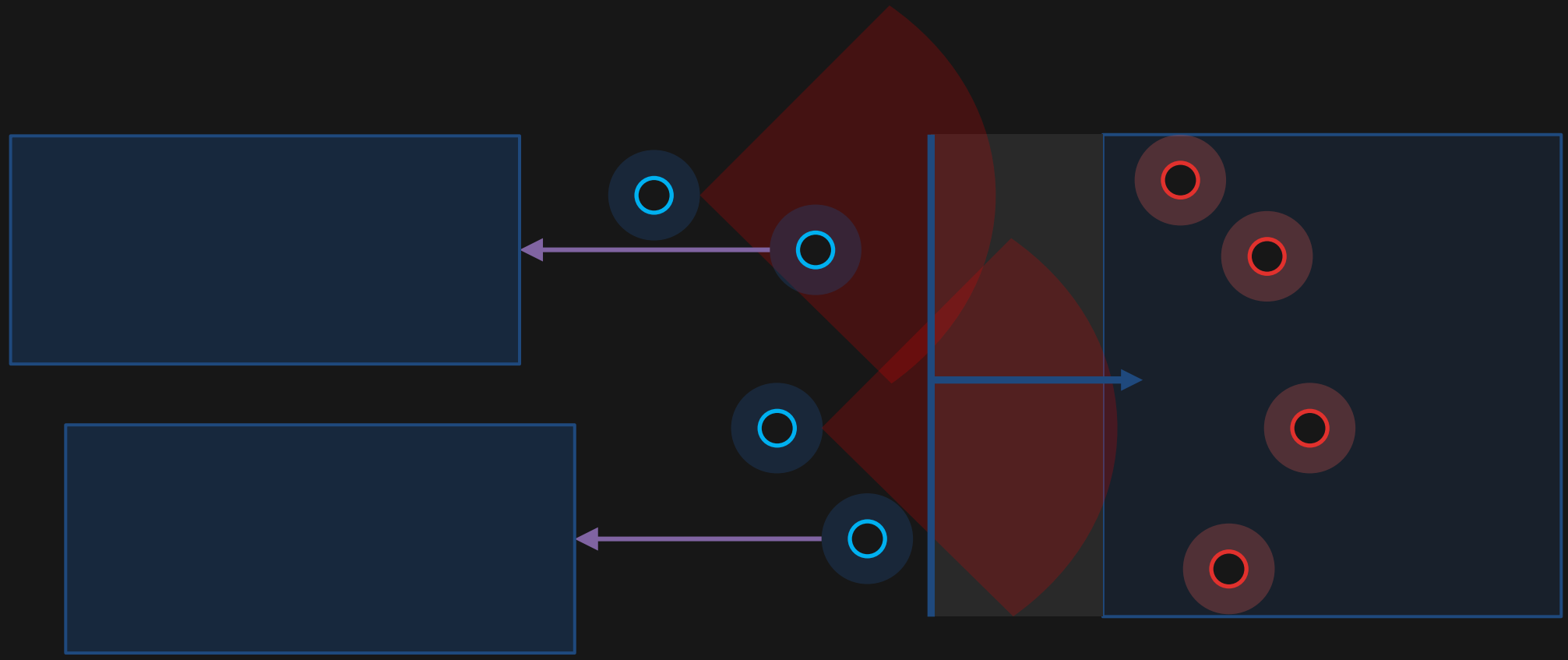
The goal during normal combat is:

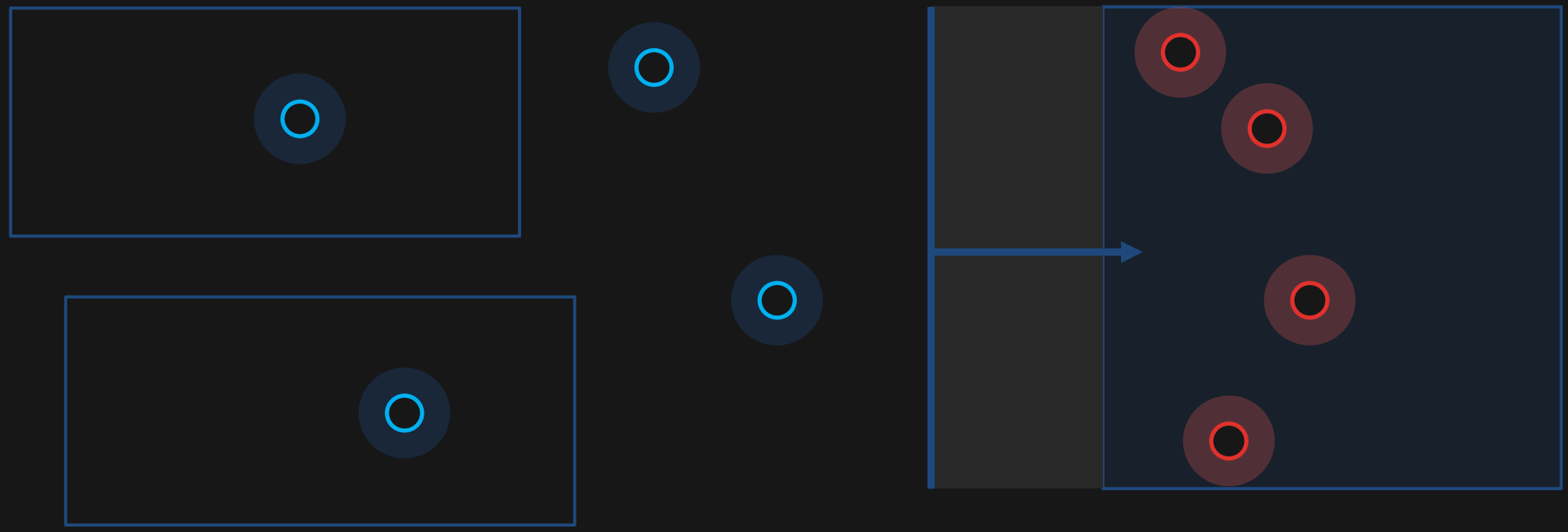
- Maintain good spacing.
- Clear direction of combat.
- Well separated sides.

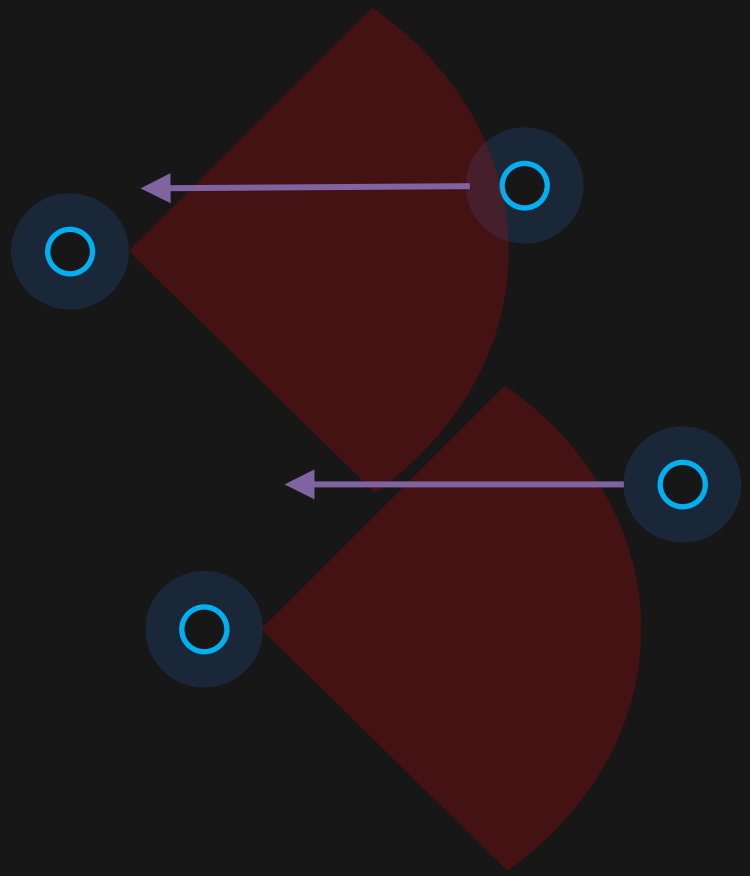
When confidence is low, the AI tries to retreat.

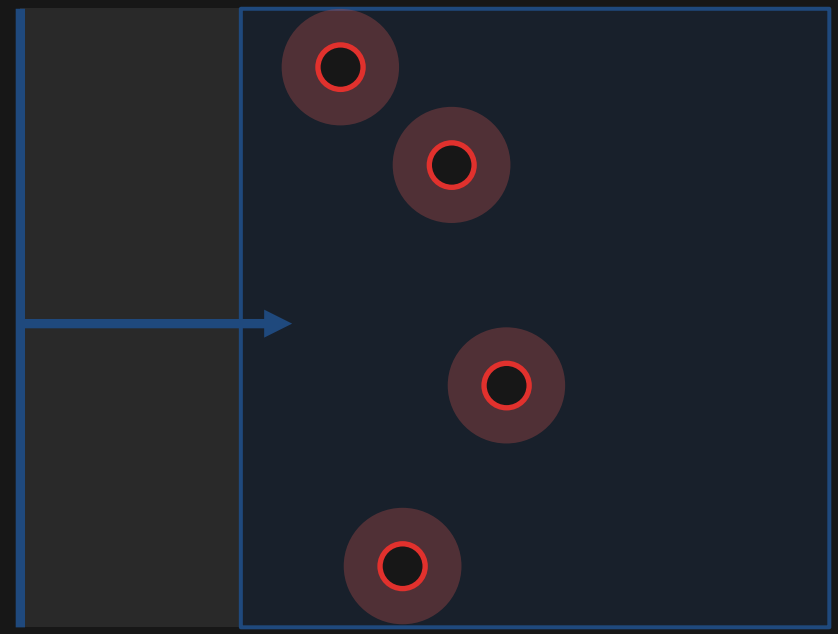








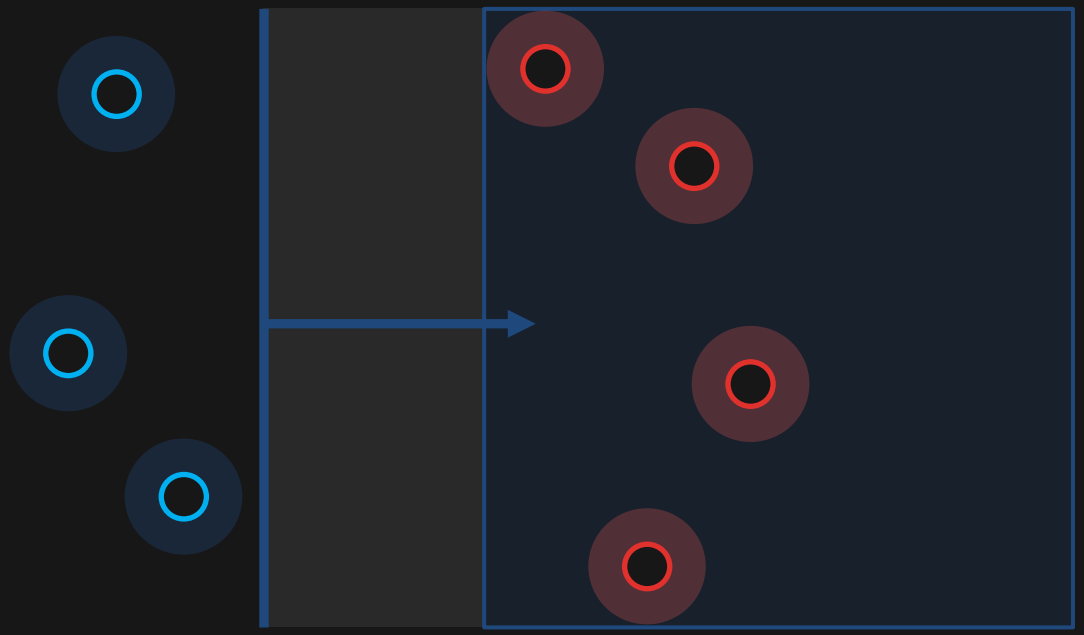


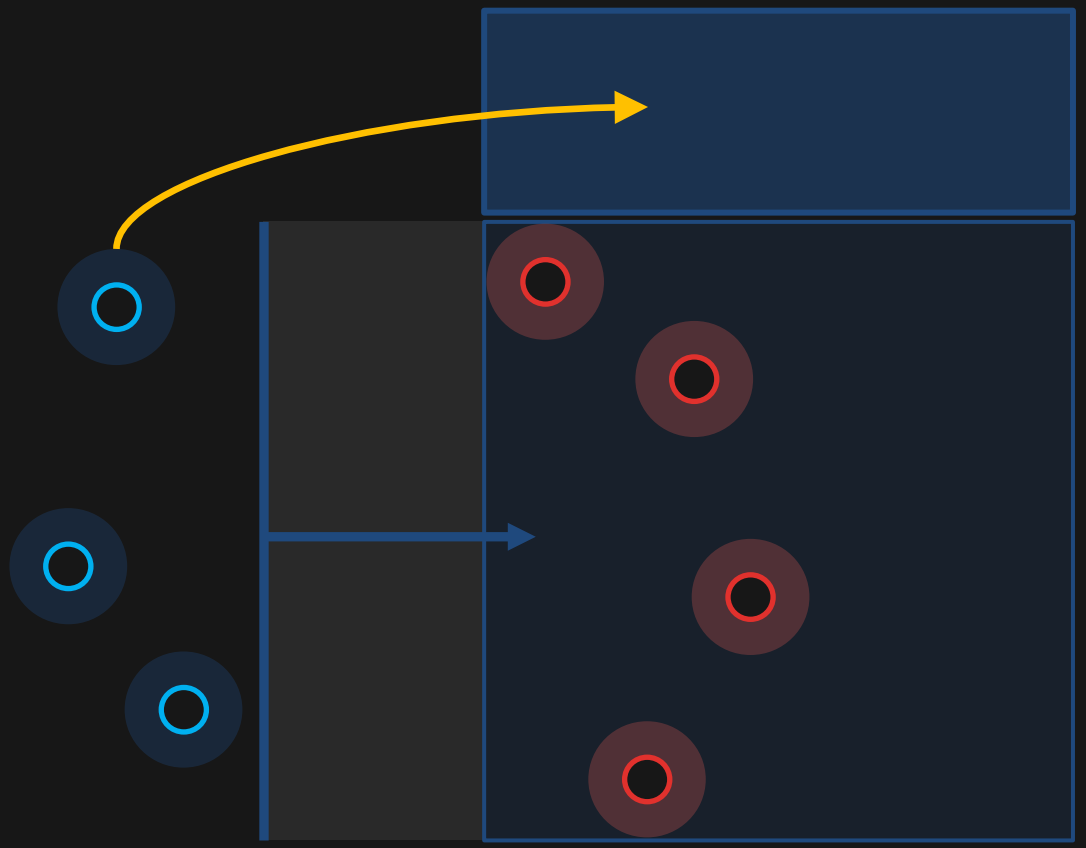


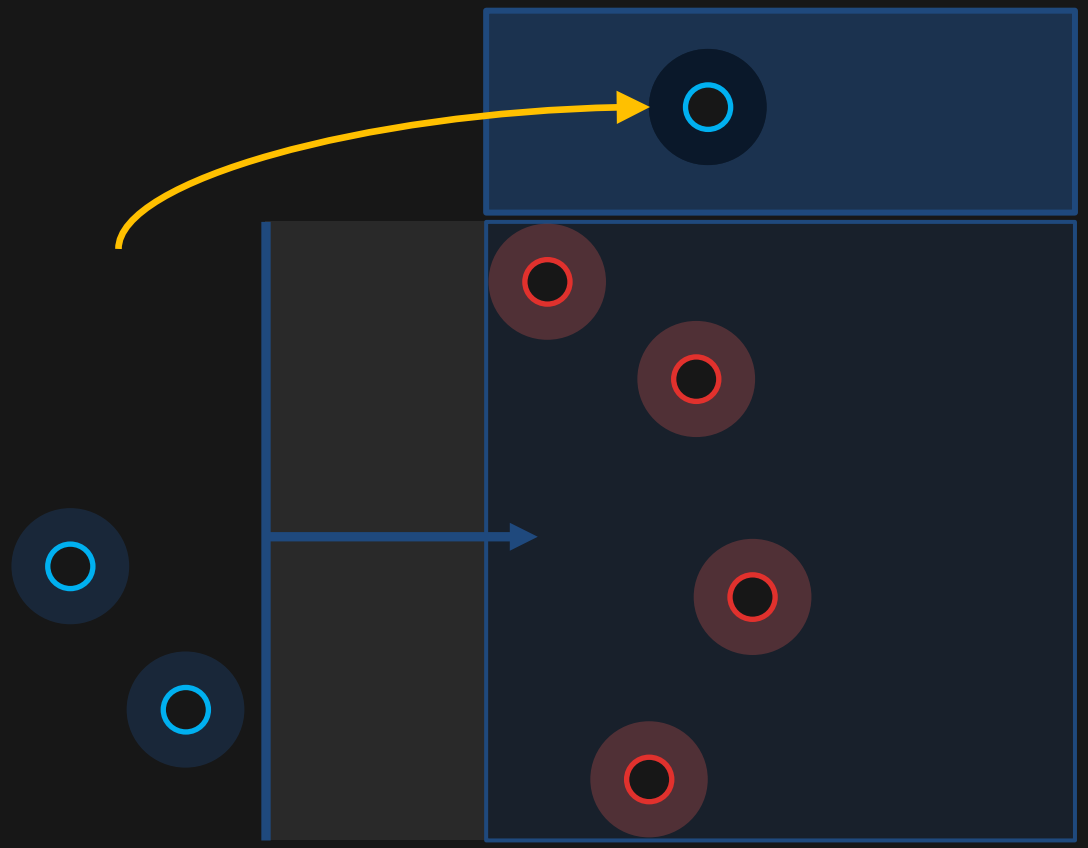
When confidence is high, the squad will go on the offensive.

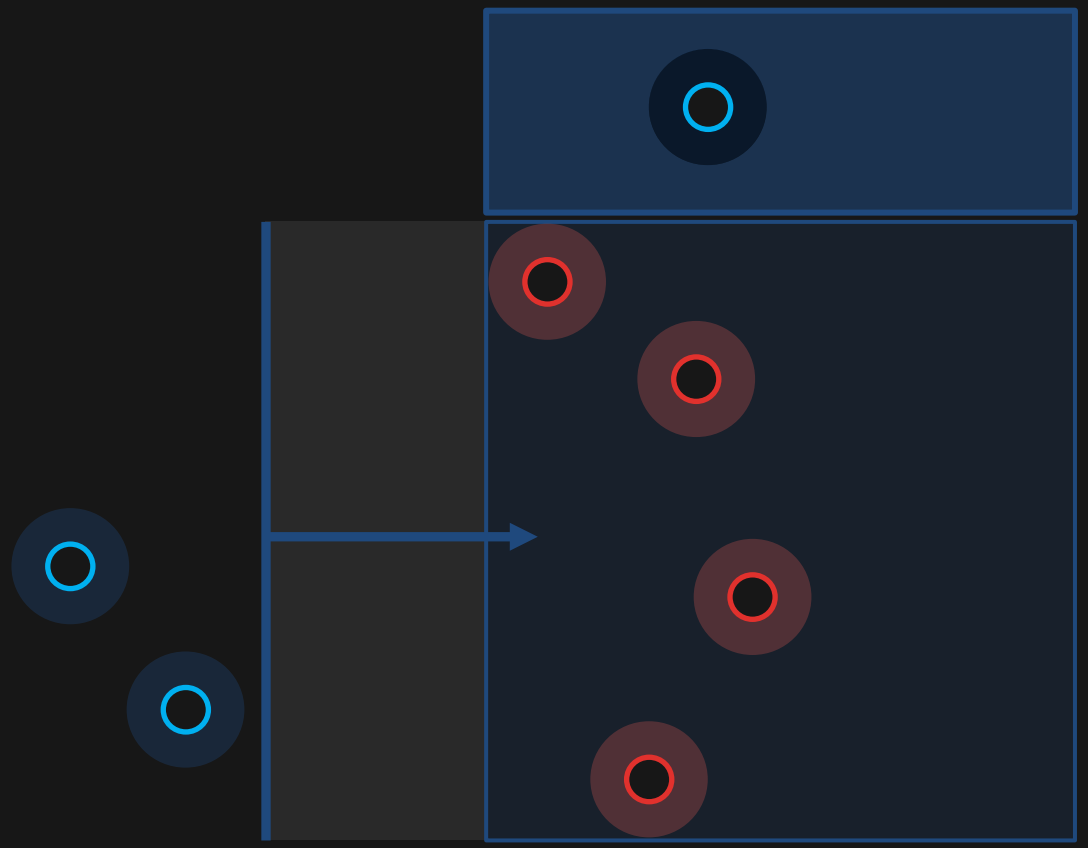
- Try to move close to the enemy.

When the squad is close enough, it will try to flank the enemy.



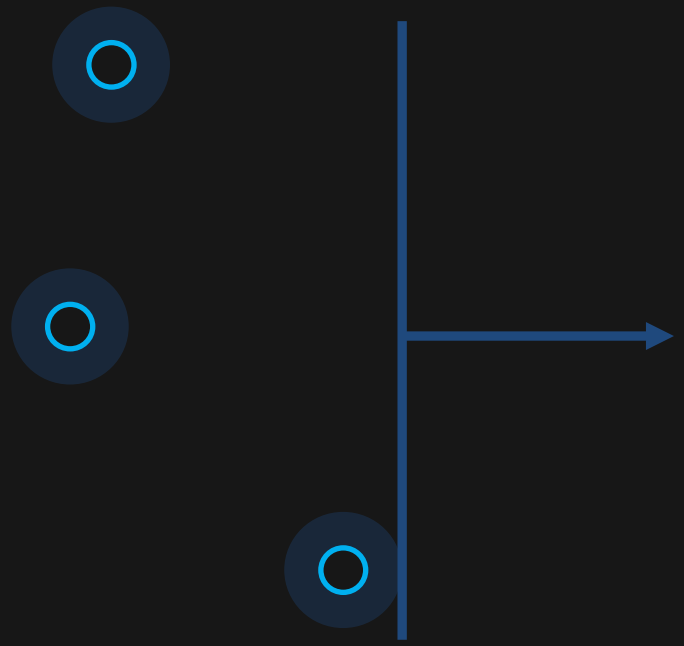


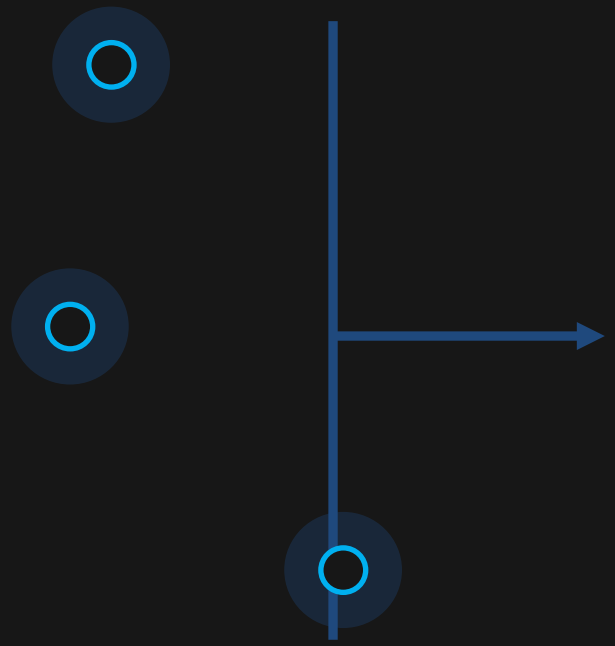


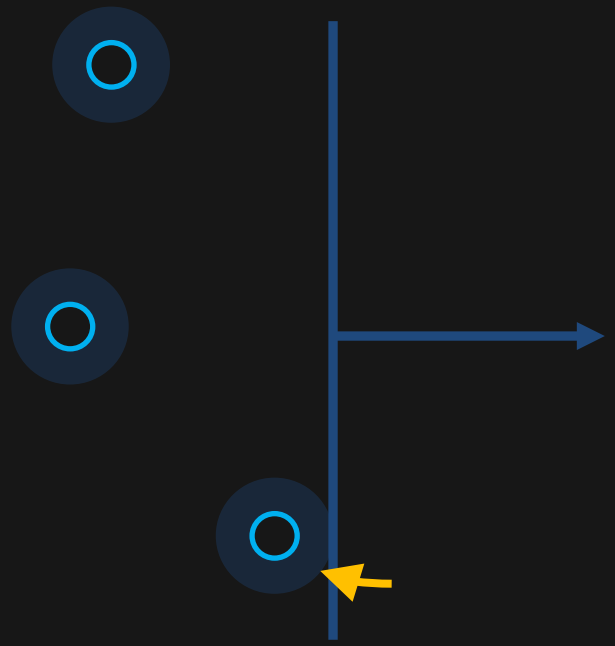


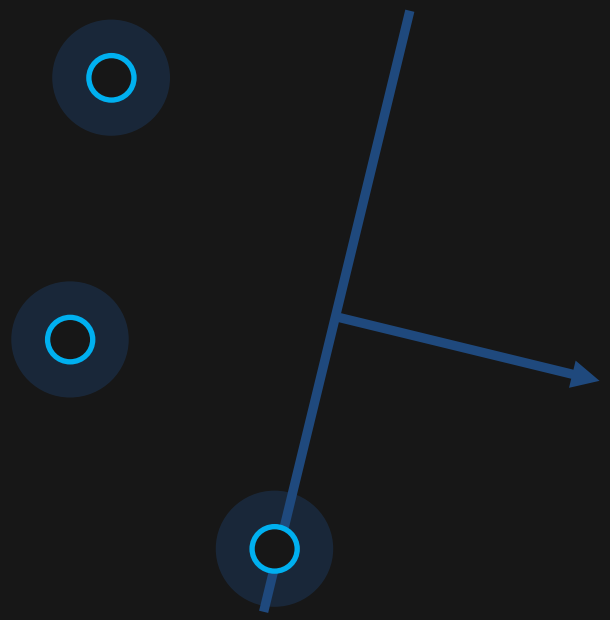
THE PROBLEM WITH CHANGE

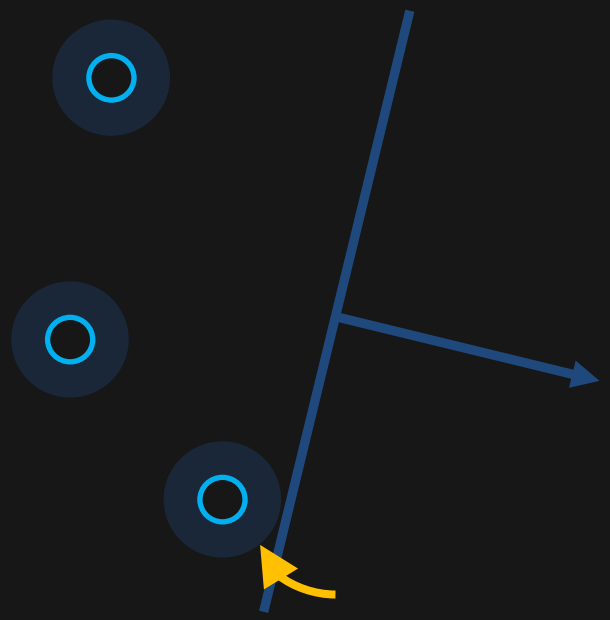
We use the Frontline to determine if an AI’s position is valid.

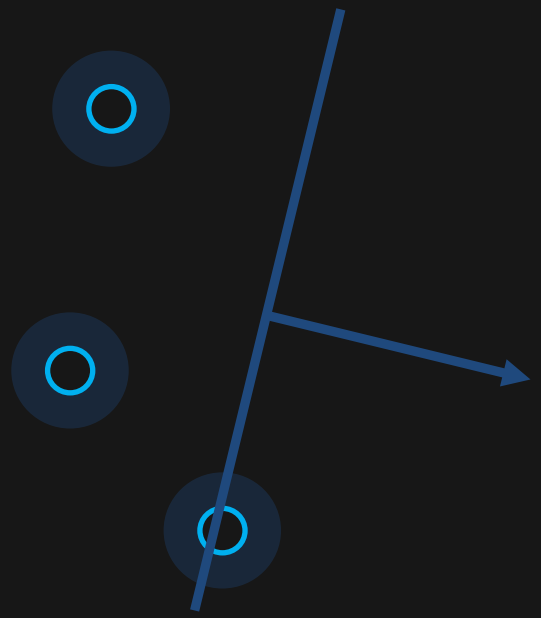


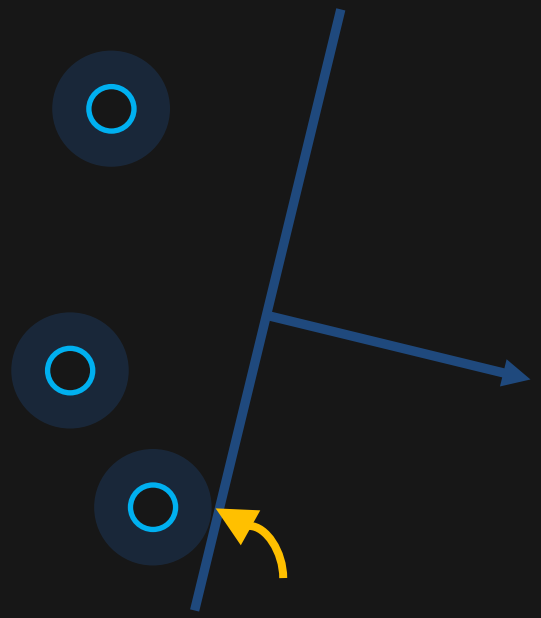








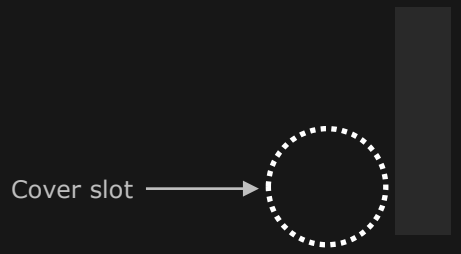




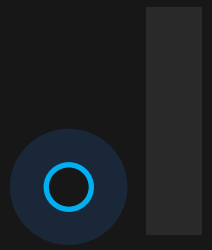
Some AI archetypes do not play nice with the Frontline and are ignored.

Days Gone is a cover shooter.

AIs in cover uses cover slots.



AIs fighting from cover moves around a lot.



AIs fighting from cover moves around a lot.

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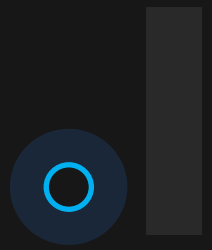

We use the position of the AI’s when it is in cover.

The cover slot doesn’t move.

The frontline is computed as a sliding window average.

Using an average over time makes the AI slow to react to big changes.

Significant changes are adopted quickly.

DEALING WITH FLANKERS

Flankers cannot be
part of the Frontline.

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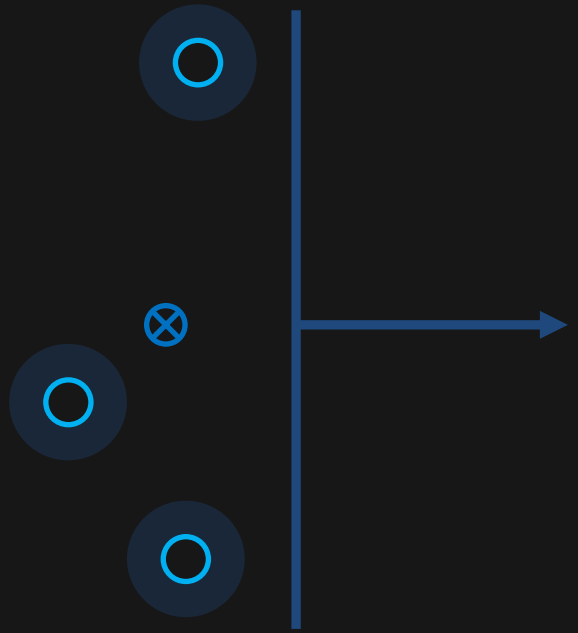

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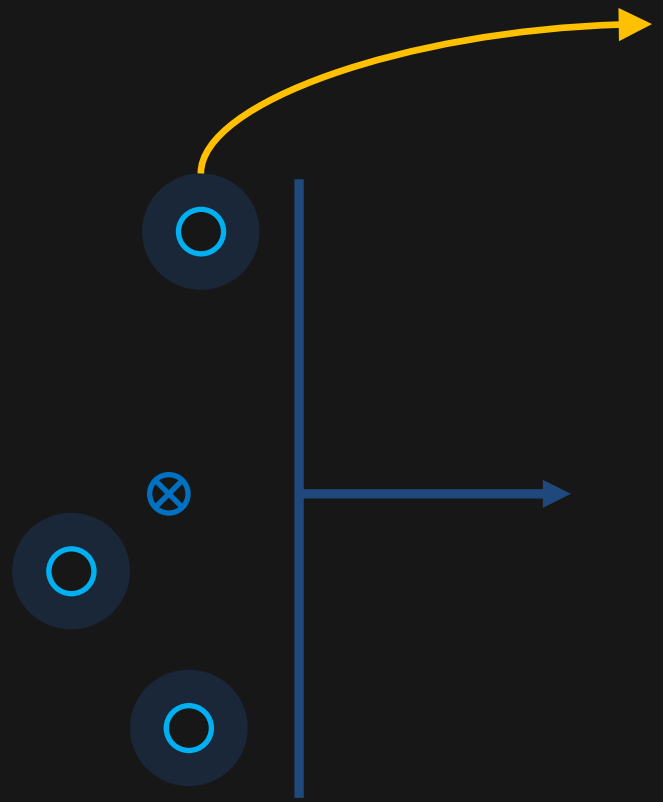

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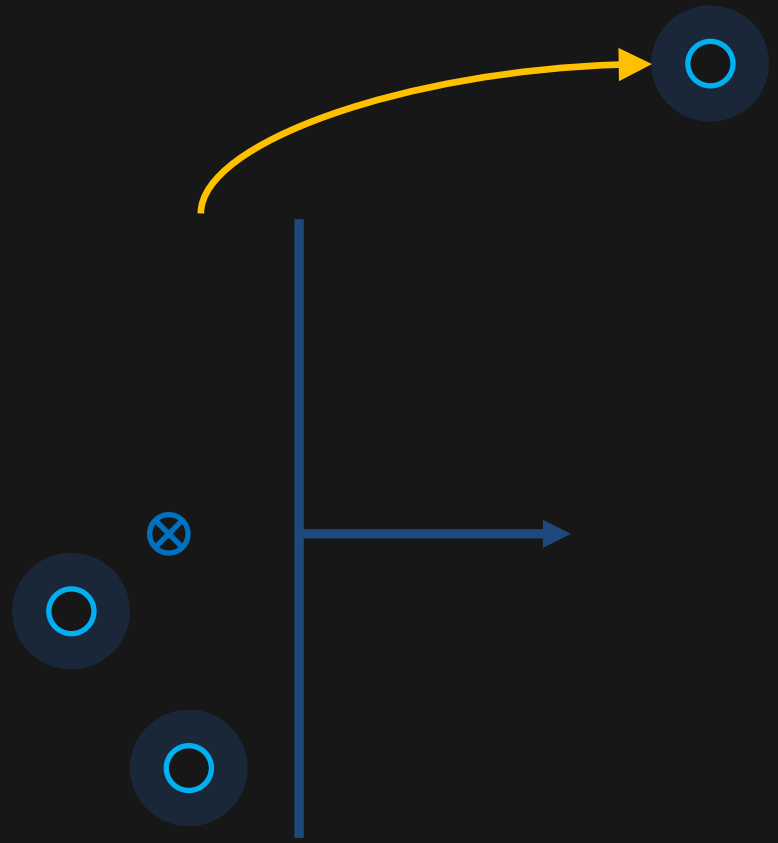

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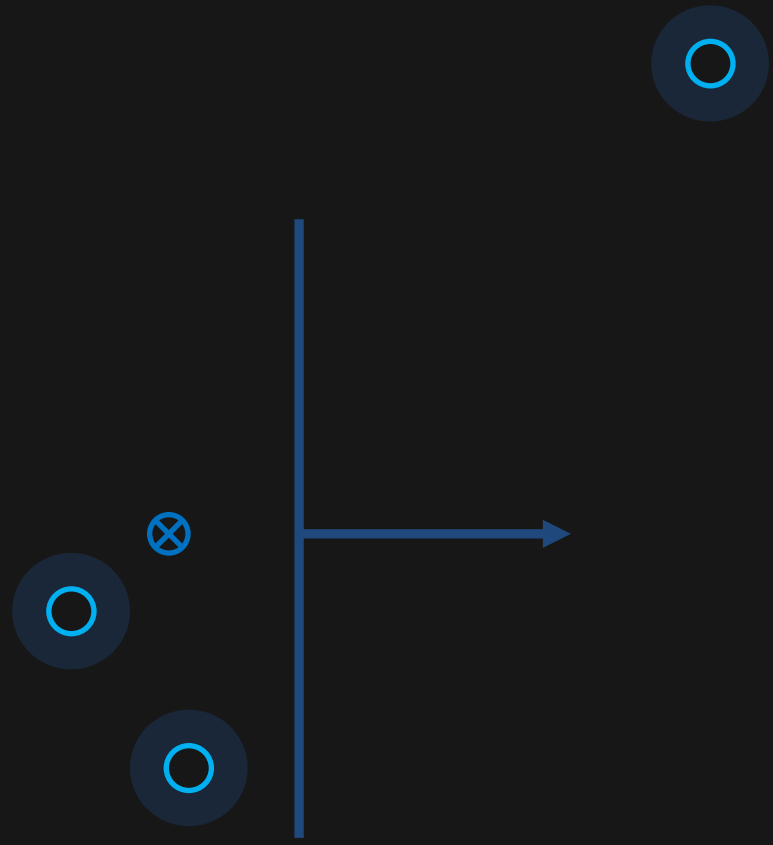

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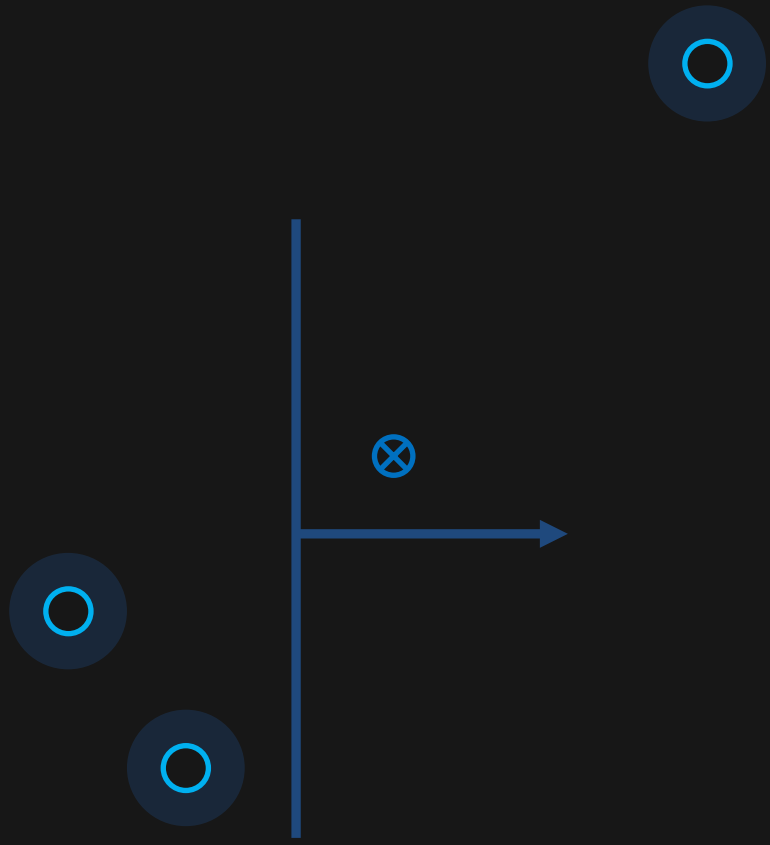

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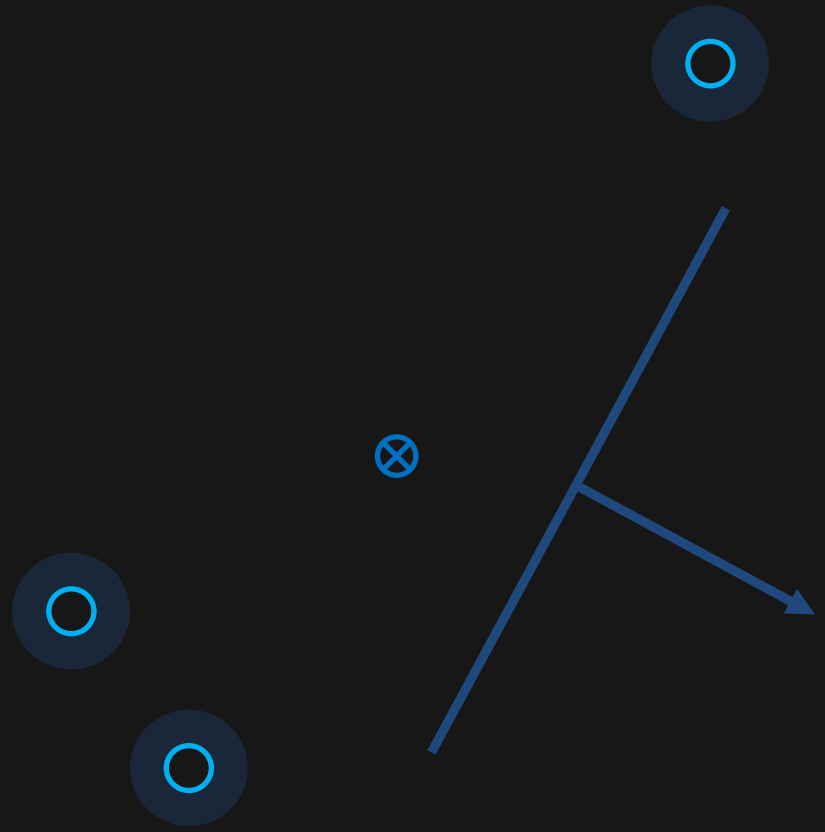
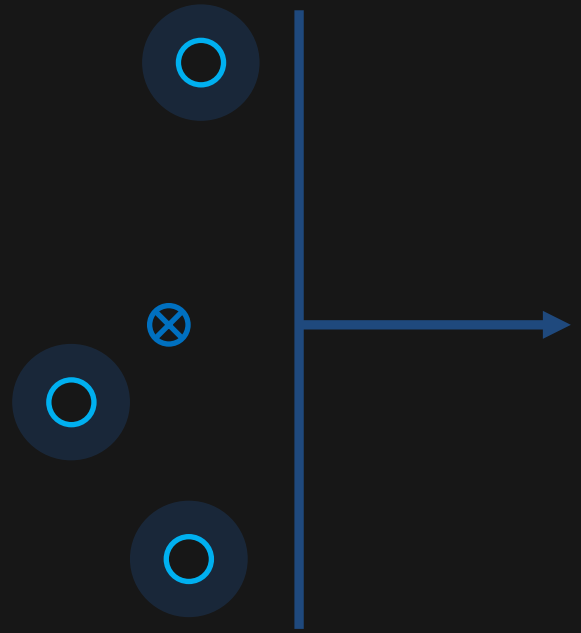


Identifying friendly flankers is easy.

- The squad knows who is a flanker.

Uncounted flankers affect the Frontline too.



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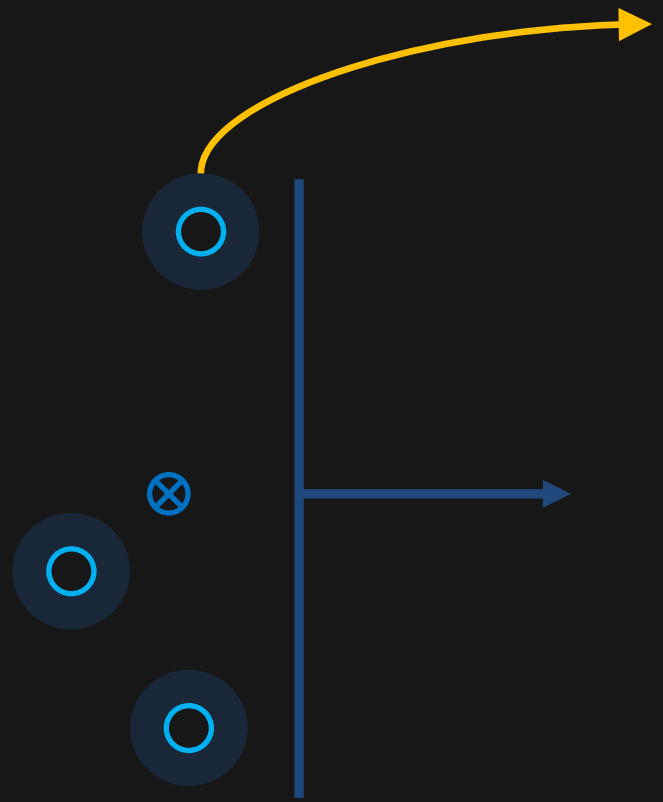

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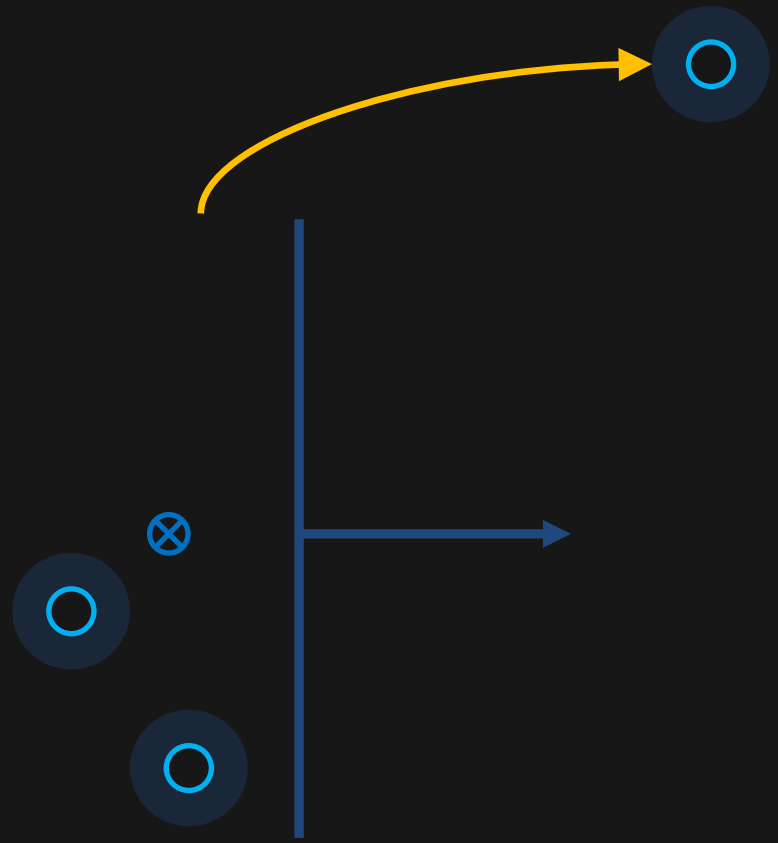

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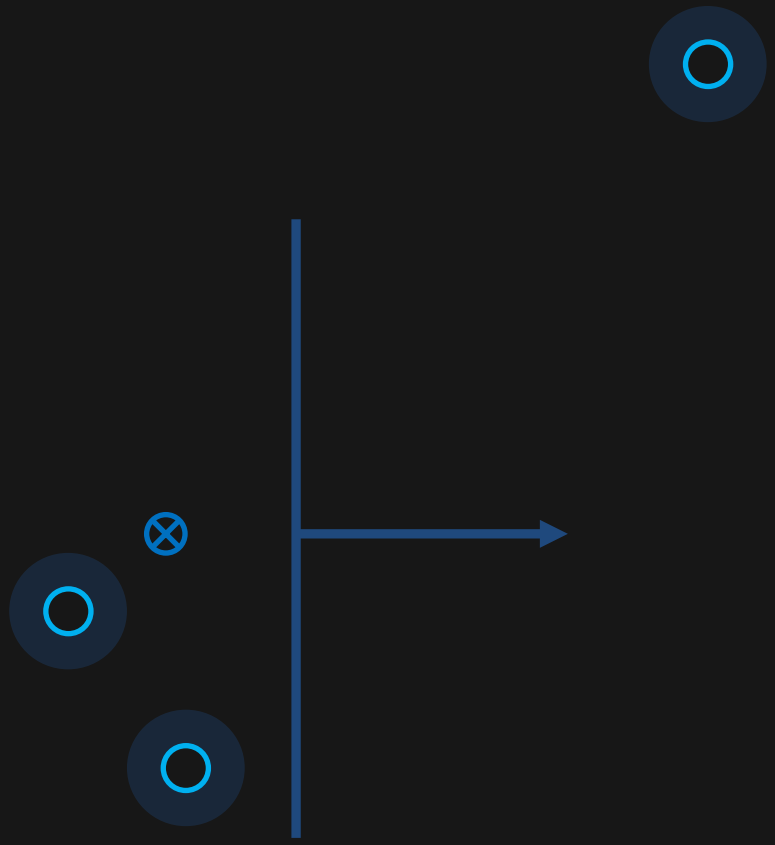

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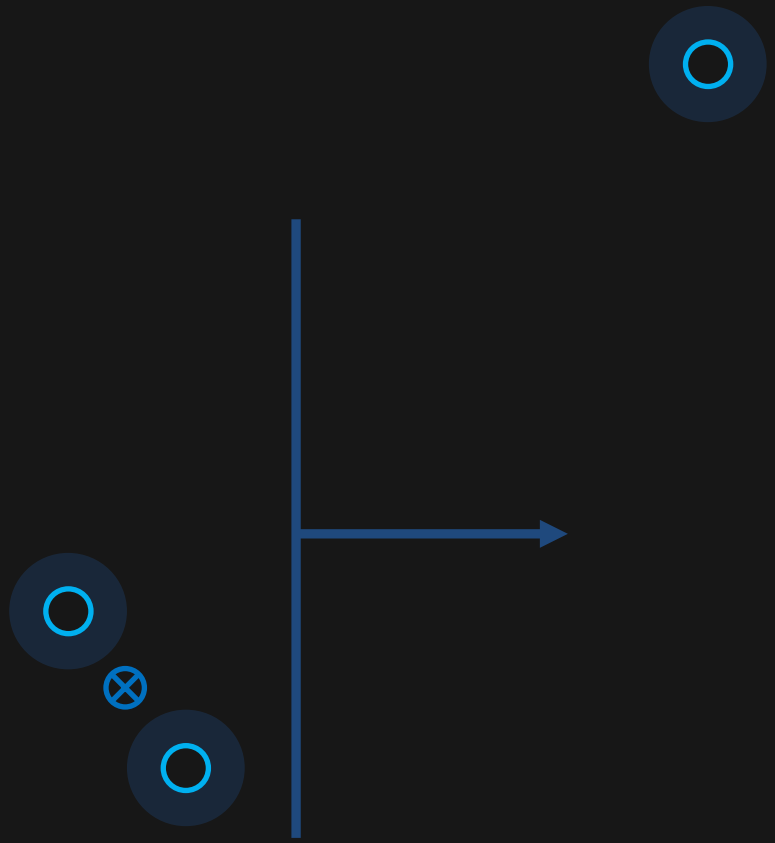
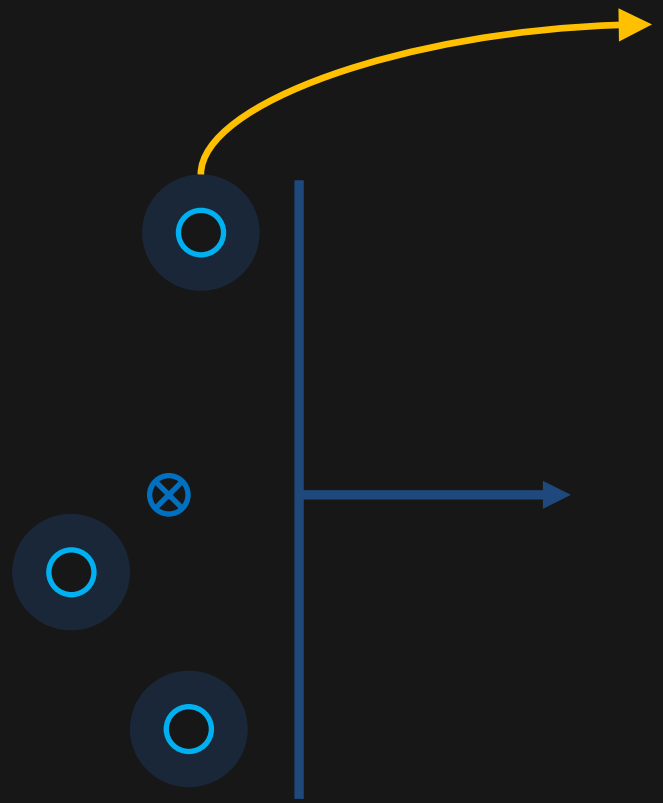


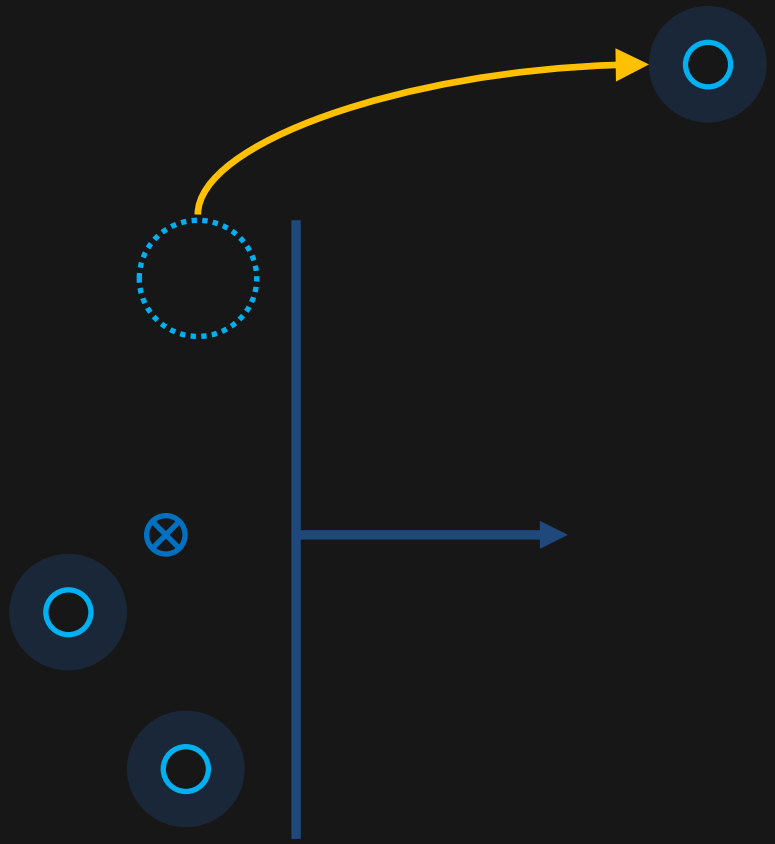
Uncounted flankers affect the Frontline too.

This can invalidate the flanker’s position.

Uncounted flankers affect the Frontline too.



Flankers leave a ghost behind.



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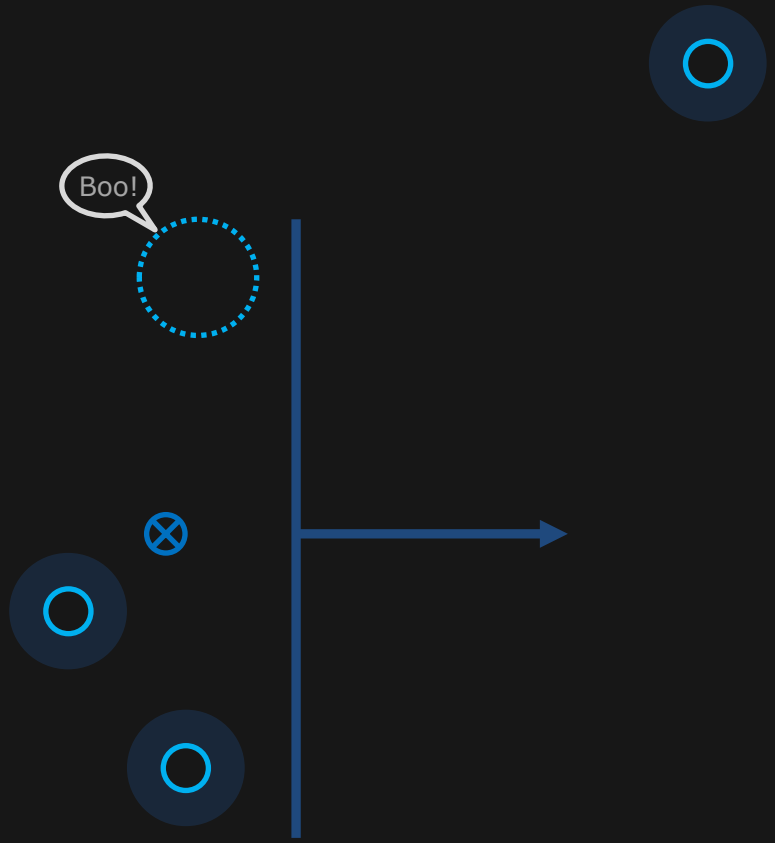
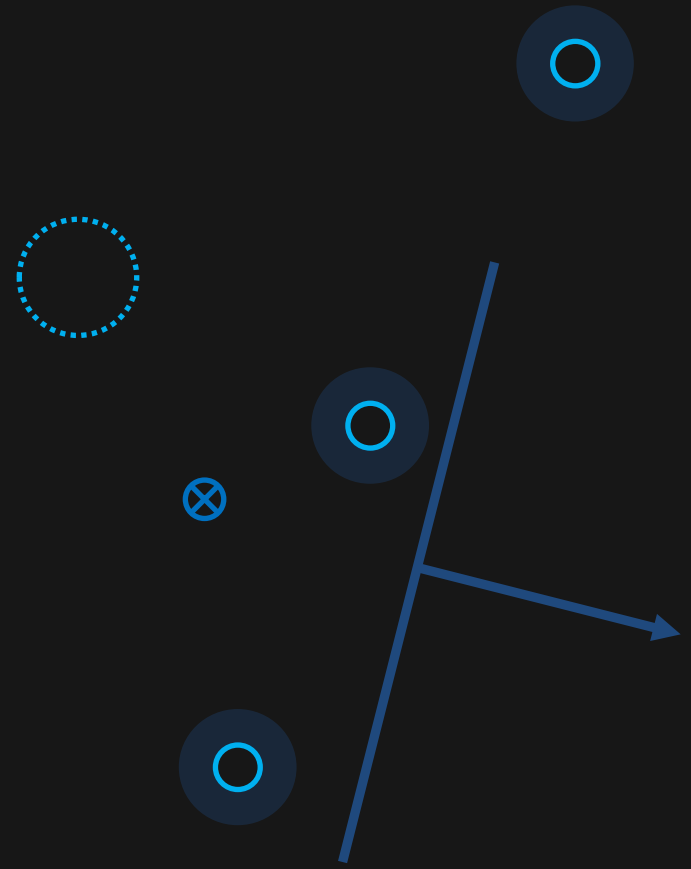


The ghost is removed if:

- The Frontline moves far enough.



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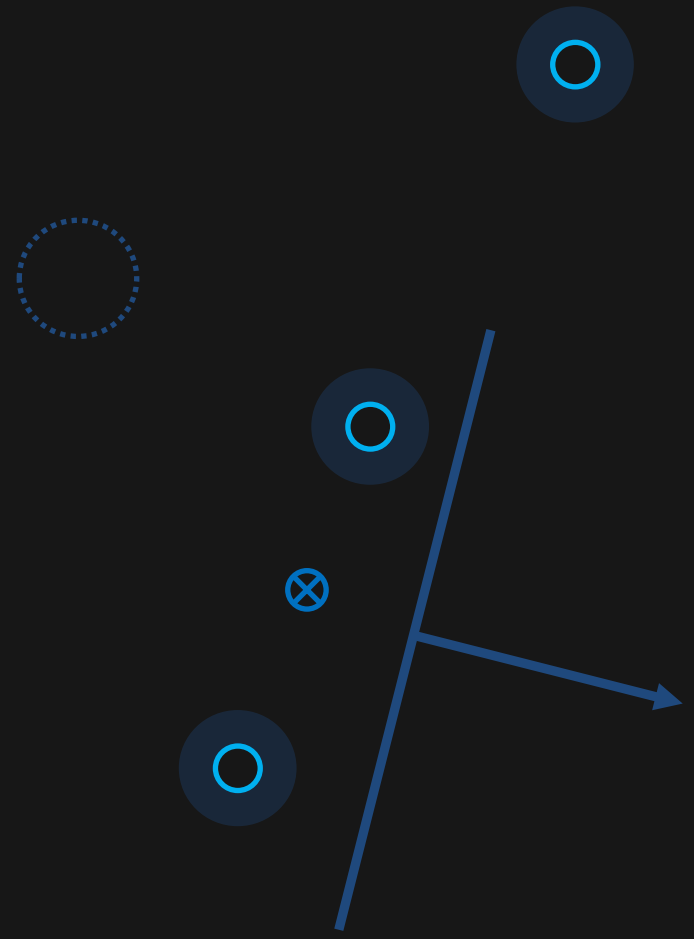
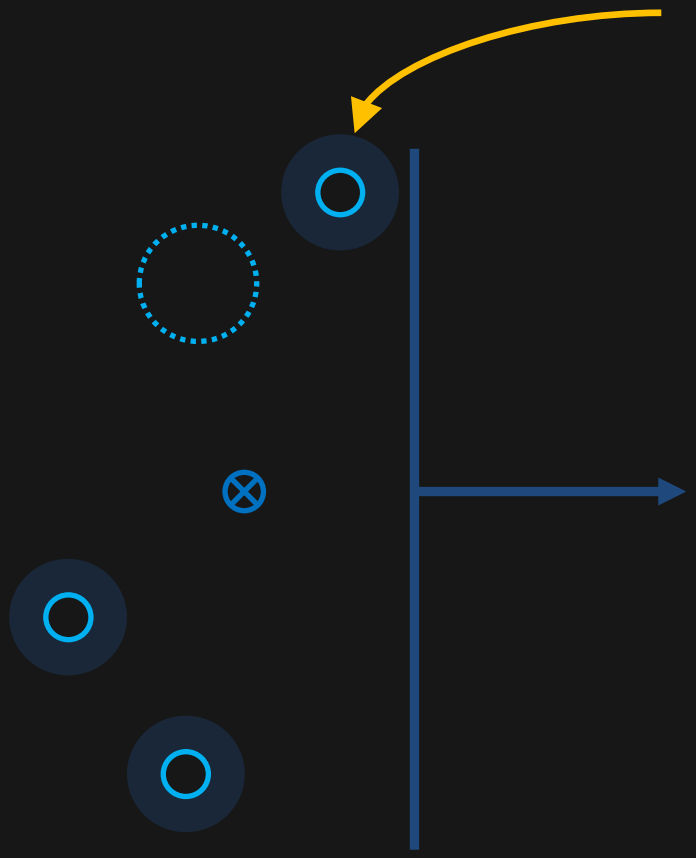


The ghost is removed if:

The AI no longer a flanker.



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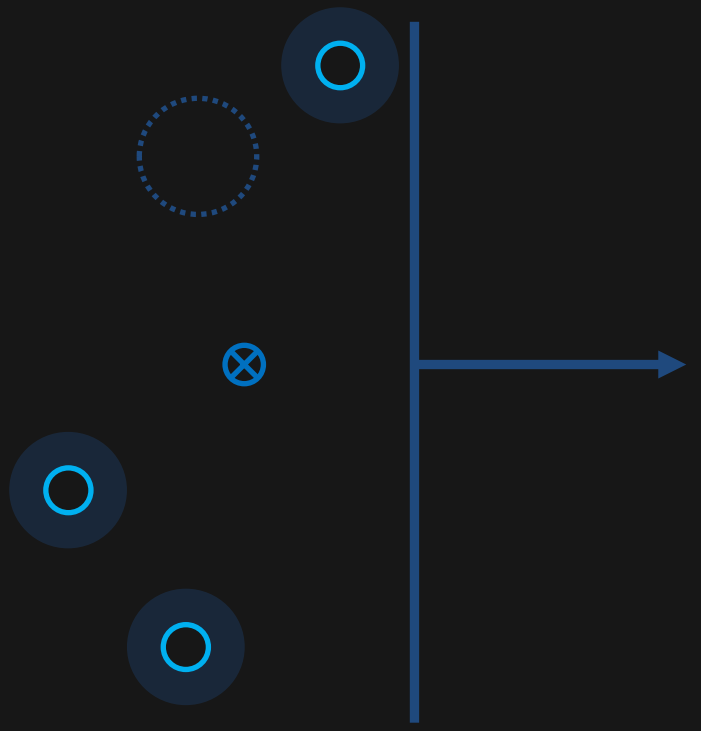
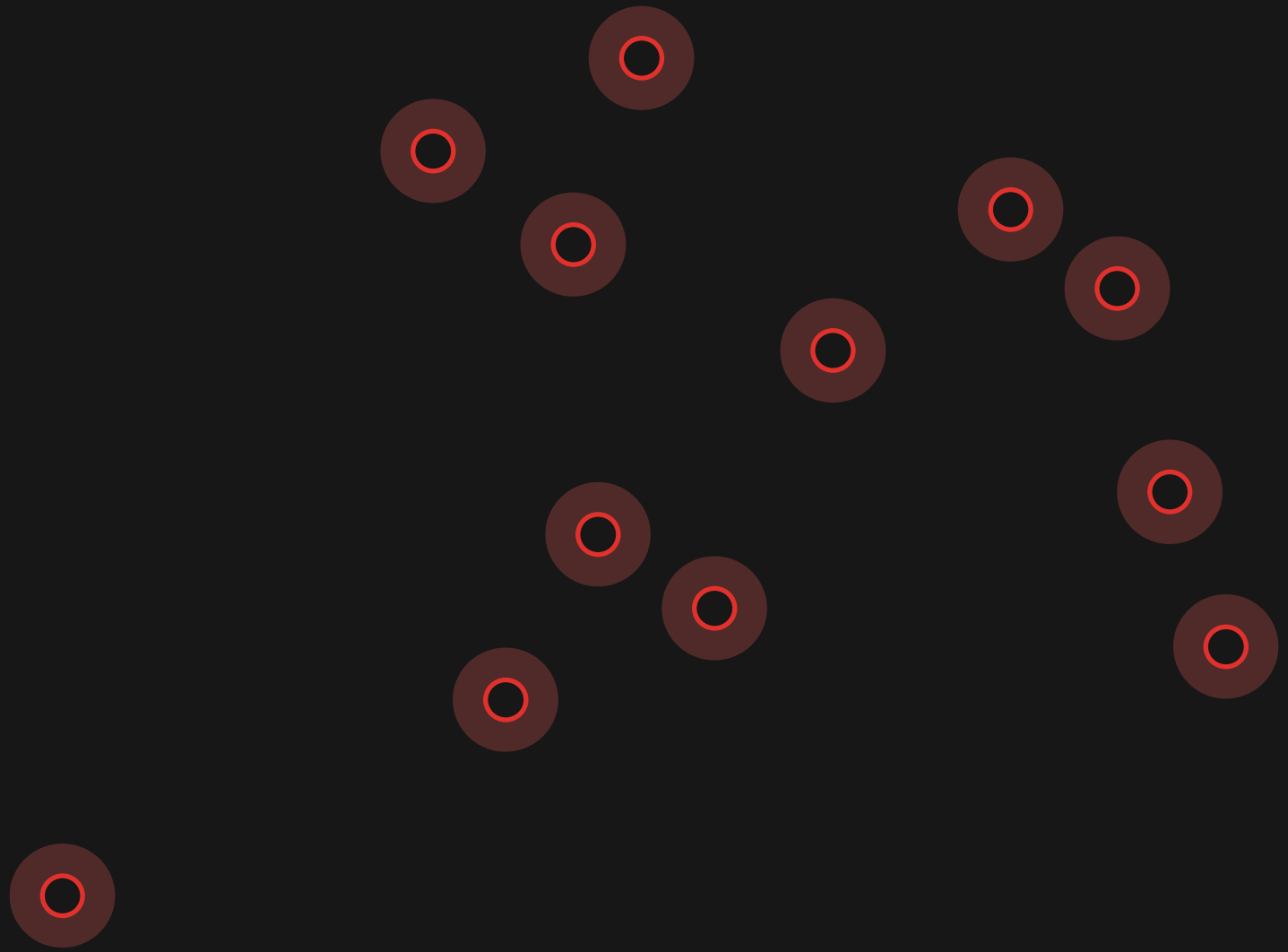
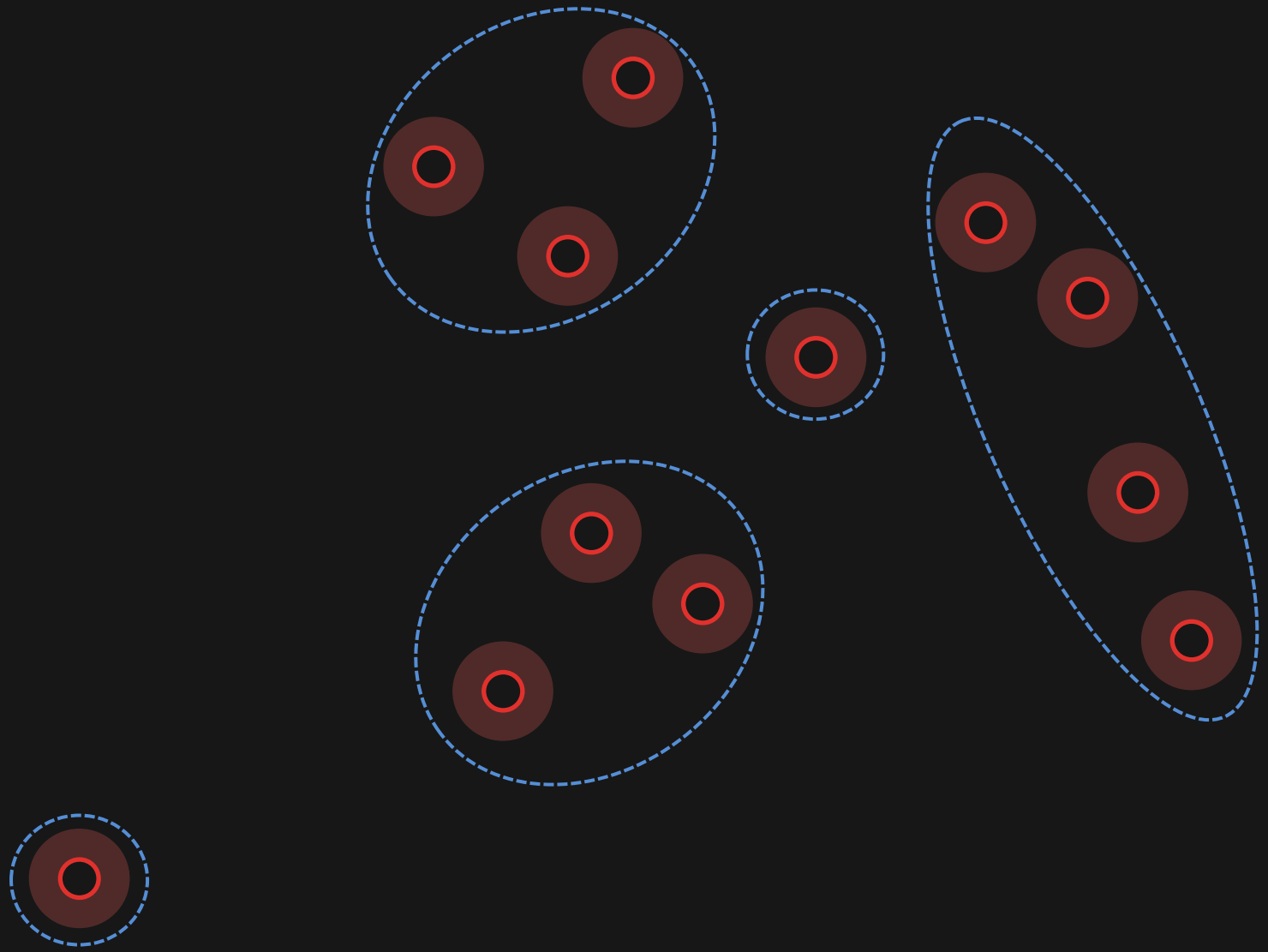


Enemy flankers are more complicated.

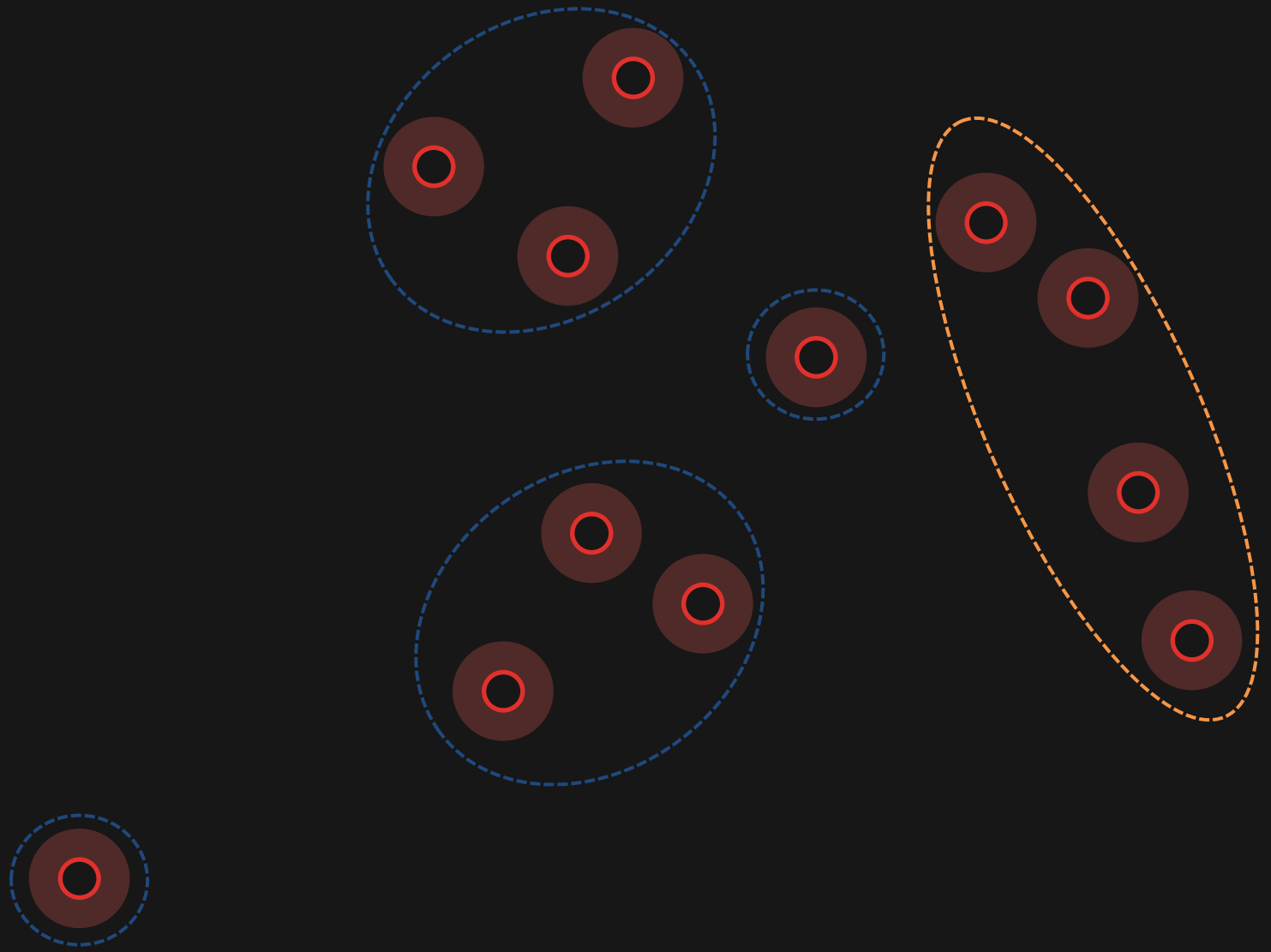
Find clusters of enemies.



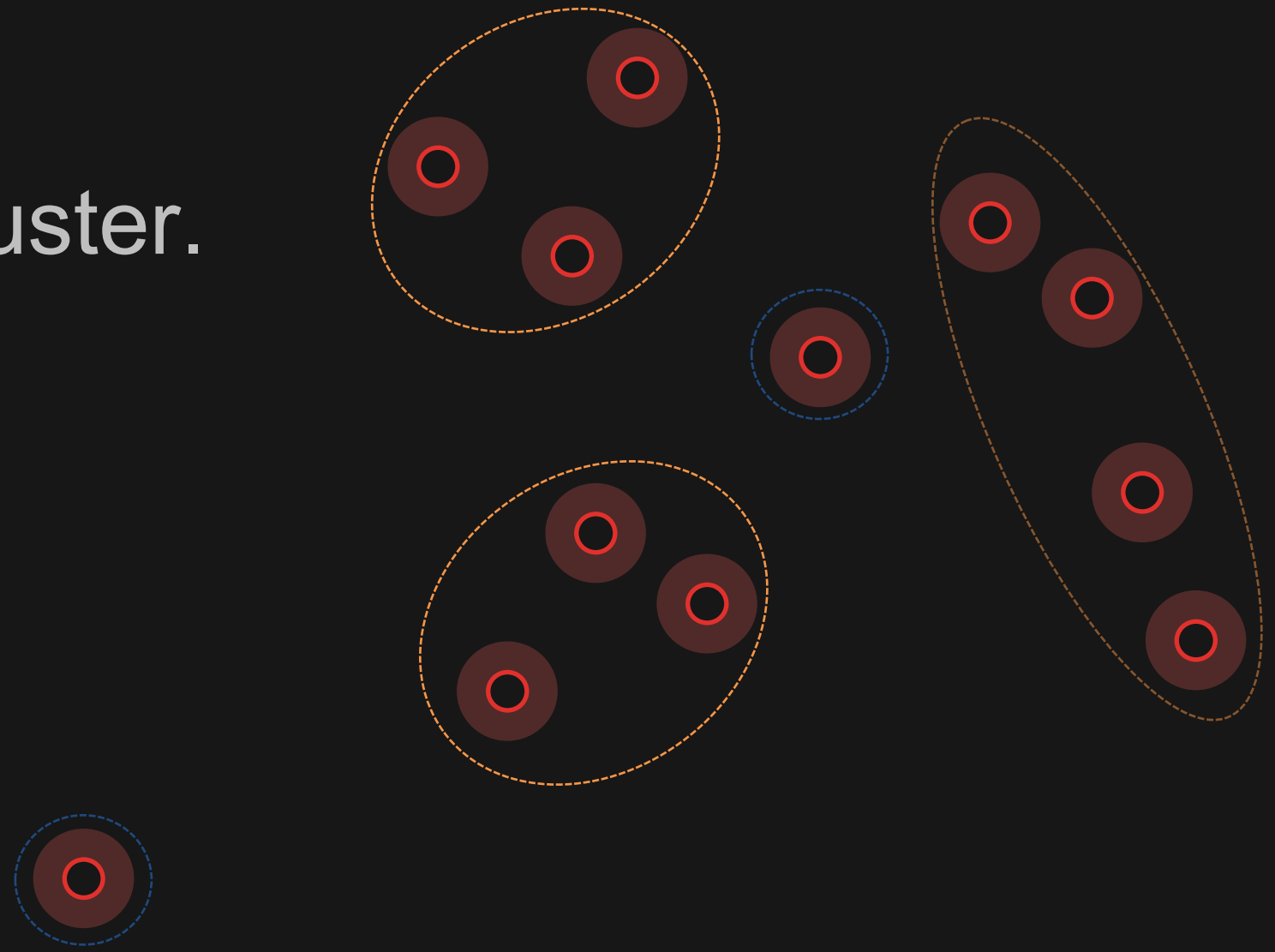
Find clusters of enemies.



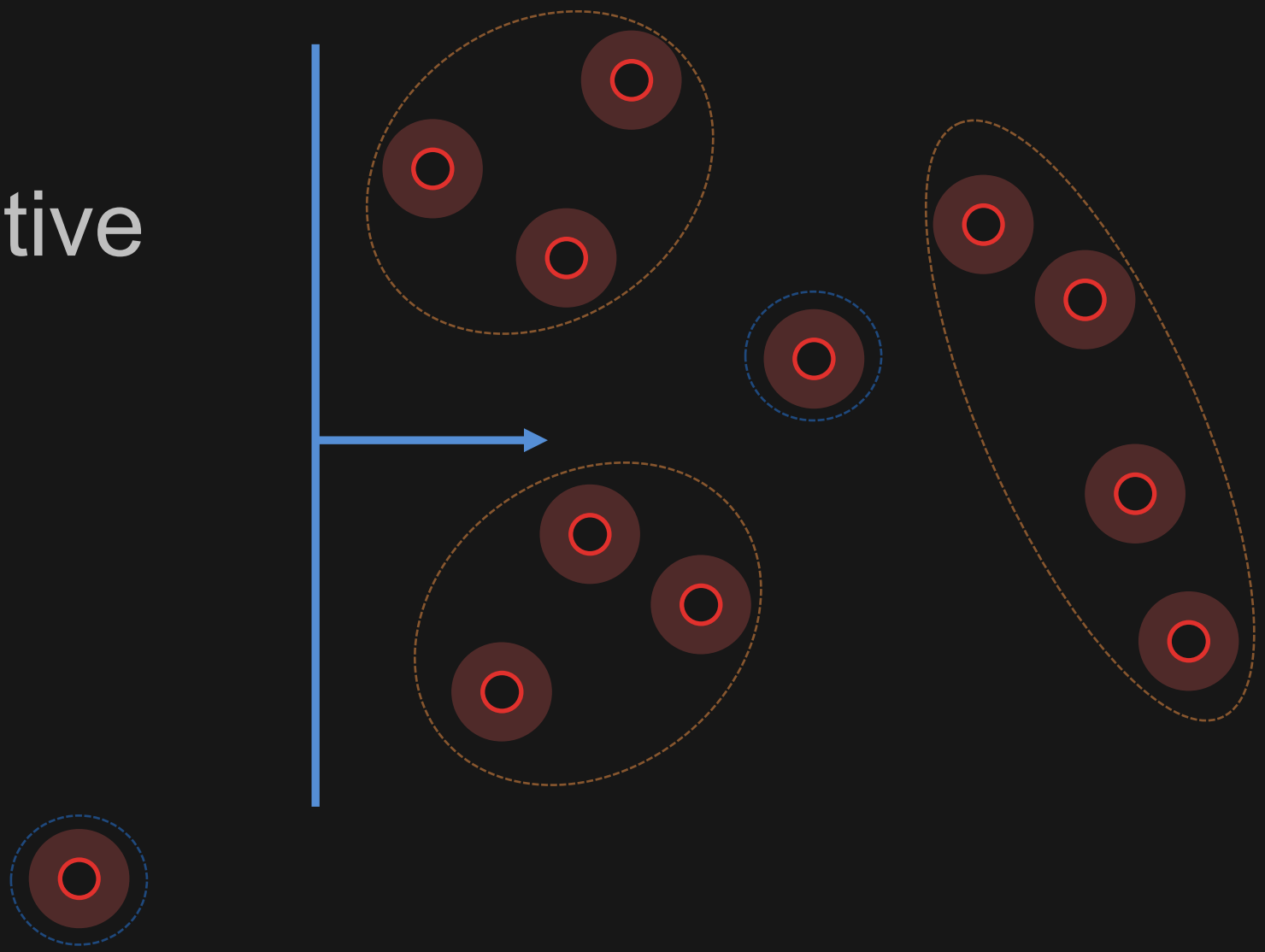
Find the largest cluster.



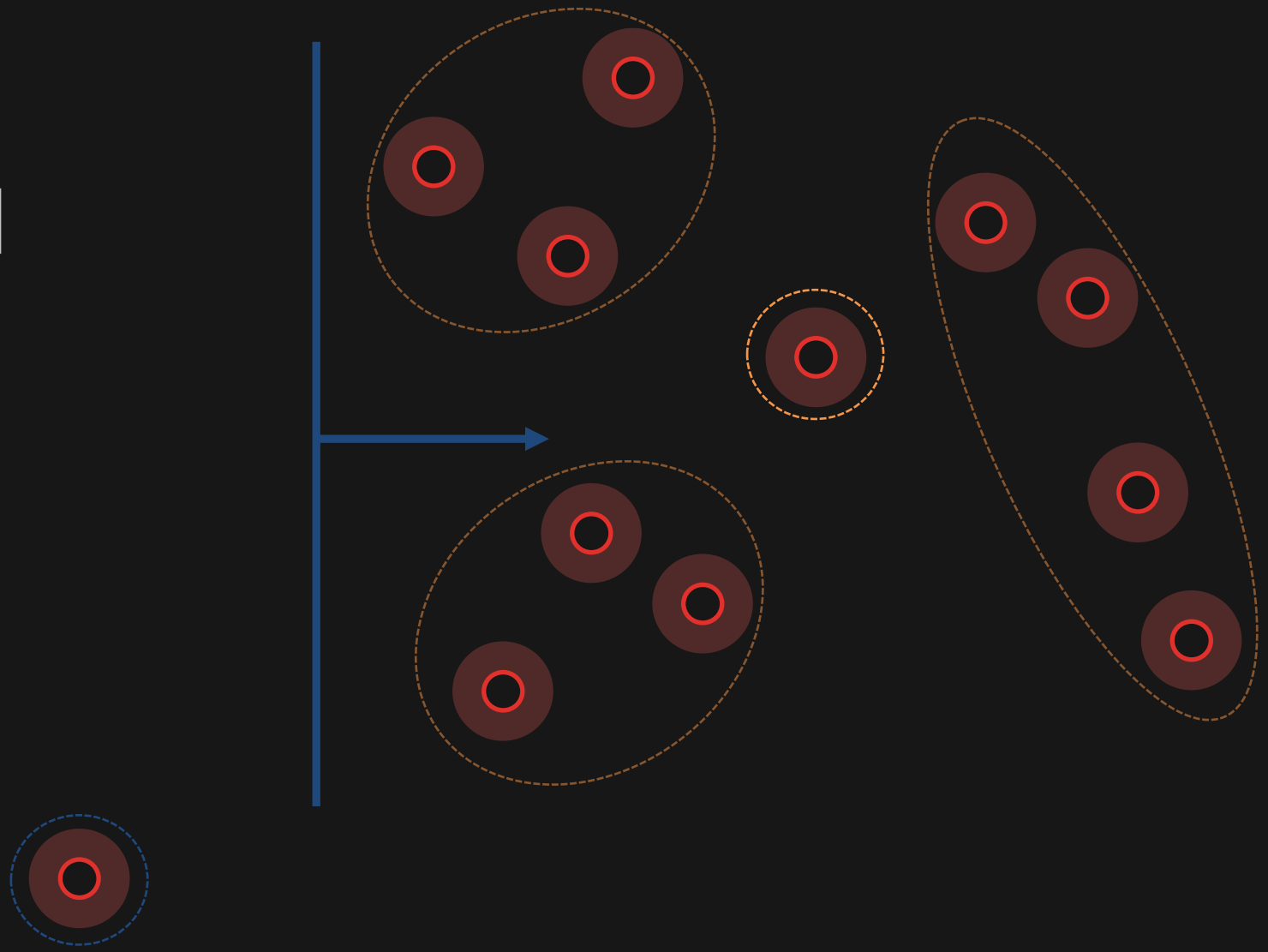
Add any large cluster.



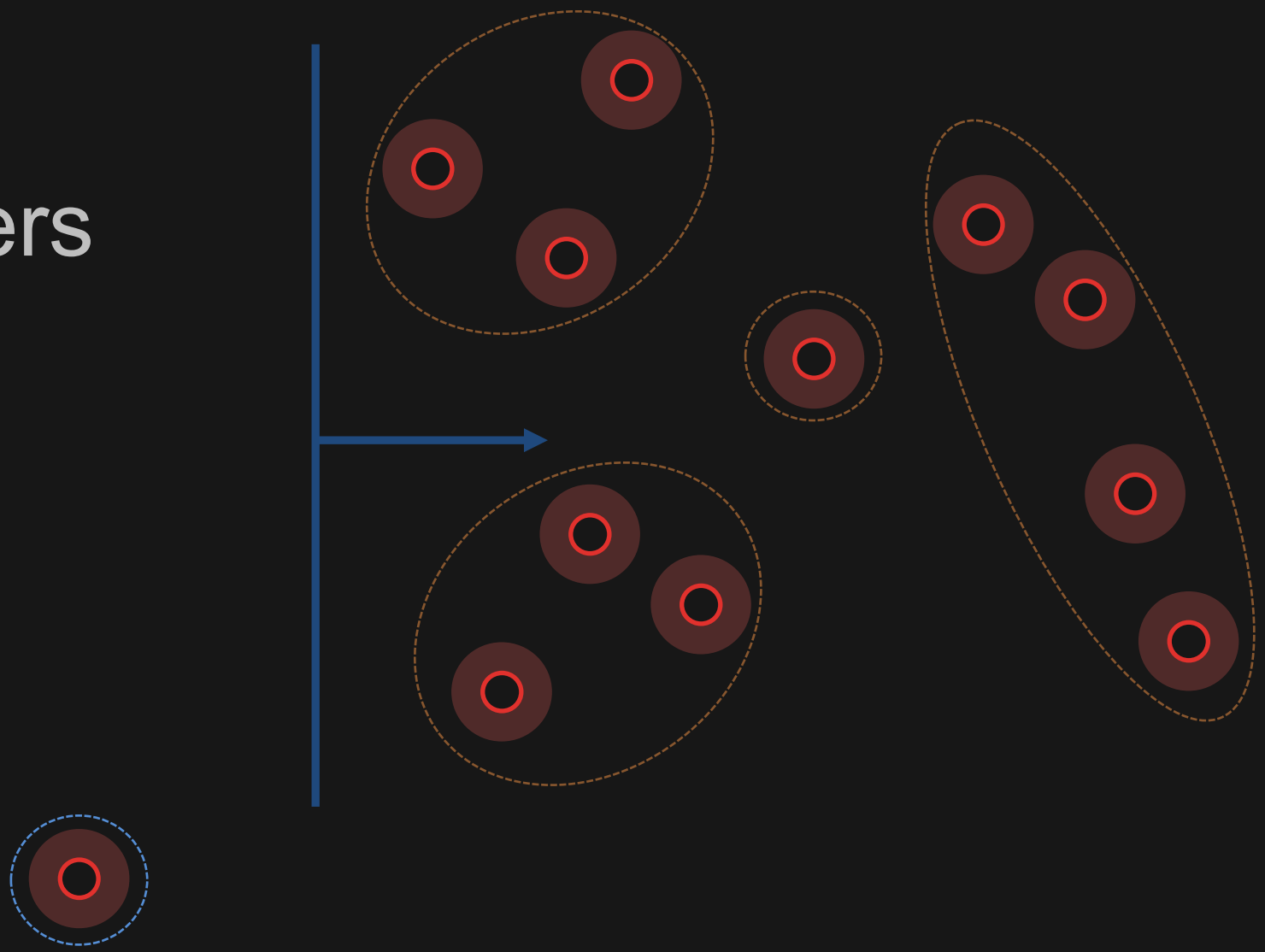
Calculate a tentative direction.



And add covered clusters.

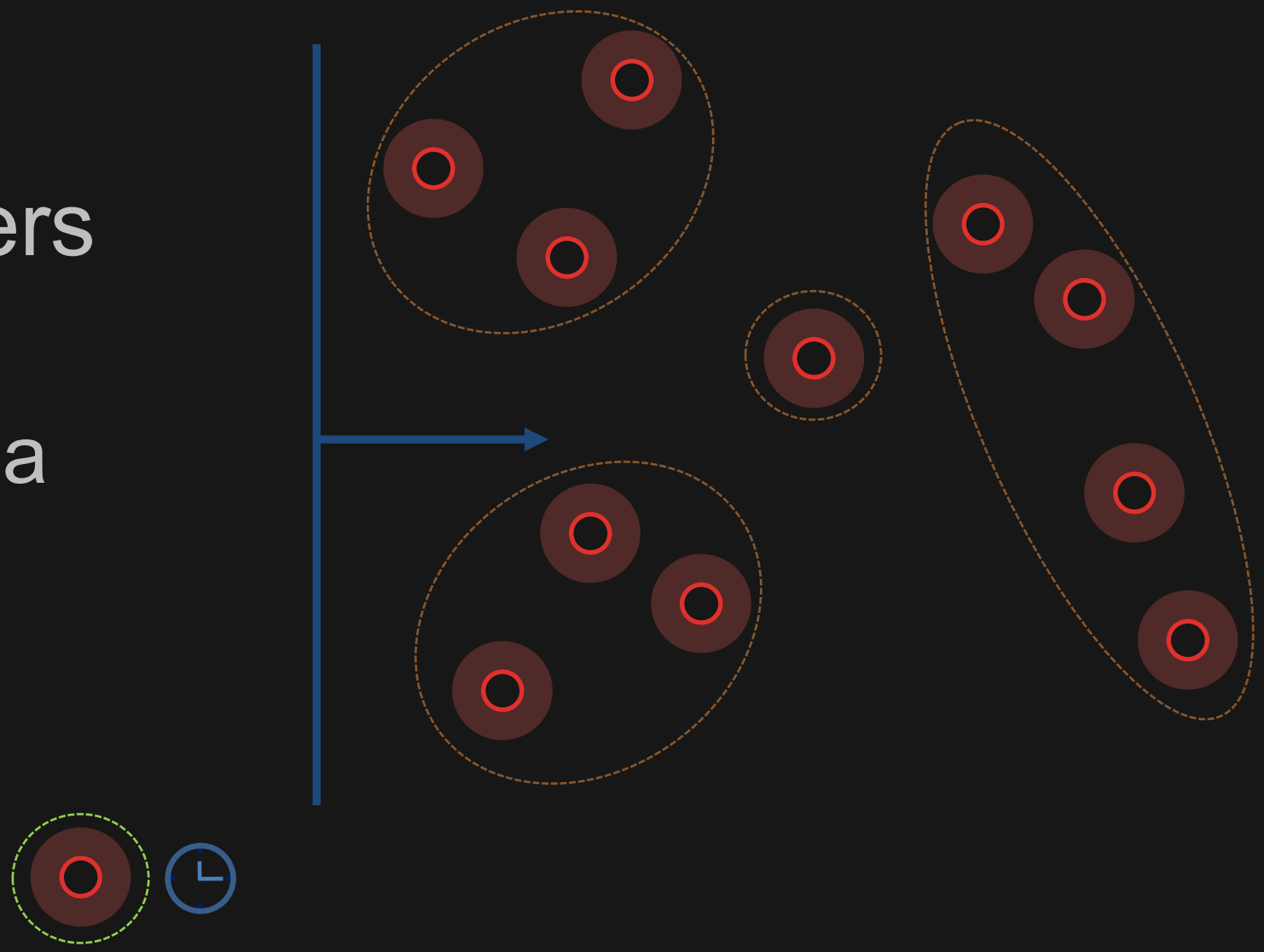


Remaining clusters are flankers.

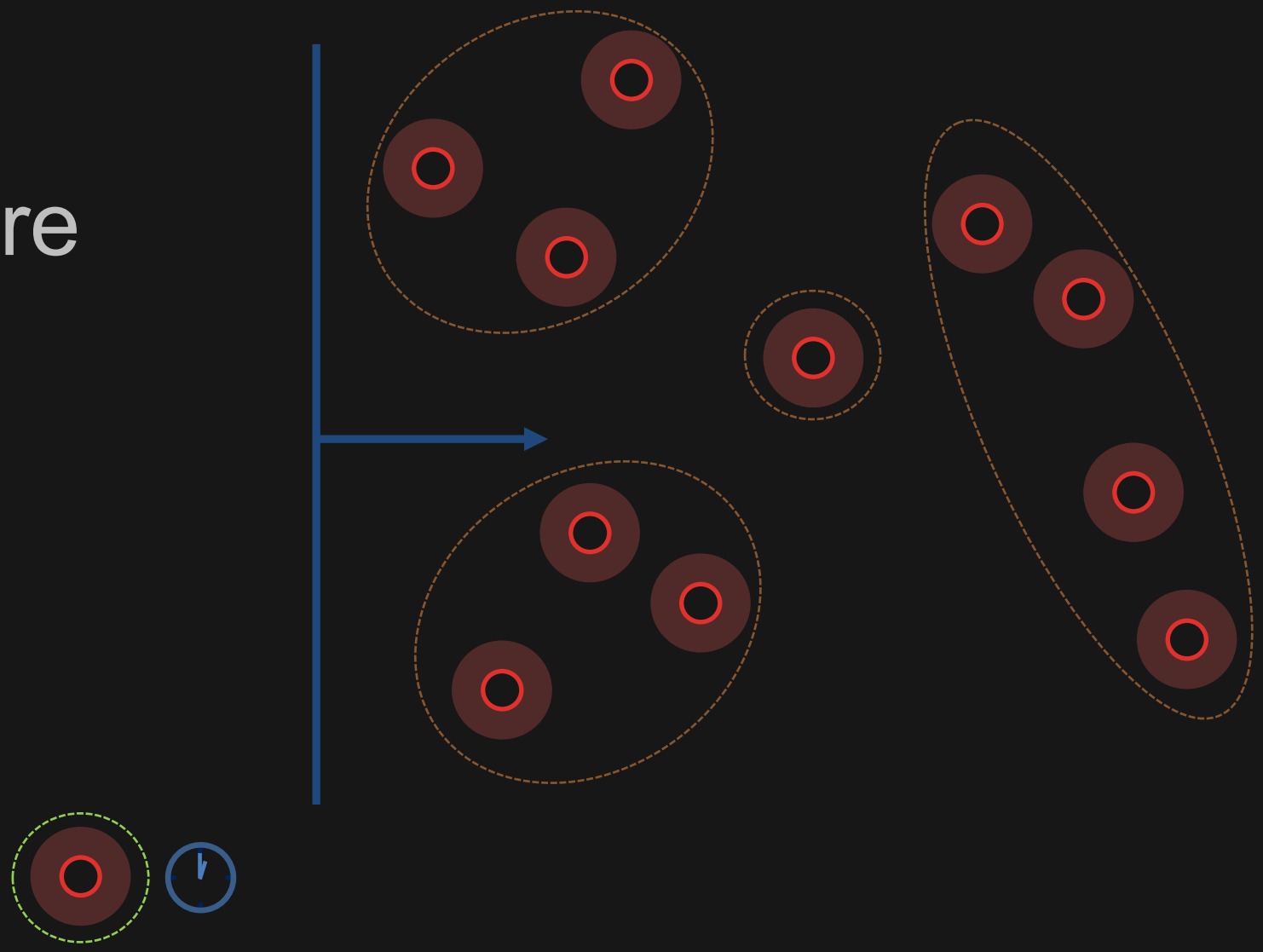


Remaining clusters are flankers.

- Flankers receive a timestamp.



Expire flankers are added.



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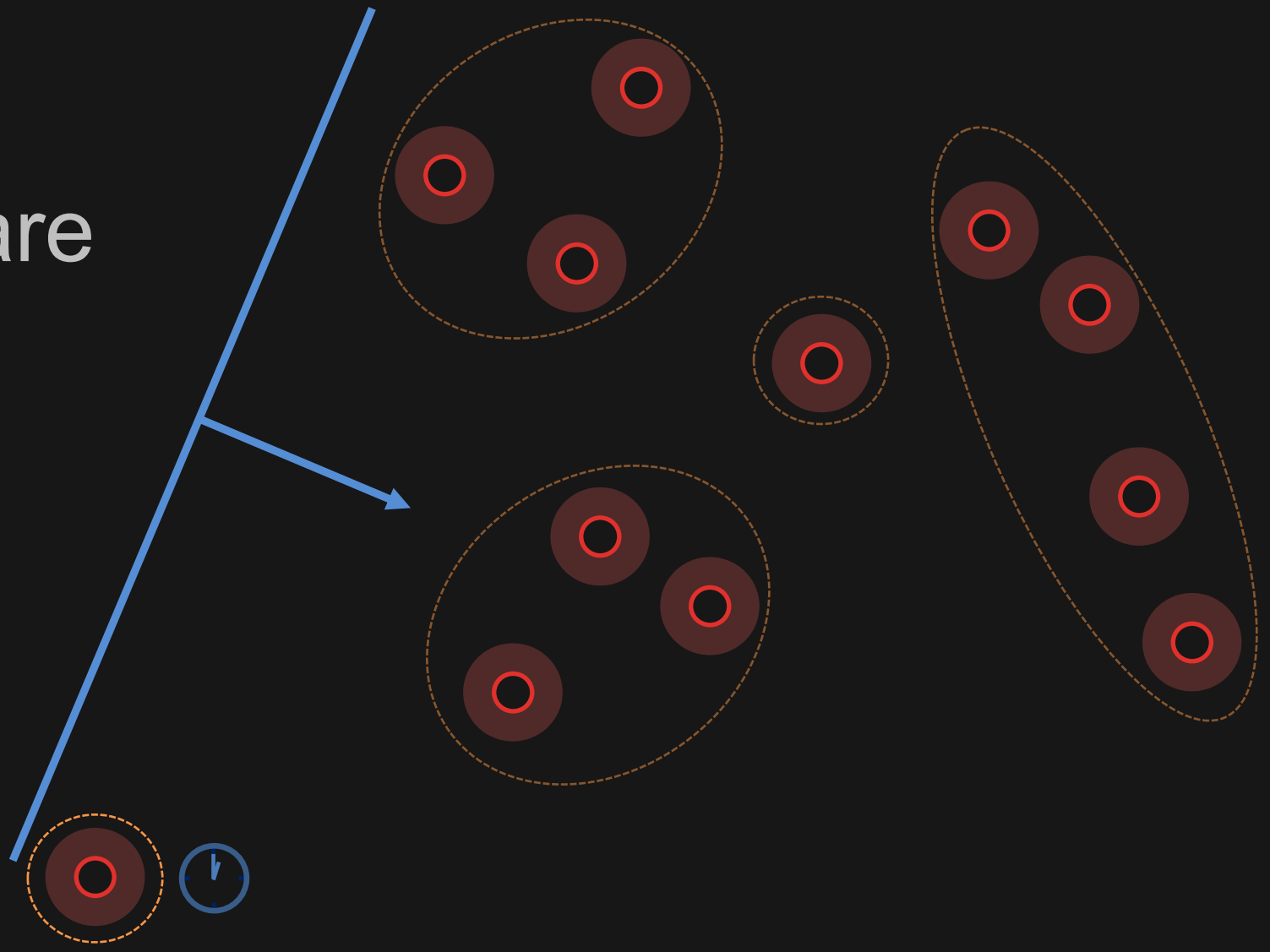

The player moves much more than the AI.

The AI cannot keep up.

DESIGNER DIRECTIONS

Level designers provide context and identify features:

- Defend Zones
- Home Areas
- Fortification Zones

Defend Zones are areas in which the AI operates.

Confidence is used to prevent the AI from wandering off.

Home Areas are used to mark up where the squad is anchored.

The squad always retreats to their Home Area.

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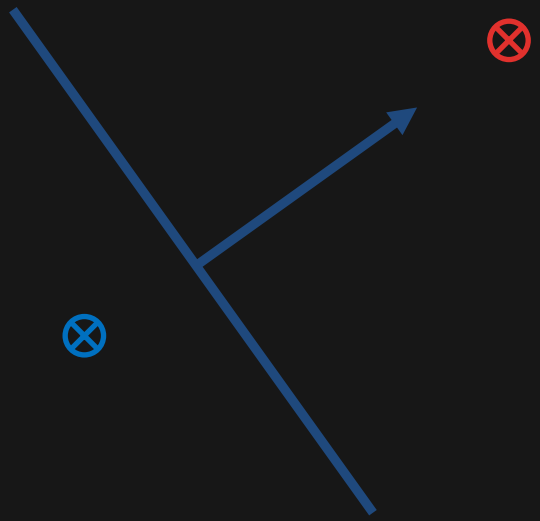

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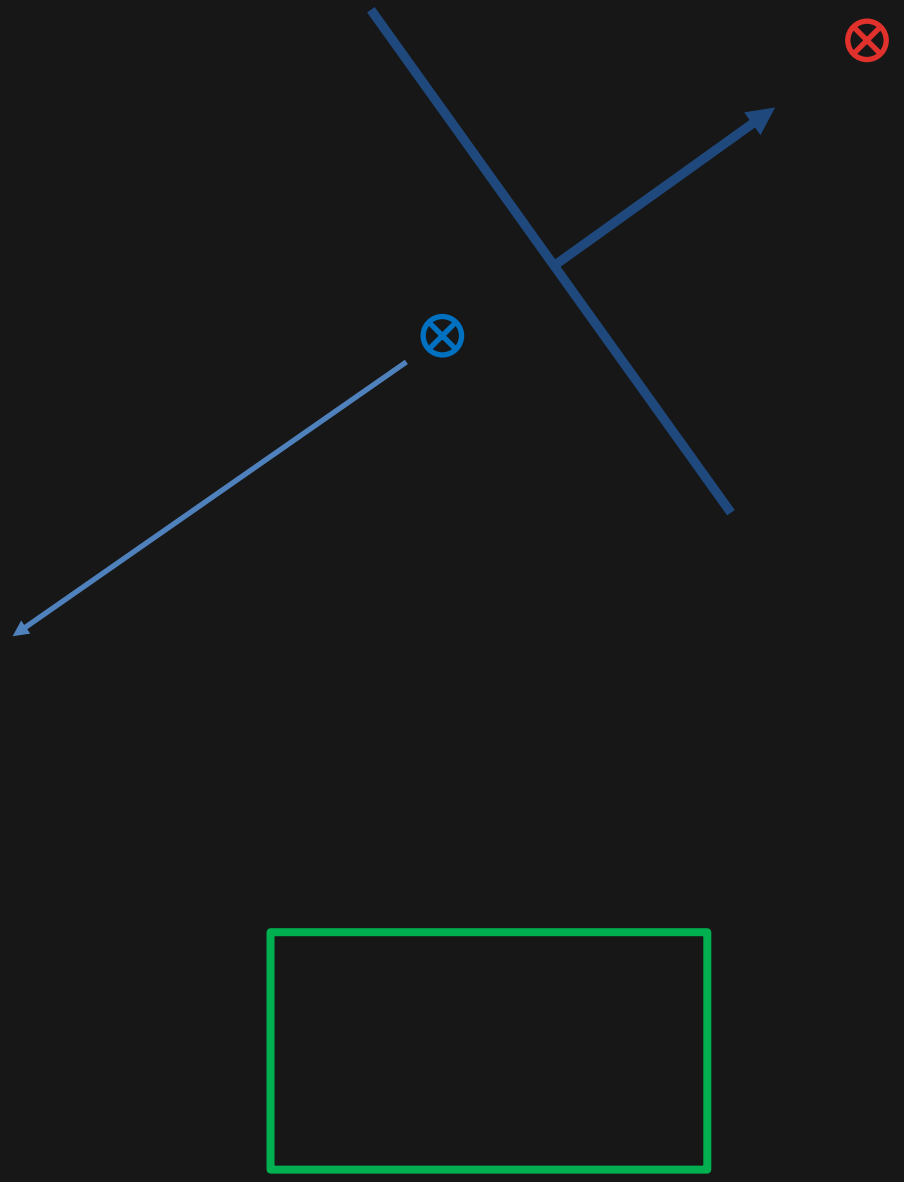

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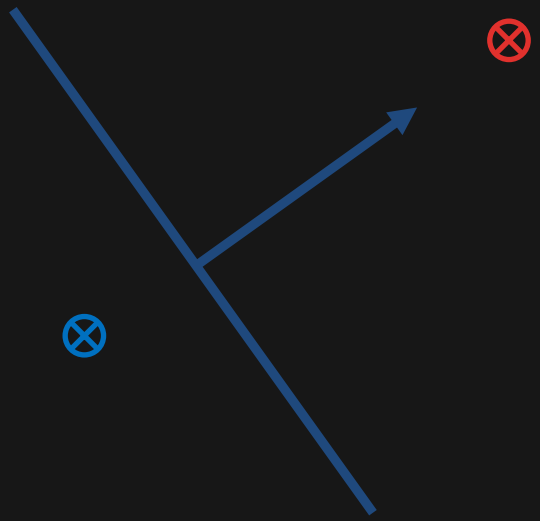

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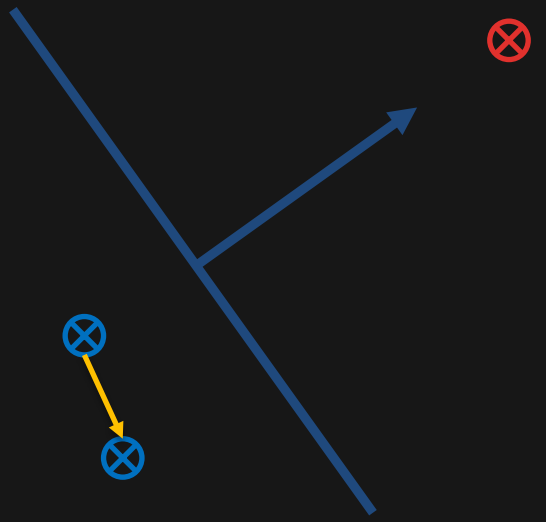
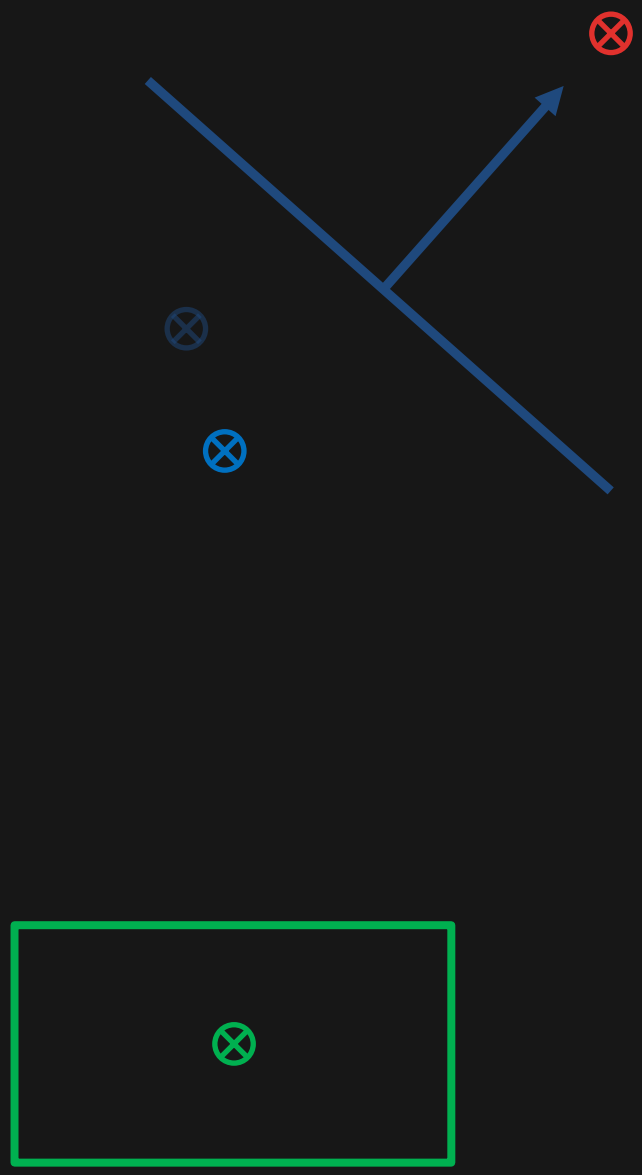
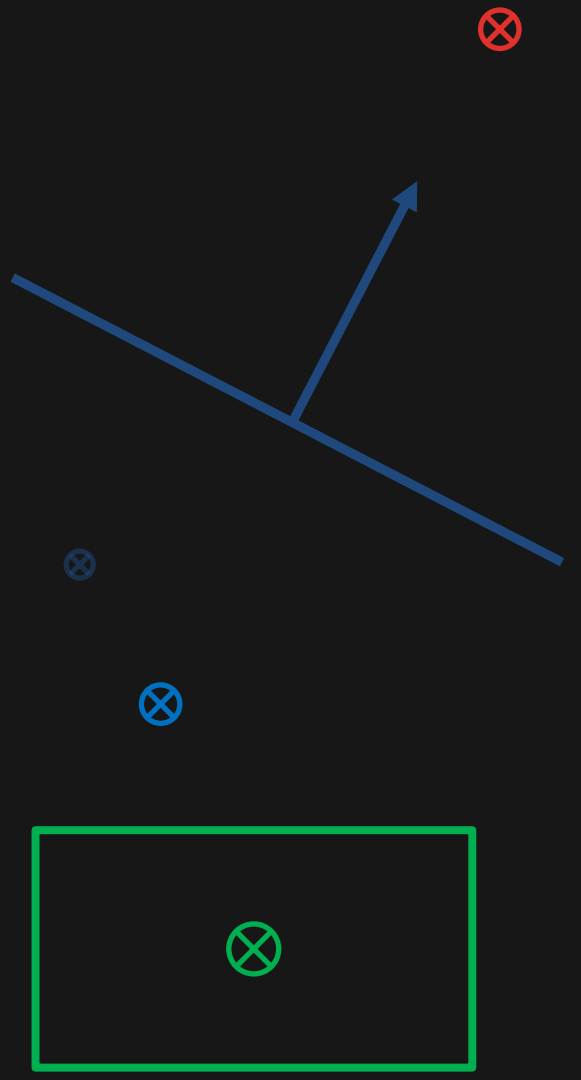


The squad always retreats to their Home Area.



The closer to the Home Area, the greater its influence.



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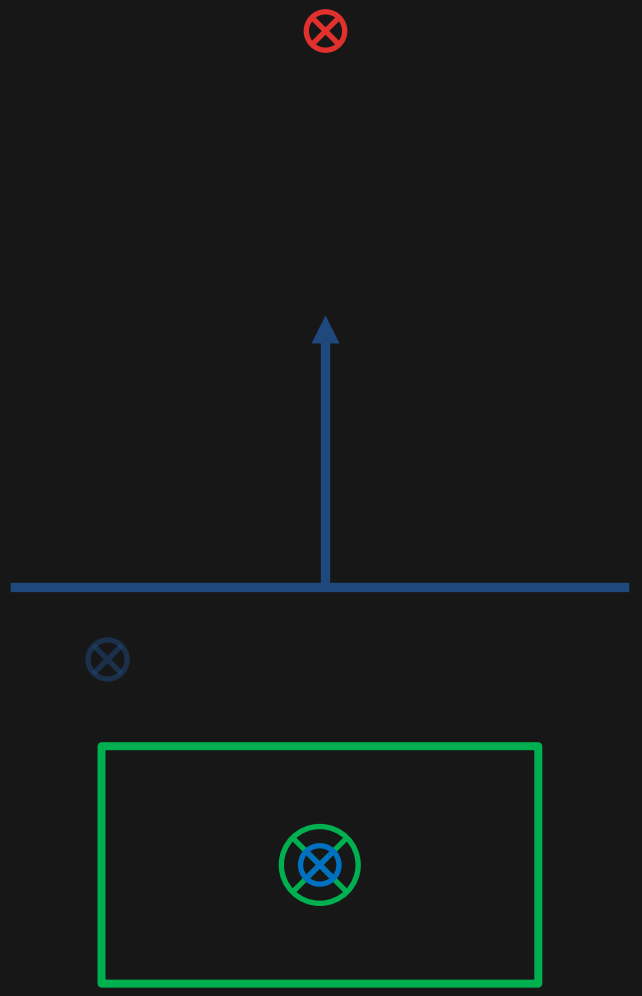
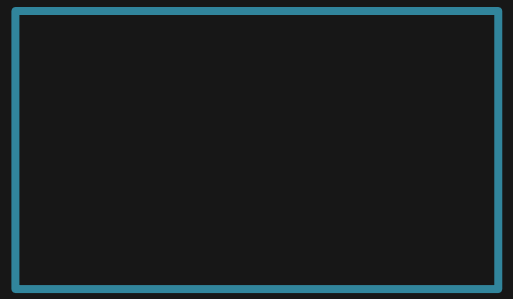


AI needs to take advantage of strong points and choke points.

A level designer adds Fortification Zones to identify good defensive positions.

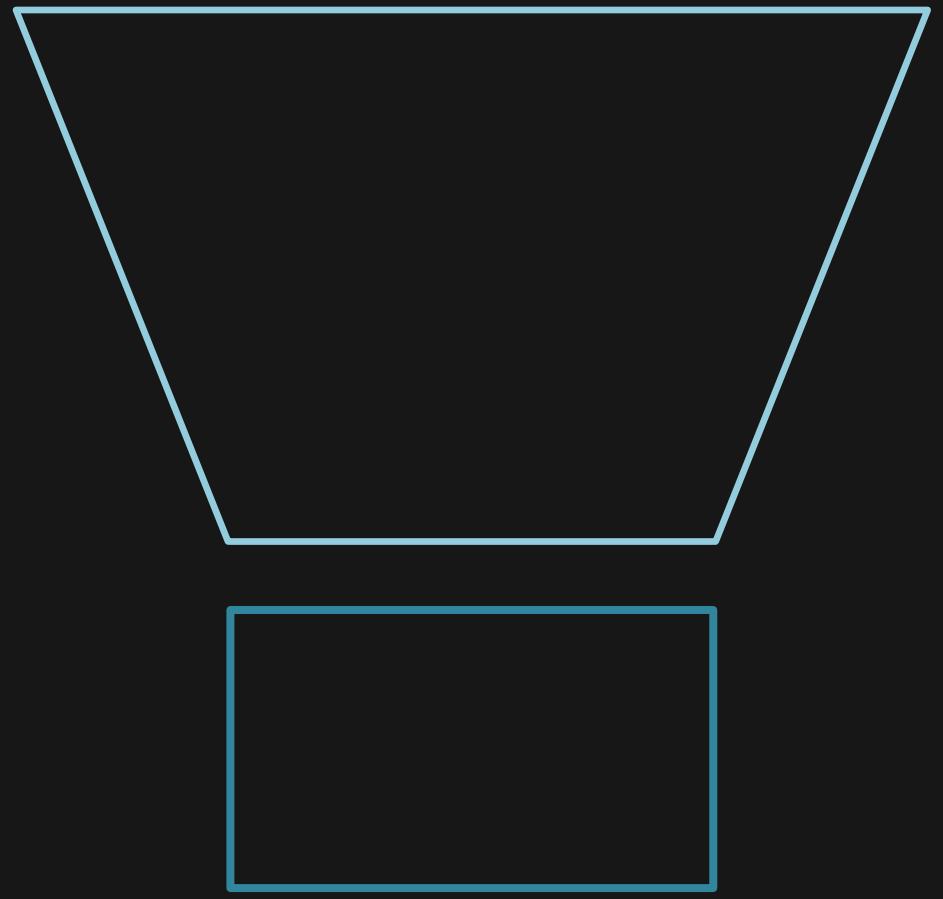
Fortification Zones consists of:

- An area to fight from.

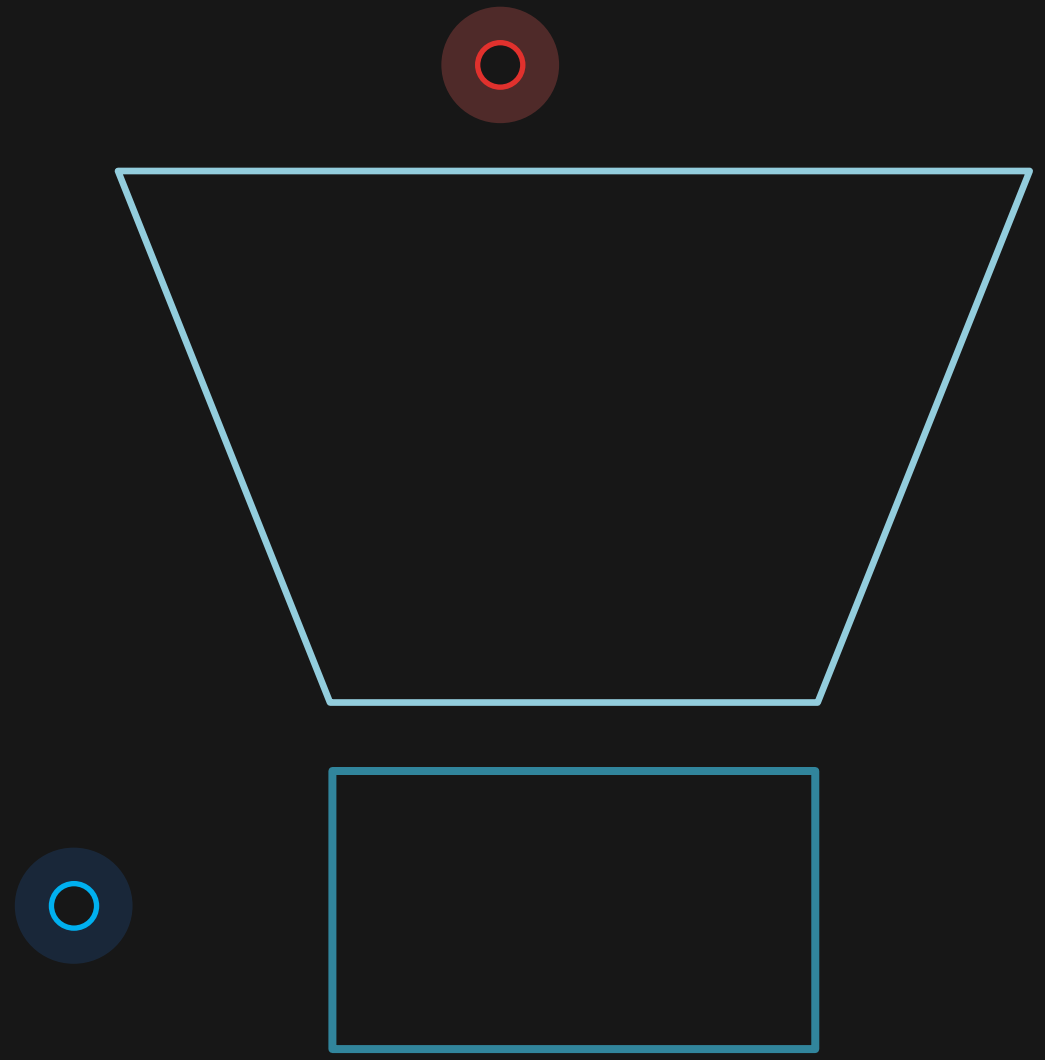


Fortification Zones consists of:

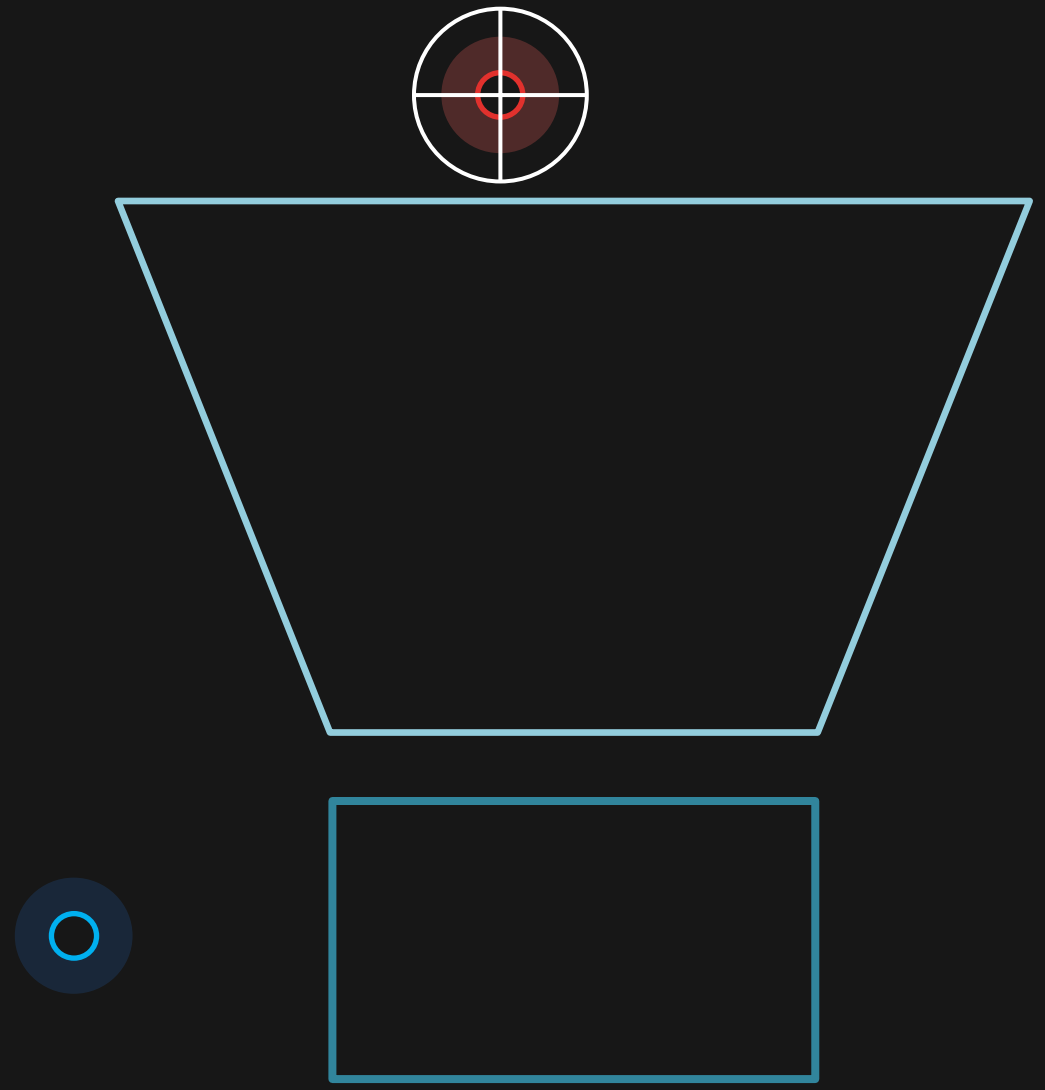
- An area to fight from.
- A kill zone to attack.



The AI’s target’s position decides if the Fortification Zone is valid.



The AI’s target’s position decides if the Fortification Zone is valid.



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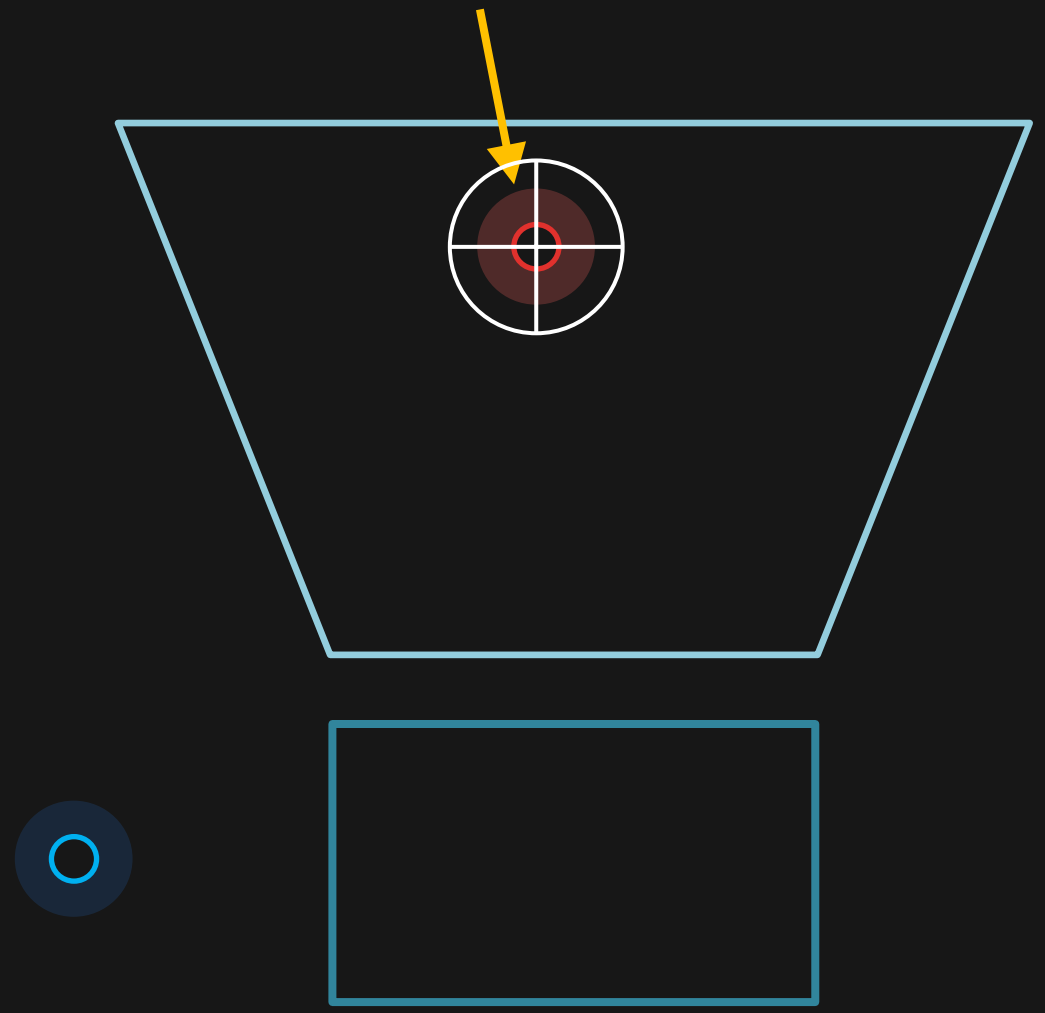

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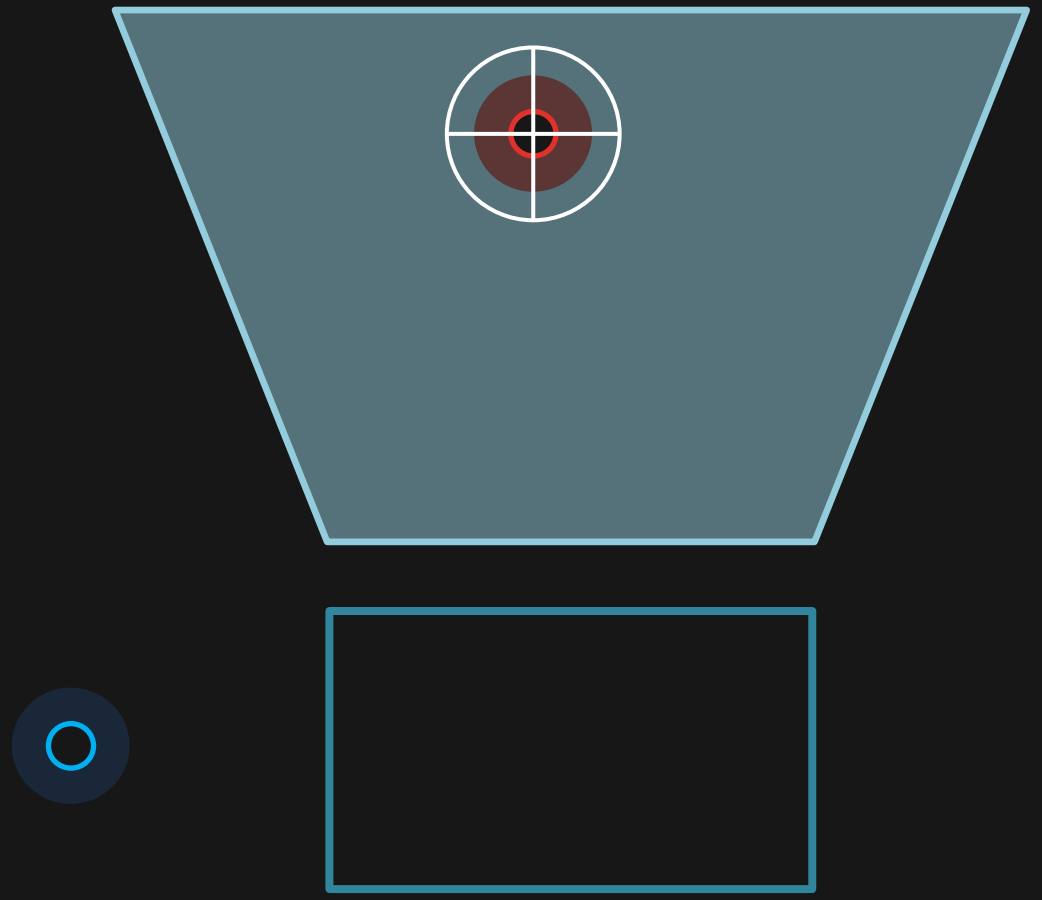

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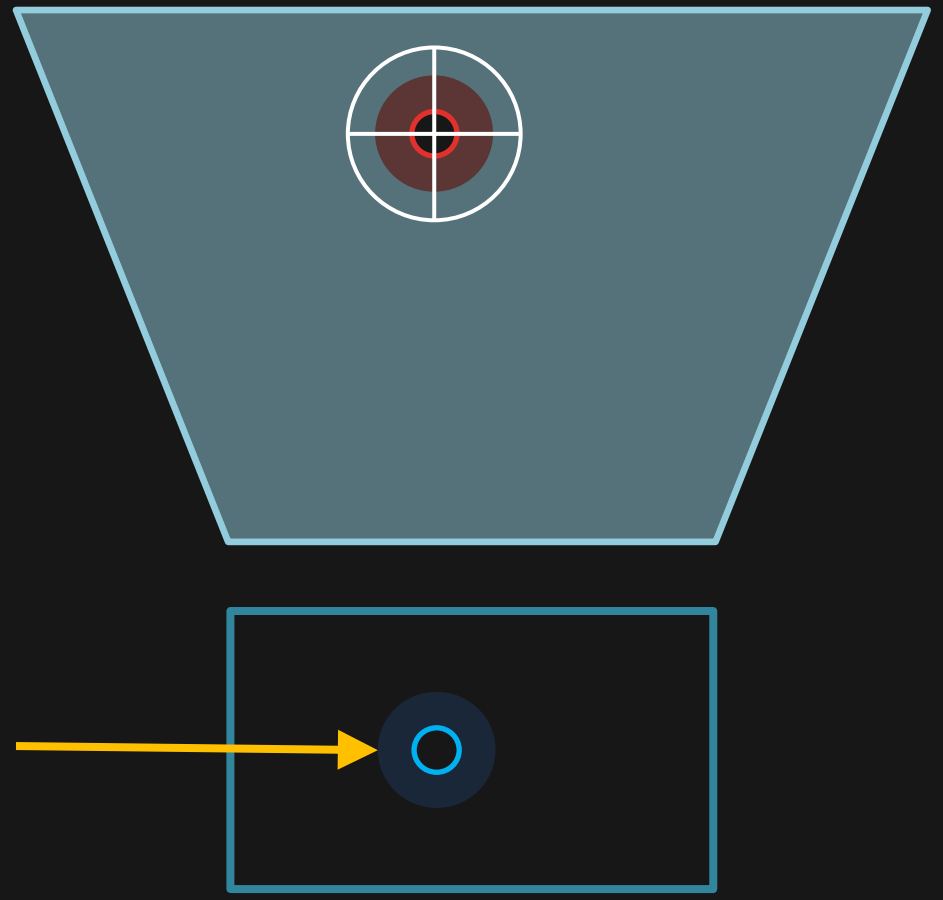
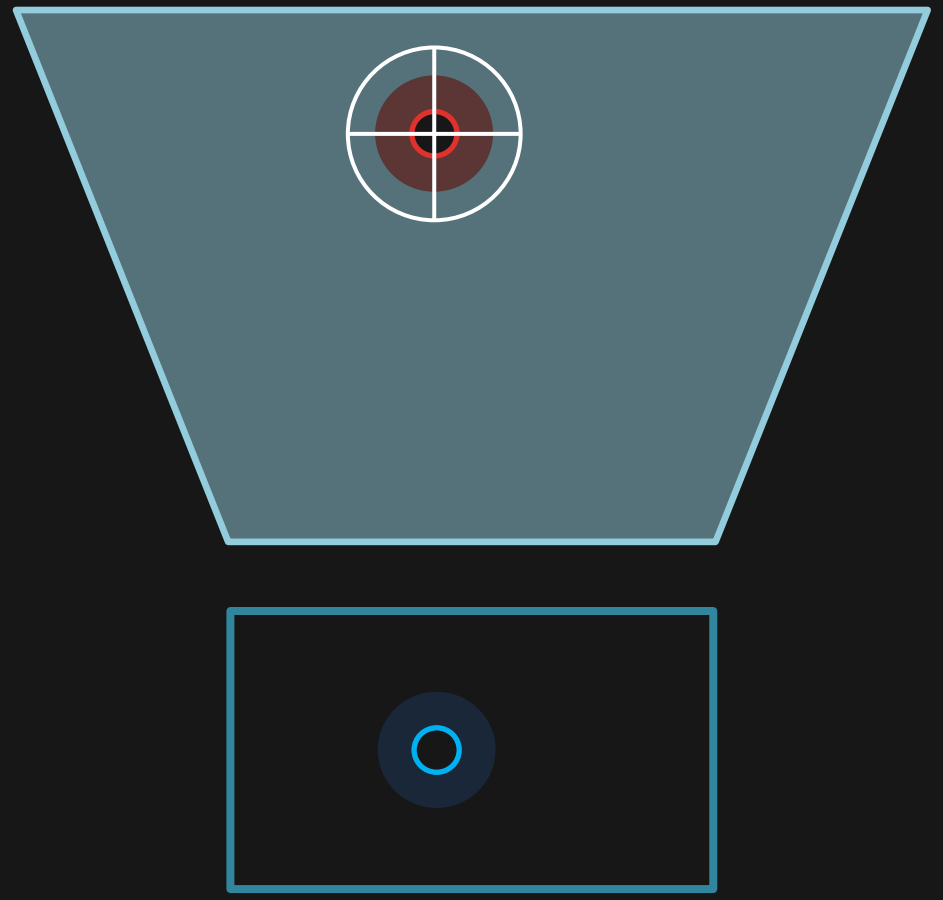


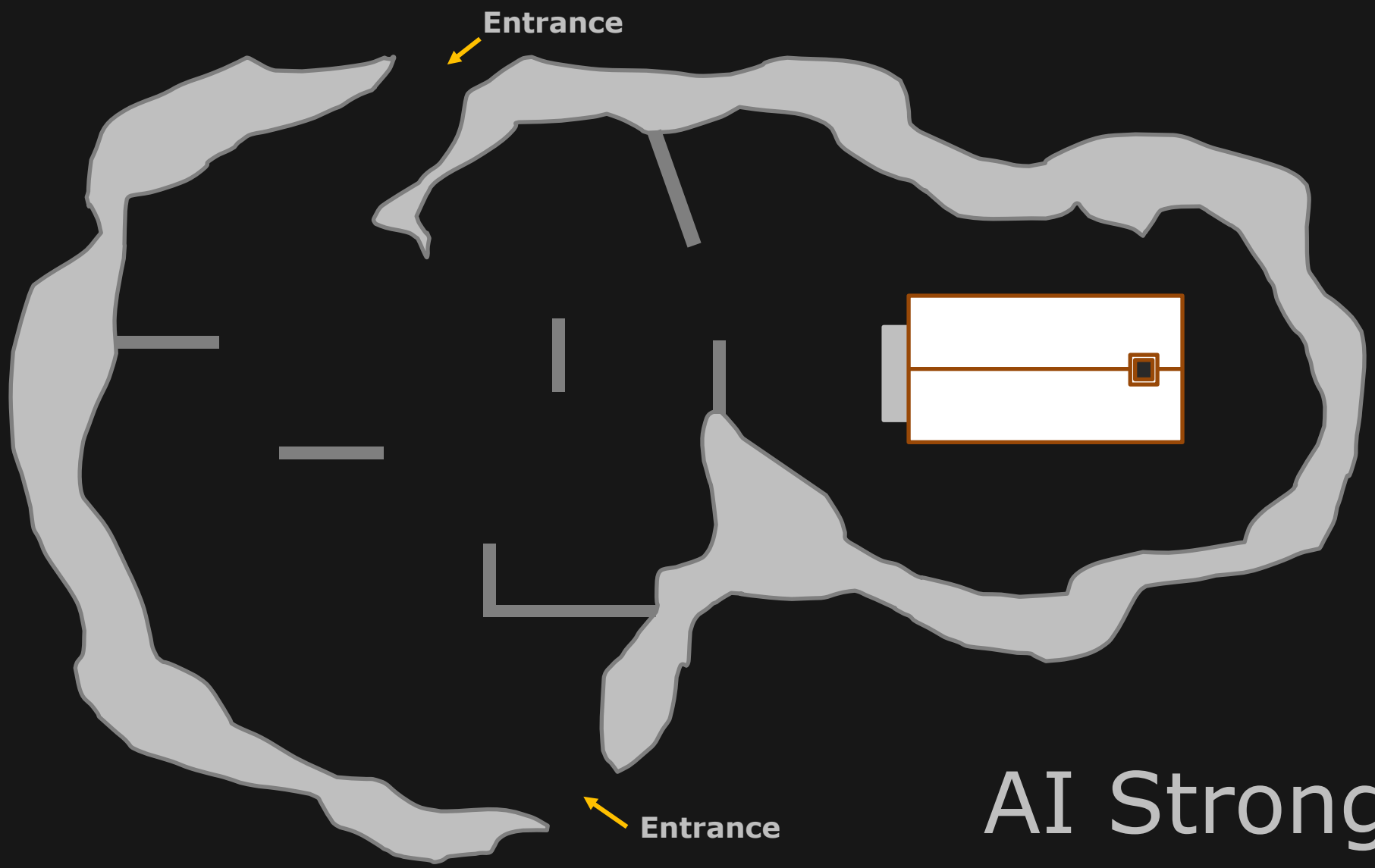
The AI’s target’s position decides if the Fortification Zone is valid.



AI Stronghold

AI Stronghold

AI Stronghold



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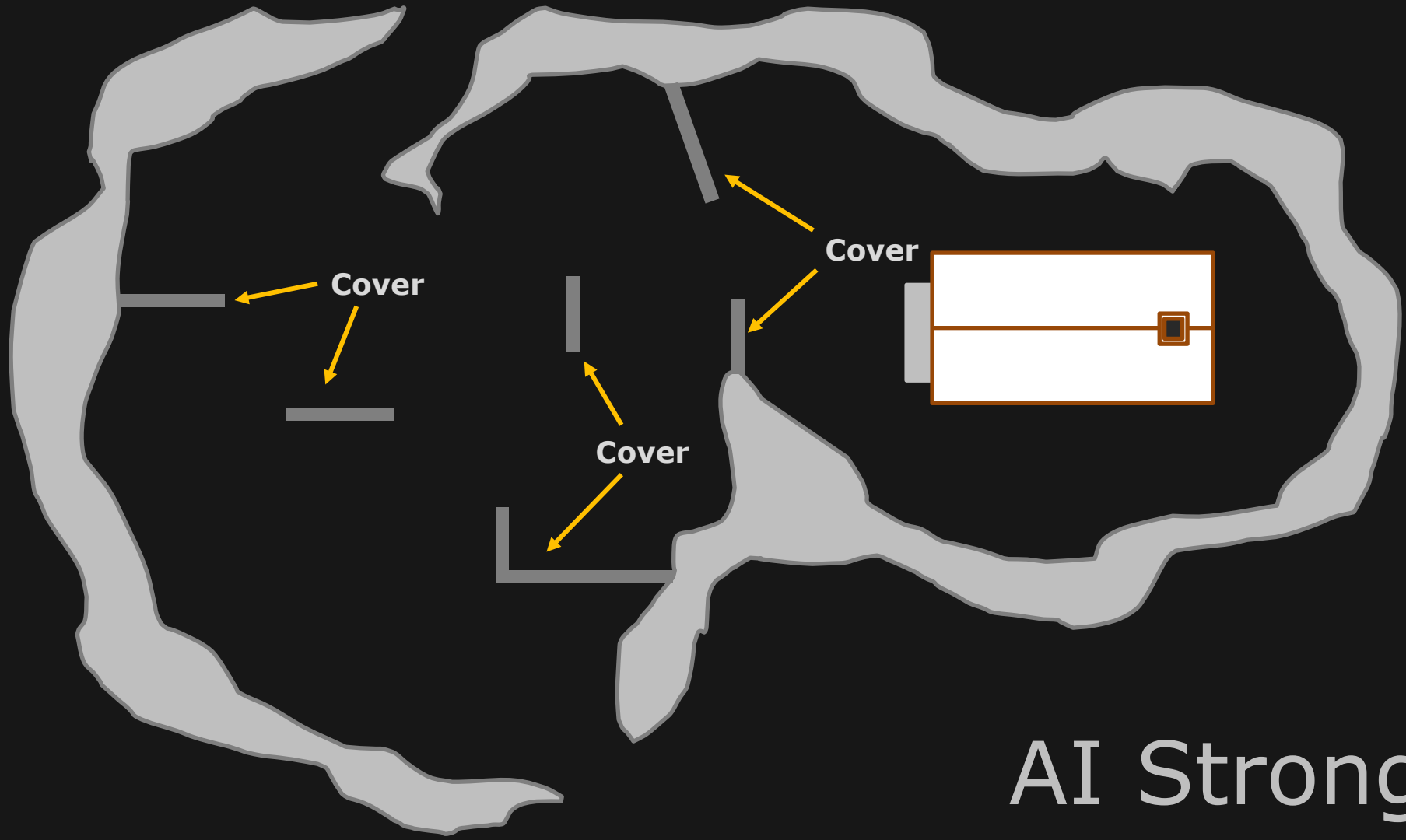

AI Stronghold

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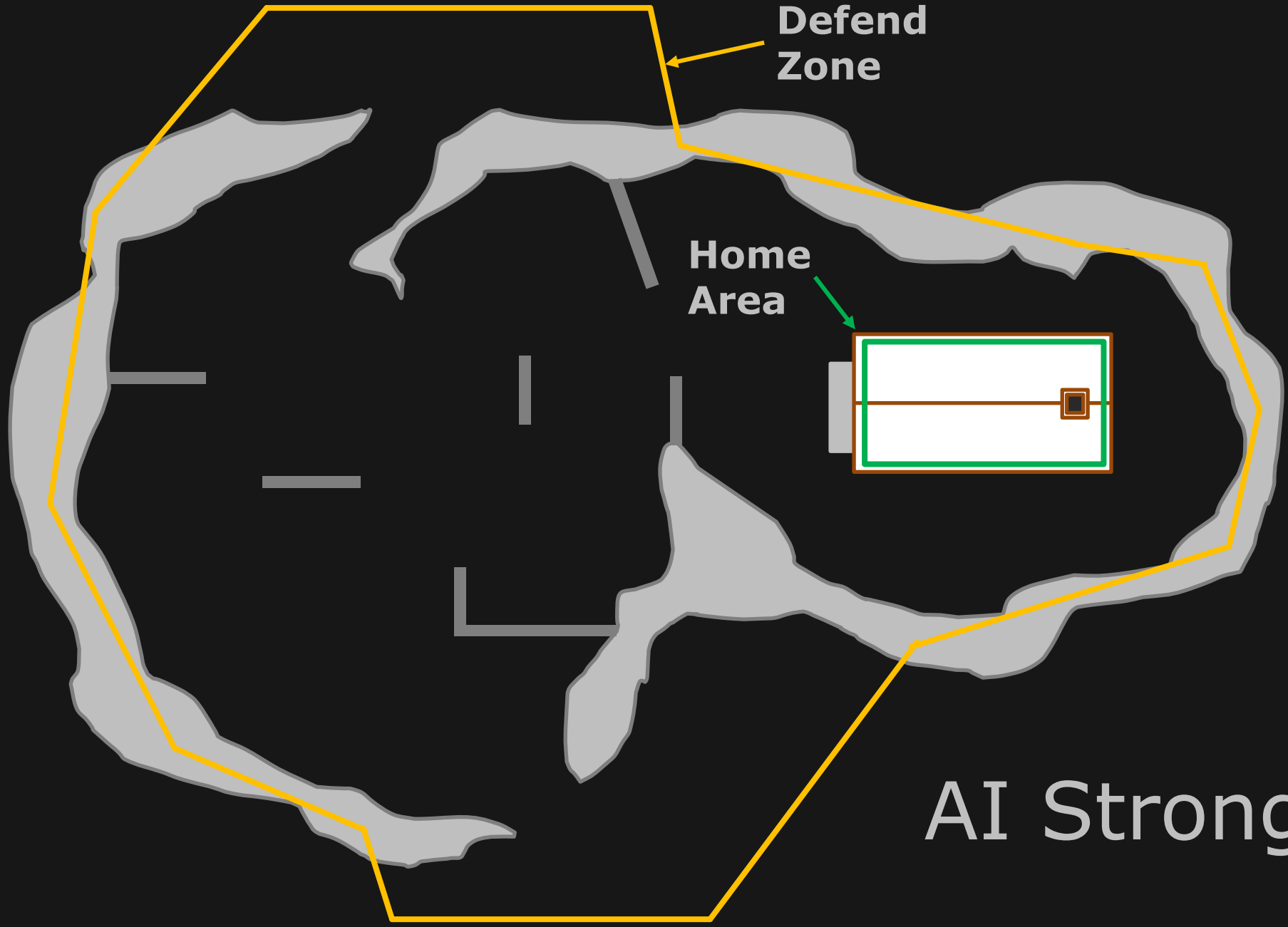

AI Stronghold

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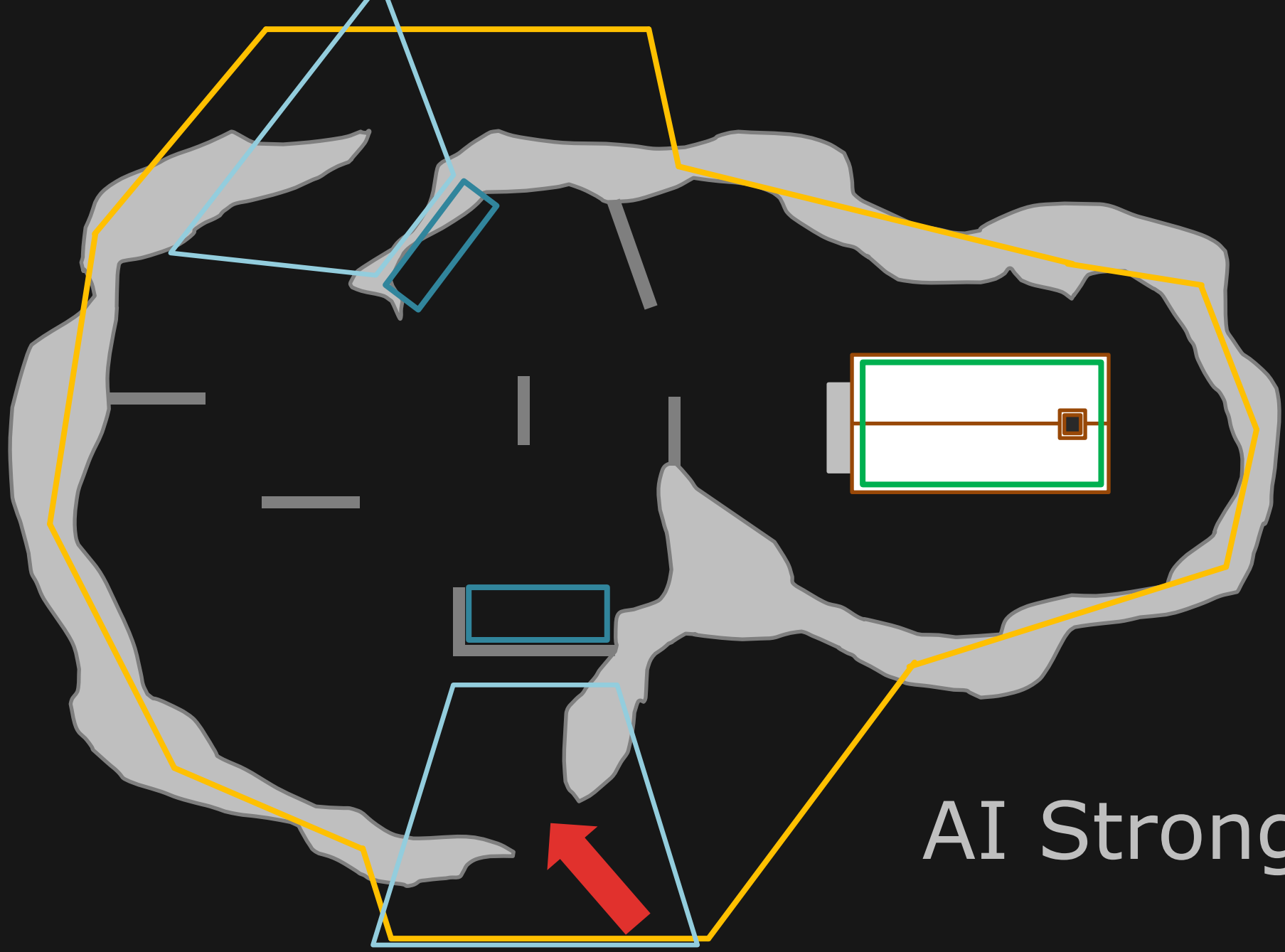

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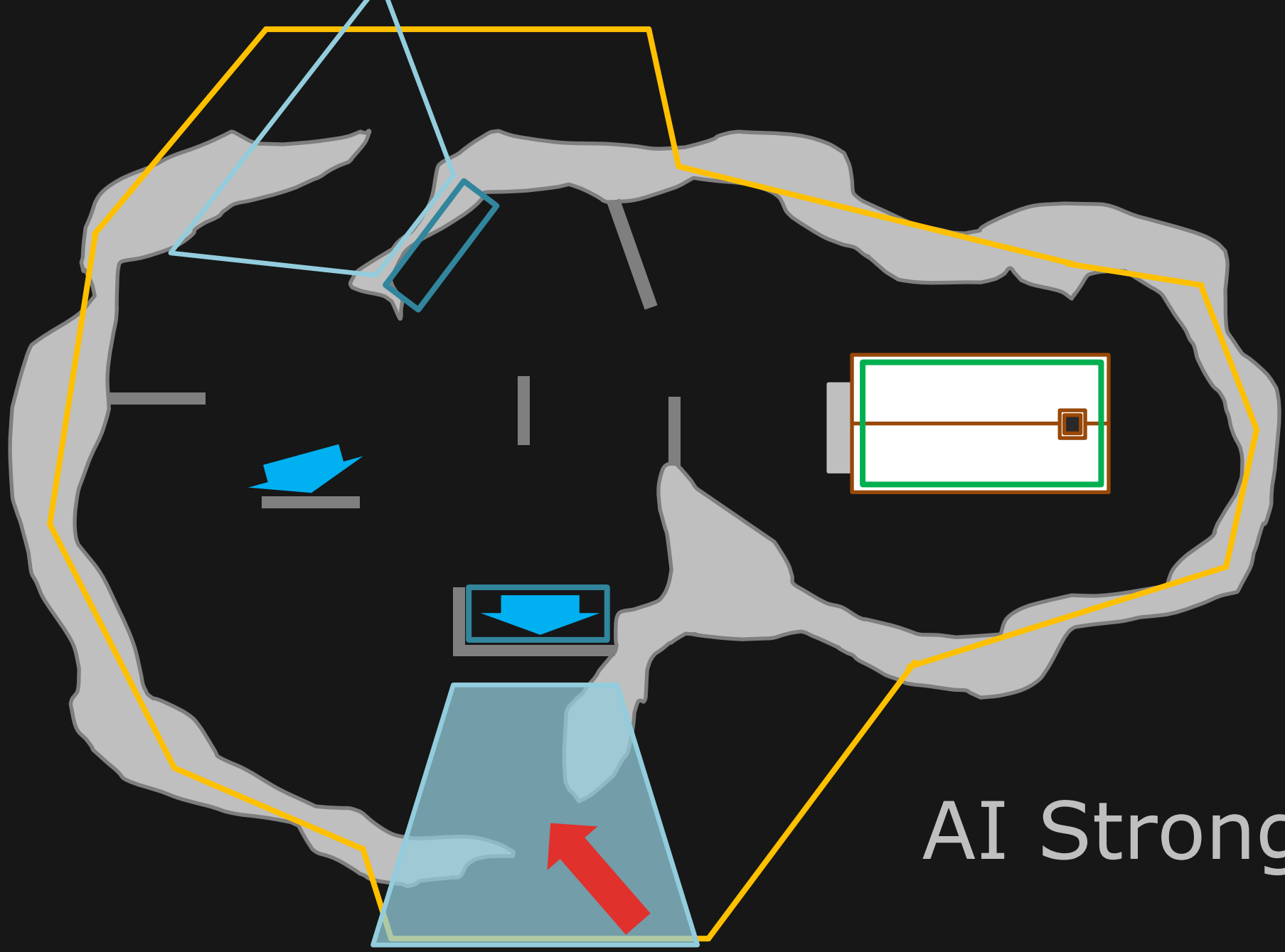
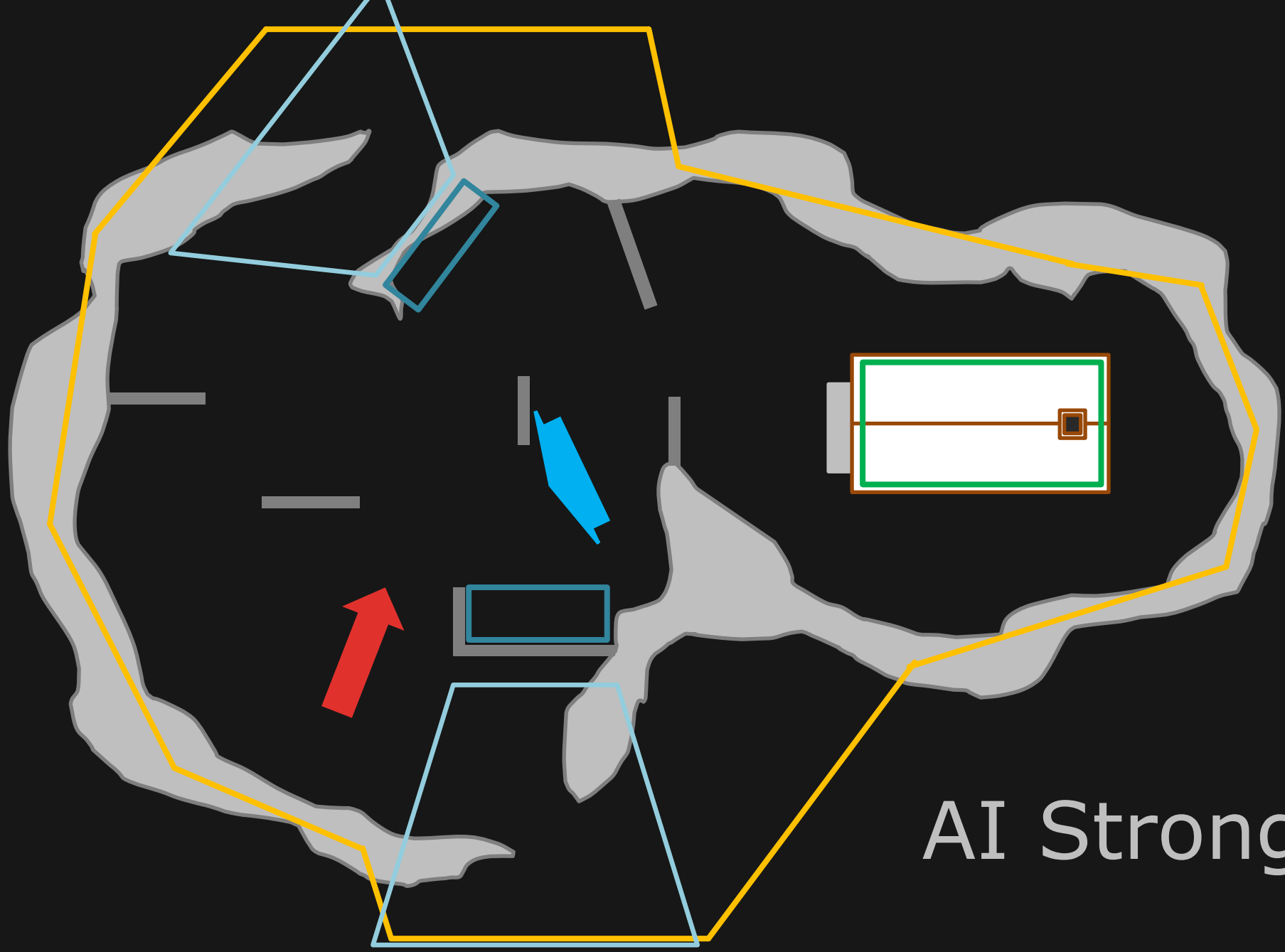


AI Stronghold



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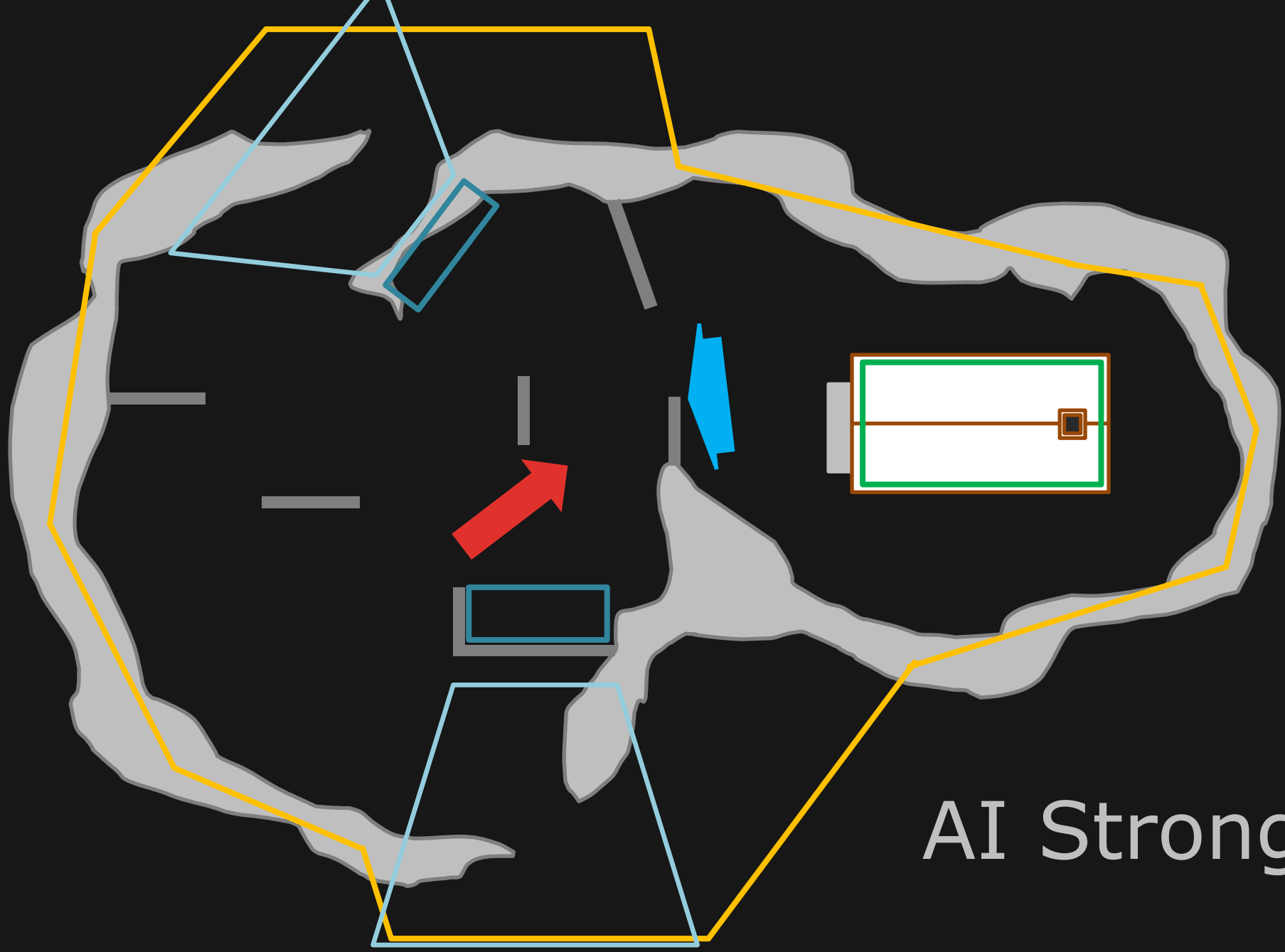

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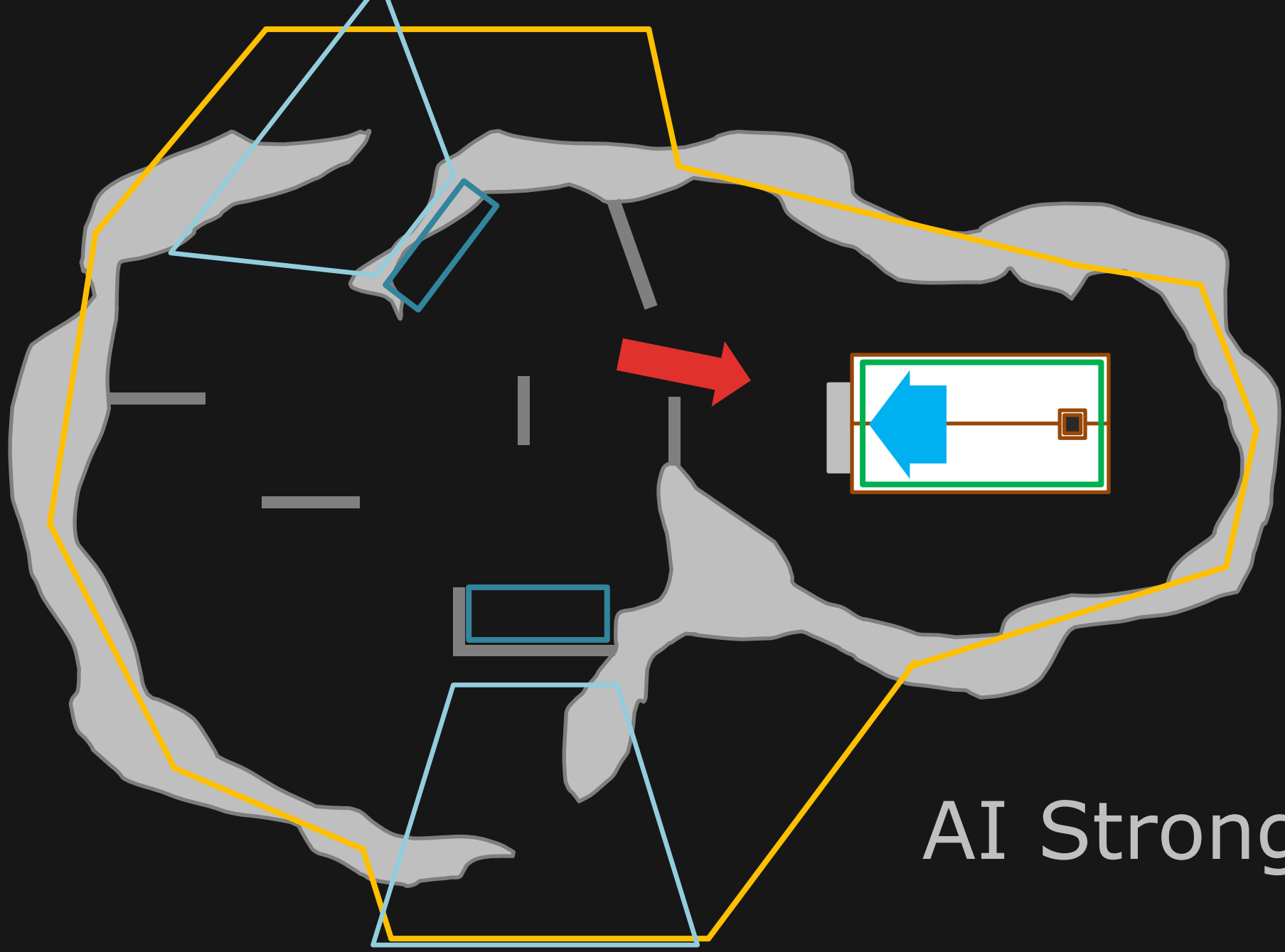

AI Stronghold

Worked well for most of our cases.

Special behaviors for fighting in and around buildings.

Primarily for fighting against human opponents.

The player tends to intuitively respect the frontline.

Thanks To:

Days Gone AI Team:

- Darren Chisum
- Brian Hitt
- Jacob Jackson
- Boyd Pellet

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Bend Studio:

- Phil Baca
- Shay Casey
- Jonathan Harman
- John Hoffman
- Josh Jacobi
- Julie O’Leary
- Chris Reese
- Susan Thompson
- Calvin Wong

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